

# CONTEMPORARY MATHEMATICS

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## Factorizations of $b^n \pm 1$ , $b = 2, 3, 5, 6, 7, 10, 11, 12$ Up to High Powers

Third Edition

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and S. S. Wagstaff, Jr.



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American Mathematical Society  
Providence, Rhode Island

This work is dedicated to the memory of  
Lt.-Col. Allan J. C. Cunningham  
(1842-1928), an industrious computer  
and maker of mathematical tables.

This edition is also dedicated to the memory of  
Derrick Henry Lehmer (1905-1991),  
our friend, co-author and long-time collaborator.

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## I. Introduction to the Short Tables.

The following four tables, which contain the known prime factors of the commonly encountered numbers  $2^n \pm 1$  and  $10^n \pm 1$ , have been placed at the beginning of this book for easy reference. Prime factors are given explicitly in these tables and are thus immediately and conveniently at hand. The factorizations are presented differently here than in the main tables, where the factors of a number must usually be collected from various lines in the same or related tables. For example, in the main tables, the 17 prime factors of  $2^{120} - 1 = (2^{15} - 1)(2^{15} + 1)(2^{30} + 1)(2^{60} + 1)$  must be collected from 17 different lines in the four separate base two tables; the 11 prime factors of  $10^{70} + 1$  can all be found in Table 10+, but on 6 different lines. The short tables, of course, may also serve as a check on the reader's ability to use the main tables properly.

The notation "Pxx" in a line represents a prime factor with xx decimal digits, which are given explicitly in Appendix A. For example, the factorization of  $2^{269} - 1$  is given as "269 13822297.P74" in the Short 2- table. The 74 digits of the large prime factor may be found in Appendix A in the two lines which begin "74 2,269-". They appear as

6862 5988504811 7742593646  
7066155294 8915363901 8450354163 7191246347 7873783063

When there are more factors than will fit on one line, the extra factors are given on the next line (followed by the line number), the factorization being broken at a multiplication dot, which is repeated on the second line. In Short 2+, for example, the final two prime factors for line 210 are 146919792181 and 1041815865690181. Note that we use a period rather than a centered dot for multiplication.

Factorizations of  $2^n - 1$ ,  $n \leq 400$ 

$n$	Prime Factors
2	3
3	7
4	3·5
5	3 <sup>1</sup>
6	3·3·7
7	127
8	3·5·17
9	7·73
10	3·11·31
11	23·89
12	3·3·5·7·13
13	8191
14	3·43·127
15	7·31·151
16	3·5·17·257
17	131071
18	3·3·3·7·19·73
19	524287
20	3·5·5·11·31·41
21	7·7·127·337
22	3·23·89·683
23	47·178481
24	3·3·5·7·13·17·241
25	31·601·1801
26	3·2731·8191
27	7·73·262657
28	3·5·29·43·113·127
29	233·1103·2089
30	3·3·7·11·31·151·331
31	2147483647
32	3·5·17·257·65537
33	7·23·89·599479
34	3·43691·131071
35	31·71·127·122921
36	3·3·3·5·7·13·19·37·73·109
37	223·616318177
38	3·174763·524287
39	7·79·8191·121369
40	3·5·5·11·17·31·41·61681
41	13367·164511353
42	3·3·7·7·43·127·337·5419
43	431·9719·2099863
44	3·5·23·89·397·683·2113
45	7·31·73·151·631·23311

46	3·47·178481·2796203
47	2351·4513·13264529
48	3·3·5·7·13·17·97·241·257·673
49	127·443·2676798593
50	3·11·31·251·601·1801·4051
51	7·103·2143·11119·131071
52	3·5·53·157·1613·2731·8191
53	6361·69431·20394401
54	3·3·3·3·7·19·73·87211·262657
55	23·31·89·881·3191·201961
56	3·5·17·29·43·113·127·15790321
57	7·32377·524287·1212847
58	3·59·233·1103·2089·3033169
59	179951·320·3431780337
60	3·3·5·5·7·11·13·31·41·61·151·331·1321
61	230584300·9213693951
62	3·715827883·2147483647
63	7·7·73·127·337·92737·649657
64	3·5·17·257·641·65537·6700417
65	31·8191·14529·5143558111
66	3·3·7·23·67·89·683·20857·599479
67	193707721·76·1838257287
68	3·5·137·953·26317·43691·131071
69	7·47·178481·1005·2678938039
70	3·11·31·43·71·127·281·86171·122921
71	228479·48544121·212885833
72	3·3·3·5·7·13·17·19·37·73·109·241·433·38737
73	439·2298041·936·1973132609
74	3·223·1777·25781083·616318177
75	7·31·151·601·1801·100801·10567201
76	3·5·229·457·174763·524287·525313
77	23·89·127·58128364·3249112959
78	3·3·7·79·2731·8191·121369·22366891
79	2687·202029703·111·3491139767
80	3·5·5·11·17·31·41·257·61681·4278255361
81	7·73·2593·71119·262657·97685839
82	3·83·13367·164511353·8831418697
83	167·579·1261411327·5649087721
84	3·3·5·7·7·13·29·43·113·127·337·1429·5419·14449
85	31·131071·952097280·6333758431
86	3·431·9719·2099863·293·2031007403
87	7·233·1103·2089·4177·985·7737155463
88	3·5·17·23·89·353·397·683·2113·2931542417
89	6189700·1964269013·7449562111
90	3·3·3·7·11·19·31·73·151·331·631·23311·18837001
91	127·911·8191·112901153·2·3140471537
92	3·5·47·277·1013·1657·30269·178481·2796203
93	7·2147483647·65881228·8653553079
94	3·283·2351·4513·13264529·16·5768537521
95	31·191·524287·420778751·3·0327152671
96	3·3·5·7·13·17·97·193·241·257·673·65537·22253377

97	11447·138426 0723582848 5645766393
98	3·43·127·436 3953127297·443 2676798593
99	7·23·73·89·199·153649·599479·3 3057806959
100	3·5·5·5·11·31·41·101·251·601·1801·4051·8101·268501
101	743 2339208719·34111753 1003194129
102	3·3·7·103·307·2143·2857·6529·11119·43691·131071
103	2550183799·39 7665642994 1438590393
104	3·5·17·53·157·1613·2731·8191·858001·308761441
105	7·7·31·71·127·151·337·29191·106681·122921·152041
106	3·107·6361·69431·20394401·2805 9810762433
107	162 2592768292 1336339157 8010288127
108	3·3·3·3·5·7·13·19·37·73·109·87211·246241·262657·279073
109	745988807·8700 3598609872 0987332873
110	3·11·11·23·31·89·683·881·2971·3191·201961·48912491
111	7·223·321679·26295457·319020217·616318177
112	3·5·17·29·43·113·127·257·5153·15790321·5 4410972897
113	3391·23279·65993·1868569·106681 8132868207
114	3·3·7·571·32377·174763·524287·1212847·160465489
115	31·47·14951·178481·4036961·264650 7710984041
116	3·5·59·233·1103·2089·3033169·107367629·536903681
117	7·73·79·937·6553·8191·86113·121369·7830118297
118	3·2833·37171·179951·1824726041·320 3431780337
119	127·239·20231·131071·6 2983048367·13 1105292137
120	3·3·5·5·7·11·13·17·31·41·61·151·241·331·1321·61681·4562284561
121	23·89·727·1 7863938783 6316422785 8270210279
122	3·76861433 6404564651·230584300 9213693951
123	7·13367·3887047·164511353·17772225 3954175633
124	3·5·5581·8681·49477·384773·715827883·2147483647
125	31·601·1801·26 9089806001·471088316 8879506001
126	3·3·3·7·7·19·43·73·127·337·5419·92737·649657·7 7158673929
127	170141183 4604692317 3168730371 5884105727
128	3·5·17·257·641·65537·274177·6700417·6728 0421310721
129	7·431·9719·2099863·110530 3606504929 4753459639
130	3·11·31·131·2731·8191·409891·7623851·14529 5143558111
131	263·10350794 4310551623 8671861923 7468234569
132	3·3·5·7·13·23·67·89·397·683·2113·20857·312709·599479·4327489
133	127·524287·163 5372208527 2539885143 4325720959
134	3·7327657·193707721·76 1838257287·671 3103182899
135	7·31·73·151·271·631·23311·262657·348031·4997 1617830801
136	3·5·17·17·137·953·26317·43691·131071·354689·287 9347902817
137	3203221559 6496435569·54 3904218360 0204290159
138	3·3·7·47·139·178481·2796203·16 8749965921·1005 2678938039
139	562 5767248687·1238761322 0520833576 2278423601
140	3·5·5·11·29·31·41·43·71·113·127·281·86171·122921·7416361·47392381
141	7·2351·4513·13264529·4375578271·64667503 5253258729
142	3·228479·48544121·56409643·212885833·1395 2598148481
143	23·89·8191·724153·15 8822951431·578217211 3400990737
144	3·3·3·5·7·13·17·19·37·73·97·109·241·257·433·577·673·38737·48 7824887233
145	31·233·1103·2089·2679 8951577838 6281469002 7494144991
146	3·439·1753·2298041·936 1973132609·179591803 8741070627
147	7·7·7·127·337·443 2676798593·27416 7236252872 5535068727
148	3·5·149·223·593·1777·25781083·184481113·231769777·616318177



149	8665626856 6282183151 . 82351 0933669084 6723986161	
150	3 . 3 . 7 . 11 . 31 . 151 . 251 . 331 . 601 . 1801 . 4051 . 100801 . 10567201 . 113 3836730401	
151	18121 . 55871 . 165799 . 2332951 . 72890 8838338825 3664437433	
152	3 . 5 . 17 . 229 . 457 . 1217 . 148961 . 174763 . 524287 . 525313 . 2451 7014940753	
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154	3 . 23 . 43 . 89 . 127 . 617 . 683 . 78233 . 3 5532364099 . 58128364 3249112959	
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157	852133201 . 6 0726444167 . 165 4058017289 . 213438 7368610417	
158	3 . 2687 . 202029703 . 111 3491139767 . 2014 8763660243 8195784363	
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167	2349023 . 7963 8304766856 5073777786 1629608744 8490695649	
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198	3 · 3 · 3 · 7 · 19 · 23 · 67 · 73 · 89 · 199 · 683 · 5347 · 20857 · 153649 · 599479 · 3 3057806959 · .24209 9935645987	198
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202	3 · 743 2339208719 · 34111753 1003194129 · 8451004001 5215293433 1135470251	
203	127 · 233 · 1103 · 2089 · 136417 · 121793911 · 11348055 5808832720 1109085605 3175361113	
204	3 · 3 · 5 · 7 · 13 · 103 · 137 · 307 · 409 · 953 · 2143 · 2857 · 3061 · 6529 · 11119 · 13669 · 26317 · .43691 · 131071 · 1326700741	204
205	31 · 13367 · 2940521 · 164511353 · 7 0171342151 · 3 6557250655 0879718167 4078959681	
206	3 · 2550183799 · 41 5141630193 · 814276708 1771726171 · 39 7665642994 1438590393	
207	7 · 47 · 73 · 79903 · 178481 · 634569679 · 223 2578641663 · 1005 2678938039 · 4216 6482463639	
208	3 · 5 · 17 · 53 · 157 · 257 · 1613 · 2731 · 8191 · 858001 · 308761441 · 789198817 2627109114 3763623681	
209	23 · 89 · 524287 · 9480 3416684681 · 151234 8937147247 · 53469 5054132396 0232319657	
210	3 · 3 · 7 · 7 · 11 · 31 · 43 · 71 · 127 · 151 · 211 · 281 · 331 · 337 · 5419 · 29191 · 86171 · 106681 · .122921 · 152041 · 664441 · 1564921	210
211	15193 · 6027295643 3838849161 · 3593875704 4958237573 8819989426 8773153439	
212	3 · 5 · 107 · 6361 · 69431 · 15358129 · 20394401 · 586477649 · 2805 9810762433 · 180143 9824104653	
213	7 · 66457 · 228479 · 48544121 · 212885833 · 284988197 2114740679 · 420526857 4191396793	
214	3 · 643 · 841157474 4904788148 8635567801 · 162 2592768292 1336339157 8010288127	
215	31 · 431 · 1721 · 9719 · 2099863 · 731516431 · 51 4851898711 · 2979272 8974404776 4444862191	
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218	3 · 104124649 · 745988807 · 8700 3598609872 0987332873 · 20777 5684736234 8863128179	
219	7 · 439 · 3943 · 2298041 · 936 1973132609 · 67116589 8617413417 · 48 1531461520 4347717321	
220	3 · 5 · 5 · 11 · 11 · 23 · 31 · 41 · 89 · 397 · 683 · 881 · 2113 · 2971 · 3191 · 201961 · 48912491 · .41 5878438361 · 363 0105520141	220
221	1327 · 8191 · 131071 · 23654 5439841839 9772605086 2092143634 5855283986 6247069233	
222	3 · 3 · 7 · 223 · 1777 · 3331 · 17539 · 321679 · 25781083 · 26295457 · 319020217 · 616318177 · .10777 5231312019	222
223	18287 · 196687 · 1466449 · 2916841 · 14 6949526239 8780123809 · 5962 4259998711 6128415063	
224	3 · 5 · 17 · 29 · 43 · 113 · 127 · 257 · 449 · 2689 · 5153 · 65537 · 15790321 · 183076097 · .5 4410972897 · 35842 9848460993	224
225	7 · 31 · 73 · 151 · 601 · 631 · 1801 · 23311 · 100801 · 115201 · 617401 · 10567201 · 1348206751 · .1386136 9826299351	225
226	3 · 227 · 3391 · 23279 · 48817 · 65993 · 1868569 · 636190001 · 106681 8132868207 · .49100336 9344660409	226
227	2698633 3437777017 · 79 9217773820 5979626491 5069508677 2095354566 0121688631	
228	3 · 3 · 5 · 7 · 13 · 229 · 457 · 571 · 32377 · 131101 · 160969 · 174763 · 524287 · 525313 · 1212847 · .160465489 · 27 5415303169	228
229	1504073 · 20492753 · 5983345 7464970183 · 467795120 1875837235 3428000034 8743236593	
230	3 · 11 · 31 · 47 · 691 · 14951 · 178481 · 2796203 · 4036961 · 1884103651 · 34576 7385170491 · .264650 7710984041	230
231	7 · 7 · 23 · 89 · 127 · 337 · 463 · 599479 · 58128364 3249112959 · .4982 3976511782 5615133830 2204762057	231
232	3 · 5 · 17 · 59 · 233 · 1103 · 2089 · 59393 · 3033169 · 107367629 · 536903681 · .822801951 6714411983 2390568177	232
233	1399 · 135607 · 622577 · 1168681 2987907760 0270344856 3247662600 8506653285 3492178431	
234	3 · 3 · 3 · 7 · 19 · 73 · 79 · 937 · 2731 · 6553 · 8191 · 86113 · 121369 · 22366891 · 7830118297 · .53 0230622637 0307681801	234
235	31 · 2351 · 4513 · 13264529 · 2391314881 · 7 2296287361 · .73202 3003951580 0584547353 7146974751	235

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236	3 · 5 · 1181 · 2833 · 3541 · 37171 · 157649 · 174877 · 179951 · 5521693 · 1824726041 · .10 4399276341 · 320 3431780337	236
237	7 · 1423 · 2687 · 49297 · 202029703 · 111 3491139767 · 2372882351 2345609279 · .3135737341 7090093431	237
238	3 · 43 · 127 · 239 · 20231 · 43691 · 131071 · 823679683 · 6 2983048367 · 13 1105292137 · .1 4316255316 5560959297	238
239	479 · 1913 · 5737 · 176383 · 134000609 · .711000871 7824458123 1050142792 5375409686 3768062879	239
240	3 · 3 · 5 · 5 · 7 · 11 · 13 · 17 · 31 · 41 · 61 · 97 · 151 · 241 · 257 · 331 · 673 · 1321 · 61681 · 394783681 · .4278255361 · 4562284561 · 4 6908728641	240
241	22000409 · 160619 4743723522 8941273750 8720216839 2258056563 2899087995 3332340439	
242	3 · 23 · 89 · 683 · 727 · 117371 · 110541845 8279780045 5736061107 · .1 7863938783 6316422785 8270210279	242
243	7 · 73 · 487 · 2593 · 71119 · 262657 · 97685839 · 1675 3783618801 · 19297 1705688577 · .371299016 3251158343	243
244	3 · 5 · 733 · 1709 · 3456749 · 36 8140581013 · 66 7055378149 · 76861433 6404564651 · .230584300 9213693951	244
245	31 · 71 · 127 · 1471 · 122921 · 443 2676798593 · .25235990 2034571016 8562142988 5170852973 8525821631	245
246	3 · 3 · 7 · 83 · 739 · 13367 · 165313 · 3887047 · 164511353 · 8831418697 · 1319431 7913029593 · .17772225 3954175633	246
247	8191 · 15809 · 524287 · 645 9570124697 · 40200 4106269663 · .1282 8161176172 6506045349 6956212169	247
248	3 · 5 · 17 · 5581 · 8681 · 49477 · 290657 · 384773 · 715827883 · 2147483647 · 3770202641 · .11 4162918040 1976895873	248
249	7 · 167 · 1621324657 · 579 1261411327 5649087721 · .8241594690 1671373595 5227441843 2855740327	249
250	3 · 11 · 31 · 251 · 601 · 1801 · 4051 · 229668251 · 26 9089806001 · 471088316 8879506001 · .55 1948541833 6288303251	250
251	503 · 54217 · 1 7823028721 4063289511 · 616 7688219869 5257501367 · .120703 9617824989 3039969681	251
252	3 · 3 · 3 · 5 · 7 · 7 · 13 · 19 · 29 · 37 · 43 · 73 · 109 · 113 · 127 · 337 · 1429 · 5419 · 14449 · 92737 · .649657 · 4 0388473189 · 7 7158673929 · 11 8750098349	252
253	23 · 23 · 47 · 89 · 178481 · 4103188409 · 1999 5773632843 5366769577 · .44 6677117627 9779840303 9426178361	253
254	3 · 56713727 8201564105 7722910123 8628035243 · .170141183 4604692317 3168730371 5884105727	254
255	7 · 31 · 103 · 151 · 2143 · 11119 · 106591 · 131071 · 949111 · 952097280 6333758431 · .57024515 7763977554 5838643151	255
256	3 · 5 · 17 · 257 · 641 · 65537 · 274177 · 6700417 · 6728 0421310721 · .5964958 9127497217 · 57 0468920068 5129054721	256
257	53500 6138814359 · 11556 8539524661 9182673033 · .374550598 5018109365 8177663009 6313181393	257
258	3 · 3 · 7 · 431 · 1033 · 9719 · 2099863 · 1591582393 · 293 2031007403 · 1568 6603697451 · .110530 3606504929 4753459639	258
259	127 · 223 · 616318177 · 2499285769 · .212343 7096088009 8806027750 1855527137 0686697057 8963970119	259
260	3 · 5 · 5 · 11 · 31 · 41 · 53 · 131 · 157 · 521 · 1613 · 2731 · 8191 · 51481 · 409891 · 7623851 · .34110701 · 10814 0989558681 · 14529 5143558111	260
261	7 · 73 · 233 · 1103 · 2089 · 4177 · 985 7737155463 · .3 2801702501 4102923449 9886637529 6008088651 1412965881	261
262	3 · 263 · 1049 · 4744297 · 1823311286 8120778178 4391813611 · .10350794 4310551623 8671861923 7468234569	262
263	23671 · 1357 2264529177 · 1202263 6053684849 8024035943 · .383725 1266551709 6450131573 0676446647	263
264	3 · 3 · 5 · 7 · 13 · 17 · 23 · 67 · 89 · 241 · 353 · 397 · 683 · 2113 · 7393 · 20857 · 312709 · 599479 · .4327489 · 1761345169 · 2931542417 · 9 8618273953	264

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266	3.43.127.4523.174763.524287.1067882904 4384829528 4382097033. .163 5372208527 2539885143 4325720959	266
267	7.78903841.2875 3302853087.6189700 1964269013 7449562111. .24 1243324377 1392408426 7316537353	267
268	3.5.269.7327657.15152453.42875177.193707721.2559066073.76 1838257287. .671 3103182899.973 9278030221	268
269	13822297.P74	
270	3.3.3.3.7.11.19.31.73.151.271.331.631.811.15121.23311.87211.262657. .348031.18837001.4997 1617830801.38583 8642647891	270
271	1 5242475217.	
272	.24 8927757868 1318902773 3054156782 0045256364 2739707732 8654218838 6932989391 3.5.17.17.137.257.953.26317.43691.131071.354689.383521.236 8179743873. .287 9347902817.3 7320072247 0799764577	272
273	7.7.79.127.337.911.8191.121369.108749551.112901153.2 3140471537. .409320 4977277417.8697759580 1949844993	273
274	3.1097.15619.3212796 3626435681.10549821 2027592977.3203221559 6496435569. .54 3904218360 0204290159	274
275	23.31.89.601.881.1801.3191.201961.3 8202766513 4363932751. .4074891477 3548868150 3330808737 9995347151	275
276	3.3.5.7.13.47.139.277.1013.1657.30269.178481.2796203.16 8749965921. .541 5624023749.1005 2678938039.7033 4392823809	276
277	1121297.31133636 3056102094 8220110905 0392404721. .6955979459 7765400522 8093485158 9652278783	277
278	3.4506937.562 5767248687.1238761322 0520833576 2278423601. .51542 6395246617 9530007417 4250365699	278
279	7.73.16183.34039.1437967.2147483647.83373 2508401263.65881228 8653553079. .20344 3983695186 7299888617	279
280	3.5.5.11.17.29.31.41.43.71.113.127.281.61681.86171.122921.7416361. .15790321.47392381.841798420 7765786201 1867889681	280
281	80929.P80	
282	3.3.7.283.2351.4513.1681003.13264529.4375578271.3 5273039401. .11 1349165273.16 5768537521.64667503 5253258729	282
283	9623.6 8492481833. .2 3579543011 7989932228 5089392956 5870383844 1678738515 0267731105 7483194673	283
284	3.5.569.228479.48544121.56409643.148587949.212885833.4999465853. .5585522857.47 2287102421.1395 2598148481	284
285	7.31.151.191.32377.524287.1212847.420778751.3 0327152671. .14 9147703568 9218775711.253 4924298663 7720573561	285
286	3.23.89.683.2003.2731.8191.724153.6156182033.1 0425285443.15 8822951431. .1550 0487753323.578217211 3400990737	286
287	127.13367.164511353.1 7137716527. .51 9543908777 4865574425 6192963206 2209192728 9554884381 7842228913	287
288	3.3.3.5.7.13.17.19.37.73.97.109.193.241.257.433.577.673.1153.6337.38737. .65537.22253377.3 8941695937.27 8452876033.48 7824887233	288
289	131071.12761663.1790 5831260439 2742511009. .33 2093499435 6628805321 7335207909 4760898942 0068445023	289
290	3.11.31.59.233.1103.2089.3033169.7553921.9998028 5472471530 0883845411. .2679 8951577838 6281469002 7494144991	290
291	7.11447.272959.2065304407.5434876633.138426 0723582848 5645766393. .1170 7116447776 5187765955 6633665719	291
292	3.5.293.439.1753.9929.2298041.936 1973132609.64930 1712182209. .179591803 8741070627.94 4473296560 1851473921	292
293	401223 6245561622 1971122353. .396 6452270281 3889041561 1220710757 9216439107 4310303170 1971222447	293

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294	3·3·7·7·7·43·127·337·5419·748819·436 3953127297·443 2676798593. .2603288584 5392093851·27416 7236252872 5535068727	294
295	31·4721·132751·179951·5794391·128818831·3812358161·320 3431780337. .45282 4604065751·44 1097523065 0827973711	295
296	3·5·17·149·223·593·1777·25781083·184481113·231769777·616318177. .2098 8936657440 5864861512 6425661022 2593863921	296
297	7·23·73·89·199·153649·262657·599479·8950393·3 3057806959. .17088661 8823141738 0818309508 0729277164 8313599433	297
298	3·1193·650833·38369587·8665626856 6282183151·82351 0933669084 6723986161. .79845595 7350425985 6359124657	298
299	47·599·8191·178481·9341359·1 4718679249·1344447683 6590589479. .5144156315 1591093599·2 6024244971 2509916159	299
300	3·3·5·5·5·7·11·13·31·41·61·101·151·251·331·601·1201·1321·1801·4051·8101. .63901·100801·268501·10567201·13334701·1182468601·113 3836730401	300
301	127·431·9719·490631·2099863·3655 0582371197 8039310711. .2033695 2491372732 4581005538 4288578491 9705927999	301
302	3·18121·55871·165799·2332951·1871 7738334417·72890 8838338825 3664437433. .50 8340508241 0077967730 6460621499	302
303	7·607·743 2339208719·34111753 1003194129. .15127682 2241373525 5864403005 2641058393 2437477852 0631853993	303
304	3·5·17·229·257·457·1217·27361·148961·174763·524287·525313·2451 7014940753. .6939446 0463940481·116 9955781771 7358904481	304
305	31·1831·2441·4271·270841·48407 4637694471·230584300 9213693951. .36 4371848053 9731284003 8029362441 7256758401	305
306	3·3·3·7·19·73·103·307·919·2143·2857·6529·11119·43691·123931·131071. .2 6159806891·2743 9122228481·755824 8842417934 7083438319	306
307	14608903·85798519·2 3487583303·7 8952752017. .1121774 7647447052 5577861298 9378353385 4572309313 4076373561	307
308	3·5·23·29·43·89·113·127·397·617·683·2113·8317·78233·869467061·3019242689. .3 5532364099·7609 6559910757·58128364 3249112959	308
309	7·2550183799·19 5327276678 0718501831·39 7665642994 1438590393. .7521737478 7325720535 8122784001 7636545169	309
310	3·11·31·31·311·11161·11471·73471·715827883·2147483647·4649919401. .1815 8209813151·594760 3221397891·2912605 6043168521	310
311	5344847·2 6476493739 1020515846 8946067671. .2948036 8134895929 6477194164 0646430621 8755953753 9328375831	311
312	3·3·5·7·13·13·17·53·79·157·241·313·1249·1613·2731·3121·8191·21841·121369. .858001·22366891·308761441·841593759 4876209925 4554456081	312
313	10960009·1478797 0697180273·38571 9476428914 1165278097. .2669301 2026551688 2861649499 5862048325 8358551879	313
314	3·15073·2350291·852133201·6 0726444167·165 4058017289·213438 7368610417. .1775178 3757817897·9683329919 8971305921	314
315	7·7·31·71·73·127·151·337·631·23311·29191·92737·106681·122921·152041. .649657·870031·983431·29 7283071559 6370681022 8435378401	315
316	3·5·317·2687·202029703·111 3491139767·3 8136461186 6507317969. .2014 8763660243 8195784363·6044 6290980621 5075725313	316
317	9511·58749252 1482839879·48681 2267132209 8041565641. .981563923 1755686605 0313174400 3116158457 2466128599	317
318	3·3·7·107·6043·6361·6679·69431·13960201·20394401·540701761·22 9890275929. .2805 9810762433·44751303 6651810208 4427698737	318
319	23·89·233·1103·2089·18503·64439·8 4819793631. .9609 3220390955 5426827710 7484843200 2182622501 5228170095 4275029793	319
320	3·5·5·11·17·31·41·257·641·61681·65537·414721·3602561·6700417·4278255361. .4447 9210368001·94 4556849534 8456305599 1838558081	320
321	7·1786 6285599391·162 2592768292 1336339157 8010288127. .2 1051680008 9955301807 2924887925 8818886965 0399862249	321

322	3 · 43 · 47 · 127 · 1289 · 178481 · 2796203 · 3188767 · 4 5076044553 · 1480860771 5315782481 · .8103467492 7597923271 4980036156 4410265219	322
323	647 · 7753 · 131071 · 524287 · 3904435878 8825633753 · .1 2696398284 5458876397 2435091645 2598691857 1846507555 0865591017	323
324	3 · 3 · 3 · 3 · 3 · 5 · 7 · 13 · 19 · 37 · 73 · 109 · 163 · 2593 · 71119 · 87211 · 135433 · 246241 · 262657 · .279073 · 3618757 · 97685839 · 106979941 · 168410989 · 272010961 · 4977454861	324
325	31 · 601 · 1801 · 7151 · 8191 · 5 1879585551 · 14529 5143558111 · .46136793 9193695361 0429590532 0141225322 6033973964 4049093601	325
326	3 · 150287 · 704161 · 110211473 · 1 1281292593 · 2 7669118297 · 102339 8150341859 · .3623045457 0129675721 · 3375 7054705039 0415041769	326
327	7 · 745988807 · 2059727673 4348736647 · 331 5702979495 9983067039 · .881 1616575406 1081804047 · 8700 3598609872 0987332873	327
328	3 · 5 · 17 · 83 · 10169 · 13121 · 13367 · 181549 · 12112549 · 43249589 · 164511353 · 8562191377 · .8831418697 · 12243 8641224656 1215510639 2056552353	328
329	127 · 2351 · 4513 · 12503 · 200033 · 9106063 · 13264529 · 270447871 · .99340183 7923042561 0659608142 8856937819 4109188864 7157503817	329
330	3 · 3 · 7 · 11 · 11 · 23 · 31 · 67 · 89 · 151 · 331 · 683 · 881 · 2971 · 3191 · 20857 · 201961 · 599479 · .48912491 · 415365721 · 225212 7523412251 · 20485 6883529738 0486760231	330
331	1693 7389168607 · 86511 8802936559 · .29 8542624980 1974636137 6721533356 9428005686 4688358212 5372179668 2625551919	331
332	3 · 5 · 167 · 499 · 997 · 1163 · 2657 · 155377 · 13063537 · 1 3455809771 · 4 6202197673 · .20 9957719973 · 14806719 7374074653 · 579 1261411327 5649087721	332
333	7 · 73 · 223 · 1999 · 10657 · 169831 · 321679 · 1238761 · 26295457 · 36085879 · 199381087 · .319020217 · 616318177 · 69 8962539799 · 409646055 9560875111	333
334	3 · 2349023 · 7963 8304766856 5073777786 1629608744 8490695649 · .6235740319 2785191176 6905528625 6140883865 3121833643	334
335	31 · 464311 · 193707721 · 1532217641 · 76 1838257287 · .21505 4093284059 2106005778 3156144213 6184854608 4491128444 8661782641	335
336	3 · 3 · 5 · 7 · 7 · 13 · 17 · 29 · 43 · 97 · 113 · 127 · 241 · 257 · 337 · 673 · 1429 · 2017 · 3361 · 5153 · 5419 · .14449 · 15790321 · 2 5629623713 · 5 4410972897 · 8 8959882481 · 153859 5959564161	336
337	18199 · 2806537 · 9 5763203297 · 72 6584894969 · .78778047 3264667429 9361242084 2416198311 3940080688 2247552723 9136925369	337
338	3 · 2731 · 4057 · 8191 · 674 0339310641 · 492991076 4223610387 · .185262386 4601108673 2742614043 · 3 3407622839 5239532950 6327023033	338
339	7 · 3391 · 23279 · 65993 · 1868569 · 10113049 · 106681 8132868207 · .3200216 2476840557 4452943847 · 4760 1379922835 9986081422 6997712217	339
340	3 · 5 · 5 · 11 · 31 · 41 · 137 · 953 · 1021 · 4421 · 26317 · 43691 · 131071 · 550801 · 23650061 · .722690435 2843746841 · 952097280 6333758431 · 2683142303 6065352611	340
341	23 · 89 · 2147483647 · 556012549 3425335999 · 1269 0114180536 9975317583 · .144421113 7344578755 4135614601 8455080327 6100931567	341
342	3 · 3 · 3 · 7 · 19 · 19 · 73 · 571 · 32377 · 174763 · 524287 · 1212847 · 93507247 · 160465489 · .30426 4563479254 1312037847 · 19 1774583879 4026811634 9766612211	342
343	127 · 6073159 · 1428389887 · 6 2228099977 · 443 2676798593 · .58 9618044748 4416472481 4095915114 3380931461 1824837521 3688557057	343
344	3 · 5 · 17 · 173 · 431 · 9719 · 101653 · 500177 · 2099863 · 3855260977 · 175 9217765581 · .293 2031007403 · 6408215 0767423457 · 14253 4327510312 6327372769	344
345	7 · 31 · 47 · 151 · 14951 · 178481 · 4036961 · 1005 2678938039 · 264650 7710984041 · .1623 8361411159 5675973306 3205096145 7324182993 2932497191	345
346	3 · 347 · 4153 · 730753 · 1505447 · 3 5374479827 · 4 7635010587 · 7008443 6712553223 · .1552 8574328857 2277679887 · 16434 6424772818 9221623609	346
347	141 4318911295 2632419639 · P83	347
348	3 · 3 · 5 · 7 · 13 · 59 · 233 · 349 · 1103 · 2089 · 4177 · 29581 · 3033169 · 107367629 · 536903681 · .2 7920807689 · 985 7737155463 · 2217021 4192500421 · 9607679 1871613611	348
349	177 9973928671 · 34 7203962732 1265779992 0861294559 · .18 5553936486 3068386822 9284313709 3603368550 9547424669 1696225599	349
350	3 · 11 · 31 · 43 · 71 · 127 · 251 · 281 · 601 · 1051 · 1801 · 4051 · 39551 · 86171 · 110251 · 122921 · .60816001 · 34 7833278451 · 3401003 2331525251 · 5353 4762479148 8552837151	350

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352	3 · 5 · 17 · 23 · 89 · 257 · 353 · 397 · 683 · 2113 · 65537 · 229153 · 5304641 · 119782433 · .2931542417 · 4 3872038849 · 27 5509565477 8488426047 7762382801 1666349761	352
353	931921 · 2927 4554768003 0196411680 5545194017 · .6725414 7561119557 8150388018 8940925566 0519600395 7457367584 3402666863	353
354	3 · 3 · 7 · 2833 · 13099 · 37171 · 179951 · 184081 · 1824726041 · 2 7989941729 · 320 3431780337 · .445 3762543897 · 189868549 6465999273 · 921362408 4535989031	354
355	31 · 228479 · 48544121 · 212885833 · 12 1932688511 · .822 3125624363 2928398155 1459269790 5768406610 7973340993 8550717411 1379292321	355
356	3 · 5 · 179 · 1069 · 62020897 · 1858477 4046020617 · 5790 1779199499 9956106149 · .1237940 0392854506 4364330189 · 6189700 1964269013 7449562111	356
357	7 · 7 · 103 · 127 · 239 · 337 · 2143 · 4999 · 11119 · 20231 · 131071 · 6 2983048367 · 13 1105292137 · .2452 6224891371 5001137177 · 8 8894321245 9351249796 3252165417	357
358	3 · 359 · 1433 · 5 8745093521 · 434 7868190665 8793734959 5056277570 7707143803 · .148945910 9360039866 4569401970 9543372166 4951999121	358
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360	3 · 3 · 3 · 5 · 5 · 7 · 11 · 13 · 17 · 19 · 31 · 37 · 41 · 61 · 73 · 109 · 151 · 181 · 241 · 331 · 433 · 631 · 1321 · .23311 · 38737 · 54001 · 61681 · 18837001 · 29247661 · 4562284561 · 16 8692292721 · .46977549 5062434961	360
361	524287 · 952 2401530937 · 36 4505682067 7060879117 8096385783 · .258112211 7924395218 6920238827 4131312903 6848393342 8434308863	361
362	3 · 1811 · 43441 · 1164193 · 7648337 · 31675363 · 7923871 0972852956 2534464766 5764672671 · .1781 0163630112 6245793428 1173397808 5990447907	362
363	7 · 23 · 89 · 727 · 8713 · 599479 · 7593961 · 7 5824014993 · 1 7863938783 6316422785 8270210279 · .33569 4389427634 9540717714 2157304182 3051433281	363
364	3 · 5 · 29 · 43 · 53 · 113 · 127 · 157 · 911 · 1093 · 1093 · 1613 · 2731 · 4733 · 8191 · 224771 · 1210483 · .112901153 · 2 3140471537 · 2 5829691707 · 886108 5190774909 · 55633852 5912325157	364
365	31 · 439 · 8761 · 2298041 · 936 1973132609 · 1382 8603741081 · 8259 5052745831 · .256513 9526231840 7934919734 7817377970 6743128539 0452848441	365
366	3 · 3 · 7 · 367 · 55633 · 76861433 6404564651 · 230584300 9213693951 · .372017086 2530514630 3973352041 · 1772303 9943798878 2976979507 7302561451	366
367	12479 · 51791041 · 7813 8581882953 · 3013111165 4089911444 6723859201 · .197557 4008195191 0036006278 8275098751 2009286363 8283602681	367
368	3 · 5 · 17 · 47 · 257 · 277 · 1013 · 1657 · 30269 · 178481 · 2796203 · 4 3717618369 · .54967540 8461419937 · 39702 9956747290 2879791777 · 2912800 0924361888 8211558641	368
369	7 · 73 · 13367 · 3887047 · 164511353 · 637638 6802464073 · 17772225 3954175633 · .2429301 5036958172 5249341464 4754212492 0559238437 0695685937	369
370	3 · 11 · 31 · 223 · 1481 · 1777 · 25781083 · 28136651 · 616318177 · 158785 5697992791 · .72488085 9928576000 1152755641 · 778 4293653978 8760854061 8330873281	370
371	127 · 743 · 2969 · 6361 · 69431 · 20394401 · 6 3781899287 · 2 0471236659 7949333831 · .1459803 3715563444 4285232523 8769793184 5146475626 6456641329	371
372	3 · 3 · 5 · 7 · 13 · 373 · 5581 · 8681 · 49477 · 384773 · 529510939 · 715827883 · 2147483647 · .2903110321 · 95108 8215727633 · 65881228 8653553079 · 461154528 3086450689	372
373	25569151 · P105	
374	3 · 23 · 89 · 683 · 43691 · 131071 · 707983 · 103 2670816743 8438609988 5005627895 0666491537 · .219116582 5376888084 7501577164 2457906201 5865776131	374
375	7 · 31 · 151 · 601 · 751 · 1801 · 100801 · 10567201 · 26 9089806001 · 471088316 8879506001 · .21397310 2046405409 2520609592 4599407068 1827513979 3055476751	375
376	3 · 5 · 17 · 283 · 2351 · 3761 · 4513 · 13264529 · 1198107457 · 7484047069 · 2 3592342593 · .16 5768537521 · 14073 7471578113 · 450194 6625921233 · 1 8135230685 2476069537	376
377	233 · 1103 · 2089 · 5279 · 8191 · 148055441 · 359661017 · P81	
378	3 · 3 · 3 · 3 · 7 · 7 · 19 · 43 · 73 · 127 · 337 · 379 · 5419 · 87211 · 92737 · 119827 · 262657 · 649657 · .1560007 · 7 7158673929 · 12 7391413339 · 5620 2143607667 · .2076174 8554425839 2970753527	378

379	18 0818808679.P103	
380	3·5·5·11·31·41·191·229·457·761·2281·54721·174763·524287·525313·420778751· .3 0327152671·27669663 1250953741·241692362 0660807201·301134747 9614249131	380
381	7·2287·15241·349759·170141183 4604692317 3168730371 5884105727· .339 2128785962 1179611077 0323541353 2814941272 8532035452 4672773903	381
382	3·383·7068569257·3 9940132241·33258 4516519201·8727449712 4602996457· .10461836 2256444679 3972631570 5346110693 5039257407 7339085483	382
383	1440847·7435494593·5038230 4420458112 9045587727· .15174 9235586808 1261681843 6353130417· .240522700 2351678934 9690025659 9634325263	383
384	3·3·5·7·13·17·97·193·241·257·641·673·769·65537·274177·6700417·22253377· .6728 0421310721·1844674406 9414584321·442499 8269453035 9355647316 4314770689	384
385	23·31·71·89·127·881·3191·55441·122921·201961·197 1764055031·58128364 3249112959· .310553 4168119044 4478126719 7559651345 7115147392 5765532041	385
386	3·6563·13821503·35679139·1871670769·745509 9975844049· .12 8076133738 8845898643·616 5444023324 8340616559· .147322653 2114531733 1353282383	386
387	7·73·431·9719·2099863·11492353·2276 3003975641·68340 4033534957 8249140287· .110530 3606504929 4753459639·3 5489505810 9826355908 4652467359	387
388	3·5·389·971·1553·3881·4657·5821·11447·31817·3555339061·4959325597· .39 4563864677·1763 7260034881·110087601 8364883721· .138426 0723582848 5645766393	388
389	56478911·4765678679.P100	
390	3·3·7·11·31·79·131·151·331·2731·8191·107251·121369·409891·7623851·22366891· .14529 5143558111·5714 0392112607 6957182161·1343041968 4509926257 2814573351	390
391	47·37537·131071·178481·2580624 8225716242 8454918322 4489963592 7231330561· .47352 9906275104 7834629348 9474767666 4271002855 2319600543	391
392	3·5·17·29·43·113·127·197·7057·273617·1007441·15790321·375327457·1 9707683773· .140 5628248417·436 3953127297·443 2676798593·498 1857697937·36456 5561997841	392
393	7·263·36093121·51118297·58352641·10350794 4310551623 8671861923 7468234569· .98333 0461445530 2578430964 2808939555 1222341502 8355534287	393
394	3·7487·19 7002597249·134895935 2853811313·2519515738 6725301225 9144010843· .268288 0399791288 6929710867 0418919894 9048689384 5712448833	394
395	31·2687·12641·202029703·5435488351·1 6203007441·111 3491139767· .3868132159 6249165469 0527257306 3237265865 9771994032 1344865278 2202624081	395
396	3·3·3·5·7·13·19·23·37·67·73·89·109·199·397·683·2113·5347·20857·42373· .153649·235621·312709·599479·4327489·3 3057806959·846 3901912489· .1597 5607282273·24209 9935645987	396
397	2383·6353·50023·53993·202471·5877983·8141328728 0852258794 0886856743· .1 2349042135 7600027254 2841146073·6 5974859102 7032651990 0042655193	397
398	3·16 4504919713·488416409 3883941177 6600490985 8632430297 7543600799· .2678230073 7649837925 6993682056 8604337537 0049896379 8805883563	398
399	7·7·127·337·32377·73417·83791·524287·1212847· .163 5372208527 2539885143 4325720959· .297246 1473987634 4125010817 4337037758 7796038883 8436140673	399
400	3·5·5·5·11·17·31·41·101·251·257·401·601·1601·1801·4051·8101·25601·61681· .268501·340801·2787601·82471201·3173389601·4278255361· .432 3632031270 0288550654 3172618401	400



## Short 2+

### Factorizations of $2^n + 1$ , $n \leq 400$

$n$	Prime Factors
1	3
2	5
3	3·3
4	17
5	3·11
6	5·13
7	3·43
8	257
9	3·3·3·19
10	5·5·41
11	3·683
12	17·241
13	3·2731
14	5·29·113
15	3·3·11·331
16	65537
17	3·43 <sup>6</sup> 91
18	5·13·37·109
19	3·174763
20	17·61681
21	3·3·43·5419
22	5·397·2113
23	3·2796203
24	97·257·673
25	3·11·251·4051
26	5·53·157·1613
27	3·3·3·3·19·87211
28	17·15790321
29	3·59·3033169
30	5·5·13·41·61·1321
31	3·715827883
32	641·6700417
33	3·3·67·683·20857
34	5·137·953·26317
35	3·11·43·281·86171
36	17·241·433·38737
37	3·1777·25781083
38	5·229·457·525313
39	3·3·2731·22366891
40	257·4278255361
41	3·83·8831418697
42	5·13·29·113·1429·14449
43	3·293·2031007403
44	17·353·2931542417

45	$3 \cdot 3 \cdot 3 \cdot 11 \cdot 19 \cdot 331 \cdot 18837001$
46	$5 \cdot 277 \cdot 1013 \cdot 1657 \cdot 30269$
47	$3 \cdot 283 \cdot 16 \cdot 5768537521$
48	$193 \cdot 65537 \cdot 22253377$
49	$3 \cdot 43 \cdot 43^6 \cdot 3953127297$
50	$5 \cdot 5 \cdot 5 \cdot 41 \cdot 101 \cdot 8101 \cdot 268501$
51	$3 \cdot 3 \cdot 307 \cdot 2857 \cdot 6529 \cdot 43691$
52	$17 \cdot 858001 \cdot 308761441$
53	$3 \cdot 107 \cdot 2805 \cdot 9810762433$
54	$5 \cdot 13 \cdot 37 \cdot 109 \cdot 246241 \cdot 279073$
55	$3 \cdot 11 \cdot 11 \cdot 683 \cdot 2971 \cdot 48912491$
56	$257 \cdot 5153 \cdot 5 \cdot 4410972897$
57	$3 \cdot 3 \cdot 571 \cdot 174763 \cdot 160465489$
58	$5 \cdot 107367629 \cdot 536903681$
59	$3 \cdot 2833 \cdot 37171 \cdot 1824726041$
60	$17 \cdot 241 \cdot 61681 \cdot 4562284561$
61	$3 \cdot 76861433 \cdot 6404564651$
62	$5 \cdot 5581 \cdot 8681 \cdot 49477 \cdot 384773$
63	$3 \cdot 3 \cdot 3 \cdot 19 \cdot 43 \cdot 5419 \cdot 7 \cdot 7158673929$
64	$274177 \cdot 6728 \cdot 0421310721$
65	$3 \cdot 11 \cdot 131 \cdot 2731 \cdot 409891 \cdot 7623851$
66	$5 \cdot 13 \cdot 397 \cdot 2113 \cdot 312709 \cdot 4327489$
67	$3 \cdot 7327657 \cdot 671 \cdot 3103182899$
68	$17 \cdot 17 \cdot 354689 \cdot 287 \cdot 9347902817$
69	$3 \cdot 3 \cdot 139 \cdot 2796203 \cdot 16 \cdot 8749965921$
70	$5 \cdot 5 \cdot 29 \cdot 41 \cdot 113 \cdot 7416361 \cdot 47392381$
71	$3 \cdot 56409643 \cdot 1395 \cdot 2598148481$
72	$97 \cdot 257 \cdot 577 \cdot 673 \cdot 48 \cdot 7824887233$
73	$3 \cdot 1753 \cdot 179591803 \cdot 8741070627$
74	$5 \cdot 149 \cdot 593 \cdot 184481113 \cdot 231769777$
75	$3 \cdot 3 \cdot 11 \cdot 251 \cdot 331 \cdot 4051 \cdot 113 \cdot 3836730401$
76	$17 \cdot 1217 \cdot 148961 \cdot 2451 \cdot 7014940753$
77	$3 \cdot 43 \cdot 617 \cdot 683 \cdot 78233 \cdot 3 \cdot 5532364099$
78	$5 \cdot 13 \cdot 13 \cdot 53 \cdot 157 \cdot 313 \cdot 1249 \cdot 1613 \cdot 3121 \cdot 21841$
79	$3 \cdot 2014 \cdot 8763660243 \cdot 8195784363$
80	$65537 \cdot 414721 \cdot 4447 \cdot 9210368001$
81	$3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 19 \cdot 163 \cdot 87211 \cdot 135433 \cdot 272010961$
82	$5 \cdot 10169 \cdot 181549 \cdot 12112549 \cdot 43249589$
83	$3 \cdot 499 \cdot 1163 \cdot 2657 \cdot 155377 \cdot 1 \cdot 3455809771$
84	$17 \cdot 241 \cdot 3361 \cdot 15790321 \cdot 8 \cdot 8959882481$
85	$3 \cdot 11 \cdot 43691 \cdot 2683142303 \cdot 6065352611$
86	$5 \cdot 173 \cdot 101653 \cdot 500177 \cdot 175 \cdot 9217765581$
87	$3 \cdot 3 \cdot 59 \cdot 3033169 \cdot 9607679 \cdot 1871613611$
88	$257 \cdot 229153 \cdot 119782433 \cdot 4 \cdot 3872038849$
89	$3 \cdot 179 \cdot 62020897 \cdot 1858477 \cdot 4046020617$
90	$5 \cdot 5 \cdot 13 \cdot 37 \cdot 41 \cdot 61 \cdot 109 \cdot 181 \cdot 1321 \cdot 54001 \cdot 29247661$
91	$3 \cdot 43 \cdot 2731 \cdot 224771 \cdot 1210483 \cdot 2 \cdot 5829691707$
92	$17 \cdot 2912800 \cdot 0924361888 \cdot 8211558641$
93	$3 \cdot 3 \cdot 529510939 \cdot 715827883 \cdot 2903110321$
94	$5 \cdot 3761 \cdot 7484047069 \cdot 14073 \cdot 7471578113$
95	$3 \cdot 11 \cdot 2281 \cdot 174763 \cdot 301134747 \cdot 9614249131$

96	641.6700417.1844674406.9414584321
97	3.971.1553.31817.110087601.8364883721
98	5.29.113.197.1.9707683773.498.1857697937
99	3.3.3.19.67.683.5347.20857.24209.9935645987
100	17.401.61681.340801.2787601.3173389601
101	3.8451004001.5215293433.1135470251
102	5.13.137.409.953.3061.13669.26317.1326700741
103	3.41.5141630193.814276708.1771726171
104	257.789198817.2627109114.3763623681
105	3.3.11.43.211.281.331.5419.86171.664441.1564921
106	5.15358129.586477649.180143.9824104653
107	3.643.841157474.4904788148.8635567801
108	17.241.433.38737.33975937.13899.1501037953
109	3.104124649.20777.5684736234.8863128179
110	5.5.41.397.2113.41.5878438361.363.0105520141
111	3.3.1777.3331.17539.25781083.10777.5231312019
112	449.2689.65537.183076097.35842.9848460993
113	3.227.48817.636190001.49100336.9344660409
114	5.13.229.457.131101.160969.525313.27.5415303169
115	3.11.691.2796203.1884103651.34576.7385170491
116	17.59393.822801951.6714411983.2390568177
117	3.3.3.19.2731.22366891.53.0230622637.0307681801
118	5.1181.3541.157649.174877.5521693.10.4399276341
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120	97.257.673.394783681.4278255361.4.6908728641
121	3.683.117371.110541845.8279780045.5736061107
122	5.733.1709.3456749.36.8140581013.66.7055378149
123	3.3.83.739.165313.8831418697.1319431.7913029593
124	17.290657.3770202641.11.4162918040.1976895873
125	3.11.251.4051.229668251.55.1948541833.6288303251
126	5.13.29.37.109.113.1429.14449.4.0388473189.11.8750098349
127	3.56713727.8201564105.7722910123.8628035243
128	5964958.9127497217.57.0468920068.5129054721
129	3.3.1033.1591582393.293.2031007403.1568.6603697451
130	5.5.41.53.157.521.1613.51481.34110701.10814.0989558681
131	3.1049.4744297.1823311286.8120778178.4391813611
132	17.241.353.7393.1761345169.2931542417.9.8618273953
133	3.43.4523.174763.1067882904.4384829528.4382097033
134	5.269.15152453.42875177.2559066073.973.9278030221
135	3.3.3.3.11.19.331.811.15121.87211.18837001.38583.8642647891
136	257.383521.236.8179743873.3.7320072247.0799764577
137	3.1097.15619.3212796.3626435681.10549821.2027592977
138	5.13.277.1013.1657.30269.541.5624023749.7033.4392823809
139	3.4506937.51542.6395246617.9530007417.4250365699
140	17.61681.15790321.841798420.7765786201.1867889681
141	3.3.283.1681003.3.5273039401.11.1349165273.16.5768537521
142	5.569.148587949.4999465853.5585522857.47.2287102421
143	3.683.2003.2731.6156182033.1.0425285443.1550.0487753323
144	193.1153.6337.65537.22253377.3.8941695937.27.8452876033
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146	5.293.9929.64930.1712182209.94.4473296560.1851473921
147	3.3.43.5419.748819.436.3953127297.2603288584.5392093851

148	17.2098 8936657440 5864861512 6425661022 2593863921
149	3.1193.650833.38369587.79845595 7350425985 6359124657
150	5.5.5.13.41.61.101.1201.1321.8101.63901.268501.13334701.1182468601
151	3.1871 7738334417.50 8340508241 0077967730 6460621499
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153	3.3.3.19.307.2857.6529.43691.123931.2 6159806891.2743 9122228481
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156	17.241.858001.308761441.841593759 4876209925 4554456081
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158	5.317.3 8136461186 6507317969.6044 6290980621 5075725313
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162	5.13.37.109.246241.279073.3618757.106979941.168410989.4977454861
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164	17.13121.8562191377.12243 8641224656 1215510639 2056552353
165	3.3.11.11.67.331.683.2971.20857.48912491.415365721.225212 7523412251
166	5.997.13063537.4 6202197673.20 9957719973.14806719 7374074653
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168	97.257.673.2017.5153.2 5629623713.5 4410972897.153859 5959564161
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171	3.3.3.19.19.571.174763.160465489.19 1774583879 4026811634 9766612211
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176	65537.5304641.27 5509565477 8488426047 7762382801 1666349761
177	3.3.2833.13099.37171.1824726041.445 3762543897.189868549 6465999273
178	5.1069.5790 1779199499 9956106149.1237940 0392854506 4364330189
179	3.5 8745093521.434 7868190665 8793734959 5056277570 7707143803
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181	3.1811.31675363.1781 0163630112 6245793428 1173397808 5990447907
182	5.29.53.113.157.1093.1093.1613.4733.886108 5190774909.55633852 5912325157
183	3.3.76861433 6404564651.1772303 9943798878 2976979507 7302561451
184	257.4 3717618369.54967540 8461419937.39702 9956747290 2879791777
185	3.11.1481.1777.25781083.28136651.778 4293653978 8760854061 8330873281
186	5.13.373.5581.8681.49477.384773.95108 8215727633.461154528 3086450689
187	3.683.43691.219116582 5376888084 7501577164 2457906201 5865776131
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189	3.3.3.3.19.43.379.5419.87211.119827.7 7158673929.12 7391413339.5620 2143607667
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191	3.10461836 2256444679 3972631570 5346110693 5039257407 7339085483
192	769.274177.6728 0421310721.442499 8269453035 9355647316 4314770689
193	3.6563.35679139.1871670769.745509 9975844049.12 8076133738 8845898643
194	5.389.3881.4657.5821.3555339061.4959325597.39 4563864677.1763 7260034881
195	3.3.11.131.331.2731.107251.409891.7623851.22366891.5714 0392112607 6957182161
196	17.7057.273617.1007441.15790321.375327457.140 5628248417.36456 5561997841
197	3.19 7002597249.134895935 2853811313.2519515738 6725301225 9144010843
198	5.13.37.109.397.2113.42373.235621.312709.4327489.846 3901912489.1597 5607282273
199	3.2678230073 7649837925 6993682056 8604337537 0049896379 8805883563

200	257.1601.25601.82471201.4278255361.432 3632031270 0288550654 3172618401
201	3.3.2011.9649.6324667.7327657.671 3103182899.591515 4911853267 6874448563
202	5.809.9491060093.521 8735279937.60050 3817460697.5342503736 3873248657
203	3.43.59.3033169.596834617.3692022713.252 7158146155 6596241868 8965855731
204	17.17.241.8161.354689.40932193.146 7129352609.287 9347902817.73753 9985835313
205	3.11.83.8831418697.212582056 3389437533 3902438938 3459784675 7304863651
206	5.41201.17325013.520379897.47300015 7711296729.1170 7009745765 6623005977
207	3.3.3.19.139.2796203.16 8749965921.6113142872 4042278348 4044389824 1613032969
208	65537.928513.1 8558466369.2 3877647873.2131 6654212673.71566847 0267111297
209	3.419.683.174763.34 1062328465 4639440707.1 6077920187 8039402409 5514317003
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211	3.4643.9878177.5344743097.19 9061567251.22 4811275125 7517586423 4185190299
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270	5 · 5 · 13 · 37 · 41 · 61 · 109 · 181 · 541 · 1321 · 30241 · 49681 · 54001 · 246241 · 279073 · 29247661 · .16504 1853060421 · 16624293 5471754241	270

## Short 2+

## Prime Factors

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271	3 · 1627 · 11541796 6565804897 · 46 3526001587 3357770993 · .1453023029 4820448549 4451955596 4740294049	271
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344	257 · 4129 · P98	344
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354	5 · 13 · 709 · 1181 · 3541 · 12037 · 31153 · 157649 · 174877 · 5397793 · 5521693 · 94789873 · .10 4399276341 · 2084785 8316750657 · 29952400 8711790907 8735942093	354
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367	3.2203.19819.146264881313513.20837062885084633147. .460233616861852066165180033789571.1636198597169607245088331633873083979	367
368	65537.76392570609857.1335570346574631363954390476479681. .89915373937922777877614505795576574280561874130802566460033	368
369	3.3.3.19.83.739.18451.165313.174907.8831418697.26309368807003. .13194317913029593.23365041083799063007245010292408927930007906086731	369
370	5.5.41.149.593.29246281.184481113.231769777.567471221.1392776941. .4964166554103541.1258710725115650761.4299881834172078350686174001	370
371	3.43.107.28059810762433.18351945672220987.10471846336802440580575859. .90338901802490793533882683.715302895574501987260955609	371
372	17.241.1489.29761.290657.3770202641.22415398357688737. .1141629180401976895873.1889440425670100451996180195442651130966948029537	372
373	3.60427.694579497316894264425661243659806371972188318857. .152796756325290043462779779478758328705905947521327614399129	373
374	5.137.397.953.2113.5237.26317.551353793.26509131221.1819762572673. .35155077044989397.4029292065629191839853.135322045917118601273437	374
375	3.3.11.251.331.2251.4051.229668251.1133836730401.5519485418336288303251. .19963778429046466946251.35758633131596900685051378954141001	375
376	257.3308801.3853249.487073399939357470433.163875530636702837695009. .2673989784183378728255297.220079330589145989807908723201	376
377	3.59.2731.3033169.13454377.P95	
378	5.13.29.37.109.113.757.1429.14449.246241.279073.40388473189.118750098349. .456376431053626339473533320957.304832756195865229284807891468769	378
379	3.15012732261073.728040923721821697586308784409. .37551870149160225933510841998425767070380445542467219009673638189257459	379
380	17.1217.61681.148961.24517014940753.3435950210316335724157758000789490561. .153787279330237476887106331233239525756635010497681	380
381	3.3.3049.38257184231365987.56713727820156410577229101238628035243. .82723179283707558079607521798312521771184766697594996913	381
382	5.3821.25212001.5972216269.89618875387061. .1833085153842665442652283234165143433597. .20844252715379252090938485003447004944677	382
383	3.1351710731785981752792617.5609122817914313723820539. .866140553743041477859225887851118773868045256339779536563782349481	383
384	59649589127497217.5704689200685129054721.349621839326921795694385454593. .331192380488114152600457428497953408512758882817	384
385	3.11.11.43.281.617.683.2971.78233.86171.48912491.219980531.35532364099. .4362989211422861340320935785851.1276130308645500829341614664372811	385
386	5.773.3089.148997.14402030644704405877.635283689603233836449. .378791300027089635677652285973.25564774360363212740382247547878573	386

## Short 2+

## Prime Factors

xxxiv

387	3 · 3 · 3 · 19 · 1033 · 1591582393 · 293 2031007403 · 1568 6603697451 · · 1090536789 6894030236 4939183451 · · 7451156 8294243628 8633065028 2569882523 9868474219	387
388	17 · 25507121 · P109	
389	3 · 107 4456464321 · 136937 9108017267 · 274209 4407638203 · P75	
390	5 · 5 · 13 · 13 · 41 · 53 · 61 · 157 · 313 · 521 · 1249 · 1321 · 1613 · 2341 · 3121 · 21841 · 51481 · · 468781 · 34110701 · 723447661 · 10814 0989558681 · · 892527 8993793241 · 7204 5377242751 8446437641	390
391	3 · 2347 · 43691 · 1578859 · 2796203 · 194902553 · 29143833 4156037699 · · 2911194824 8642861801 · 22 4571405277 1430777876 1430067868 3897932954 9117936841	391
392	257 · 3137 · 5153 · 50177 · 101921 · 258721 · 5 4410972897 · P83	
393	3 · 3 · 787 · 1049 · 4744297 · 1823311286 8120778178 4391813611 · · 7237 4970654455 4305500305 7643920459 · · 43 3685074806 8862980289 1926711765 5888254843	393
394	5 · 4729 · 52009 · 1079423677 · 15 2874915601 · 51480 3697091705 0130439411 8553664009 · · 38621 6338580579 8697201354 7951946615 1272644136 4448411929	394
395	3 · 11 · 5531 · 1415681 · 2014 8763660243 8195784363 · P85	
396	17 · 241 · 353 · 433 · 7393 · 38737 · 1761345169 · 2931542417 · 9 8618273953 · 31 1712063697 · · 5 6695862294 8012073585 6356719714 1118195727 7548591444 4634179633	396
397	3 · 13499 · 321571 · 476401 · 17414009 · P97	
398	5 · 797 · 7655 4648784441 · 209907 3106303095 0253038854 6087971791 8033130293 · · 10081167 1534441046 1444141839 6101802392 2317850375 1442552629	398
399	3 · 3 · 43 · 571 · 4523 · 5419 · 63841 · 174763 · 160465489 · 113556903 2520567138 0495907537 · · 1067882904 4384829528 4382097033 · 109 8012961987 4039209485 8844294643	399
400	65537 · 414721 · 4447 9210368001 · 339942637 7632056001 · 48504 8422208437 1979240001 · · 1295 4118820893 5646963818 8447165919 8620897441 0651257601	400

Factorizations of  $10^n - 1$ ,  $n \leq 150$ 

$n$	Prime Factors
1	3·3
2	3·3·11
3	3·3·3·37
4	3·3·11·101
5	3·3·41·271
6	3·3·3·7·11·13·37
7	3·3·239·4649
8	3·3·11·73·101·137
9	3·3·3·3·37·333667
10	3·3·11·41·271·9091
11	3·3·21649·513239
12	3·3·3·7·11·13·37·101·9901
13	3·3·53·79·265371653
14	3·3·11·239·4649·909091
15	3·3·3·31·37·41·271·2906161
16	3·3·11·17·73·101·137·5882353
17	3·3·2071723·5363222357
18	3·3·3·3·7·11·13·19·37·52579·333667
19	3·3·11111111111111111111
20	3·3·11·41·101·271·3541·9091·27961
21	3·3·3·37·43·239·1933·4649·10838689
22	3·3·11·11·23·4093·8779·21649·513239
23	3·3·11111111111111111111111111111111
24	3·3·3·7·11·13·37·73·101·137·9901·99990001
25	3·3·41·271·21401·25601·182521213001
26	3·3·11·53·79·859·265371653·1058313049
27	3·3·3·3·3·37·757·333667·440334654777631
28	3·3·11·29·101·239·281·4649·909091·121499449
29	3·3·3191·16763·43037·62003·77843839397
30	3·3·3·7·11·13·31·37·41·211·241·271·2161·9091·2906161
31	3·3·2791·6943319·57336415063790604359
32	3·3·11·17·73·101·137·353·449·641·1409·69857·5882353
33	3·3·3·37·67·21649·513239·1344628210313298373
34	3·3·11·103·4013·2071723·5363222357·21993833369
35	3·3·41·71·239·271·4649·123551·102598800232111471
36	3·3·3·3·7·11·13·19·37·101·9901·52579·333667·99999000001
37	3·3·2028119·247629013·2212394296770203368013
38	3·3·11·909090909090909091·11111111111111111111111111111111
39	3·3·3·37·53·79·265371653·900900900990990990991
40	3·3·11·41·73·101·137·271·3541·9091·27961·1676321·5964848081
41	3·3·83·1231·538987·201763709900322803748657942361
42	3·3·3·7·7·11·13·37·43·127·239·1933·2689·4649·459691·909091·10838689
43	3·3·173·1527791·1963506722254397·2140992015395526641
44	3·3·11·11·23·89·101·4093·8779·21649·513239·1052788969·1056689261

45	3 · 3 · 3 · 3 · 31 · 37 · 41 · 271 · 238681 · 333667 · 2906161 · 418550283 0133110721	
46	3 · 3 · 11 · 47 · 139 · 2531 · 54979 7184491917 · 111 1111111111 1111111111	
47	3 · 3 · 35121409 · 316362908 7634585250 0140615403 8726382279	
48	3 · 3 · 3 · 7 · 11 · 13 · 17 · 37 · 73 · 101 · 137 · 9901 · 5882353 · 99990001 · 999999 9900000001	
49	3 · 3 · 239 · 4649 · 505885997 · 1976 7301445981 9096356802 3014679333	
50	3 · 3 · 11 · 41 · 251 · 271 · 5051 · 9091 · 21401 · 25601 · 18 2521213001 · 7887 5943472201	
51	3 · 3 · 3 · 37 · 613 · 210631 · 2071723 · 52986961 · 5363222357 · 1316816 4561429877	
52	3 · 3 · 11 · 53 · 79 · 101 · 521 · 859 · 265371653 · 1058313049 · 19 0038197677 7332243781	
53	3 · 3 · 107 · 1659431 · 132581526 7337711173 · 471988 5879949142 5660200071	
54	3 · 3 · 3 · 3 · 3 · 7 · 11 · 13 · 19 · 37 · 757 · 52579 · 333667 · 70541929 · 1 4175966169 · 44033 4654777631	
55	3 · 3 · 41 · 271 · 1321 · 21649 · 62921 · 513239 · 83251631 · 13006 3569267805 8358830121	
56	3 · 3 · 11 · 29 · 73 · 101 · 137 · 239 · 281 · 4649 · 7841 · 909091 · 121499449 · 1 2752200102 0150503761	
57	3 · 3 · 3 · 37 · 21319 · 10749631 · 1111111111 1111111111 · 39311 2302230512 9377976519	
58	3 · 3 · 11 · 59 · 3191 · 16763 · 43037 · 62003 · 7 7843839397 · 1540832 0493066255 7781201849	
59	3 · 3 · 255 9647034361 · 434087 6285657460 2121445342 8992855982 6755746751	
60	3 · 3 · 3 · 7 · 11 · 13 · 31 · 37 · 41 · 61 · 101 · 211 · 241 · 271 · 2161 · 3541 · 9091 · 9901 · 27961 · .2906161 · 4188901 · 39526741 60	
61	3 · 3 · 733 · 4637 · 329401 · 974293 · 1360682471 · 10600 7173861643 · 706170999 0156159479	
62	3 · 3 · 11 · 2791 · 6943319 · 5733641506 3790604359 · 9090909090 9090909090 9090909091	
63	3 · 3 · 3 · 3 · 37 · 43 · 239 · 1933 · 4649 · 10837 · 23311 · 45613 · 333667 · 10838689 · 45121231 · .192143 6048294281 63	
64	3 · 3 · 11 · 17 · 73 · 101 · 137 · 353 · 449 · 641 · 1409 · 19841 · 69857 · 976193 · 5882353 · 6187457 · .83442 7406578561 64	
65	3 · 3 · 41 · 53 · 79 · 271 · 265371653 · 16 2503518711 · 5538396 9973640240 5628651064 0780600481	
66	3 · 3 · 3 · 7 · 11 · 11 · 13 · 23 · 37 · 67 · 4093 · 8779 · 21649 · 513239 · 599144041 · 18 3411838171 · .134462821 0313298373 66	
67	3 · 3 · 493121 · 7986359577 8924342083 · 2 8213380943 1766670012 6315366099 9177245677	
68	3 · 3 · 11 · 101 · 103 · 4013 · 2071723 · 28559389 · 1491383821 · 5363222357 · 2 1993833369 · .232455 7465671829 68	
69	3 · 3 · 3 · 37 · 277 · 20386 4078068831 · 111 1111111111 1111111111 · .15953520 8632922464 4348978893 69	
70	3 · 3 · 11 · 41 · 71 · 239 · 271 · 4649 · 9091 · 123551 · 909091 · 4147571 · 10259880 0232111471 · .26521279 3249617641 70	
71	3 · 3 · 2415731423 9362767357 6957439049 · 4 5994811347 8868463102 2172889522 3034301839	
72	3 · 3 · 3 · 3 · 7 · 11 · 13 · 19 · 37 · 73 · 101 · 137 · 3169 · 9901 · 52579 · 98641 · 333667 · 99990001 · .99 9999000001 · 319904 4596370769 72	
73	3 · 3 · 1 2171337159 · 185519384 2151350117 · .4920 7341634646 3269340017 3948250213 1487446637 73	
74	3 · 3 · 11 · 7253 · 2028119 · 247629013 · 42265 0073734453 · 29655734 7313446299 · .22 1239429677 0203368013 74	
75	3 · 3 · 3 · 31 · 37 · 41 · 151 · 271 · 4201 · 21401 · 25601 · 2906161 · 18 2521213001 · .15763 9855537391 9170916417 0940063151 75	
76	3 · 3 · 11 · 101 · 72281703 6322379041 · 90909090 9090909091 · 1111111111 1111111111 · .136977818 7490592461 76	
77	3 · 3 · 239 · 4649 · 5237 · 21649 · 42043 · 513239 · 29920507 · .13661 4668576002 3293714964 4755591574 0910181043 77	
78	3 · 3 · 3 · 7 · 11 · 13 · 13 · 37 · 53 · 79 · 157 · 859 · 6397 · 216451 · 265371653 · 1058313049 · .38 8847808493 · 9009 0090090099 0990990991 78	
79	3 · 3 · 317 · 6163 · 10271 · 307627 · 4917219553 6083790769 · .366 0574762725 5214615271 4056487508 0461079917 79	
80	3 · 3 · 11 · 17 · 41 · 73 · 101 · 137 · 271 · 3541 · 9091 · 27961 · 1676321 · 5070721 · 5882353 · .5964848081 · 197210 6116664671 7498359681 80	
81	3 · 3 · 3 · 3 · 3 · 37 · 163 · 757 · 9397 · 333667 · 2462401 · 44033 4654777631 · .67642 1558270641 · 1306548 9780800777 8425046117 81	

82	3 · 3 · 11 · 83 · 1231 · 538987 · 267050278 1396266997 · 34 0419382980 6058997303 · .2017637099 0032280374 8657942361	82
83	3 · 3 · 336 7147378267 · 95125385 0862415437 3682136329 · .34 6895716385 8578045447 4113739450 5425384477	83
84	3 · 3 · 3 · 7 · 7 · 11 · 13 · 29 · 37 · 43 · 101 · 127 · 239 · 281 · 1933 · 2689 · 4649 · 9901 · 226549 · .459691 · 909091 · 10838689 · 121499449 · 445819222 3320340849	84
85	3 · 3 · 41 · 271 · 2071723 · 262533041 · 5363222357 · 811 9594779271 · .422 2100119405 5301701793 3119029148 8789678081	85
86	3 · 3 · 11 · 173 · 1527791 · 57009401 · 2182600451 · 196350 6722254397 · .214099201 5395526641 · 73061 1655657181 7748755241	86
87	3 · 3 · 3 · 37 · 3191 · 4003 · 16763 · 43037 · 62003 · 72559 · 7 7843839397 · .31017025 1658029759 0451577932 3733949834 2763245483	87
88	3 · 3 · 11 · 11 · 23 · 73 · 89 · 101 · 137 · 617 · 4093 · 8779 · 21649 · 513239 · 1052788969 · .1056689261 · 16205834 8460129675 8492708265 6402106953	88
89	3 · 3 · 497867 · 103733951 · 10 4984505733 · 50785 5496602631 5671444089 · .403513310 2228090532 8493281847 5878953159	89
90	3 · 3 · 3 · 3 · 7 · 11 · 13 · 19 · 31 · 37 · 41 · 211 · 241 · 271 · 2161 · 9091 · 29611 · 52579 · 238681 · .333667 · 2906161 · 3762091 · 898 5695684401 · 418550283 0133110721	90
91	3 · 3 · 53 · 79 · 239 · 547 · 4649 · 14197 · 17837 · 4262077 · 265371653 · 4 3442141653 · .31687736 5766624209 · 1107421 8647053005 4291318013	91
92	3 · 3 · 11 · 47 · 101 · 139 · 1289 · 2531 · 1837 1524594609 · 54979 7184491917 · .111 1111111111 1111111111 · 41810033 0007166986 7932658901	92
93	3 · 3 · 3 · 37 · 2791 · 6943319 · 5733641506 3790604359 · .9009009009 0090090090 0900900900 9909909909 9099099099 0990990991	93
94	3 · 3 · 11 · 6299 · 35121409 · 485506 7598095567 · 2972627 0500913900 6771611927 · .316362908 7634585250 0140615403 8726382279	94
95	3 · 3 · 41 · 191 · 271 · 59281 · 63841 · 1111111111 1111111111 · .12899812 3195084954 3985493631 · 965 1946171216 4079145607 0347951751	95
96	3 · 3 · 3 · 7 · 11 · 13 · 17 · 37 · 73 · 97 · 101 · 137 · 353 · 449 · 641 · 1409 · 9901 · 69857 · 206209 · .5882353 · 99990001 · 6 6554101249 · 7511 8313082913 · 999999 9900000001	96
97	3 · 3 · 12004721 · 846035 7313969192 3376721153 7899097169 · .1093 9984685537 0537540339 2668420701 1910766229 6580348039	97
98	3 · 3 · 11 · 197 · 239 · 4649 · 909091 · 505885997 · 1976 7301445981 9096356802 3014679333 · .5076141624 3655329949 1878172639 5939035533	98
99	3 · 3 · 3 · 3 · 37 · 67 · 199 · 397 · 21649 · 34849 · 333667 · 513239 · 134462821 0313298373 · .3 6285372434 2990469324 7662354742 6886978631 1886053883	99
100	3 · 3 · 11 · 41 · 101 · 251 · 271 · 3541 · 5051 · 9091 · 21401 · 25601 · 27961 · 60101 · 7019801 · .18 2521213001 · 1410 3673319201 · 7887 5943472201 · 168058 8011350901	100
101	3 · 3 · 45315301 8181661323 4555190841 · 129 0632822328 4896195198 5354966759 · .1 8998088572 8193752528 4207842137 4368604969	101
102	3 · 3 · 3 · 7 · 11 · 13 · 37 · 103 · 613 · 4013 · 210631 · 2071723 · 52986961 · 5363222357 · .2 1993833369 · 29 1078844423 · 1316816 4561429877 · 3 7752695530 9799110357	102
103	3 · 3 · 1031 · 7034077 · P93	
104	3 · 3 · 11 · 53 · 73 · 79 · 101 · 137 · 521 · 859 · 1580801 · 265371653 · 1058313049 · .19 0038197677 7332243781 · 63 2527440202 1507450906 2241224544 3923049201	104
105	3 · 3 · 3 · 31 · 37 · 41 · 43 · 71 · 239 · 271 · 1933 · 4649 · 123551 · 2906161 · 10838689 · .3 0703738801 · 62 5437743071 · 10259880 0232111471 · 578020 5030878619 1965409441	105
106	3 · 3 · 11 · 107 · 1659431 · 132581526 7337711173 · 471988 5879949142 5660200071 · .90 9090909090 9090909090 9090909090 9090909090 9090909091	106
107	3 · 3 · 643 · 999809 · 9885089 · 215257037 · 2386760191 · 51139953 8427507881 · .64682695 0155548399 · 10288079 4672225387 9130231155 6310051849	107
108	3 · 3 · 3 · 3 · 3 · 7 · 11 · 13 · 19 · 37 · 101 · 109 · 757 · 9901 · 52579 · 153469 · 333667 · 70541929 · .1 4175966169 · 99 9999000001 · 44033 4654777631 · 597795771 5633453386 6654838281	108
109	3 · 3 · 1192679 · 7 1276748097 1213008079 · 52 9527534876 7234696493 · .2468297439 8435543596 2408390910 3782185372 8210515008 6881669547	109
110	3 · 3 · 11 · 11 · 23 · 41 · 271 · 331 · 1321 · 4093 · 5171 · 8779 · 9091 · 21649 · 62921 · 513239 · .83251631 · 2 0163494891 · 3187 2784116567 4579776721 · 13006 3569267805 8358830121	110



135	3·3·3·3·3·31·37·41·271·757·238681·333667·1577071·2906161·16357951· .310362841·25 8360989311·44033 4654777631·418550283 0133110721· .483418418 5972206772 3851735391 5231961831	135
136	3·3·11·73·101·103·137·4013·2071723·28559389·152533657·1491383821· .5363222357·2 1993833369·232455 7465671829· .655527 4617188258 3264230070 8688843668 7780323722 2654400793	136
137	3·3·2467·2535528323·10298 7975692876 2117455431·1401758 9416299060 9843314797·P74	
138	3·3·3·7·11·13·37·47·139·277·2531·31051·14357 4021480139·20386 4078068831· .54979 7184491917·111 1111111111 1111111111·246494 4534764905 9192745899· .15953520 8632922464 4348978893	138
139	3·3·11912 4859925363·P124	
140	3·3·11·29·41·71·101·239·271·281·421·3541·4649·9091·27961·123551·909091· .3471301·4147571·13489841·121499449·6 0368344121·10259880 0232111471· .26521279 3249617641·8 4865448387 9497562821	140
141	3·3·3·37·283·35121409·72103049 8171501831· .316362908 7634585250 0140615403 8726382279· .44 1506346488 3600484821 1413514191 9313523563 7149481071 6121566453 3500695867	141
142	3·3·11·290249·2415731423 9362767357 6957439049· .4 5994811347 8868463102 2172889522 3034301839· .31321 0694641810 6835541520 9323405389 5417069794 9315618971 6729115659	142
143	3·3·53·79·21649·513239·2823679·180523201·265371653· .47 4286764445 9170572792 9369346443·P74	143
144	3·3·3·3·7·11·13·17·19·37·73·101·137·3169·8929·9901·52579·98641·333667· .5882353·99990001·99 9999000001·319904 4596370769·999999 9900000001· .11199 4624258035 6142905139 4333072012 5433979169	144
145	3·3·41·271·3191·16763·43037·62003·9605671·7 7843839397· .1558928097 4996818911·80684370 0012696988 5399615167 0133742711· .74490973 1145732233 9936139310 8905952897 7143716201	145
146	3·3·11·293·1 2171337159·185519384 2151350117·108266849 6453995983 7294043117· .28 6578888976 1949979999 2259233090 8602103011· .4920 7341634646 3269340017 3948250213 1487446637	146
147	3·3·3·37·43·239·1933·4649·63799·4715467·10838689·505885997· .26765 2966241599·260394188 3787374089·1976 7301445981 9096356802 3014679333· .4769337181 4649591479 9770475387 6850429427	147
148	3·3·11·101·149·3109·7253·111149·2028119·247629013·70 8840373781· .42265 0073734453·29655734 7313446299·6 6903168666 1427842829· .22 1239429677 0203368013·405481405 1406277475 8071840361	148
149	3·3·12517·53559 6779200919·P130	
150	3·3·3·7·11·13·31·37·41·151·211·241·251·271·2161·4201·5051·9091·21401·25601· .2906161·18 2521213001·7887 5943472201·15763 9855537391 9170916417 0940063151· .1 0000099999 9999899998 9999900000 0000100001	150



# Short 10+

## Factorizations of $10^n + 1$ , $n \leq 150$

$n$	Prime Factors
1	11
2	101
3	7 · 11 · 13
4	73 · 137
5	11 · 9091
6	101 · 9901
7	11 · 909091
8	17 · 5882353
9	7 · 11 · 13 · 19 · 52579
10	101 · 3541 · 27961
11	11 · 11 · 23 · 4093 · 8779
12	73 · 137 · 99990001
13	11 · 859 · 1058313049
14	29 · 101 · 281 · 121499449
15	7 · 11 · 13 · 211 · 241 · 2161 · 9091
16	353 · 449 · 641 · 1409 · 69857
17	11 · 103 · 4013 · 2 1993833369
18	101 · 9901 · 99 9999000001
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- 136 17·17·5882353·1 3355595217·P117
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- 138 101·829·1289·9901·1569889·1837 1524594609·53643053 1035337769·  
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- 139 11·557·2503·P132
- 140 73·137·7841·851761·1676321·5964848081·1 2752200102 0150503761·P91

## Short 10+

## Prime Factors

xliv

141	7.11.13.6299.344887.9127213.485506 7598095567.11 6080338393 4463712259. .2972627 0500913900 6771611927. .300735662 7055904894 8142559741 5127087965 9052470389 2560552659	141
142	101.569.7669.38062384 9488714809.7 7169265188 3350877868 9508504941. .93611 3822875139 5032943162 5811490669. .8251988265 9061966708 7624834867 1944663928 8430446081	142
143	11.11.23.859.4093.8779.51767.1058313049.2 2144088539.26 4752347289. .1 0473010110 7272149081.P74	143
144	97.353.449.641.1409.13249.69857.206209.1067329.6 6554101249.7511 8313082913.P86	
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146	101.5911541.1669 2085818029.577429 4197526381.1822027 4280260783 5615596881.P82	
147	7.7.7.11.13.127.197.2689.459691.909091. .5076141624 3655329949 1878172639 5939035533.P84	147
148	73.137.61544617.1644476 5848115921.P120	
149	11.2087.96 1568303145 0065714899. .16545960 9176797865 8661343653 2979227063 5207840943.P76	149
150	61.101.601.3541.9901.27961.60101.261301.3903901.4188901.7019801.39526741. .16 8290119201.1410 3673319201.168058 8011350901.2507409103 8628125301. .38654 6587957181 5645672995 8859629701	150

### III. Introduction to the Main Tables\*.

“The invention of new [factorization] methods may push off the limits of the unknown a little farther, just as the invention of a new astronomical instrument may push off a little the boundaries of the physical universe; but the unknown regions are infinite, and if we could come back a thousand years from now, we should no doubt find workers in the theory of numbers announcing in the journals new schemes and new processes for the resolution of a given number into its factors.”

*D. N. Lehmer* [66]

#### A. The Cunningham-Woodall Tables and Their Influence— The Cunningham Project

In 1925, Lt.-Col. Allan J. C. Cunningham and H. J. Woodall published a small volume of tables [11] of factorizations of  $b^n \pm 1$  for the bases  $b = 2, 3, 5, 6, 7, 10, 11, 12$  to various high powers  $n$ . These tables collected from scattered sources the known prime factors for the bases 2 and 10 and also presented the authors’ results of thirty years’ work with these and the other bases. (See [11, pp. xii, xviii] and [55] for a general survey of factor tables.)

For decades these useful tables served as a basic reference on factors of these numbers. The tables were not only a summary of what was known, but a disclosure of what was not. Furthermore, by leaving blanks in the tables where new factors could be entered, by putting question marks on numbers of unknown character, and by giving credit to those who had discovered notable prime factors in the past, the authors stimulated work on the remaining composite numbers in the tables.

In the *Introduction* to the tables, a somewhat unsatisfactory account of the multiplicative structure of  $b^n \pm 1$  was given in a rather finicky notation and terminology. Many useful examples were given to illustrate how numbers of the different forms factor. However, much remained unsaid as to just how the numbers factor algebraically and how the various algebraic factors divide one another.

This is particularly true in the section on Aurifeuillian factorization, where there is no mention of the form of the primitive part in such factorizations. As is clear from the parenthetical remark at the bottom of page vi, the authors knew neither this form nor the rule that determines which L or M will divide another L or M [36, p. 181]. All in all, though, this pleasant and important little book—a labor of love—was and is much valued by those who are fortunate enough to own a copy.

In the fifty years following 1925, some copies of these tables became so filled with inserted factors and other information that the present volume, which we consider to be an extension and an updating of the earlier tables, comes none too soon. Many new prime factors have been discovered in the last thirty years through the use of computers and by new methods of factoring and primality testing. Evidence of this abundance can be seen, for example, in the fact that all the numbers in the

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\*The text of this Introduction is essentially that used in the first edition. A few typographical errors were corrected and the old status report was deleted. The new text for the second edition appears in Section IV. The new text for the third edition appears in Section V.

Cunningham-Woodall base three tables (up to  $n = 111$ ) are completely factored in the present work, and that it is no longer feasible to keep track of the discoverers of all the new prime factors.

In a way, it is sad that rapid and accurate automatic computers have spoiled the hand calculator's pleasure and feeling of accomplishment in factoring what was an immense number. Indeed, many of the factors in these tables were monuments in their day to this kind of achievement. But transcending the limits of human power by machines can bring with it, all the same, a new sense of power in achievement and also a freedom from drudgery which may well stimulate the devising of new methods and the setting of new goals when the old goals are reached. And certainly, there is still a real feeling of accomplishment in breaking apart some huge number which has withstood assaults for decades, especially when in doing so one has had to devise and carefully carry out some new computational scheme. The current invasion of small electronic computers into homes and offices may well lead to renewed interest in attacking the large composite numbers still remaining in these tables.

For many years we have referred to the ongoing work on these tables as "The Cunningham Project". As new factors have been found or primality tests have been completed, the accumulation of information has prompted a continual reorganization of the data into forms better suited to updating. The new data, which at first were written in the Cunningham-Woodall tables, were later transferred to boxes of Hollerith cards, making the modification and listing of the tables much simpler. In 1968 BT (authors' initials will be used throughout this work), using an IBM 360/67 at the Thomas J. Watson IBM Research Laboratories, systematically found all factors  $< 10^8$  of most of the entries in the present tables (except for base 2), of which many were new. He also discovered the compositeness or probable-primality of all the cofactors using Fermat's congruence, at the suggestion of JLS. This information was incorporated manually into the files of Hollerith cards. In 1970, Mike Morrison and JB subjected the resulting tables to a computer checking scan on the IBM 360/91 at UCLA. Several errors were discovered among the data manually accumulated over the years. In later years, the data were placed in a data set (disk file) on the computer system at Northern Illinois University, DeKalb, along with all the primality testing information that had accumulated for years in an impressive stack of computer printout.

With all the information in a data set (and the large stack of printout happily thrown away), new formats were devised which provided for a simple presentation of prime and algebraic factors in the tables in which a prime factor is listed as such only once at its first appearance. Some of the remaining problems in the tables were identified and listed, and the factoring and primality testing programs available at DeKalb were set to work in an attempt to solve these problems.

Substantial progress has been made over the last several years, and the range of  $n$  has been extended in each table, although we have used only the original bases of the Cunningham-Woodall tables.

The present tables are now at the limits of what can be done by factoring through 50 digits using the method in [75], although more progress will no doubt be made when the two excellent factoring methods of J. M. Pollard [80, 81] have been used more. We have listed in Appendix C the remaining composite cofactors with 64 or fewer digits as an aid or a challenge to venturesome readers. (See IV for the progress made between the first and second editions of this book.)

When the tables were essentially ready for distribution, SSW wrote and ran a checking program which tested the factorizations in the different tables to see if: (1) a listed factor actually divided the respective number; (2) all factors were present in complete factorizations; (3) all factors listed were probable primes base 13; (4) the line numbers listed in parentheses were complete and correct. Minor checking was also done to see if the lengths of cofactors were correct and if periods and parentheses were in the right places. Finally, the cofactors themselves were again checked as probable primes base 13 and were stored in the proper appendices along with their labels and lengths.

## B. Developments Contributing to the Present Tables.

Since 1925, tremendous developments in technology, factorization and primality testing have contributed to the enlargement and improvement of the Cunningham-Woodall tables. In the account which follows, we have tried to give both a technical and a personal review of events that have been an engrossing and, at times, an exciting part of our lives for many years. Although this account is in no way a history of the developments in these various fields, we do seek to present, as they were seen by us, those aspects which relate to the Cunningham Project.

We have tried to mention those who have contributed in some significant way to these events. It is perhaps worth remarking that few people have ever busied themselves with actually factoring  $b^n - 1$  or with testing numbers for primality. We regret this and hope this volume will stimulate others to add to our knowledge of these things.

### 1. Developments in Technology.

The main technological developments that helped to bring the factor tables into their present form are listed below in roughly chronological order.

(a) *Automatic Multiply and Divide.* In about 1925 automatic multiply and divide operations became available on mechanical calculators in the United States. This improvement reduced errors and computing time, enough so that hand calculation in factorization and primality testing could persist until rather recently. Now, however, even the more accessible calculations are usually done by electronic computers.

Some who worked by hand on problems relating to  $b^n - 1$  after 1925 were D. N. Lehmer, DHL and Emma Lehmer [40], M. Kraitchik [34, 35], P. Poulet [83 and see 56], H. S. Uhler [105, 106], A. Ferrier [14 to 19], N. G. W. H. Beeger [1], R. E. Powers [84], E. Gabard [6, 20, 31], and K. R. Isemonger [3, 6, 29, 30, 31]. Their results, usually obtained after long hours of work at a desk calculator, are a tribute to diligent and careful computation.

(b) *The Bicycle-chain Sieve* [42, 64]. This machine was built by DHL in 1927 and was the first fully automatic machine to be used for factoring and primality testing. (Prior to this, paper strip methods had been used for hand-sifting [33, Ch. 2], as well as various stencil devices such as the factor stencils of D. N. Lehmer [67, 69, 40, p. 336] and the Hollerith card stencils of J. D. Elder [13].) The scanning rate of the machine was 50 numbers per second, and it produced impressive results for its day, such as the two factorizations

$$10^{20} + 1 = 73.137.1676321.5964848081$$

$$2019210335106439 = 25709599.78539161$$



these latter being factors of  $3^{111} + 1$ .

(c) *The Photoelectric Number Sieve* [10, 48, 49, 50, 64]. This machine was built in 1932 by DHL and his associates. It used electronics that were advanced for its time, as well as high-precision gears to carry out the sifting. Among its many results are the two factorizations

$$\begin{aligned} 2^{79} - 1 &= 2687.202029703.1113491139767 \\ 2^{93} + 1 &= 3^2.529510939.715827883.2903110321 \end{aligned}$$

and a proof that the cofactor 3011347479614249131 of  $2^{95} + 1$  is a prime. The scanning rate of this machine was 5000 numbers per second. For a delightful account by D. N. Lehmer of the photoelectric number sieve, see [68]. (See the status report in section **V B** for more about this machine.)

(d) *The ENIAC (Electronic Numerical Integrator and Computer)*. In [57] and [62] DHL gave an account of how “during a holiday weekend” this machine produced 85 new factors of  $2^k \pm 1$  for  $k \leq 500$ . (See [56, 63].) Collecting the results was pleasantly overwhelming—“picking plums at waist height”—considering that a few new factors would be all that the most industrious hand computer would expect to find in months of labor. Here, then, was already an example of a practice that was to be repeated over and over again in the decades to follow: letting a computer factor and test for primality on *idle time*. Many results in these tables were obtained on idle time, quite often to the benefit of the machines which were better left running than being shut down. (In at least two instances these machine-language programs, which the machine operators and IBM engineers came to regard as *test programs*, detected intermittent hardware failures which had evaded the standard machine tests.) The vast amount of time spent organizing the extensive output and the cases to be run, and preparing setups to be run (often throughout the night) attests to the great interest and pleasure we felt at a time when factoring and primality testing had not yet been recognized as being relevant to the transfer of funds or to national security. This persistent involvement over the years has led to a considerable development in the theory and the practice of factoring and primality testing.

(e) *The SWAC (Standards Western Automatic Computer)*. This was the first large electronic computer in the western United States (UCLA, 1950). Although this machine had a memory of only 256 words of 37 bits each (later augmented with a 4096-word drum), it was a very nice binary machine which allowed for flexible bit manipulation with its four-address system. It had a 16 microsecond cycle time, a bit-parallel addition taking 4 cycles and a multiplication taking 23. It was directly suitable for number theory in that it, unlike some more modern general purpose computers, produced an exact double-word integer product.

Much number theory was done on this machine [70]. At least three programs run on the SWAC dealt with material in this book. One was a Fermat number factoring routine written by JLS [95] which discovered factors of  $2^{2^{10}} + 1$  and  $2^{2^{16}} + 1$  in 1953. The other two were written by Raphael M. Robinson, who caused a mild sensation by programming a primality test for the Mersenne numbers  $M_p = 2^p - 1$  which ran when first tried, even though he had never programmed a computer before. His modest account is given in [90]: “The program was first tried on the SWAC on January 30 [1952], and two new [Mersenne] primes were found *that*

*day* (our emphasis), three other primes were found on June 25, October 7, and October 9" [and see MTAC **6** (1952) 61, 205; **7** (1953) 72]. These were the primes corresponding to  $p = 521, 607, 1279, 2203$  and  $2281$ . In addition to discovering this impressive list of new Mersenne primes, the program was used to check the Mersenne number results found earlier by hand calculation.

The second program of Robinson was used by Robinson and JLS to find factors of the Fermat numbers  $F_n = 2^{2^n} + 1$ . Although the machine was somewhat unreliable because of its Williams tube electrostatic memory, it was a wonderful machine with which to reach out beyond human powers. One minute of SWAC time was roughly equivalent to one year of desk calculator time.

When programmed as a sieve, the SWAC was capable of sifting 100,000 numbers a minute, only one-third the speed that the photoelectric number sieve had achieved twenty years earlier.

A charming feature of the SWAC was its loudspeaker which emitted squawks and noises characteristic of the loops in the running program. After running the program for a while, the machine operator, who was usually the programmer, could tell more or less what the computer was doing by just listening to it.

(f) *The IBM 701*. One of these machines was installed at UC Berkeley in 1954 and was taken out in 1962. Originally it had an electrostatic Williams tube memory like the SWAC, but in a short time it was given a magnetic core memory and so became much more reliable.

Many researchers owe a great deal to Ted Ross, the IBM engineer who made the 701 the reliable machine that it was for its full life at Berkeley. The computer had a reasonably large memory and a peripheral magnetic drum for slower extra storage. Its cycle time was 12 microseconds. An addition took 5 cycles, a multiplication or division 38. It was a fine machine for number theory, since it gave a double-word product and an exact quotient and remainder on division. It also had a good set of "bit-pushing" instructions which facilitated some ingenious machine-language programming.

The computer could operate at either a full or a half-word level, each word consisting of 35 bits and a sign. The arithmetic on the machine was in signed binary, in contrast to the now common twos-complement arithmetic which can be awkward.

Within a few years of operation, the 701's library of programs had some very useful software, such as a good symbolic assembler and several types of dumps, including a snap dump and a couple of trace dumps. There were three magnetic tape units that gave the system greater flexibility in operation. On the other hand, there was no higher level language and the hardware itself was lacking in many ways. There was no BCD, no floating-point arithmetic, and there were no index registers. It was also necessary to program all input-output and all the checking that went with it. All programs were initially loaded on-line through the card reader.

Three different projects contributing to these tables were carried out on the 701. In [92] Raphael M. Robinson reported on a direct search for factors using a difference table to generate the sequence of trial divisors. From this search came several complete factorizations as well as the first factors of the Mersenne numbers  $M_{109}$  and  $M_{157}$ .

In [2], six new factors of  $2^p - 1$  for  $p = 163, 181, 193, 229, 239$  and  $241$  were reported, along with many other factors of  $M_p$  obtained by direct search. Because this search was done at zero priority, a considerable effort was made to minimize the search time by using a succession of divide routines requiring fewer machine cycles for larger divisors. Whenever the divisor surpassed a certain power of two, a new program was manually loaded. In [3], another direct search produced many new factors of the numbers  $2^{2^p} + 1$ ,  $p$  prime. This program also keyed the divide routines to the growing size of the divisors, but this time the program itself kept track of their size and wrote the routine to be used on the next larger class of divisors.

DHL also wrote a primality test for numbers  $2^p \pm 2^{(p+1)/2} + 1$  which had no known prime factors. In this way, for instance,  $2^{379} + 2^{190} + 1$  was discovered to be a prime. The factoring program completely factored two numbers, namely  $2^{83} - 2^{42} + 1$  and  $2^{59} + 2^{30} + 1$ , the latter having been listed as a prime in 1929 by Kraitchik [35, p. 87].

(g) *The IBM 704*. This machine was a tremendous improvement over the 701, with which it was incompatible. It was the first of the series of IBM computers—numbered 704, 709, 7090, 7094—that, like the 701, were excellent for number theory. Internally they used signed binary arithmetic.

The hardware improvements in the 704 were many. It had, for example, three index registers, a larger instruction repertoire, BCD mode, floating-point arithmetic, automatic input-output checking, simpler-to-use magnetic tape drives, and a more rapid card reader. The assembler was also much improved. As with all the IBM computers, the 704 was excellently maintained and was very reliable.

A number-theoretic subroutine package for multiple-precision arithmetic was written in machine-language for this machine by Jerry (G. D.) Johnson, and the package turned out to be compatible with all the later machines in this series. This package permitted left and right shifting of binary words and contained the basic number-theoretic subroutines for signed integers that allowed for their addition, subtraction, multiplication and division, and also the computation of  $a^n \pmod{m}$ , the GCD, and the Jacobi symbol.

Several programs based on this package of subroutines were written by JB and were much used on this project. Among these were a direct-search factoring program as well as a primality testing program which could determine the primality of a probable prime  $N$  when the complete factorization of  $N - 1$  was known.

The main results obtained on this machine were the discovery of a second factor of  $F_{10}$  and the factorization of

$$M_{101} = 7432339208719.341117531003194129.$$

The latter was obtained in 1963 by Jerry Johnson, DHL and JB from a direct search based on a quadratic sieve constructed from quadratic residues in the continued fraction expansion of  $\sqrt{mN}$  for various values of  $m$ . To produce these residues, the 704 ran for hundreds of hours without an error!  $M_{101}$  had been the smallest composite Mersenne number with no known factors, and this factorization had been sought for decades. It was discovered in only two hours because the sequence of trial divisors had such large differences between consecutive terms.

(h) *The Delay-line Sieves (DLS 127, DLS 157)* [59, 64, 7]. In December of 1965 the delay-line sieve DLS 127 (“Dick Lehmer’s Sieve”) [6] began running at UC

Berkeley. This sieve, which was designed by DHL and made operational through the good offices and efforts of Paul Morton and Robert Coffin, used electronic delay-lines in place of the earlier bicycle chains and gears. Its scanning rate, as well as that of the later DLS 157, was  $10^6$  numbers per second. The later model, DLS 157, which is still running, was made from DLS 127 by adding shift registers (instead of more delay-lines) for the prime moduli from 131 to 157. Both sieves operated on 100 watts of power. (See the status report in section **IV B**.)

An interesting design problem that had to be solved in building the sieve was how to save the bit patterns in the delay-lines during their individual sieving when it was necessary to pause long enough to print out a solution that the sieve had just discovered. To do this, the individual bit patterns were hooked end to end and circulated as a serpentine through the whole machine. Whenever the serpentine had returned to its original position, the individual sieving could then be started again [64].

Many factorizations and primality tests were done using these sieves. The notable factorization,

$$2^{109} - 2^{55} + 1 = 5.74323515777853.1746518852140345553$$

was completed on the DLS 127 by a difference of squares method. These sieves are the most rapid we have used, the nearest competitor being a sieve program with a scanning rate of about  $10^5$  numbers per second, written by JB [6] for the IBM 7094.

(i) *The IBM 709, 7090, 7094.* These machines continued the trend begun by the 704, the tubes in the 709 being replaced by transistors in the latter two machines. The 7094 had 7 index registers, and a marvelous and useful array of machine instructions. The cycle time was 2.18 microseconds, with add, multiply and divide times of 2, 5 and 8 cycles, respectively.

Careful programming of the data channels on the machine permitted input and output that were independent of the main processor and parallel to it. There was also an excellent collection of standard programs for assemblies, dumps, trace routines, and other debugging aids.

The machines used were primarily those at UC Berkeley, Stanford (thanks to G. Forsythe) and UCLA. In the latter part of its life, the 7094, which was owned by UC Berkeley, sat in the basement of the mathematics building. It had no data channels or maintenance contracts, for it had been superseded by the CDC 6400. Nonetheless, since factoring programs require little input and produce little output, the 7094 gave JB, JLS, DHL and Emma Lehmer a marvelous opportunity to work. Thus with patience we put the program into the memory in binary through the console switches. Of course no one else was using the machine, so it became essentially our machine. When after months of excellent service some hardware began to fail, we either programmed around the difficulty or dug into our pockets for a little money to bring in an IBM engineer to fix the machine.

In the days before its final sad demise, JB wrote some factoring and primality testing programs based on the multiple-precision package of Jerry Johnson. The primality program tested the primality of a probable prime  $N$ , given the complete factorization of  $N - 1$ . Later, a more elaborate program was written by JB which automated the passing between levels in primality testing [4]. This program was a predecessor of the DOWNRUN program of JLS and Marvin Wunderlich, used extensively at DeKalb and described in **3(b)** below.

JB wrote not only a simple direct search factoring program, but also a very productive difference of squares program [6]. Results obtained by the latter program include the factorizations of  $M_{103}$ ,  $M_{163}$  and

$$2^{107} + 2^{54} + 1 = 843589.8174912477117.23528569104401.$$

A large number of factorizations obtained on the 7090 and the 7094 appear in these tables for the first time, but are lost in the profusion of more recent results.

Some primality testing on Fermat and Mersenne numbers was done by JLS and Alex Hurwitz at UCLA [96]. They ran a modular check during the testing on each arithmetic operation and discovered over a long period of time that the machine did in fact make several arithmetic errors. Of course, such primality testing made unusually heavy repetitive use of the fixed point instructions. BT developed a package of Fortran and Assembly language multiple-precision integer arithmetic and trial-divisor factorization programs for the 7094 at the IBM Research Center, and used it for work on odd perfect numbers in 1967 [103, 104]. This work depended on the evaluation and factorization of a number of values of  $\sigma(n)$ , the sum-of-divisors function. As is well known, if  $n = \prod_i p_i^{a_i}$ , then  $\sigma(n) = \prod_i \sigma(p_i^{a_i})$  and  $\sigma(p^a) = (p^{a+1} - 1)/(p - 1)$ . Aside from the denominator  $p - 1$ , this is of the same form as the numbers  $b^n - 1$  considered in the present work, where  $b = p$ ,  $n = a + 1$ . However, the interest extended to a greater range of prime values  $p$  of the base, and a lesser range of the exponent, than the present work. Complete factorizations were made of all cyclotomic numbers  $\Phi_q(p) < 10^{18}$  for which  $p$  and  $q$  are odd primes, and  $p > 14$ , also for scattered larger  $p$  as needed, some also for  $q = 2$ . These factorizations may be found in [104]. The ones for  $p < 12$  are subsumed in the present tables.

Perhaps the most impressive computer center that we used was at the Bell Telephone center at Holmdel, New Jersey. Several 7094's were hooked into a single system. They could be switched for different use as easily as one could reassign the numbers on a tape unit. This center came close to the ideal of having a system which was not so generalized that simple, standard things couldn't be done simply. Among the single user machines the 7094 was indeed outstanding for number theory.

(j) *The IBM 360 Series.* With the introduction of this series of computers, the single-user became one of the several persons using the machine at the same time. The word size was shrunk to 32 bits, and the machine was incompatible with the 7094. It also employed twos-complement arithmetic, but the exact product, quotient, and remainder in integer arithmetic survived. It was designed to be a very versatile machine with a complicated job control language, but its generality made it hard to use for simple tasks.

The first model of this machine we used at UCLA was the 360/91, which had a look-ahead feature as well as a stack (instruction cache). These gave the machine great speed when a program was written in machine language, since then branching and register loading could often be accomplished in no extra time.

A drawback in using a stack and look-ahead was that when two instructions were being executed at the same time and an error occurred, it was difficult to determine what had happened. This produced a rather mystical, interpretive feeling among the programmers who had to try to guess what had happened and how to fix it, instead of just taking a dump, finding out what had happened and then removing the errors.

The cycle time on this 360 was 60 nanoseconds. For fixed point, the add time was 1 cycle, multiply time 7 to 11 cycles and divide time about 37 cycles. For floating point, the add time was 1 or 2 cycles, multiply time 3 or 4 cycles and divide time 9 to 12 cycles. In addition, execution of instructions was overlapped, especially floating point instructions, so that for many purposes, even for computations with integers, the floating point instructions gave much faster computations.

The fine collection of software surrounding this machine included excellent file-management features, assemblers, compilers, editors and interpreters. Also, it was possible to use David Cantor's valuable multiple-precision integer subroutine package.

The main program run on this machine was written by Mike Morrison and JB. In this program, which is discussed in **2(d)** below, a great deal of auxiliary factoring was done by dividing by a fixed set of small primes. Unfortunately the designers of the 360 had given the machine rather slow fixed-point multiply and divide instructions, while making the double-length floating-point operations very fast. Evidently their rationale was that all really important scientific calculations involve only approximate numbers. Thus, when we wanted to divide by 3, say, we programmed the division in floating-point rather than in fixed-point because the former was several times faster. The programming of this required that the binary point end up in the correct position so the integer part could be properly recovered. This was greatly assisted by an interpreter which allowed for a single-step-at-a-time analysis of how the floating-point instructions worked.

This machine's large memory permitted us to use over a million bytes of memory in the crucial reduction stage of a very large matrix of bits that produced the factorizations of  $F_7$ , the first and most significant factorization done on this machine among dozens of others that appear in these tables.

After being used on the 360 at UCLA for several years, the factorization program was moved in 1973 to the 360/67 at DeKalb. The program was further developed by Marvin Wunderlich, who used his own multiple-precision integer package and who also devised an automatic submission feature which made the program fully automatic. In this improved form, one could merely submit the number to be factored and, after some time, collect the printout of factors along with some interesting statistical data.

In addition to this powerful program, another program called DOWNRUN was written to implement a primality test devised by JLS and Wunderlich [98]. These two programs, used together, have allowed us to bring these tables to their present advanced state. Free computer time at NIU has of course been invaluable, as has the enthusiastic sponsorship of JLS and his Foundation for Number Theory Computing. This Foundation and its supporters deeply influenced the development and promotion of fine computing in number theory during the 1970's.

The 360/75 at the University of Illinois was used by SSW in the table testing mentioned in section A above. Also, he used the DEC 10/KI in a two months' factoring rerun that covered the complete set of tables and discovered or rediscovered the factors up to  $2^{35}$  in the tables. The number representation and set of DEC 10 instructions facilitated multiple-precision arithmetic in base  $2^{35}$ . Since this computer is a dual processor, one processor could work full time for the two months on the factoring, while the other satisfied the time-sharing needs of most of the other users. Much of the information gleaned from these runs was put into final form in files at DeKalb, where a good editor (WILBUR) from Stanford was in use.

The IBM 4341 was used by SSW to factor some large numbers, such as 2,302M and  $10^{56} + 1$ , by the continued fraction method. He also used the Illinois Central Editor (ICE) to perform the final testing on the tables. The factoring was done with “bulk time”, an arrangement whereby the interstitial time on the machine could be used essentially independently of other large projects.

The 360/91 at IBM at Yorktown Heights was used by BT for a search for Mersenne primes which discovered the prime  $M_{19937}$  [102]. The program that did this testing was written by BT with very careful thought to timing, in that the programs took advantage of the author’s detailed knowledge of instruction and hardware operation. To utilize the greater speed of the 360/91 on floating versus fixed point, the relevant programs were written, or rewritten, in floating point.

(k) *Other Computers.* A direct search for factors was carried out over many months on an IBM 1130 at the Mathematics Department at the University of Arizona. This small 16-bit word computer is quite slow by modern standards, but slow computers are often more widely available than fast ones. A common computer center policy is to permit a fast computer to be used only by funded researchers, so that one is given the option of having little or no time on a really fast computer or a great deal of time on a slow computer. The 1130 search found all the factors less than  $2^{30}$  of  $2^n - 1$  for various  $n$  for which a search had not earlier been completed.

At UC Berkeley, after the IBM 7094 was inactivated, a CDC 6400 became the main machine. This fast machine permitted several jobs to run side-by-side in the memory, which allowed for useful computing to be done on one program while another was inputting or outputting. A small zero-priority program, written by DHL and Peter Weinberger, was tucked away in the memory and was always available to continue its search for factors up to  $10^{12}$  on a particular number. This valuable program produced many factors.

Since this program was to be as unobtrusive as possible, it was designed to take as little memory as possible, and so did its outputting by the following indirect procedure: when a factor was found, the program stored it in a particular memory location and then deliberately divided by zero. This produced an error condition that caused the system automatically to take a tiny dump of the part of the memory where the factor was stored. Fetching the factor from the dump in octal and converting it to decimal was a small matter, provided that the single sheet of output was not lost and was put in DHL’s output box.

One of the more interesting factorizations obtained by this background program was 698962539799.4096460559560875111, which finished off  $2^{333} - 1$ .

An amusing by-product of having a program always in memory, ready to run whenever nothing else was running, was that the running time of the program accurately measured the idle time of the computer. Occasionally this caused comment when it was discovered that the program had run almost 100 percent of the time.

The hardware of this machine was poor for number theory in that on multiplying, it did not produce a double-word product. One had to do each multiplication twice to get the two product words.

The Swedish computer BESK was used by Hans Riesel for several purposes [86 to 89], among them the factoring of Mersenne numbers and the primality testing of these numbers.

The Illiac II was used by D. B. Gillies [22] to factor Mersenne numbers and to study the distribution of Mersenne primes.

DHL used the Illiac IV at Moffett Field, California, for factoring and primality testing. This interesting computer had a 64-bit word and a cycle time of 64 nanoseconds. An addition took 240 nanoseconds and a multiply took 400 on the individual processors. A very useful feature of this machine was its capability of carrying out the same operation on 64 numbers at the same time.

Hugh Williams has used an Amdahl 470/V7 for some of the more difficult primality testing and for the factorization of various large composite numbers by the two-step Pollard method [80].

Finally, Robert Baillie has obtained some impressive factorizations using idle time on the Plato system's CDC 6500 at the University of Illinois, and Hiromi Suyama has found factors of several Fermat and Mersenne numbers with his own 8-bit MZ-80C microcomputer.

Some more recent factorizations have also been included in the tables. (See the status report in section IV B.)

## 2. Developments in Factorization.

“The problem of distinguishing prime numbers from composite numbers and of resolving the latter into their prime factors is known to be one of the most important and useful in arithmetic. It has engaged the industry and wisdom of ancient and modern geometers to such an extent that it would be superfluous to discuss the problem at length. Nevertheless we must confess that all methods that have been proposed thus far are either restricted to very special cases or are so laborious and prolix that even for numbers that do not exceed the limits of tables constructed by estimable men, i.e. for numbers that do not yield to artificial methods, they try the patience of even the practiced calculator. . . . The dignity of the science itself seems to require that every possible means be explored for the solution of a problem so elegant and so celebrated.” *C. F. Gauss* [21, Sec. 329]

In the past, before electronic computers, only a few factors of the numbers in these tables were discovered in a year's time, and a record was kept of who had discovered the factors. Computers have made factorization such a prolific activity that exhaustive documentation is, of course, no longer practicable. Accordingly, we mention only a few outstanding cases in this *Introduction* and make no attempt at all to document the tables themselves. A few factors in the tables have appeared earlier in privately circulated lists of E. Karst and M. Merson. (See [6, 7, 30].)

After the extensive searches for factors that we conducted, a final search by SSW put the tables in almost final form for publication. This was a direct search made after the compilation and distribution of a first version of the tables in 1976 to a few interested parties. In this search all the numbers in the tables were refactored up to a common search limit of  $2^{35}$ . With the known factors having been rediscovered and the new factors entered in the tables, we are confident that the tables contain all prime factors less than  $2^{35}$ .

In this section, we limit our discussion to the factoring methods we have actually used, since, as mentioned before, this is not a history of the subject, but rather an account of the building of these tables.



(a) *Direct Search.* This “divide and conquer” method (most often more divide than conquer) is a factoring method in which a sequence of trial divisors is generated, usually in order of increasing magnitude. Each member of the sequence, less than some factoring bound, is divided into the number  $N$  to see if it divides exactly.

The most common method of generating the sequence of trial divisors is with the use of an increment table. The increments in the table are the remaining differences after certain terms in the appropriate arithmetic sequence are sieved out because they are multiples of small primes. These primes usually don’t exceed 13 because of space limitations in the computer [92, 2]. The table of increments is first constructed by the computer and is then used over and over again to create the sequence of trial divisors.

Although composite trial divisors remain in the sequence, it is more practical just to try them as possible divisors than to spend time eliminating them, unless trying one of them is very time-consuming. In [26] the authors found it better to use an extensive sieve and eliminate most composite numbers from the sequence of trial divisors.

Perhaps the simplest way to program the construction of the increment table is through the use of a GCD subroutine, which rejects a member of the arithmetic sequence to which the factors belong if it has a factor in common with any of the sieve primes. A good check on the increment table is to sum its entries. In the direct search to  $2^{35}$ , SSW did not use an increment table. To seek small factors of  $2^p - 1$ , for example, he chose  $J$  so that  $8pJ$  was a reasonable size, say  $8pJ \approx 10^5$  with  $J$  the product of small odd primes. Then for each appropriate  $S \leq 8pJ$  with  $(S, J) = 1$ , the trial divisors  $f = S + 8pJk$ ,  $k = 0, 1, 2, \dots$ , were tested in that order for  $f < 2^{35}$ . This strategy kept the memory requirements small. Here, “appropriate” means that if  $N$  has a particular form, the sequence to which the factors belong may be severely restricted. For example, if  $N = 2^p - 1$ ,  $p$  prime, all factors are of the form  $kp + 1$  and  $8k \pm 1$ . For another example, the possible prime factors  $q$  of  $\Phi_n(b)$ , apart from a possible intrinsic factor, must belong to the arithmetic progression  $q \equiv 1 \pmod{n}$  if  $n$  is even, or  $q \equiv 1 \pmod{2n}$  if  $n$  is odd. (See section C.)

A direct search is usually made to try to find small prime factors of  $N$  before anything else is done. When the factors less than the search bound are removed, then the remaining **cofactor** (again called  $N$ ) is tested in Fermat’s congruence to determine if  $N$  is composite or if  $N$  is a **probable prime**, i.e., a number that satisfies Fermat’s congruence for some nontrivial base.

(b) *Legendre’s Method.* In this method the sequence of trial divisors is obtained by using a much more elaborate sifting method, a quadratic sieve. By using quadratic residues of  $N$ , each prime factor of  $N$  is discovered to have certain numbers (usually primes) as quadratic residues. This implies that the prime factors of  $N$  lie in readily determined arithmetic sequences. By combining these, a sequence of trial divisors can be generated.

This method [38, 75, p. 198] was used by Jerry Johnson in 1963 to factor  $N = 2^{101} - 1$ , a number which had stood for decades as the Mersenne number whose factorization was “most wanted”. In the IBM 704 program that factored it, prime quadratic residues of  $N$  were obtained from the continued fraction expansion of  $\sqrt{mN}$  for various values of  $m$ . (See [32] for a discussion of this method.) The

program that expanded  $\sqrt{mN}$  and factored the denominators of the complete quotients also checked to see if any of these denominators was a square, just as hand calculators had done for decades. The occurrence of a square can sometimes give an immediate factorization of  $N$ .

(c) *Difference of Squares and Quadratic Forms.* The difference of squares method is one of the oldest factorization methods we have used. This method, introduced by Fermat, was improved by Gauss [21, Sec. 319–321]. (See [42] for a discussion of the use of this method on early sieves and [6] for its implementation on an electronic computer, and see also [49, 50, 33, Ch. VI].) Fermat would seek to find nontrivial  $x$  and  $y$  so that  $x^2 - y^2 = N$ , from which a factorization directly follows. Gauss wrote this equation as the congruence  $y^2 \equiv x^2 - N \pmod{E}$  for various moduli  $E$ , thereby restricting the values of  $x$  to about one half of the possible residues modulo  $E$ . Combining these restrictions produced a sieve which excluded all values of  $x$  except for about one in  $2^s$  when  $s$  exclusion moduli  $E$  were used. For some numbers with a special form such as  $2^n - 1$ , the  $x$  in this representation can be shown to lie in a certain arithmetic sequence. When this information is introduced at the outset as a change of variable, the sifting problem is considerably reduced [45, 50].

Since the difference of squares method works best when  $N$  can be expressed as a product of two factors of comparable size, it is sometimes better to factor  $mN$ , instead of  $N$ , for some value of  $m$ . (See [39] for a discussion of this old idea.) One then seeks values for  $x$  and  $y$  so that  $y^2 \equiv x^2 - mN \pmod{E}$ , again for various values of  $E$ . A sieve on  $x$  is then set up as before.

This method was used on all the sieve machines of DHL, one of the most impressive results being the DLS 127 factorization

$$\frac{2^{136} + 1}{257.383521} = 2368179743873.373200722470799764577$$

[7, p. 644]. This problem was run on a standby basis on that sieve for 2600 hours before the number factored. Ten different multipliers  $m$  were used, the last, which did the job, being

$$m_{10} = 165670849 = 1 + 2^6 \cdot 3^2 \cdot 7 \cdot 17 \cdot 2417.$$

The sieve was run for only 12.5 hours with  $m_{10}$ . This sobering result shows all too well how little we knew (and still know) about choosing a good multiplier in this method.

In addition to the special case of a difference of squares, there is also Euler's factorization method of expressing  $N$  as a quadratic form in two different ways. This method was employed on the different sieves to good effect [68, 48, p. 106]. A still further method, using sets of forms, was developed in [65]. Generally speaking, however, sieve methods of factorization no longer compete with the continued fraction method. (See also [48].)

(d) *The Continued Fraction Method.* Experience with Legendre's method and an analysis of its arithmetical behavior suggested to JB that certain residues produced in the simple continued fraction expansion of  $\sqrt{mN}$  might be multiplied together to produce a perfect square. This procedure (incorrectly called "Legendre's Method" in the first edition (1969) of [32]) contrasts with method (b) above, in

which a square times a prime is sought. Although previous hand calculation with this method had shown that a square produced in this way quite often failed to lead to a factorization of  $N$ , it became apparent when this method was running at UCLA that it was, despite these failures, very much more powerful than any general factoring method that had been used before [75].

The ideas in this method had been discussed earlier from the point of view of the *failures* in the method by DHL and R. E. Powers [46], because as a hand method it continually failed to factor  $N$  despite a large amount of computation.

As the method was developed by Mike Morrison and JB, it also became apparent that a small set of primes was all that was needed in factoring the denominators of the complete quotients; most of the denominators were discarded when they did not factor enough with just these primes. This has been verified in general through the statistics that have been kept in recent years by Marvin Wunderlich. In private conversations, H. J. Godwin has also indicated that in his experience with the method, a small set of primes augmented by new primes that arise from completely factoring some of the denominators, seems to provide a growing factor base which is quite effective for the method.

Although the method often fails to factor  $N$  the first time that a square has been constructed, it almost always factors the number soon after the squares begin to appear. The power of the method can be illustrated by the factorization of  $2^{128} + 1$  [73], that of  $2^{149} - 1$  by Rich Schroepel [7, p. 645], that of the 49-digit cofactor of  $3^{121} - 1$  by SSW, and by the fact that throughout these tables no composite number with 50 or fewer digits remains to be factored. (See **IV** for more recent information.) The main reason for this power is that all the auxiliary factoring is of numbers less than  $2\sqrt{mN}$ .

(e) *The Methods of John Pollard.* Two other methods, introduced by John Pollard, were of great importance in carrying out the factorizations in these tables. The first, or “ $p - 1$ ” method [80] is often spectacularly successful since it can sometimes find a quite enormous factor  $p$  with very little computing if  $p - 1$  splits entirely or almost entirely into a product of small primes.

The  $p - 1$  method may have one or two steps. Using only the first step, one finds a factor  $p$ , regardless of its size, if  $p - 1$  is a product of small primes. Using both steps, one finds a factor  $p$  if  $p - 1$  is a product of small primes and a single larger prime.

Both the single and double step methods have been programmed and have occasionally produced much larger factors than those which can be found by most other methods. For example, using only the single step method, we found the 19-digit factor  $p = 1325815267337711173$  of  $10^{53} - 1$  in only a few minutes on the IBM 360/67, since  $p - 1 = 2^2 \cdot 3^2 \cdot 11 \cdot 53 \cdot 1279 \cdot 1553 \cdot 3557 \cdot 8941$ . Robert Baillie at the University of Illinois used the double step method to find the impressive 25-digit factor  $p = 1155685395246619182673033$  of the 63-digit cofactor of the Mersenne number  $2^{257} - 1$  in about 50 minutes on the Plato system’s CDC 6500, since  $p - 1 = 2^3 \cdot 3^2 \cdot 19^2 \cdot 47 \cdot 67 \cdot 257 \cdot 439 \cdot 119173 \cdot 1050151$ . It was fortunate that the first step was taken at least up to 119173, for otherwise this factor of  $2^{257} - 1$  would not have been found. He has kindly permitted us to publish other factors he has found by this method.

A related method which can find prime factors  $p$  of  $N$  when  $p + 1$  factors completely into small primes, has been programmed by Earl Ecklund and JB at

DeKalb. The two step method for  $p - 1$  and  $p + 1$  has been programmed by Hugh Williams at Winnipeg. In this modification of Pollard's method the divisibility properties of Lucas sequences are used. The factors found by Williams are included here with his permission (two factors were found independently by G. J. Stevens).

It sometimes happens in this method that the smallest factor is not the first to be found. For example, the impressive 23-digit factor 53199025841281128499153 is the largest factor of  $11^{59} + 1$ , and this was discovered before the two 17-digit factors.

The second method of Pollard [81], the so-called "Rho" or "Monte Carlo" method, has been used by the authors only in auxiliary factoring associated with primality testing. This powerful method was also used by M. Penk [77] to discover the factor 535006138814359 of  $2^{257} - 1$ , the largest of the original Mersenne numbers and known to be composite for half a century. Richard Brent also used a variation of this method to factor the eighth Fermat number  $F_8 = 2^{256} + 1$ , obtaining the factor 1238926361552897. The cofactor of  $F_8$  was shown to be prime by Williams and Brent.

The factorization of  $2^{191} - 1$  is interesting in that it was accomplished through the use of four different factoring methods: besides the "Euler factor" 383, the second factor was then found by direct search; the fourth was found by Pollard  $p - 1$ ; the third and fifth were found using the continued fraction method. (The second factor could actually have been found much more readily using the Pollard  $p - 1$  method.)

There is little doubt that Pollard's methods will have great importance in further factorizations in these tables, since most composite numbers in these tables have not yet been attacked by either of these methods. (This work was done by the time of the second edition. See Section IV A 2(a).)

### 3. Developments in Primality Testing.

In this section we give an account of the primality tests that have been used in building these tables. This account is more detailed than that of the preceding section, because it is almost impossible, by studying the literature alone, to determine how these primality testing methods developed.

(a) *The Theory.* By a "primality test" we shall always mean a rigorous proof of primality, and not a probabilistic method for asserting the likelihood of primality. That is, by a "primality test" on a number  $N$ , we mean an algorithm whose steps consist of verifying the hypotheses of a theorem whose conclusion is " $N$  is prime." Thus, finding that the results at each step of the algorithm are true for  $N$ , we conclude that  $N$  must be a prime.

(1) *Trial Division.* Certainly the oldest way to prove a number prime is to show by trial division that it has no nontrivial factor less than or equal to its square root. If, however, a number  $N$  is too large for trial division alone to be practical, one first asks whether  $N$  satisfies Fermat's congruence

$$(1) \quad a^{N-1} \equiv 1 \pmod{N}$$

for some base  $a$ ,  $1 < a < N - 1$ . Fermat's congruence is a necessary but not a sufficient condition for primality. If it holds for an odd  $N > 1$ , we call  $N$  a **probable prime** base  $a$  and write "PRP(a)" or just "PRP". Many authors, including ourselves, have previously used the misnomer "pseudoprime" for "probable prime". We now use "pseudoprime" only for a composite number satisfying (1).

When  $N$  satisfies (1), one should try to complete a primality test on  $N$  rather than try to factor it. There is almost no chance that it is composite. In practice such composite  $N$  are almost never encountered; but when they are, we greet these true novelties with pleasure and curiosity. (See [6, p. 91].) Recently Carl Pomerance, JLS and SSW [82, p. 1024] suggested that augmenting one Fermat test with one specific test of the Lucas type might be a fast test for primality. No composite number is known which passes this pair of tests, but they have not proved that no such number exists. All of the probable primes in the tables have passed this specific test, giving convincing evidence, but no final proof, that they are primes. The computing was done by SSW.

(2) *Fermat's Method*. Factoring methods generally rely upon exhaustive trials of values in certain sequences. The difference of squares factoring method discussed in 2(c) provides an example.

Here  $N = ab = x^2 - y^2$  where the nontrivial values of  $x$  lie in the interval  $\sqrt{N} < x < \frac{1}{2}(B + \frac{N}{B})$ , where  $B$  is the direct search bound. If no  $x$  in this interval gives a factor of  $N$ , then  $N$  must be a prime. Often whole collections of  $x$  values can be disposed of without trying them by imposing necessary conditions on  $x$ , as in the quadratic exclusion method (a quadratic sieve) of Gauss. An example of this method can be found in [43].

(3) *Euler's Method*. Euler showed that if an odd number  $N$  can be expressed as a sum of two squares in essentially only one way, then  $N$  is prime. This has been used as a means of testing for primality when the number of possible representations could be scanned completely.

(4) *Converses of Fermat's Congruence*. E. Lucas [71, p. 302; 72, p. 441] published two somewhat ineffective converses of (1), but the first really effective converse theorems for testing primality were published by M. Kraitchik [34, p. 135] and DHL [40, p. 330].

*Theorem 1*. If there exists an  $a$  for which  $a^{N-1} \equiv 1$ , but  $a^{(N-1)/q} \not\equiv 1 \pmod{N}$  for each prime factor  $q$  of  $N - 1$ , then  $N$  is prime.

The effectiveness of this theorem for large  $N$  arises from the fact that the needed remainders can be calculated in roughly  $\log_2 N$  multiplications and divisions [60, p. 124]. Although several bases may have to be tried among the numbers for which the Jacobi symbol  $(a|N) = -1$  before a single  $a$  is found for which all the hypotheses of Theorem 1 are satisfied, the main difficulty in using the theorem is that all the prime factors  $q$  of  $N - 1$  must be found; but when  $N - 1$  could be factored, this theorem was often implemented. For example, the primality of the 49-digit factor  $N$  of  $2^{179} - 1$  was proved, with  $a = 19$ , from

$$N - 1 = 2^4 \cdot 3 \cdot 5 \cdot 7 \cdot 41 \cdot 163 \cdot 179 \cdot 643 \cdot 919 \cdot 43399 \cdot 1071379 \cdot 23262667 \cdot 1159540629640123.$$

Using Theorem 1 at two levels [4] gave the primality of the 37-digit factor  $N$  of  $2^{181} - 1$ , since  $N - 1 = 2 \cdot 5 \cdot 181 \cdot M$ , where  $M$ , a probable prime base 19, can be proved to be prime from the factorization

$$M - 1 = 2 \cdot 3 \cdot 47 \cdot 253567 \cdot 811039 \cdot 2293751 \cdot 32910082955041.$$

The standard test for primality of the Fermat number  $F_n = 2^{2^n} + 1$  is the subject of the next theorem.

*Theorem 2.* (Pépin [78]) The Fermat number  $F_n$  is prime for  $n \geq 1$  if and only if  $3^{(F_n-1)/2} \equiv -1 \pmod{F_n}$ .

This test is well suited to binary computers [90], and see [40], p. 334], for the powering is pure squaring and the reductions  $\pmod{F_n}$  can be accomplished without dividing by noting that

$$A \cdot 2^{2^n} + B = A(2^{2^n} + 1) + (B - A) \equiv B - A \pmod{F_n}$$

(5) *Proth's Theorem.* In [85], E. Proth published the following important generalization of Pépin's theorem.

*Theorem 3.* Let  $N = k \cdot 2^n + 1$ , where  $1 \leq k < 2^n$ . If  $a^{(N-1)/2} \equiv -1 \pmod{N}$  for some  $a$ , then  $N$  is prime.

The importance of this theorem, beyond its immediate application to numbers of certain forms, is that the complete factorization of  $N - 1$  is not needed to finish a primality test on  $N$ .

Theorem 3 was used in [3] by DHL for the primality testing of the numbers  $N = 2^p \pm 2^{(p+1)/2} + 1$ , where  $p$  is prime. Here the power of 2 in  $N - 1$  is larger than the cofactor, so the test can be made by Proth's theorem. For example, the number  $2^{457} - 2^{229} + 1$  was proved to be prime in this way.

Rather than computing the required remainders  $\pmod{N}$  directly, the reductions in powering were first made with respect to the intermediate modulus  $2^{2p} + 1 = (2^p - 2^{(p+1)/2} + 1)(2^p + 2^{(p+1)/2} + 1)$ , using the scheme mentioned in (4), and then with respect to the actual modulus  $N$ .

Sometimes the algebraic form of  $N$  readily yields the factorization of  $N - 1$ . For example [3], and see [40, p. 329] and [54]], for certain  $p$ , 5 divides  $2^p \pm 2^{(p+1)/2} + 1$  and the quotient  $N$  is a probable prime. For such  $p$  we then have

$$N - 1 = 4[2^{(p-1)/2} \mp 1][2^{(p-3)/2} \pm 1]/5.$$

(6) *Pocklington's Theorem.* This theorem of 1914 is of great importance in the primality testing of numbers which are not of any special form.

*Theorem 4.* Suppose that  $N - 1 = q^n R$ , where  $q$  is a prime and  $q \nmid R$ . If  $a$  is such that  $a^{N-1} \equiv 1 \pmod{N}$  and  $(a^{(N-1)/q} - 1, N) = 1$ , then each prime factor  $p$  of  $N$  satisfies  $p \equiv 1 \pmod{q^n}$ .

Although this theorem does not mention primality explicitly, it does give valuable information about the form of possible factors of the probable prime  $N$ . This theorem is stronger than Theorem 1, for the condition  $(a^{(N-1)/q} - 1, N) = 1$  is more stringent than the condition  $a^{(N-1)/q} \not\equiv 1 \pmod{N}$ .

The first and most immediate application of this theorem is to combine the modular conditions on  $p$  for different divisors of  $N - 1$ . For instance, if  $q_1^m$  and  $q_2^n$  divide  $N - 1$  and the hypotheses in Theorem 4 are satisfied, then any prime factor of  $N$  will be congruent to 1  $\pmod{q_1^m q_2^n}$ . Accordingly, we have the following primality test.

*Corollary 1.* Suppose  $N - 1 = FR$ , where  $F$  is completely factored,  $F > R$  and  $(F, R) = 1$ . If there exists an  $a$  for which  $a^{N-1} \equiv 1 \pmod{N}$ , but  $(a^{(N-1)/q} - 1, N) = 1$  for each prime factor  $q$  of  $F$ , then  $N$  is prime.

This result is a very practical primality test, which for large  $N$  almost certainly will show that  $N$  is prime when enough prime factors of  $N - 1$  have been found for their product  $F$  to exceed  $R = (N - 1)/F$ . In fact, this corollary is a generalization of Theorem 3, where the factored part is just a power of 2.

This corollary was used in many of the primality tests for numbers in these tables. Moreover, Theorem 4 can sometimes be useful in showing that  $N$  is prime even when  $F < R$ . For, if  $F$  is not too small, a direct search can sometimes be made with the terms of the sequence  $kF + 1$  to show that  $N$  has no factor  $\leq \sqrt{N}$ . (Some divisors in this sequence can be eliminated in advance by sieving with small primes.) This method was used in [40] to show that  $N = 440334654777631$ , the cofactor of  $10^{27} - 1$ , is a prime. (The correct remainders mod  $N$  of  $3^{(N-1)/5}$  and  $3^{(N-1)/52189481}$  are 313433259338997 and 78523825886276 respectively.)

Another way to use the form of the factors of  $N$  in case  $F < R$  is to introduce this information into a difference of squares factorization, with the hope of cutting the possible values of  $x$  to only a few or none. This method was introduced and used in [40], where, for example, the number  $N = (10^{31} + 1)/11 = 90909090909090909090909090909091$  could be shown to be prime because of the fortunate factorization of  $N - 1 = 10(10^{30} - 1)/11$ . (See [41, 43] for other examples.)

(7) *Lucas' Theorem.* In 1878 [71, p. 302] E. Lucas published a theorem which permitted the complete factorization of  $N + 1$  to be used for primality testing in a way comparable to that of  $N - 1$ . To do this he introduced a pair of second order recurring sequences (now called **Lucas sequences**) defined as follows:

$$\begin{aligned} U_{n+2} &= PU_{n+1} - QU_n, & U_0 &= 0, & U_1 &= 1, \\ V_{n+2} &= PV_{n+1} - QV_n, & V_0 &= 2, & V_1 &= P, \end{aligned}$$

where  $P$  and  $Q$  are integers. Also, we let  $D = P^2 - 4Q$  and  $\varepsilon_N = (D|N)$ , where the latter is the Jacobi symbol. With this theorem made effective by using only prime divisors  $q$  as in Theorem 1, we have the theorem of DHL [44, p. 442].

*Theorem 5.* If  $N|U_{N-\varepsilon_N}$ , but  $N \nmid U_{(N-\varepsilon_N)/q}$  for each prime  $q$  dividing  $N - \varepsilon_N$ , then  $N$  is prime.

If  $P$  and  $Q$ , and therefore  $D$ , are chosen so that  $\varepsilon_N = -1$ , then the hypotheses relate to  $N + 1$ . The choice of Lucas sequence here compares with the choice of base in the  $N - 1$  theorems. That is, one experiments with choices  $P$  and  $Q$  until the sequence allows all the hypotheses to be satisfied. This theorem requires the computation of remainders (mod  $N$ ) for terms with large subscripts. Lucas sequences satisfy many useful identities. For example, to compute  $U_m \pmod{N}$  one can use

$$\begin{aligned} U_{2n} &= U_n V_n, \\ V_{2n} &= V_n^2 - 2Q^n, \\ U_{2n+1} &= (PU_{2n} + V_{2n})/2, \\ V_{2n+1} &= (DU_{2n} + PV_{2n})/2. \end{aligned}$$

The test in Theorem 5 was programmed by DHL for the IBM 7094 with  $P = 1$  and  $Q$  chosen so that  $\varepsilon_N = -1$ . This program was used to demonstrate the primality of the 24-digit factor  $N$  of  $2^{109} - 1$ , using  $Q = 5$ . Here

$N + 1 = 2.3.67.83.233.M$ , where  $M$  was shown to be prime by Theorem 1, with  $a = 3$ , from  $M - 1 = 2.3.503.1801.7643.2693893$ . The theorem was also used [6] at several levels to show the primality of the 38-digit factor  $N$  of  $2^{131} - 1$ . The factorization  $N + 1 = 2.3.5.7^2.11^2.2711.N_1$  was used with  $Q = 17$ , the factor  $N_1$  being shown prime with  $Q = 29$  and  $N_1 + 1 = 2.3^3.89^2.30211.N_2$ , where  $N_2$  is in turn shown to be prime with  $Q = -1$  from the complete factorization  $N_2 + 1 = 2^2.389.22901.46616380229$ .

The most familiar use of Lucas sequences is for testing the primality of Mersenne numbers. This was initiated by Lucas [71, pp. 305, 316] and made into a simple test by DHL in [44, p. 443]; see also [51].

*Theorem 6.* For  $p$  odd, the Mersenne number  $M_p$  is prime if and only if  $M_p | S_{p-1}$ , where  $S_{n+1} = S_n^2 - 2$ ,  $S_1 = 4$ .

This test, like the one for Fermat numbers (Theorem 2), can be carried out without dividing, because  $A.2^p + B = A(2^p - 1) + (A + B) \equiv A + B \pmod{M_p}$ . This well-known Lucas-Lehmer test has been used for all the modern testing of these numbers [90, 86, 28, 22, 102, 76, 101].

(8) A “Lucas-Pocklington” Theorem. As Pocklington’s theorem is so important, it was reasonable to look for an analogous theorem for Lucas sequences. This was proved by DHL [44, p. 443].

*Theorem 7.* Let  $N + 1 = q^n R$  where  $q$  is prime and  $q \nmid R$ . If  $\{U_n\}$  is a Lucas sequence for which  $N | U_{N-\varepsilon_N}$  and  $(U_{(N-\varepsilon_N)/q}, N) = 1$ , then each prime factor  $p$  of  $N$  satisfies  $p \equiv \pm 1 \pmod{q^n}$ .

As in Theorem 5, we choose a sequence with  $\varepsilon_N = -1$  so that  $N + 1$  appears in the subscripts. However, in this theorem the factors  $p$  belong to the *two* residue classes  $\pm 1 \pmod{q^n}$  for each prime divisor  $q$  in  $N + 1$ , which cannot be combined immediately into these two classes  $\pmod{F}$ , where  $F$  is the product of the moduli. In fact, it was long thought that if  $s$  of these congruences were combined by the Chinese remainder theorem, the best that could be said about a prime factor  $p$  of  $N$  was that it belonged to one of  $2^s$  different residue classes  $\pmod{F}$ . This apparent difficulty blocked the development of Lucas analogues for theorems on the “minus” side [44, p. 443, footnote].

It therefore came as a considerable surprise when Mike Morrison [74] proved that even though there are  $2^s$  possible ways of combining the individual congruences, it is nonetheless true that each prime factor  $p$  of  $N$  satisfies  $p \equiv \pm 1 \pmod{F}$ . The following result opened the way to developing the “plus” side theorems.

*Theorem 8.* Suppose that  $N + 1 = FR$ , where  $F$  is completely factored and  $(F, R) = 1$ . If there exists a Lucas sequence  $\{U_n\}$  for which  $N | U_{N+1}$  and  $(U_{(N+1)/q}, N) = 1$  for each prime factor  $q$  of  $F$ , then each prime divisor  $p$  of  $N$  satisfies  $p \equiv \pm 1 \pmod{F}$ .

We learned recently that a result equivalent to Theorem 8 appears in Riesel [118, page 59, Sats 3.7].

(9) *Change of Base or Sequence. The Extra 2.* In the summer of 1964, JLS and JB were working together at UCLA. Out of this collaboration came two important ideas in primality testing. The first is a theorem of JLS [6, p. 89].

*Theorem 9.* If  $N - 1$  is completely factored and for each  $q_i$  dividing  $N - 1$  there exists an  $a_i$  for which  $a_i^{N-1} \equiv 1 \pmod{N}$ , but  $a_i^{(N-1)/q_i} \not\equiv 1 \pmod{N}$ , then  $N$  is prime.



This theorem is an improvement on Theorem 1, since if an  $a$  can be found for which  $a^{N-1} \equiv 1 \pmod{N}$ , but  $a^{(N-1)/q} \not\equiv 1 \pmod{N}$  for a particular  $q$ , then that  $q$  has been settled once and for all regardless of what bases are used for the other  $q_i$ . Thus, it is no longer necessary to find a single base  $a$  for which all the hypotheses are satisfied. This idea carried over into all the other theorems on the minus side [7, pp. 621–623]. On the plus side, JB suggested that if a change in sequence were needed, then another Lucas sequence should be tried with the same  $D$ . This can easily be done by the transformations  $P_1 = P + 2$  and  $Q_1 = P + Q + 2$ . Using these ideas, it was possible to develop “change of sequence” theorems on the plus side that paralleled the change of base theorems on the minus side [7, pp. 629–631].

The second idea has to do with an extra factor of 2 that JB inadvertently put in the modulus of a difference of squares sieve setup for factoring. When the factor was found, JLS proved by a parity argument that the extra 2 should indeed be there. Later JB proved the general rule [6, p. 89] “. . . the modulus can be increased by a factor of 2 if  $(N - 1)/n$  is odd.” Although this extra two in the modulus made the search for  $x$  go twice as fast and is therefore a useful improvement in difference of squares factoring whenever it can be made, it was to play an important role in primality testing, where the double modulus gave a correct size remainder in the theory. (See [7, eqs. (9) and (19)].)

(10) *Introduction of the Search Bound.* In 1966, DHL found a way of introducing into primality theory the information that  $N - 1$  has no factor below a certain bound. In its original, unpublished form (it first appeared in [7, p. 625] in the midst of the ideas that are developed there) it was expressed as follows:

*Theorem 10.* Let  $N - 1 = FR$ , where  $F$  is completely factored and  $(F, R) = 1$ . If there is an  $a$  for which  $a^{N-1} \equiv 1 \pmod{N}$ ,  $(a^F - 1, N) = 1$ , and  $(a^{(N-1)/q} - 1, N) = 1$  for each prime factor  $q$  of  $F$ , and if all the prime factors of  $R$  exceed  $\sqrt{R/F}$ , then  $N$  is prime.

Note that the new element here is the GCD condition  $(a^F - 1, N) = 1$ . It should be emphasized that  $\sqrt{R/F}$  is a bound on the size of the factors of the *auxiliary* factorization of  $N - 1$  and not on  $N$  itself.

(11) *The Cube Root Theorem.* A major improvement in primality testing was introduced by JLS in 1970, when he analyzed difference of squares techniques in primality testing. He observed that if the first trial divisor did not divide  $N$  (highly unlikely since  $N$  was a probable prime), then the next one was so much larger that proof of primality required the factoring of  $N - 1$  only up to the cube root of  $N$ . What follows is an early form of this theorem.

*Theorem 11.* Let  $N - 1 = FR$ , where  $F$  is completely factored and  $(F, R) = 1$ . Suppose there exists an  $a$  for which  $a^{N-1} \equiv 1 \pmod{N}$  and  $(a^{(N-1)/q} - 1, N) = 1$  for each prime factor  $q$  of  $F$ . Let  $R = rF + s$ ,  $1 \leq s < F$ , and suppose  $N < 2F^3 + 2F$ ,  $F > 2$ . If  $r$  is odd, or if  $r$  is even and  $s^2 - 4r \neq t^2$ , then  $N$  is prime. Otherwise,  $s^2 - 4r = t^2$  and

$$N = \left[\frac{1}{2}(s - t)F + 1\right]\left[\frac{1}{2}(s + t)F + 1\right].$$

It is clear that all the computations that are required in this theorem are practical, being either powers or GCD's. As soon as  $F$  becomes large enough

during the factoring of  $N - 1$  for  $2F^3 + 2F$  to exceed  $N$ , then the primality test can be completed. In all the improvements that have been mentioned so far, the thrust has been to eliminate unnecessary computing or to replace time-consuming factoring by powering or GCD's.

(12) *The Joint Paper of 1975*. The major plan in [7] was to use the factorization of  $N + 1$  in parallel to that of  $N - 1$ . The many different ideas:

- (a) Morrison's theorem on the "plus" side,
- (b) change of base and change of Lucas sequence,
- (c) the extra 2,
- (d) the factor bound,
- (e) the cube root theorem,

coalesced into the powerful **combined theorem** of JLS [7, Theorem 20 and its Corollary 11]. Further slight sharpening has resulted in the following form of the combined theorem.

*Theorem 12.* Let  $N - 1 = F_1R_1$  and  $N + 1 = F_2R_2$ , where  $F_1, F_2$  are complete factorizations and  $R_1, R_2$  are composite numbers with no factors less than  $B_1, B_2$ , respectively, and define  $G = \max(B_1F_1, B_2F_2 - 1)$ . If  $N < GB_1B_2F_1F_2/2$ , then  $N$  is prime if it passes the powering and GCD tests analogous to those of Theorems 7 to 11. The denominator 2 may be omitted if  $N = 4k+1$  and  $B_1F_1 > B_2F_2$  or if  $N = 4k-1$  and  $B_2F_2 > B_1F_1$ .

(b) *The Programs*. Most of the numbers marked as primes in these tables have been shown to be prime by the program DOWNRUN. This program was written by JLS and Marvin Wunderlich and is used in conjunction with two auxiliary factoring routines whenever a more powerful factoring program than DOWNRUN is needed. The factoring routines are the continued fraction program of JB and Mike Morrison and a single step Pollard  $p - 1$  routine. The continued fraction program is the automated version due to Wunderlich that can factor a number of up to 43 digits in a couple of hours.

DOWNRUN begins its work by finding all factors of  $N - 1$  and  $N + 1$  below the direct search bound. These numbers are factored simultaneously. If no complete factorization of  $N - 1$  or of  $N + 1$  is found, then the product of their known factors, along with the bound, is tried in the inequalities of Theorems 10 or 12. If neither of the cofactors  $R_1, R_2$  of  $N \mp 1$  is a probable prime base 13, the direct search is continued to  $10^6$  and the same procedure is repeated.

If  $R_1$  or  $R_2$  is found to be a probable prime, then the program *goes down* and does not presently come back up to the same level again. Thus, it can happen when both  $R_1$  and  $R_2$  are probable primes and  $R_1 < R_2$  that the possibilities for  $R_2$  are not explored because the program went down on the minus side and was not able to complete the primality test. There is an option in the program, however, that permits the user to select the side on which the program may go down.

The program is also set up to accept factoring hints to help it in completing the proof. The simple yet incomplete strategy used in DOWNRUN is based on the practical observation that all but the larger numbers will automatically be processed using this simple strategy. The larger numbers can then be handled by designing a

more complicated strategy that can be implemented using the input control options of DOWNRUN. A detailed description of the simple strategy is given in [98].

The primes in the table with at most 25 digits were shown to be prime either by direct search up to their square roots or by DOWNRUN. Since testing for primality up to this number of digits turns out to be somewhat trivial when the auxiliary factoring goes up to  $10^6$ , we have not said anything further about the primality of these numbers in the tables other than to list them in the main tables. Most primes and probable primes with more than 25 digits are listed in Appendix A. (See VII for more information.) The primality proof for each of the primes is summarized in Appendix B.

In the final stages of preparing these tables, the probable primes with at most 72 digits were sent to Hugh Williams, whose powerful testing program can often routinely settle the primality of numbers up to 80 or even more digits. His programs found that every large probable prime which we sent to him was prime.

These programs are based on the primality theory which Williams has developed beyond that detailed in [7]. In his important extensions [107 to 111, 117] he utilizes properties of extensions of Lucas' and Lehmer's functions, as well as the factors of the cyclotomic polynomials  $N^2 + N + 1$ ,  $N^2 + 1$  and  $N^2 - N + 1$ . His fine paper [111] on primality testing delineates these extensions in the setting in which they arise and contains what needs to be said about the form the theory has taken since the publication of [7]. Because it is a rather complete account of these matters, we refer the reader to these papers. Further extensions of this kind appear to require new ideas since the higher cyclotomic polynomials have not yet been shown to be readily applicable to primality testing. However, some work in this direction is now being done. See section IV A 3.

A few prime proof summaries based on proofs due to others have been included in Appendix B.

(c) *The Proof Summaries.* The notation in the proof summaries that are listed in Appendix B employs the following abbreviations and signs:

- PPL Proth-Pocklington-Lehmer. The proof was made using Theorems 1, 2 and the Corollary in [98, p. 110] and the prime factors of  $N - 1$ .
- CMB Combined Theorem. The proof was made using Theorems 3 and 4 in [98, p. 110] and prime factors of  $N - 1$  and  $N + 1$ . The extra 2, mentioned in Theorem 12, was used if needed.
- BLS7 Theorem 7 of [7]. The proof was made using Theorem 11 above. (This notation was not used in the first edition. See IV A 3(c).)
- $p$  A prime factor  $p > 10^6$ , given as a "hint". It is followed by an M, P, F3, F4 or F6, indicating it is respectively a factor of  $N - 1$ ,  $N + 1$ ,  $N^2 + N + 1$ ,  $N^2 + 1$  or  $N^2 - N + 1$  at some level. This factor, which was discovered by one of the auxiliary factoring programs, is input with the number to be tested and is used to complete the primality test.

*Example.* 34 10,49– 201457393P CMB

Here the hint is the prime 201457393 which is a factor of  $N + 1$ .

- ( $n$ ) This notation, placed after PPL or CMB, indicates the direct search had to be taken to  $n$ , instead of the standard  $10^6$ , in order to obtain a sufficiently large search bound to complete the proof.

Example. \*115 3,287- 42521761M CMBF4F6(10\*\*8)

The combined theorem proves the primality using a hint on the minus side. Some small factors of F4 and F6 and the factor bound  $10^8$  are used in the proof. (There were many proofs with search bounds  $> 10^6$  in the first edition, but most were simplified in the second edition.)

(\* This proof is due to Hugh Williams.)

-,+ A minus sign indicates the cofactor  $R_1$  of  $N - 1$  is a probable prime base 13 and the program, after finishing its testing of  $N$  assuming that  $R_1$  is a prime, *went down* and then showed that  $R_1$  actually is a prime by carrying out a primality test on it. (See **3(a)(4)**.) A plus sign means the same, but for the cofactor  $R_2$  of  $N + 1$ .

Example. 40 2,278M +-CMB

Here, after removal of the factors  $2.3^2.5.157$  from  $N + 1$  (the plus sign), we obtain the probable prime

$$R_2 = 88546630665248948043897559039615307$$

and then with the removal of the factors  $2.7.233$  from  $R_2 - 1$  (the minus sign), we have the probable prime

$$R = 27144889842197715525413108227963$$

which was proved to be prime using the combined theorem.

Example. 58 2,329- -+-----CMB

Here the program descended 6 times before it was able to complete the test on this 58-digit cofactor of  $2^{329} - 1$ .

Examples. 50 10,190M 6129730457M -PPL  
52 2,289- +80216641M CMB.

In the first example the hint is removed from  $N - 1$  and then the probable prime cofactor is tested for primality. In the second example, the hint is used only after the program goes down on the plus side.

Mersenne This Mersenne number has been proved prime by the standard test, Theorem 6, **3(a)(7)** above.

(5\*\*58+1)/26 M This indicates that the prime  $(5^{58} + 1)/26$  is to be used as a hint on the minus side. There are also other hints of this type given in Appendix B, always for large numbers, where the primality test becomes easy with this information. Other examples, which vary slightly in format, are:

83 6,107+ Cofactor of  $6^{**}53 - 1$  M CMB  
89 2,447- Alg.PPL See [7]  
231 2,1149+ Factors of  $2^{**}382 - 1$  PPL

Example. 178 2,745- Factors of  $2^{**}148-1$  ---1317031M  
89165962987803776023M BLS7.

After factors dividing  $N - 1$ , the program goes down three times on the minus side. The proof was completed by the Cube Root Theorem with two hints on the minus side.

**C. Multiplicative Structure of  $b^n \pm 1$ .**

**1. Algebraic and Primitive Factors.**

The way in which  $b^n - 1$  factors is determined in part by the polynomial factorization

$$(2) \quad x^n - 1 = \prod_{d|n} \Phi_d(x), \quad n \geq 1,$$

where  $\Phi_d(x)$  is the  $d$ th cyclotomic polynomial, given by the formula

$$\Phi_d(x) = \prod_{\delta|d} (x^\delta - 1)^{\mu(d/\delta)}$$

where  $\mu$  is the Möbius function [55, p. 28]. Since  $\Phi_d(x)$  is irreducible over the integers for  $d \geq 1$ , the polynomial factorization in (2) is complete. Of course, it does not follow that the factorization

$$(3) \quad b^n - 1 = \prod_{d|n} \Phi_d(b)$$

is complete, since the integer  $\Phi_d(b)$  may not be prime.

(a) Let  $n \geq 3$  be odd and let  $1, d_1, \dots, d_s$  be the proper divisors of  $n$ . Then the factorization (3) is presented in Table  $b-$  in the format

$$n \quad (1, d_1, \dots, d_s) \quad p_1 \cdot p_2 \dots$$

where  $p_1 \cdot p_2 \dots$  is the product of the known factors of  $\Phi_n(b)$ , the **primitive part** in the factorization. The **algebraic part** is then  $(b^n - 1)/\Phi_n(b)$ . The divisor  $d = 1$  is omitted from the parentheses in Table 2-, because the factor  $\Phi_1(2) = 1$  is trivial.

Since in this format a factor  $\Phi_d(b)$  with  $d < n$  is indicated only by its subscript, each of its prime factors needs to be entered only once in the table (after the parentheses on line  $d$ ), rather than throughout the table at each place where  $\Phi_d(b)$  occurs.

A prime divisor  $p$  of  $b^n - 1$ ,  $n \geq 2$ , is called **primitive** if  $p \nmid b^k - 1$  for any  $k < n$ . Otherwise, it is called **algebraic**. It is clear that any prime  $p$  dividing  $\Phi_d(b)$  in (3) for  $d < n$  will be algebraic, since then  $p$  will divide  $b^d - 1$  because  $\Phi_d(b)$  does. On the other hand, any primitive factor of  $b^n - 1$  will have to divide the primitive part  $\Phi_n(b)$ . It is not true, however, that every prime factor of  $\Phi_n(b)$  is primitive. An algebraic prime factor of  $\Phi_n(b)$  is called **intrinsic** and is indicated in the main tables by an asterisk, except when  $p = n = 2$ . For example,  $\Phi_{21}(2) = 7*337$ . Note that 7 divides  $2^3 - 1$ , so 7 is an algebraic factor of  $\Phi_{21}(2)$ .

A primitive prime divisor  $p$  of  $b^n - 1$  is said to have **rank**  $n$ , and we write  $r(p) = n$ . A prime  $p$  is an intrinsic factor of  $\Phi_m(b)$  if and only if  $m = p^k r(p)$ ,  $k \geq 1$ . Furthermore, when  $p$  is intrinsic, it divides  $\Phi_m(b)$  just once, if  $m > 2$ .

(b) To find the factorization of  $b^{2n} - 1 = (b^n - 1)(b^n + 1)$  requires the table of the factorizations of  $b^n + 1$ ,  $n \geq 1$ . Thus, writing  $2n = 2^t m$ ,  $m$  odd, and using (2), we obtain

$$x^n + 1 = (x^{2n} - 1)/(x^n - 1) = \prod_{d|2n} \Phi_d(x) / \prod_{d|n} \Phi_d(x),$$

so

$$x^n + 1 = \prod_{d|m} \Phi_{2^t d}(x).$$

This result shows that the primitive part of  $b^n + 1$  is  $\Phi_{2n}(b)$ , and

$$(4) \quad b^n + 1 = \prod_{d|m} \Phi_{2^t d}(b).$$

If the proper divisors of  $m$  are  $1, d_1, \dots, d_s$ , then, since  $\Phi_{2n}(b)$  is the primitive part of  $b^n + 1$ , the factorization in (4) is given in Table  $b+$  in the format

$$n \quad (2^{t-1}, 2^{t-1}d_1, \dots, 2^{t-1}d_s) \quad p_1 \cdot p_2 \dots$$

where as before  $p_1 \cdot p_2 \dots$  is the product of the known prime factors of  $\Phi_{2n}(b)$ .

It should be noted that the very long table for the factorization of  $2^n + 1$  has been broken into three tables, as in the earlier tables [11], which give the factorization of  $2^{2k-1} + 1$ ,  $2^{4k-2} + 1$  and  $2^{4k} + 1$ . They are labeled respectively “Table 2+ (odd)”, “Table 2LM” and “Table 2+(4k)”. For each other base  $b$ , however, there is only the single “Table  $b+$ ”.

## 2. Aurifeullian Factorizations.

For each base  $b$ , certain of the numbers  $b^n \pm 1$  factor in a way different from the factorization obtained in (3) or (4). This second factorization is due to the existence of special polynomial identities, discovered by and named after Aurifeuille [11, p. v]. These identities show how to write  $\Phi_n(x)$  in a form which becomes a difference of squares when  $x$  has certain values. In particular, putting  $x = 2^{2k-1}$  in the identity

$$x^2 + 1 = \Phi_2(x^2) = (x + 1)^2 - 2x$$

yields the factorization

$$(5) \quad 2^{4k-2} + 1 = (2^{2k-1} - 2^k + 1)(2^{2k-1} + 2^k + 1).$$

Similarly, replacing  $x$  by  $3^{2k-1}$  and  $12^{2k-1}$  in the identity

$$x^3 + 1 = (x + 1)\Phi_3(-x) = (x + 1)[(x + 1)^2 - 3x]$$

yields the factorizations

$$(6) \quad 3^{6k-3} + 1 = (3^{2k-1} + 1)(3^{2k-1} - 3^k + 1)(3^{2k-1} + 3^k + 1)$$

and

$$(7) \quad 12^{6k-3} + 1 = (12^{2k-1} + 1)(12^{2k-1} - 2^{2k-1}3^k + 1)(12^{2k-1} + 2^{2k-1}3^k + 1).$$

For compactness we write formulas (5), (6), (7) with  $h = 2k - 1$  as

$$2^{2h} + 1 = L_{2h}M_{2h} \quad 3^{3h} + 1 = (3^h + 1)L_{3h}M_{3h} \quad 12^{3h} + 1 = (12^h + 1)L_{3h}M_{3h}$$

where

$$L_{2h}, M_{2h} = 2^h + 1 \mp 2^k \quad \text{and} \quad L_{3h}, M_{3h} = 3^h + 1 \mp 3^k \quad \text{or} \quad 12^h + 1 \mp 2^h 3^k.$$

In the same way we may set  $x = 5^h, 6^h, 7^h, 10^h$  and  $11^h$  in the respective identities

$$x^5 - 1 = (x - 1)\Phi_5(x) = (x - 1)[(x^2 + 3x + 1)^2 - 5x(x + 1)^2]$$

$$x^6 + 1 = (x^2 + 1)\Phi_6(x^2) = (x^2 + 1)[(x^2 + 3x + 1)^2 - 6x(x + 1)^2]$$

$$x^7 + 1 = (x + 1)\Phi_7(-x) = (x + 1)[(x + 1)^6 - 7x(x^2 + x + 1)^2]$$

$$x^{10} + 1 = (x^2 + 1)\Phi_{10}(x^2) \quad \text{and} \quad x^{11} + 1 = (x + 1)\Phi_{11}(-x)$$

$$\text{where} \quad \Phi_{10}(x^2) = (x^4 + 5x^3 + 7x^2 + 5x + 1)^2 - 10x(x^3 + 2x^2 + 2x + 1)^2$$

$$\text{and} \quad \Phi_{11}(-x) = (x^5 + 5x^4 - x^3 - x^2 + 5x + 1)^2 - 11x(x^4 + x^3 - x^2 + x + 1)^2$$

and obtain the factorizations

$$(8) \quad 5^{5h} - 1 = (5^h - 1)L_{5h}M_{5h}, \quad L_{5h}, M_{5h} = 5^{2h} + 3 \cdot 5^h + 1 \mp 5^k(5^h + 1)$$

$$(9) \quad 6^{6h} + 1 = (6^{2h} + 1)L_{6h}M_{6h}, \quad L_{6h}, M_{6h} = 6^{2h} + 3 \cdot 6^h + 1 \mp 6^k(6^h + 1)$$

$$(10) \quad 7^{7h} + 1 = (7^h + 1)L_{7h}M_{7h}, \quad L_{7h}, M_{7h} = (7^h + 1)^3 \mp 7^k(7^{2h} + 7^h + 1)$$

$$(11) \quad 10^{10h} + 1 = (10^{2h} + 1)L_{10h}M_{10h}, \quad \text{where} \quad L_{10h}, M_{10h} \\ = 10^{4h} + 5 \cdot 10^{3h} + 7 \cdot 10^{2h} + 5 \cdot 10^h + 1 \mp 10^k(10^{3h} + 2 \cdot 10^{2h} + 2 \cdot 10^h + 1)$$

$$(12) \quad 11^{11h} + 1 = (11^h + 1)L_{11h}M_{11h}, \quad \text{where} \quad L_{11h}, M_{11h} \\ = 11^{5h} + 5 \cdot 11^{4h} - 11^{3h} - 11^{2h} + 5 \cdot 11^h + 1 \mp 11^k(11^{4h} + 11^{3h} - 11^{2h} + 11^h + 1).$$

The appropriate formulas for L and M are also given at the end of each relevant main table.

The binomials with an Aurifeuillian factorization can be completely factored more readily than most other  $b^n \pm 1$ , because they break into two roughly equal pieces. For this reason, Table 2LM has been extended to 2400, twice as far as the other base 2 tables. The Aurifeuillian factorizations for the larger bases (in Tables 3+, 5-, 6+, 7+, 10+, 11+ and 12+) are not given in a separate table, but are incorporated in a special format in the tables themselves and are carried somewhat farther than the consecutively indexed entries, the extensions being listed below a line of dashes in the respective tables. (The line of dashes is omitted if it comes at a page boundary.)

Since the factorizations produced in (5) to (12) cut across those produced in (3) and (4), it is important to analyze how the two factorizations relate to each other.

*Example 1.* Since  $156 = 2^2 \cdot 39$ , we have from (4) that

$$2^{78} + 1 = \prod_{d|39} \Phi_{4d}(2) = \Phi_4(2)\Phi_{12}(2)\Phi_{52}(2)\Phi_{156}(2) \\ = (5)(13)(53.157.1613)(\underline{13*}.\underline{313.1249.3121.21841})$$

and from (5) that

$$2^{78} + 1 = L_{78}M_{78} = (13.53.157.\underline{13*}.\underline{313.1249}) (5.1613.\underline{3121.21841}).$$

The fact that the second factorization splits both the algebraic and primitive parts of  $2^{78} + 1$  suggests that in order to describe this multiplicative structure, the primitive parts of  $L_n$  and  $M_n$  should be defined so that  $L_n$  and  $M_n$  can be expressed as a product of primitive parts as in (3). To do this we denote the respective primitive parts by  $L_n^*$  and  $M_n^*$ . For base  $b$ , let  $\varepsilon_d = \varepsilon_d(b) = [1 + (b|d)]/2$ , where  $d$  is odd,  $(b, d) = 1$  and  $(b|d)$  is the Jacobi symbol. (Recall that  $(b|1) = 1$ .) Also, let  $n = 2^s m$ ,  $m$  odd,  $s \geq 0$ . Then we have the formulas (which we state without proof)

$$(13) \quad L_n^* = \prod'_{d|m} [(L_{n/d})^{\varepsilon_d} (M_{n/d})^{1-\varepsilon_d}]^{\mu(d)}$$

and

$$(14) \quad M_n^* = \prod'_{d|m} [(L_{n/d})^{1-\varepsilon_d} (M_{n/d})^{\varepsilon_d}]^{\mu(d)},$$

so that

$$(15) \quad L_n = \prod'_{d|m} [(L_{n/d}^*)^{\varepsilon_d} (M_{n/d}^*)^{1-\varepsilon_d}]$$

and

$$(16) \quad M_n = \prod'_{d|m} [(L_{n/d}^*)^{1-\varepsilon_d} (M_{n/d}^*)^{\varepsilon_d}].$$

In each case the prime on the product sign indicates that the product is taken over the divisors  $d$  of  $m$  such that  $(b, d) = 1$ . It is easily shown that  $\Phi_{4n}(b) = L_{2n}^* M_{2n}^*$  for odd  $n$  and that  $(L_n^*, M_n^*) = 1$ .

In Table 2LM (as in the other Aurifeuillian tables) we write the subscript  $n$  as a line number in front of L and M for ease of use, and list the L's and M's on the right of (15) and (16) with  $d < m$  inside parentheses and the known prime factors of the primitive part after the parentheses as before. (In the first column of this table the line number  $4k - 2$  is written only in front of the L, not the M). Hence, using (13) to (16), the first five pairs of lines of Table 2LM would be:

2L 1	6L (2M) 1	10L (2M) 5*	14L (2L) 113	18L (2L,6M) 37
M 5	M (2L) 13	M (2L) 41	M (2M) 29	M (2M,6L) 109

Now, since  $L_2^* = L_6^* = 1$ , we can simplify the presentation by omitting 2L and 6L and writing 2 and 6 for  $M_2^*$  and  $M_6^*$ . These five pairs of lines then become:

2 5	6 (2) 13	10L (2) 5*	14L 113	18L (6) 37
		M 41	M (2) 29	M (2) 109

The other simplification of this kind that can be made in the Aurifeuillian tables is in Table 3+, where the entry

3	(1) L.M
L	1
M	7



is abbreviated as 3 (1) 7.

*Example 2.* With  $b = 2$  and  $n = 78 = 2.39$  we have from (15) that

$$(17) \quad L_{78} = \prod'_{d|39} [(L_{78/d}^*)^{\varepsilon_d} (M_{78/d}^*)^{1-\varepsilon_d}] = L_2^* \cdot M_6^* \cdot M_{26}^* \cdot L_{78}^* \\ = (1)(13)(53.157)(\underline{13^*} \cdot \underline{313.1249}),$$

since  $M_6^* = M_6/L_2 = 13$  and  $M_{26}^* = M_{26}/L_2 = 53.157$ . Also, by interchanging L and M in (17) we obtain immediately

$$M_{78} = M_2^* \cdot L_6^* \cdot L_{26}^* \cdot M_{78}^* = (5)(1)(1613)(\underline{3121.21841}),$$

since  $L_{26}^* = L_{26}/M_2 = 1613$ . These factorizations are given in Table 2LM as

$$\begin{array}{l} 78L \quad (6,26M) \quad 13^* \cdot 313.1249 \\ M \quad (2,26L) \quad 3121.21841. \end{array}$$

Note here that  $L_{78}^* \cdot M_{78}^* = \Phi_{156}(2)$ , as it should.

For  $b > 2$ , formulas (6) to (12) are given in a three-line format:

$$\begin{array}{l} n \quad (\dots) \quad L \cdot M \\ L \quad (\dots) \quad L_n^* \\ M \quad (\dots) \quad M_n^* \end{array}$$

where the first line contains the triple product in (6) to (12) and the second and third lines give the factorizations of the L and M indicated in the first line.

*Example 3.* With  $b = 6$  and  $n = 210$ , we have from (9), (13) and (14) that

$$L_{210} = \prod'_{d|35} [(L_{210/d}^*)^{\varepsilon_d} (M_{210/d}^*)^{1-\varepsilon_d}], \text{ where } \varepsilon_d = [1 + (6|d)]/2.$$

Thus,  $L_{210} = M_6^* \cdot M_{30}^* \cdot L_{42}^* \cdot L_{210}^*$  and therefore we have directly

$$M_{210} = L_6^* \cdot L_{30}^* \cdot M_{42}^* \cdot M_{210}^*.$$

Hence, the factorization of  $6^{210} + 1 = (6^{70} + 1) L_{210} M_{210}$  is given in Table 6+ as

$$\begin{array}{l} 210 \quad (2,10,14,70) \quad L \cdot M \\ L \quad (6M,30M,42L) \quad L_{210}^* \\ M \quad (6L,30L,42M) \quad M_{210}^* . \end{array}$$

Here the decomposition of the algebraic factor  $6^{70} + 1$  is of course obtained from (4).

In computing  $L_n^*$  and  $M_n^*$  the following ‘‘crossover’’ theorem [36, p. 181; 37, p. 46] is sometimes useful. Assume that  $(b, k) = 1$ .

$$\begin{array}{l} \text{If } (b|k) = +1, L_n \text{ divides } L_{kn} \text{ and } M_n \text{ divides } M_{kn}. \\ \text{If } (b|k) = -1, L_n \text{ divides } M_{kn} \text{ and } M_n \text{ divides } L_{kn}. \end{array}$$

#### D. Acknowledgements.

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The impressive results of the last twenty-five years would not have been obtained without easy access to computers. Accordingly we would like to express our gratitude to the directors and the staffs of the following computing establishments: Mathematics Department, University of Arizona; Bell Telephone Laboratories, Murray Hill; The Computer Center, UC, Berkeley; IBM, Yorktown Heights; Northern Illinois University; University of Illinois; The Computer Center, Stanford University; and the Computing Facility, UCLA.

There are four persons we would like to single out for special thanks. The first is Hugh Williams, whose assistance in the final stages of factoring and primality testing of large “hold-outs” has been most helpful. The second is Mike Morrison, who has assisted us at several stages of the work and who set up at Northern Illinois University the factoring program which he and JB developed at UCLA. This program, and its later automatic version due to Marvin Wunderlich and SSW, were of signal importance in much of our primality testing, as well as in the factoring of all composite numbers in the tables with no more than 50 digits.

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The fourth person is Emma Lehmer, who, except for her insistence to the contrary, would have been listed among the authors of this work. To have worked with her and thereby to have benefited from her cheerful and effective involvement in all the stages of this work has put us very much in her debt. We wish to express our deep appreciation to her.

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Additional references (201, 202, . . .) for the second edition appear in section **IV B**. Additional references (301, 302, . . .) for the third edition appear in section **V C**.

#### IV. Update to the Introduction for the Second Edition\*.

The tables of the first edition contained all factors known to the authors on October 23, 1982. Since then more than two thousand new factorizations have been discovered. Appendix C lists the smallest composite cofactors in the tables. In the first edition it contained numbers with 51 to 64 digits. Now it gives numbers of 80 to 100 digits. The lists of “wanted” factorizations in the first edition had 25 numbers with 52 to 71 digits. They have all been factored. Other “wanted” lists have since been issued and many of their entries have been factored. The “wanted” lists (of the second edition) now contain numbers with 86 to 291 digits. All remaining numbers  $b^n \pm 1$  with exponent  $n < 100$  now appear on the “wanted” lists. All but nine of the numbers for base  $b > 2$  considered in [11] have been completely factored!

The smallest probable prime (PRP) in Appendix A of the first edition had 54 digits. Prime proofs have now been completed for all numbers up to 221 digits. In this edition we have updated the tables and appendices to June 22, 1987, and reviewed the developments in technology, factorization and primality testing which have produced the recent advances. We also include a few references to recent work which, though it has not contributed to this edition, may produce results in the future.

Since some of the first edition tables had very few composite entries, and since now most of the Aurifeuillians in those tables with base  $> 2$  have been factored, we decided to extend the higher base tables in the second edition. The numbers we have added to these tables have been factored with about the same effort that was applied to numbers in the first edition. The factoring for these extensions was done mostly by Robert Silverman, Peter Montgomery and SSW. Some factors of  $10^n \pm 1$  came from Samuel Yates [262] and his updates.

The tables of the first edition were found to be nearly free of errors. The most interesting error was the composite number 1223165341640099735851, which was listed as a *prime* factor of  $6^{175} - 1$ . A. O. L. Atkin found that this number is 34840572551.35107498301. Other errors were the line references in the parentheses of the first lines of 3,399+ and 11,209+. The first digit of  $k$  for the second factor of  $F_7$  was missing. These errors have been corrected in the present edition.

The format of the tables and appendices has been changed a little in this edition. In the first edition the decimal digits of a prime factor appeared in the main tables if it had no more than 25 digits; otherwise it was placed in Appendix A. In the first edition no penultimate prime factor had more than 25 digits. In the present edition many penultimate prime factors have more than 25 digits and they are given in full in the main tables. Only final prime factors are given in Appendix A. On the other hand, final prime factors with 21 to 25 digits have been placed in Appendix A when a line could be saved in the main tables. At the beginning of each table final factors are given in full as long as they fit, so as to enhance the pleasing triangular shape of the beginning of each table.

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\*The text of this part of the Introduction to the second edition is essentially that used in the second edition. In this section the word “now” means, “on June 22, 1987.” A few typographical errors were corrected and the old status report was deleted. The new text for the third edition appears in Section V.

The inclusion of so many large new prime factors forced many more factorizations to be split into two lines in the main tables. When it was necessary to break a factorization we aligned the second line as follows, unless it was very long: If the factorization was incomplete, put the “C” in the column for “C”’s. The last digit of a broken complete factorization appears two columns to the left of the “C”’s. (In the first edition we tried to align a dot in the second line with a dot in the first line.)

### A. Developments Contributing to the Second Edition.

In this section we list some of the advances in technology, factoring algorithms and primality testing which made the second edition better than the first one.

#### 1. Developments in Technology.

The use of personal computers and supercomputers for factoring has continued as has the construction of special machines designed for factoring. The use of networks of microcomputers to factor numbers is a new development. More memory has become available in modern computers due to its dramatically reduced cost. Meaningful error messages are now generated when an error occurs during the execution of overlapping instructions.

(a) *Supercomputers.* Davis and Holdridge [215] at Sandia National Laboratories used a Cray-1 and a Cray X-MP to obtain all of the “Ten Most Wanted” factorizations of the first edition. They made the first implementation of the quadratic sieve factoring algorithm on a supercomputer.

McCurdy and Wunderlich [260, 261] have programmed the continued fraction algorithm on the MPP computer. With this machine, they factored the 62-digit composite divisor of  $5^{171} + 1$ .

Herman te Riele et al. [229] have programmed the quadratic sieve algorithm on a Cyber 205. They factored the 82-digit number  $(7^{104} + 1)/(7^8 + 1)$  and several smaller numbers.

Young and Buell [263] used a Cray-2 to determine that the Fermat number  $F_{20}$  is composite. They checked this calculation with a Cray X-MP.

Many more general purpose supercomputers of various designs are being built, which should make it possible to factor even larger numbers.

(b) *The Extended Precision Operand Computer.* With the assistance of many students at the University of Georgia, J. W. Smith and SSW [240, 249, 253] built a special processor, the Extended Precision Operand Computer (EPOC), to factor numbers with the continued fraction algorithm of III B 2(d). This machine has a 128-bit word length and several remaindering units (the “Mod Squad”) to perform the trial divisions quickly. Its results include the factoring of the 62-digit primitive part of  $3^{204} + 1$ . The elliptic curve method (see B 2(d) below) is presently being programmed on the EPOC.

(c) *The Dubner Processor.* Dubner and Dubner [218] built a special computer which rapidly performs arithmetic with large integers. Their greatest success has been in finding small divisors of large numbers by Brent’s variation [204] of Pollard’s “Rho” method and by the elliptic curve method. (See [257] for an account of how this machine assisted in the proof that  $(10^{1031} - 1)/9$  is prime.)

(d) *Small Machines.* Hiromi Suyama continues to factor numbers from the Cunningham Project using his microcomputer. Yûji Kida found the 30-digit prime



divisor of  $7^{127} - 1$  with his NEC PC-9801VM2 personal computer. There is little doubt that with the increase in power of small computers many factorizations will continue to be discovered on these machines.

The host computer for the EPOC (see (b) above) is an IBM PC. The host prepares the factor base and initializes the continued fraction expansion of  $\sqrt{mN}$ . It transmits this information to the EPOC and starts the EPOC. When the EPOC factors a  $Q$  (see 2(c) below), it sends the pair  $A, Q$  to the host to be stored. After the host has collected enough of these pairs, it computes the null space of a large matrix and factors  $N$ .

(e) *A Distributed Network of Small Computers.* Silverman [247, 248] has factored many large numbers using the quadratic sieve algorithm running on a network of SUN microcomputers at MITRE Corporation. The master processor assigns a different polynomial to each SUN. After the SUN sieves the range of this polynomial, it reports the results back to the master processor, which then determines whether there is likely to be enough information to factor the number. The most difficult number Silverman has factored so far is the 87-digit number  $(5^{128} + 1)/514$ . At present, this is the largest number ever factored by a general purpose factoring algorithm, i.e., one which can factor all numbers of a given size in about the same time.

## 2. Developments in Factorization.

Several methods which were discussed in the first edition have been improved. They include Pollard's methods and the continued fraction method. The quadratic sieve method was just mentioned in the first edition, because it had hardly been used at that time, although it had been used a great deal by M. Kraitchik as a hand method and was cited in the first edition in III B 1(a). It has now been programmed and has been much advanced in the past five years. A completely new method, which uses elliptic curves, has had a major effect on the tables of this edition. (See [208] for a comparison of the best factoring methods and for recommended choices of their parameters.) Some good general references for recent progress in factoring and prime testing are [217, 225, 236, 242, 243, 256].

(a) *More about Pollard's Methods.* As was predicted in III B 2(e), Pollard's  $p - 1$  [80] and "Rho" [81] methods have been of great importance in factoring numbers in these tables.

Baillie has completed his search for factors for all numbers in the Cunningham Project using the two-step  $p - 1$  method with limits 200000 and 10200000. The largest factor he found was  $p = 174463386657191516033932614401$ , which divides  $2^{740} + 1$ . (Note that  $p - 1 = 2^8 \cdot 5^2 \cdot 17 \cdot 37 \cdot 1627 \cdot 5387 \cdot 68111 \cdot 152081 \cdot 477361$ .) Baillie's efforts have contributed hundreds of factors to this book.

See Williams [255] for the  $p + 1$  analogue of the  $p - 1$  method. (Cf. III B 2(e).)

See [204, 206] for an account of Brent's improvement of Pollard's Rho method, which factored  $F_8$  just before the first edition went to press. Dubner [218] has since factored many numbers by the Rho method.

Montgomery [231] has proposed other variations of Pollard's methods.

(b) *More about the Continued Fraction Method.* Just before the first edition was published, Carl Pomerance [237] made a substantial improvement to the continued fraction method by optimizing the "early abort" strategy in it. (An "early abort"

strategy determined when to stop the trial divisions of a given residue part way through the factor base if not enough factors have been found at that point.) His analysis predicted more precisely where in the factor base one should examine the progress made so far and how small the remaining cofactor should be if one is to continue work on this residue. SSW programmed this strategy on an IBM computer at the University of Georgia and factored many numbers in the 50 to 54-digit range. The same algorithm now runs on the EPOC (See **A 1(b)** above). For factoring numbers in the 50 to 60-digit range, the early abort strategy cuts the running time by about an order of magnitude. (See [241] for a good choice of the parameters.)

One way to implement the continued fraction factoring algorithm on a parallel computer is to compute terms in widely-spaced intervals in the continued fraction expansion of  $\sqrt{mN}$ . After this is done, each processor of the parallel computer can work independently on its own section of the continued fraction expansion. Williams and Wunderlich [259] explain how to do this by jumping ahead in the expansion.

(c) *Kraitchik's Method (The Quadratic Sieve Algorithm)*. Only one factorization reported in the first edition was obtained by the quadratic sieve algorithm, namely that obtained by Joseph Gerver [219] who factored the 47-digit composite divisor of  $3^{225} - 1$  on an HP3000. A hand version of this method had been used extensively by M. Kraitchik [34, 35, 37] to factor many numbers in older tables. Although the method with its variants was well-known to JB and DHL, no one had used it in modern times to factor numbers, until Carl Pomerance [237, 238] re-discovered the method, analyzed it theoretically and found it was a powerful method. Others have re-discovered some of the techniques of Kraitchik, such as matching large cofactors of the residues, and have contributed new ideas and programming techniques to the point where now this algorithm has factored most of the composite numbers with 54-79 digits which remained in the first edition. (Some numbers in this range were factored by other algorithms before the quadratic sieve method was used.)

Davis and Holdridge [216] used it to factor several numbers having 53 to 69 digits on a Cray-1. They also factored  $(10^{71} - 1)/9$  with it on a Cray X-MP. Silverman [247, 248] implemented the algorithm first on a VAX and then on a network of SUN's. He factored hundreds of numbers of 54 to 87 digits from this project. His effort was the major force which advanced the lower limit of Appendix C from 54 to 80 digits. Niebuhr, te Riele and SSW have factored a few numbers with this algorithm.

The quadratic sieve algorithm is similar to the continued fraction algorithm in that both algorithms generate pairs  $A, Q$  with  $A^2 \equiv \pm Q \pmod{N}$ , where  $N$  is the number to be factored. In both algorithms some of these congruences with  $Q$  factored are multiplied to construct congruences  $X^2 \equiv Y^2 \pmod{N}$  which yield factors of  $N$  as  $\text{GCD}(X + Y, N)$ . (This is Kraitchik's [36, pp. 147–151] method of "cycles".) The  $A$ - $Q$  pairs in the continued fraction algorithm arise in the continued fraction expansion of  $\sqrt{mN}$  and have  $0 < Q < 2\sqrt{mN}$ . The small size of the  $Q$ 's improves their chance of being factored completely by trial division by the primes in the factor base. The  $Q$ 's in the quadratic sieve algorithm are numbers in the range of one or more quadratic polynomials. Although most of them are larger

than  $2\sqrt{mN}$ , this disadvantage is more than offset by the fact that they may be factored by sieving rather than by trial division.

Gerver [219] used just the single polynomial  $Q(x) = (x + \lfloor \sqrt{N} \rfloor)^2 - N$ , sieving it over the interval  $-499999999 < x < 400000000$  in blocks of 10000  $x$ 's. However,  $|Q(x)|$  becomes large when  $x$  is far from 0. Davis and Holdridge began by using this polynomial, but found [214] a way to construct other polynomials whose values are divisible by a specified prime beyond the factor base. They used this technique to match some otherwise unmatched "large primes". (See [207, p. 42].) Then Montgomery (see [238]) found an elegant way to construct many polynomials with slightly smaller average values. Silverman [247] implemented Montgomery's version.

(d) *The Elliptic Curve Factoring Method.* On February 14, 1985, H. W. Lenstra, Jr., announced the first factoring algorithm to use twentieth century mathematics. This method, called the Elliptic Curve Method (ECM), computes a high multiple of a point on a random elliptic curve modulo the number  $N$  to be factored. During this calculation one hopes to encounter a noninvertible denominator modulo  $N$  and thereby discover a proper factor of  $N$  in the unsuccessful extended GCD computation. Like the Pollard methods, ECM tends to find small prime factors of  $N$  before large ones. However, for most primes Lenstra's method is even faster in practice than those of Pollard. (See [228, 202, 205, 210, 231, 253] for more details about ECM.)

The choice and parametrization of the curves are important issues. Chudnovsky and Chudnovsky [210] and Suyama have suggested ways to select and parametrize elliptic curves having special properties which accelerate the algorithm. Montgomery [231] considered several versions of a second step for ECM, analogous to that of the  $p - 1$  method. Although the second step does not speed ECM theoretically, it has important practical value, as most interesting factors are discovered during the second step. Brent [205] suggested a "birthday paradox" variation of the second step of ECM.

Several researchers have programmed ECM. The most effective version so far has been that of Montgomery [231] which has produced hundreds of factors for the tables in this book. Although Montgomery found most of them, Silverman and SSW found some others with Montgomery's VAX program. Silverman has also written an ECM program for SUN workstations. Brent has a version of ECM, too. Suyama and Kida have found a number of factors by ECM on their own microcomputers.

(e) *Other New Factoring Methods.* Schnorr and Lenstra [246] have published a factoring algorithm which requires little storage. It will factor  $N$  efficiently if the class number  $h(-mN)$  is free of large prime divisors for some small multiplier  $m$ . Buell [209] has investigated the probability that  $h(-mN)$  will have this property. Atkin has factored several numbers in this book by a practical class number algorithm he calls "SPAR".

The continued fraction method and Kraitchik's method have a step in which one computes the null space of a huge matrix over  $\mathbf{GF}(2)$ . This time-consuming elimination step limits the size of the factor base which may be used. Several researchers [235, 254] have suggested techniques for speeding up this step.

Multiplication of numbers modulo  $n$  occurs frequently in factoring and prime testing programs. Montgomery [230] has found a way to compute  $ab \pmod{n}$

quickly when  $a$ ,  $b$  and  $n$  are large numbers and the computer's divide instruction is slow compared to its multiplication instruction.

### 3. Developments in Primality Testing.

In the first edition we mentioned a new, but unused, primality testing method which is (a) below. The elliptic curve methods in (b) were developed after the first edition was published. In **III B 3(b)** we mentioned Williams' primality theory which utilizes factors of  $\Phi_k(N)$ , for  $k = 1, 2, 3, 4$  and  $6$ , to prove that  $N$  is prime. H. W. Lenstra, Jr., [226, 227] has extended this theory to all cyclotomic polynomials and has related it to the APR primality test described below.

(a) *The Method of Adleman, Pomerance and Rumely.* These three researchers [201] invented a new method for testing a number for primality. Later, Cohen and H. W. Lenstra, Jr. [212] transformed this test into a practical primality test. Cohen and A. K. Lenstra [211] implemented this test on various computers. With the version of the program which A. K. Lenstra left at Bell Laboratories, Odlyzko has proved the primality of all numbers in Appendix A up to 210 digits. He stopped at 210 digits because larger numbers would require much larger values of the parameters  $E$  and  $I$  (mentioned in the next paragraph) and hence much longer running times. The proof for a 200-digit prime takes only a few minutes on a Cray-1.

The Adleman-Pomerance-Rumely algorithm (APR) begins by subjecting  $N$  to a series of tests similar to the usual probable prime tests. If  $N$  fails any one of these tests, then  $N$  is composite. But if  $N$  passes them all, then  $N$  either is prime or is divisible by one of the numbers  $N^j \bmod E$  for  $j = 0, 1, \dots, I - 1$ , where  $E$  is an integer slightly greater than  $\sqrt{N}$  and  $I$  is an integer  $< (\log N)^{c \log \log \log N}$  for some constant  $c$ . The algorithm concludes by checking that  $N$  is not a multiple of one of these numbers. The only way to verify an APR proof of primality is to repeat all of its steps. No information about the proof will shorten the work needed to verify it. By contrast, the hints in Appendix B (other than search limits) are real short-cuts to checking proofs of the type described in **III B 3**. (Actually, some versions of the APR test can use divisors of  $N^2 - 1$  to reduce the size of  $I$ . Hints like the ones in Appendix B would reduce the work needed to check this type of APR proof.) Nothing was added to Appendix B to indicate APR proofs. Numbers listed as "P" (instead of "PRP") in Appendix A, but for which there is no proof in Appendix B, were proved prime by APR, mostly by Odlyzko. Using another version of his program, A. K. Lenstra has proved primality of some primes  $> 210$  digits. (See Rumely's excellent survey paper [245] for a concise overview of the APR method. See [211, p. 120] for the details of the APR proof of the primality of the 247-digit divisor of  $2^{892} + 1$ .)

(b) *Elliptic Curve Primality Tests.* Several researchers [203, 210, 220] have invented primality tests which use the theory of elliptic curves. The basic idea for showing that  $N$  is prime by these tests is to show that, for any prime factor  $p \leq \sqrt{N}$  of  $N$ , there is an elliptic curve defined over  $\mathbf{Z}/p$  which has more points than allowed by the Hasse-Weil theorem, that is, more than  $p + 2\sqrt{p} + 1$  points.

Atkin (see 4.12 of [225]) has developed a practical primality test based on elliptic curves. He has used it to prove the primality of several large numbers in Appendix A, but as yet has not published his method.

(c) *Other Changes and Additions to Appendix B of the Second Edition.* Because of the power of the new primality tests mentioned in (a) and (b), we lack rigorous

prime proofs for only 35 numbers in Appendix A (marked “PRP” there). The smallest one has 222 digits.

Since only the APR test was used on all the new primes smaller than 211 digits that were added to Appendix A since the first edition, some quite small numbers would have no proof summary even though it would be possible to find one easily by the methods of **III B 3**. We decided to provide such proofs where we could do so with little effort. Because the new factoring algorithms mentioned above are so powerful we could construct such proofs for nearly all primes in Appendix A up to 100 digits. At the same time, in order to shorten the work of those who might check the proof summaries in Appendix B, we simplified many of the old proofs, especially those with a search limit  $> 10^6$ . Since we wrote a new program to generate these proofs, we did not confine ourselves to just the PPL and CMB proofs constructed by the DOWNRUN program of **III B 3(b)**. We also used the powerful Theorem 7 of [7], which is abbreviated BLS7 in Appendix B. It is the same as Theorem 11 of **III B 3(a)(11)**.

The proof summaries in Appendix B are not guaranteed to be as short as possible.

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## V. Update to the Introduction for the Third Edition.

The tables of the second edition contained all factors known to the authors on June 22, 1987. Since then more than two thousand new factorizations have been discovered. Appendix C lists the smallest composite cofactors in the tables. In the first edition this appendix contained numbers with 51 to 64 digits. In the second edition it contained numbers with 80 to 100 digits. It now contains numbers with 130 to 142 digits. The lists of “wanted” factorizations in the first edition had 25 numbers with 52 to 71 digits. These have all been factored. The lists of “wanted” factorizations in the second edition had 32 numbers with 86 to 291 digits. These have all been factored. Other “wanted” lists have since been issued and many of their entries have been factored. The current “wanted” lists (see **B** below) now contain numbers with 141 to 212 digits. All of the numbers considered in the 1925 Cunningham-Woodall book [11] have been completely factored!

The smallest probable prime (PRP) in Appendix A of the second edition had 222 digits. Prime proofs have now been completed for all prime numbers in that appendix, as well as for primes found since 1988. In this edition we have updated the tables and appendices to September 18, 2001, and reviewed the developments in technology, factorization and primality testing which have produced the recent advances. We also include a few references to recent related work which may interest the reader.

We extended the tables with base  $b > 2$  in the second edition, and we have lengthened them again in the third edition. We have attempted to factor the new numbers added to these tables using about the same effort that was applied to numbers in the second edition.

The format of the tables and appendices has been changed a little in this edition. In the first and second editions, all penultimate prime factors fit on a single line, which allowed us to break lines only at multiplication dots. Because we can now factor much larger numbers than before, some penultimate prime factors have more than 75 digits and are given on two lines with a continuation slash ( $\backslash$ ) at the end of the first line. For example, in the 2– Table one finds the entry

```
571      5711.27409.69693366045316671685098712301007940958018325270028\  
                                               49548226132675916172927.P91
```

The prime factor 6969...00284954...2927 was too long to fit on one line and had to be broken.

### A. Developments Contributing to the Third Edition.

#### 1. Developments in Technology.

The use of many personal computers and supercomputers for factoring has continued, but no new machines especially designed for factoring have been built recently.

A. K. Lenstra and M. S. Manasse [328] ran their ECM and quadratic sieve programs on networks of hundreds of small computers. H. J. J. te Riele, W. M. Lioen and D. T. Winter have factored 7,122+ C87 and 6,131– C92 by the quadratic sieve algorithm on a NEC SX-2, the world’s fastest single-CPU vector computer

(at least at that time). Later they factored 2,463+ C101 by the quadratic sieve algorithm running on one processor of a Cray Y-MP4. See also [305].

W. R. Alford and C. Pomerance [302] have implemented the quadratic sieve on hundreds of PC-class computers and factored the 95-digit numbers 7,128+ and 2,332+ and the impressive 100-digit number 12,119+. Y. Kida has factored several numbers of 95 to 101 digits with the quadratic sieve on many small computers.

B. Dixon and A. K. Lenstra [316] have written an ECM program for the MasPar computer. It found many factors reported in the third edition, including the 35-digit prime divisor of 2,511+. Lenstra [324] has factored many numbers in this edition by the quadratic sieve and the number field sieve on a MasPar computer.

ECMNET is a group of people who factor large numbers with T. Granlund's ECM program. They have found many factors reported in the third edition, including the 53-digit prime factor of 2,677–.

The group NFSNET [320] has used dozens of computers around the world to factor numbers by the special number field sieve. Their factorization of 3,349– yielded the largest penultimate prime factor known (80 digits) of any Cunningham primitive part at the time. This record has since been eclipsed by the 93-digit penultimate prime factor of 10,211– C211, found by another group called The Cabal. Yet another group, NFSNET' continued this work by factoring 2,629– and several other numbers reported in this edition.

## 2. Developments in Factorization.

Most new factors in this third edition were discovered by the quadratic sieve algorithm, the elliptic curve method or the number field sieve. (See **IV A 2(c)** and (d).)

A. K. Lenstra and M. S. Manasse [329] gave a modification to the quadratic sieve in which up to two primes larger than the factor base limit may be saved and used. This modification also speeds the number field sieve. A different modification accelerates the quadratic sieve by amortizing the polynomial initialization time. The computer science term “amortizing” here means that the cost of setting up several polynomials together is averaged over them. The modification sets up  $2^k$  polynomials for the effort of  $k$  setups, which has the effect of accelerating the setup by a factor of  $k2^{-k}$ . R. Peralta [338] calls this version the hypercube quadratic sieve, while W. R. Alford and C. Pomerance [302] call it the self-initializing quadratic sieve. Many factors reported in this edition were computed using these modifications. Just before the third edition went to press, P. Leyland and J. Franke experimented with a variation of the quadratic sieve which allows up to three large primes to be used. They found that this change speeds the algorithm beyond the use of two large primes. SSW aided Leyland's effort by combining the hypercube and three large primes variations, producing an even faster version of the quadratic sieve. This work resulted in the factorization of the 135-digit divisor of 2,1606L.

Several factors were found by an FFT extension to the  $p - 1$  method (see **III B 2(e)**) which was implemented by R. D. Silverman [333]. P. Montgomery [330] has invented an FFT extension to ECM, and it has found some new factors of Cunningham numbers. A. O. L. Atkin and F. Morain [303] describe an improved method of choosing ECM curves which speeds the algorithm. Silverman and SSW [342] tell how to choose the parameters in ECM.

A new factoring algorithm, the number field sieve [326], has been used by A. K. Lenstra and M. Manasse, by Silverman, by CWI and by NFSNET [320] to achieve

some factorizations reported here. Two impressive ones were the factorizations of  $2,512+ C148$  (see [327]) and of  $2,523- C158$ . The original algorithm works best for numbers of the form  $b^n \pm c$ , where  $c$  is small. It does not take advantage of any small factors which may already be known of a number of this form. Thus, for example, Lenstra and Manasse had to factor the entire 155-digit number  $F_9 = 2^{512} + 1$ , not just the 148-digit cofactor.

L. M. Adleman [301] has described some improvements to the number field sieve. The general number field sieve is a variation which factors numbers without special form. Though less efficient than the special number field sieve, it beats the quadratic sieve for large enough numbers. So far, it has factored only a few Cunningham numbers. The first general number field sieve factorization was that of  $3,367- C105$  by FactOregon and CWI. Several papers about the number field sieve were published in the book [325]. See also C. Pomerance's paper [339].

See [320] for some clever ways to choose polynomials for the number field sieve. See [319] for some implementation details for the number field sieve. In a paper in [325], J. M. Pollard proposed the lattice sieve, a variation of the relation collection step of the number field sieve. In [321], R. A. Golliver, A. K. Lenstra and K. S. McCurley implemented this algorithm and achieved a substantial speed-up compared to other relation collection versions reported in the literature. Near the end of the number field sieve algorithm, one has to compute the square root of a product of thousands of algebraic numbers. J. M. Couveignes' article in [325] deals with this problem, as does P. Montgomery's paper [331].

In the final step of the quadratic sieve and the number field sieve one must find the null space of a huge matrix over  $\mathbf{GF}(2)$ . Several papers [313,314,323] tell how to perform this elimination step efficiently. The ideas in these papers speeded this part of the algorithm for some factorizations reported in this edition.

M. Morimoto and Y. Kida have published a table [336] of the factorizations of the numbers  $\Phi_n(x)$  for  $1 \leq x \leq 1000$  and those  $n$  for which  $\phi(n) = 16$  or 18. Their book also lists the  $n$  and  $x$  for which  $\phi(n) \leq 100$ ,  $1 \leq x \leq 1000$  and  $\Phi_n(x)$  is prime or probably prime. A second volume [337] of their book factors the numbers  $\Phi_n(x)$  for  $1 \leq x \leq 1000$  and those  $n$  for which  $\phi(n) = 20$  or 22. It also lists the  $n$  and  $x$  for which  $102 \leq \phi(n) \leq 156$ ,  $1 \leq x \leq 1000$  and  $\Phi_n(x)$  is prime or probably prime.

Paper [343] by N. M. Stephens on ECM should have been cited in **IV A 2(d)**. See P. Stevenhagen [344] for more about the Aurifeuillian factorizations in **III C 2**. R. P. Brent [308] tells how to compute the coefficients of Aurifeuillian factorizations, as does SSW [346]. D. M. Bressoud and H. Wada have published books [311] and [345] on factorization and primality testing. A second edition of H. Riesel's book ([243] of our first edition) has appeared as [340]. P. Montgomery has written an excellent survey article [332] on factoring.

H. C. Williams and J. O. Shallit have written an informative history [347] of factoring integers and primality testing from about 1750 to about 1950. These two authors and F. Morain [341] have discovered a sieve built 75 years ago by E.-O. Carissan.

### 3. Developments in Primality Testing.

W. Bosma and M. P. van der Hulst [307] have described an efficient version of the Jacobi sum primality test of Cohen and Lenstra (see **IV A 3 (a)**). Bosma [306] has proved some new primality tests for  $h \cdot 2^k \pm 1$ . Using A. O. L. Atkin's method

(see **IV A 3(b)** and [304]), F. Morain [334], [335] has completed primality proofs for all probable primes in Appendix A, including the new large primes reported in this edition.

### B. Status of the Project and of Important Factorizations.

The tables in this book presently reside in data sets at Purdue University. The latest versions of them are available at the web site

<http://www.cerias.purdue.edu/homes/ssw/cun/index.html>.

During the past thirteen years these tables have been improved by the factorization of about ten of their numbers per month. SSW reported the new factors in annual Updates to the book and more frequent “Pages” of new factors. If you factor any numbers in this book or if you would like to receive the Updates and Pages, please write to:

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 Email: [ssw@cerias.purdue.edu](mailto:ssw@cerias.purdue.edu)

The pace of about ten new factorizations per month continues in 2001. In recent months no new prime factor  $< 35$  digits has been reported to us.

The earlier editions of this book mentioned the Computer Museum in Massachusetts where one could view DHL’s sieve machines discussed in **III B 1** (b) and (c) and **III B 2** (c). While the Computer Museum remains in Boston, the sieves have been moved to the Computer History Museum located at Moffett Field in Mountain View, California. H. C. Williams no longer uses the sieve built by C. D. Patterson [258]. It has been replaced by a new sieve called the MSSU, which is much faster and easier to use.

For many years we have maintained lists of “most wanted” and “more wanted” factorizations. At this time these lists read as follows:

#### *Ten “Most Wanted” Factorizations*

- |    |         |      |     |         |      |
|----|---------|------|-----|---------|------|
| 1. | 2,673–  | C151 | 6.  | 6,257–  | C173 |
| 2. | 2,647+  | C169 | 7.  | 5,289+  | C156 |
| 3. | 3,397–  | C178 | 8.  | 5,298+  | C189 |
| 4. | 3,397+  | C162 | 9.  | 12,178+ | C145 |
| 5. | 10,223– | C211 | 10. | 11,197+ | C205 |

#### *Twenty-Four “More Wanted” Factorizations*

2,653+	C154	2,1262M	C178	6,244+	C178	10,227–	C212
2,659+	C188	2,1294L	C187	6,251+	C179	10,223+	C201
2,661+	C148	2,716+	C163	6,257+	C200	10,226+	C197
2,1238L	C160	3,404+	C141	7,233–	C155	10,229+	C164
2,1238M	C145	5,307–	C187	7,232+	C171	11,199–	C173
2,1262L	C177	5,302+	C187	7,233+	C150	12,179–	C190

Many of these numbers are, of course, the first “hole” in their respective tables. All numbers from the 1925 Cunningham-Woodall tables have been finished. All numbers from the base 3 to base 12 tables in our first and second editions have been factored.

It is known that  $2^p - 1$  is prime for  $p = 2, 3, 5, 7, 13, 17, 19, 31, 61, 89, 107, 127, 521, 607, 1279, 2203, 2281, 3217, 4253, 4423, 9689, 9941, 11213, 19937, 21701, 23209, 44497, 86243, 110503, 132049, 216091, 756839, 859433, 1257787, 1398269, 2976221, 3021377$  and  $6972593$ , but for no other  $p < 3945000$ . Thus,  $2^{3021377} - 1$  is the thirty-seventh Mersenne prime and  $2^{6972593}$  is probably the thirty-eighth one. See [101] and [222] for the search to 100000. (See Haworth [223] for an extensive bibliography of papers on Mersenne numbers. See Colquitt and Welsh [312] for the discovery of the prime  $2^{110503} - 1$ .) See the web site

<http://www.utm.edu/research/primes/largest.html>

for the latest information about Mersenne and other large primes. The last few Mersenne primes have been found by GIMPS, the Great Internet Mersenne Prime Search, launched by George Woltman in 1996.

The “repunits”  $(10^p - 1)/9$  are prime for  $p = 2, 19, 23, 317$  and  $1031$  and for no other  $p < 20000$ . (See Williams and Seah [112, 113] and Williams and Dubner [257] for these results.) Dubner [317] has tested all  $p$  between 10000 and 50000 and found that  $(10^{49081} - 1)/9$  is a probable prime and that no other repunit primes have  $p$  in this range. Recently, Lew Baxter found that  $(10^{86453} - 1)/9$  is a probable prime.

Here is a list of the known prime and probable prime “repunits”  $(b^p - 1)/(b - 1)$  to base  $b$  for  $b = 3, 5, 6, 7, 11$  and  $12$ . Williams and Seah [113] tested all  $p \leq 1000$  for these bases. Dubner [317] has tested all  $p$  less than at least 10000 for these bases. (The probable primes are marked with stars.)

Base $b$	$p \leq 10000$ for which $(b^p - 1)/(b - 1)$ is prime or probable prime*.
3	3, 7, 13, 71, 103, 541, 1091*, 1367*, 1627*, 4177*, 9011*, 9551*
5	3, 7, 11, 13, 47, 127, 149, 181, 619, 929, 3407*, 10949*
6	2, 3, 7, 29, 71, 127, 271, 509, 1049*, 6389*, 10613*
7	5, 13, 131, 149, 1699*
11	17, 19, 73, 139, 907, 1907*, 2029*, 4801, 5153*, 10867*
12	2, 3, 5, 19, 97, 109, 317, 353, 701*, 9739*

The Fermat number  $F_{22}$  was shown composite in 1993 by Crandall, J. Doenias, C. Norrie, and J. Young [315]. Likewise,  $F_{24}$  was shown composite in 1999 by Mayer, Papadopoulos and Crandall. The remaining cofactors of  $F_{12}, F_{13}, F_{15}, F_{16}, F_{17}, F_{18}, F_{19}$  and  $F_{21}$  have been shown to be composite. McLaughlin found the factor of  $F_{25}$ . T. Taura found the factor of  $F_{28}$ . Thus,  $F_{33}$  is the smallest Fermat number whose character is unknown.

We now know that the Fermat numbers  $F_m$  are composite for  $5 \leq m \leq 32$ . No factor is known for  $F_{14}, F_{20}, F_{22}$  or  $F_{24}$ . These numbers were proved composite [96, 263] by Pépin’s [78] test. The cofactors of  $F_{12}, F_{13}, F_{15}$  through  $F_{19}$ , and  $F_{21}$  are known to be composite. A résumé of the known prime factors  $k \cdot 2^n + 1$  of  $F_m$  is given in the tables on the next pages. Some of the new factors may be found in [221, 224, 250, 252, 309, 310, 318, 322, 348]. See the URL

<http://www.prothsearch.net/fermat.html>

for Wilfrid Keller’s list of all known Fermat factors and their discoverers.

Prime factors  $k \cdot 2^n + 1$  of Fermat numbers  $F_m = 2^{2^m} + 1$ ,  $5 \leq m \leq 11$

$m$	$k$	$n-m$	$m$	$k$	$n-m$	$m$	$k$	$n-m$
5	5	2	6	1071	2	7	116503103764643	2
	52347	2		262814145745	2		11141971095088142685	2
8							604944512477	3
							45635566267264637582599393652151804972681268330878021767715	3
9							37	7
							3640431067210880961102244011816628378312190597	2
							3621289368298490241820249716318054072558304595202729608915\	
							14314523640507570656742232821636569307	2
10							11131	2
							395937	4
							1137640572563481089664199400165229051	2
							1592283623113869503509335556598021288410748667500145168297\	
							0617160257863311947248971452664548043591906237644522563833\	
							4771522398721818601964219484396906853173155530512581433264\	
							8094557751688897602656484300689557350049813382564359409255\	
							5886322403200003	3
11							39	2
							119	2
							10253207784531279	3
							434673084282938711	2
							2117461513417328557498278452933468974333762752974415095817\	
							2243537764108788193250592967656046192485007078101912652776\	
							6628345596897346355212236670930193533641001695854337995073\	
							2093737168815907697088703749358156935211877652106495842216\	
							3933812649044026502558555356775560067461648993426750049061\	
							5801917947443961034931314767816862009893777196386829764248\	
							7397357408595198031637137685910499279531872998480186978514\	
							55888094920389693172843206515004184259493454944448110057\	
							4127332689674465925347044157680237684398491775119070484261\	
							36846561848711377379319145718177075053	2

Prime factors  $k \cdot 2^n + 1$  of Fermat numbers  $F_m = 2^{2^m} + 1$ ,  $12 \leq m \leq 18$

$m$	$k$	$n-m$	$m$	$k$	$n-m$
12	7	2	15	579	6
	397	4		17753925353	2
	973	4		1287603889690528658928101555	2
	11613415	2	16	1575	3
	76668221077	2		180227048850079840107	4
13	41365885	3	17	59251857	2
	20323554055421	4	18	13	2
	6872386635861	6		9688698137266697	5
	609485665932753836099	6			

*Prime factors  $k \cdot 2^n + 1$  of Fermat numbers  $F_m = 2^{2^m} + 1$ ,  $19 \leq m \leq 4600$*

$m$	$k$	$n-m$	$m$	$k$	$n-m$	$m$	$k$	$n-m$
19	33629	2	99	16233	5	375	733251	2
	308385	2	107	1289179925	4	376	810373	2
21	534689	2	116	3433149787	4	380	321116871	5
23	5	2	117	7	3	398	120845	3
25	48413	4	122	5234775	2	416	8619	2
	1522849979	2	125	5	2		38039	3
	16168301139	2	133	88075576149	2	417	118086729	4
26	143165	3	142	8152599	3	431	5769285	3
27	141015	3	144	17	3	452	27	3
	430816215	2	146	37092477	2	468	27114089	3
28	25709319373	8	147	3125	2	544	225	3
29	1120049	2		124567335	2	547	77377	3
30	149041	2	150	5439	4	556	127	2
	127589	3		1575	7	579	63856313	2
31	5463561471303	2	164	1835601567	3	620	10084141	4
32	1479	2	172	20569603303	2	635	4258979	10
36	5	3	178	313047661	2	637	11969	6
	3759613	2	184	117012935	3	642	52943971	2
37	1275438465	2	201	4845	3	667	491628159	2
38	3	3	205	232905	2	692	717	3
	2653	2	207	3	2	723	554815	7
39	21	2	215	32111	2	744	17	3
42	43485	3	226	15	3	851	497531	8
43	212675402445	2	228	29	3	885	16578999	2
48	2139543641769	2	230	372236097	2	906	57063	2
52	4119	2	232	70899775	4	931	1985	2
	21626655	2	250	403	2	1069	137883	4
55	29	2	251	85801657	3	1082	82165	2
58	95	3	255	629	2	1114	11618577	2
61	54985063	5	256	36986355	2	1123	25835	2
62	697	2	259	36654265	3	1225	79707	6
63	9	4	267	177	4	1229	29139	4
64	17853639	3	268	21	8	1451	13143	3
66	7551	3	275	22347	4	1551	291	2
71	683	2	284	7	6	1598	10923781	2
72	76432329	2		1061341513	2	1849	98855	2
73	5	2	287	5915	2	1945	5	2
75	3447431	2	298	247	4	1990	150863	3
77	425	2	301	7183437	3	2023	29	4
	5940341195	2	316	7	4	2059	591909	4
81	271	3	329	1211	4	2089	431	10
88	119942751127	2	334	27609	7	2456	85	2
90	198922467387	2	338	27654487	4	3310	5	3
91	1421	2	343	4844391185	2	3506	501	2
93	92341	3	353	18908555	2	4250	173373	2
94	482524552001	3	370	573230511	3	4258	1435	4

*Prime factors  $k \cdot 2^n + 1$  of Fermat numbers  $F_m = 2^{2^m} + 1$ ,  $4600 < m$*

$m$	$k$	$n-m$	$m$	$k$	$n-m$	$m$	$k$	$n-m$
4724	29	3	13250	351	2	41894	4935	3
5320	21341	3	13623	48265	3	43665	2495	2
5957	421435	3	14252	1173	2	49093	165	2
6208	763	2	14276	157	4	63679	169	7
6355	115185	3	14528	17217	2	83861	99	2
6390	303	3	15161	55	3	90057	189	4
6537	17	2	17906	135	3	91213	585	2
6835	19	3	18749	11	10	94798	21	3
6909	6021	3	18757	33	9	95328	7	2
7181	168329	6	19211	13323	9	113547	39	2
7309	145	3	22296	4777	2	114293	13	3
8239	7473	3	23069	681	2	125410	5	3
8555	645	2	23288	19	2	142460	159	2
9322	8247	2	23471	5	2	146221	57	2
9428	9	3	24651	99	2	157167	3	2
9448	19	2	25006	57	4	213319	3	2
9549	1211	2	28281	81	4	303088	3	5
12185	81	4	35563	357	4	382447	3	2

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## VI. How to Use the Main Tables.

Suppose we wish to find the factorization of  $2^{147} - 1$  from the first main table (on page 2). On line 147 of that table one finds:

$$147 \quad (3,7,21,49) \quad 7*.2741672362528725535068727$$

The desired factorization is obtained from this line by multiplying together the *unparenthesized* factors in the “Prime Factors” column on the lines 3, 7, 21, 49 and 147, i.e.,

$$\begin{aligned} & \quad \quad \quad 3 \quad 7 \quad \quad 21 \quad \quad \quad 49 \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad 147 \\ 2^{147} - 1 &= 7.127.\overbrace{7*.337} \quad .4432676798593.\overbrace{7*.2741672362528725535068727} \\ &= 7^3.127.337.4432676798593.2741672362528725535068727, \end{aligned}$$

which can be checked by comparing it with the factorization in the Short 2– table. When an ultimate prime factor in one of the main tables has many digits (prime factors in the tables with 20 or fewer digits are given in full), it is listed only as P, followed by the number of its decimal digits. The actual digits are given in the full Appendix A, where the numbers are listed by: number of digits, base and line number in the relevant table. For example, the final factor at line 71 in the main 10– table is given as P41, while the factor itself appears in Appendix A as

$$41 \quad 10,71- \quad 4 \quad 5994811347 \quad 8868463102 \quad 2172889522 \quad 3034301839$$

where the digits are in groups of ten. This factorization may be verified by looking in the Short 10– table.

In the first and second editions, some primality proofs were incomplete for a few large primes. These were indicated PRP in the tables and Appendix A of those editions. All large primes with at least 60 digits for which there is no proof given in Appendix B have been proved prime by ECPP.

In some incomplete factorizations space has been left on the line for the insertion of new factors when they are found. The cofactor in this case is indicated as *composite* by a C followed by the number of its decimal digits and then the line number repeated. For example, line 1025 of Table 2– (page 11) has the entry C137, which, because it has no more than 140 digits, appears explicitly in Appendix C as:

$$137 \quad 2,1025- \quad 1985892\dots 4955410801$$

The composite cofactors in Appendix C are the numbers the authors have not yet been able to factor. It is expected that interested people who have available computer time will be able to factor many of these numbers.

For each base, there exists for certain exponents a second, independent factorization called “Aurifeuillian”, which makes the entries in these tables a little more elaborate. For example, in Table 2LM, which gives the known factors of  $2^{4k-2} + 1 = L.M = (2^{2k-1} - 2^k + 1)(2^{2k-1} + 2^k + 1)$ , each trinomial is given its own line, denoted at the left by L and M (the line number not being repeated). Thus,

for example, the complete factorization of  $2^{150} + 1$  is obtained from the two lines (on page 28)

```
150L (2,10L,30M,50M) 63901.13334701
      M (6,10M,30L,50L) 1201.1182468601
```

as

```
2 10L 30M 50M 150L
5 5* 1321 5*.268501 63901.13334701
```

and

```
6 10M 30L 50L 150M
13 41 61 101.8101 1201.1182468601
```

so we have the complete factorization

$$2^{150} + 1 = 5^3 \cdot 13 \cdot 41 \cdot 61 \cdot 101 \cdot 1201 \cdot 1321 \cdot 8101 \cdot 63901 \cdot 268501 \cdot 13334701 \cdot 1182468601.$$

Similarly, the factorization of  $11^{55} + 1$ , given in a three-line format, is obtained from the lines (on page 146)

```
55 (1,5) L.M
    L (11L) 21537414911.85480219991
    M (11M) 4951.411841.131525983711
```

as

```
1 5 11L 55L
2.2.3 13421 58367 21537414911.85480219991
```

and

```
11M 55M
23.89.199 4951.411841.131525983711
```

so the complete factorization is  $11^{55} + 1 =$

$$2^2 \cdot 3 \cdot 23 \cdot 89 \cdot 199 \cdot 4951 \cdot 13421 \cdot 58367 \cdot 411841 \cdot 21537414911 \cdot 85480219991 \cdot 131525983711$$

Throughout the tables when there are more factors than will fit on one line, they are continued onto a second line, the factorization being broken at a multiplication dot with the line number repeated at the right of this line. A few primes in the tables are too long to fit on one line. These are broken with a continuation slash (\) at the end of the first line. It should be noted that although the column heading in the main tables is Prime Factors, the factors L.M as in line 55 in the example above are also indicated in this column.

## VII. The Main Tables.

Key:	$Cxx$	Composite cofactor of $xx$ digits
	$Pxx$	Prime factor of $xx$ digits
	$(x, \dots)$	Get algebraic factors from lines $x, \dots$
	$7^*$	7 is an intrinsic (prime) factor (see <b>III C</b> )
	L,M	Aurifeuillian algebraic factorization (see <b>III C</b> )
	$h$	An odd integer, $2k - 1$

Factorizations of  $2^n - 1$ ,  $n$  odd,  $n < 1200$ 

$n$	Prime Factors
3	7
5	$3^1$
7	127
9	$(3)$ 73
11	$23 \cdot 89$
13	8191
15	$(3, 5)$ $15^1$
17	131071
19	$524287$
21	$(3, 7)$ $7^* \cdot 337$
23	$47 \cdot 178481$
25	$(5)$ $601 \cdot 1801$
27	$(3, 9)$ $262657$
29	$233 \cdot 1103 \cdot 2089$
31	$2147483647$
33	$(3, 11)$ 599479
35	$(5, 7)$ $71 \cdot 122921$
37	$223 \cdot 616318177$
39	$(3, 13)$ $79 \cdot 121369$
41	$13367 \cdot 164511353$
43	$431 \cdot 9719 \cdot 2099863$
45	$(3, 5, 9, 15)$ $631 \cdot 23311$
47	$2351 \cdot 4513 \cdot 13264529$
49	$(7)$ $443 \cdot 2676798593$
51	$(3, 17)$ $103 \cdot 2143 \cdot 11119$
53	$6361 \cdot 69431 \cdot 20394401$
55	$(5, 11)$ $881 \cdot 3191 \cdot 201961$
57	$(3, 19)$ $32377 \cdot 1212847$
59	$179951 \cdot 320 \cdot 3431780337$
61	$230584300 \cdot 9213693951$
63	$(3, 7, 9, 21)$ $92737 \cdot 649657$
65	$(5, 13)$ $14529 \cdot 5143558111$
67	$193707721 \cdot 76 \cdot 1838257287$
69	$(3, 23)$ $1005 \cdot 2678938039$
71	$228479 \cdot 48544121 \cdot 212885833$
73	$439 \cdot 2298041 \cdot 936 \cdot 1973132609$
75	$(3, 5, 15, 25)$ $100801 \cdot 10567201$
77	$(7, 11)$ $58128364 \cdot 3249112959$
79	$2687 \cdot 202029703 \cdot 111 \cdot 3491139767$
81	$(3, 9, 27)$ $2593 \cdot 71119 \cdot 97685839$
83	$167 \cdot 579 \cdot 1261411327 \cdot 5649087721$
85	$(5, 17)$ $952097280 \cdot 6333758431$
87	$(3, 29)$ $4177 \cdot 985 \cdot 7737155463$
89	$6189700 \cdot 1964269013 \cdot 7449562111$
91	$(7, 13)$ $911 \cdot 112901153 \cdot 2 \cdot 3140471537$
93	$(3, 31)$ $65881228 \cdot 8653553079$
95	$(5, 19)$ $191 \cdot 420778751 \cdot 3 \cdot 0327152671$
97	$11447 \cdot 138426 \cdot 0723582848 \cdot 5645766393$
99	$(3, 9, 11, 33)$ $199 \cdot 153649 \cdot 3 \cdot 3057806959$
101	$743 \cdot 2339208719 \cdot 34111753 \cdot 1003194129$
103	$2550183799 \cdot 39 \cdot 7665642994 \cdot 1438590393$

105 (3,5,7,15,21,35) 29191.106681.152041  
 107 162 2592768292 1336339157 8010288127  
 109 745988807.8700 3598609872 0987332873  
 111 (3,37) 321679.26295457.319020217  
 113 3391.23279.65993.1868569.106681 8132868207  
 115 (5,23) 14951.4036961.264650 7710984041  
 117 (3,9,13,39) 937.6553.86113.7830118297  
 119 (7,17) 239.20231.6 2983048367.13 1105292137  
 121 (11) 727.1 7863938783 6316422785 8270210279  
 123 (3,41) 3887047.17772225 3954175633  
 125 (5,25) 26 9089806001.471088316 8879506001  
 127 170141183 4604692317 3168730371 5884105727  
 129 (3,43) 110530 3606504929 4753459639  
 131 263.10350794 4310551623 8671861923 7468234569  
 133 (7,19) 163 5372208527 2539885143 4325720959  
 135 (3,5,9,15,27,45) 271.348031.4997 1617830801  
 137 3203221559 6496435569.54 3904218360 0204290159  
 139 562 5767248687.1238761322 0520833576 2278423601  
 141 (3,47) 4375578271.64667503 5253258729  
 143 (11,13) 724153.15 8822951431.578217211 3400990737  
 145 (5,29) 2679 8951577838 6281469002 7494144991  
 147 (3,7,21,49) 7\*.27416 7236252872 5535068727  
 149 8665626856 6282183151.82351 0933669084 6723986161  
 151 18121.55871.165799.2332951.72890 8838338825 3664437433  
 153 (3,9,17,51) 919.755824 8842417934 7083438319  
 155 (5,31) 31\*.311.11471.73471.4649919401.1815 8209813151  
 157 852133201.6 0726444167.165 4058017289.213438 7368610417  
 159 (3,53) 6679.13960201.540701761.22 9890275929  
 161 (7,23) 1289.3188767.4 5076044553.1480860771 5315782481  
 163 150287.704161.110211473.2 7669118297.3623045457 0129675721  
 165 (3,5,11,15,33,55) 20485 6883529738 0486760231  
 167 2349023.7963 8304766856 507377786 1629608744 8490695649  
 169 (13) 4057.674 0339310641.3 3407622839 5239532950 6327023033  
 171 (3,9,19,57) 93507247.30426 4563479254 1312037847  
 173 730753.1505447.7008443 6712553223.1552 8574328857 2277679887  
 175 (5,7,25,35) 39551.60816001.5353 4762479148 8552837151  
 177 (3,59) 184081.2 7989941729.921362408 4535989031  
 179 359.1433.148945910 9360039866 4569401970 9543372166 4951999121  
 181 43441.1164193.7648337.7923871 0972852956 2534464766 5764672671  
 183 (3,61) 367.55633.372017086 2530514630 3973352041  
 185 (5,37) 158785 5697992791.72488085 9928576000 1152755641  
 187 (11,17) 707983.103 2670816743 8438609988 5005627895 0666491537  
 189 (3,7,9,21,27,63) 1560007.2076174 8554425839 2970753527  
 191 383.7068569257.3 9940132241.33258 4516519201.8727449712 4602996457  
 193 13821503.616 5444023324 8340616559.147322653 2114531733 1353282383  
 195 (3,5,13,15,39,65) 1343041968 4509926257 2814573351  
 197 7487.268288 0399791288 6929710867 0418919894 9048689384 5712448833  
 199 16 4504919713.488416409 3883941177 6600490985 8632430297 7543600799  
 201 (3,67) 1609.22111.87 4494233974 2585794267 8833145441  
 203 (7,29) 136417.121793911.11348055 5808832720 1109085605 3175361113  
 205 (5,41) 2940521.7 0171342151.3 6557250655 0879718167 4078959681  
 207 (3,9,23,69) 79903.634569679.223 2578641663.4216 6482463639  
 209 (11,19) 9480 3416684681.151234 8937147247.53469 5054132396 0232319657  
 211 15193.6027295643 3838849161.3593875704 4958237573 8819989426 8773153439  
 213 (3,71) 66457.284988197 2114740679.420526857 4191396793  
 215 (5,43) 1721.731516431.51 4851898711.2979272 8974404776 4444862191  
 217 (7,31) 5209.62497.62 6870393384 0364033151.3784 2880443142 4484082633  
 219 (3,73) 3943.67116589 8617413417.48 1531461520 4347717321  
 221 (13,17) 1327.23654 5439841839 9772605086 2092143634 5855283986 6247069233  
 223 18287.196687.1466449.2916841.14 6949526239 8780123809.P24  
 225 (3,5,9,15,25,45,75) 115201.617401.1348206751.1386136 9826299351



227	2698633 343777017.P52	
229	1504073.20492753.5983345 7464970183.P39	
231	(3,7,11,21,33,77) 463.P34	
233	1399.135607.622577.P57	
235	(5,47) 2391314881.7 2296287361.P35	
237	(3,79) 1423.49297.2372882351 2345609279.3135737341 7090093431	
239	479.1913.5737.176383.134000609.P49	
241	22000409.P66	
243	(3,9,27,81) 487.1675 3783618801.19297 1705688577.371299016 3251158343	
245	(5,7,35,49) 1471.P48	
247	(13,19) 15809.645 9570124697.40200 4106269663.P34	
249	(3,83) 1621324657.P40	
251	503.54217.1 7823028721 4063289511.616 7688219869 5257501367.P26	
253	(11,23) 23*.4103188409.1999 5773632843 5366769577.P32	
255	(3,5,15,17,51,85) 106591.949111.P28	
257	53500 6138814359.11556 8539524661 9182673033.P39	
259	(7,37) 2499285769.P56	
261	(3,9,29,87) P51	
263	23671.1357 2264529177.1202263 6053684849 8024035943.P36	
265	(5,53) 2 9324808311.19774 8738449921.P38	
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1017	(3, 9, 113, 339)	54919.7238634 7544037768 2986327336 3081527460 6848381343.P151		
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1117	53617.	C332	1117
1119	(3, 373) 2239.20143.154565233.1100558881.P199		
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1125	(3, 5, 9, 15, 25, 45, 75, 125, 225, 375) 213751.1502 1258003313 8336342001.	C153	1125
1127	(7, 23, 49, 161)	C279	1127
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1135	(5, 227) 1 3283923860 2148428191.45030314 1878528372 5652516551.	C225	1135
1137	(3, 379) 328909853 1153894127.	C209	1137
1139	(17, 67) 138959.	C313	1139
1141	(7, 163) 301230847.1 6742221609.1449 3503199673.62800 7894034529. .1 3138042269 7420095809.8759 3809018275 4292028329. .106 0141230288 2966472211 1227465753.P170		1141
1143	(3, 9, 127, 381) 518814559.1003420916 4734137046 9161844713.P190		
1145	(5, 229) 4946401.199439 0009987387 7258890807 7106387241.	C233	1145

1147	(31, 37)	100937.92452690 2536493341 3947751633. .1418071209 2102984421 0677840999.	C263	1147
1149	(3, 383)	265155238 1122661167.12 9172545158 2048356963 3735619111.	C181	1149
1151		28 4278475807.813448 9876388726 0484533897.6586221 0725474511 2979229913.	C283	1151
1153		267497.8 4755607199.	C331	1153
1155	(3, 5, 7, 11, 15, 21, 33, 35, 55, 77, 105, 165, 231, 385)	2311.6250631311. .49 4224324441.	P120	1155
1157	(13, 89)	167512 5010930879.55192 6781483447 7438497153. .88355 3889809869 5059049137.154720 7812137844 2801745561.	C228	1157
1159	(19, 61)	185441.5 6256385753.	C309	1159
1161	(3, 9, 27, 43, 129, 387)	6967.5979151.6049 9150497847.	C204	1161
1163		84 8181715001.3 3709730057 0078978047.	C318	1163
1165	(5, 233)		C280	1165
1167	(3, 389)	604591287 7373534611 6971161647.	C205	1167
1169	(7, 167)	514361.6020351.7322617.893 2786385279.	P268	
1171		15 3606920351.	C342	1171
1173	(3, 17, 23, 51, 69, 391)	428417137.1822858 0446571609.40390678 2348344599. .5158 7873717864 9880676177.	C146	1173
1175	(5, 25, 47, 235)	1000943131 6533167951.10 9488380431 1836270751.	C237	1175
1177	(11, 107)	3775817.5960329.	C306	1177
1179	(3, 9, 131, 393)	28297.	C231	1179
1181		4742897.1968341 6867010662 5096599487. .199 6689110544 6691479119 0422986407.	C291	1181
1183	(7, 13, 91, 169)	28393.4665596 9015605951.	C261	1183
1185	(3, 5, 15, 79, 237, 395)	11 5150116391.2179265 2855138681.	P161	
1187		256393.113603023.1761 5331179656 9621262632 5049982897.	C311	1187
1189	(29, 41)	600619 5478204556 0713559063 9621491727.	C302	1189
1191	(3, 397)	2744 0463593147 5033688839.107126 1308516214 1902489577.	C190	1191
1193		121687.	C355	1193
1195	(5, 239)	270071.10602041.150885481.50286269 2004168161. .492568752 5543853241.	C230	1195
1197	(3, 7, 9, 19, 21, 57, 63, 133, 171, 399)		C196	1197
1199	(11, 109)	2399.174181129.	C314	1199

2+(odd)

Factorizations of  $2^n + 1$ ,  $n$  odd,  $n < 1200$

$n$	Prime Factors
1	3
3	(1) 3*
5	(1) 11
7	(1) 43
9	(1,3) 3*.19
11	(1) 683
13	(1) 2731
15	(1,3,5) 331
17	(1) 43691
19	(1) 174763
21	(1,3,7) 5419
23	(1) 2796203
25	(1,5) 251.4051
27	(1,3,9) 3*.87211
29	(1) 59.3033169
31	(1) 715827883
33	(1,3,11) 67.20857
35	(1,5,7) 281.86171
37	(1) 1777.25781083
39	(1,3,13) 22366891
41	(1) 83.8831418697
43	(1) 293 2031007403
45	(1,3,5,9,15) 18837001
47	(1) 283.16 5768537521
49	(1,7) 436 3953127297
51	(1,3,17) 307.2857.6529
53	(1) 107.2805 9810762433
55	(1,5,11) 11*.2971.48912491
57	(1,3,19) 571.160465489
59	(1) 2833.37171.1824726041
61	(1) 76861433 6404564651
63	(1,3,7,9,21) 7 7158673929
65	(1,5,13) 131.409891.7623851
67	(1) 7327657.671 3103182899
69	(1,3,23) 139.16 8749965921
71	(1) 56409643.1395 2598148481
73	(1) 1753.179591803 8741070627
75	(1,3,5,15,25) 113 3836730401
77	(1,7,11) 617.78233.3 5532364099
79	(1) 2014 8763660243 8195784363
81	(1,3,9,27) 3*.163.135433.272010961
83	(1) 499.1163.2657.155377.1 3455809771
85	(1,5,17) 2683142303 6065352611
87	(1,3,29) 9607679 1871613611
89	(1) 179.62020897.1858477 4046020617
91	(1,7,13) 224771.1210483.2 5829691707
93	(1,3,31) 529510939.2903110321
95	(1,5,19) 2281.301134747 9614249131
97	(1) 971.1553.31817.110087601 8364883721
99	(1,3,9,11,33) 5347.24209 9935645987
101	(1) 8451004001 5215293433 1135470251

103	(1)	41	5141630193.814276708	1771726171						
105	(1,3,5,7,15,21,35)	211	664441.1564921							
107	(1)	643	841157474	4904788148	8635567801					
109	(1)	104124649	20777	5684736234	8863128179					
111	(1,3,37)	3331	17539	10777	5231312019					
113	(1)	227	48817	636190001	49100336	9344660409				
115	(1,5,23)	691	1884103651	34576	7385170491					
117	(1,3,9,13,39)	53	0230622637	0307681801						
119	(1,7,17)	823679683	1	4316255316	5560959297					
121	(1,11)	117371	110541845	8279780045	5736061107					
123	(1,3,41)	739	165313	1319431	7913029593					
125	(1,5,25)	229668251	55	1948541833	6288303251					
127	(1)	56713727	8201564105	7722910123	8628035243					
129	(1,3,43)	1033	1591582393	1568	6603697451					
131	(1)	1049	4744297	1823311286	8120778178	4391813611				
133	(1,7,19)	4523	1067882904	4384829528	4382097033					
135	(1,3,5,9,15,27,45)	811	15121	38583	8642647891					
137	(1)	1097	15619	3212796	3626435681	10549821	2027592977			
139	(1)	4506937	51542	6395246617	9530007417	4250365699				
141	(1,3,47)	1681003	3	5273039401	11	1349165273				
143	(1,11,13)	2003	6156182033	1	0425285443	1550	0487753323			
145	(1,5,29)	7553921	9998028	5472471530	0883845411					
147	(1,3,7,21,49)	748819	2603288584	5392093851						
149	(1)	1193	650833	38369587	79845595	7350425985	6359124657			
151	(1)	1871	7738334417	50	8340508241	0077967730	6460621499			
153	(1,3,9,17,51)	123931	2	6159806891	2743	9122228481				
155	(1,5,31)	11161	594760	3221397891	2912605	6043168521				
157	(1)	15073	2350291	1775178	3757817897	9683329919	8971305921			
159	(1,3,53)	6043	44751303	6651810208	4427698737					
161	(1,7,23)	8103467492	7597923271	4980036156	4410265219					
163	(1)	1	1281292593	102339	8150341859	3375	7054705039	0415041769		
165	(1,3,5,11,15,33,55)	415365721	225212	7523412251						
167	(1)	6235740319	2785191176	6905528625	6140883865	3121833643				
169	(1,13)	492991076	4223610387	185262386	4601108673	2742614043				
171	(1,3,9,19,57)	19*	19	1774583879	4026811634	9766612211				
173	(1)	347	4153	3	5374479827	4	7635010587	16434	6424772818	9221623609
175	(1,5,7,25,35)	1051	110251	34	7833278451	3401003	2331525251			
177	(1,3,59)	13099	445	3762543897	189868549	6465999273				
179	(1)	5	8745093521	434	7868190665	8793734959	5056277570	7707143803		
181	(1)	1811	31675363	1781	0163630112	6245793428	1173397808	5990447907		
183	(1,3,61)	1772303	9943798878	2976979507	7302561451					
185	(1,5,37)	1481	28136651	778	4293653978	8760854061	8330873281			
187	(1,11,17)	219116582	5376888084	7501577164	2457906201	5865776131				
189	(1,3,7,9,21,27,63)	379	119827	12	7391413339	5620	2143607667			
191	(1)	10461836	2256444679	3972631570	5346110693	5039257407	7339085483			
193	(1)	6563	35679139	1871670769	745509	9975844049	12	8076133738	8845898643	
195	(1,3,5,13,15,39,65)	107251	5714	0392112607	6957182161					
197	(1)	19	7002597249	134895935	2853811313	2519515738	6725301225	9144010843		
199	(1)	2678230073	7649837925	6993682056	8604337537	0049896379	8805883563			
201	(1,3,67)	2011	9649	6324667	591515	4911853267	6874448563			
203	(1,7,29)	596834617	3692022713	252	7158146155	6596241868	8965855731			
205	(1,5,41)	212582056	3389437533	3902438938	3459784675	7304863651				
207	(1,3,9,23,69)	6113142872	4042278348	4044389824	1613032969					
209	(1,11,19)	419	34	1062328465	4639440707	1	6077920187	8039402409	5514317003	
211	(1)	4643	9878177	5344743097	19	9061567251	22	4811275125	7517586423	4185190299
213	(1,3,71)	5113	17467	102241	2035255457	6630130693	3226271929			
215	(1,5,43)	9084611	5990	4608378705	6613774301	8260871169	8924130721			
217	(1,7,31)	16233337	14050860	8590164280	2259342330	9886684274	5808905947			
219	(1,3,73)	907019	7542196643	32782446	9015622243	4135906137				
221	(1,13,17)	443	471	4692062809	450	7513575406	4465158454	0145836674	1487526913	
223	(1)	21	9256122131	204934	9592090504	3950407650	4509181712	6031830315	4708405513	

225	(1,3,5,9,15,25,45,75)	4714696801.2819414 7295371017 7758647201	
227	(1)	297371.345463157 9714210387.P44	
229	(1)	18754643.P62	
231	(1,3,7,11,21,33,77)	14323.P32	
233	(1)	467.27961.P63	
235	(1,5,47)	32 8006342451.46179790 7949997211.P27	
237	(1,3,79)	647011.13664473.P35	
239	(1)	340337.326051 4298370422 1670173899.P41	
241	(1)	2411.1 0411181203.1505982 8108442641.P43	
243	(1,3,9,27,81)	3*.1459.139483.1042940743 1911334611.9 1812505160 2568899753	
245	(1,5,7,35,49)	491.1516286875 8218274451.P29	
247	(1,13,19)	207481.10049443.355011619.P45	
249	(1,3,83)	920 2419446683.P37	
251	(1)	238451.P70	
253	(1,11,23)	4049.85009.31797547.8 1776791273.P40	
255	(1,3,5,15,17,51,85)	12241.41856 2986357561.5136614945 5494753931	
257	(1)	3723 9639534523.5 1814415660 2508243009.P43	
259	(1,7,37)	1 4562355969 0431904173 8812533139.P36	
261	(1,3,9,29,87)	523.6929826139.345341290 1832690553.3356385645 0515702761	
263	(1)	1579.92051.2926111 4397558193.P55	
265	(1,5,53)	5937 8367896686 3030035641.P40	
267	(1,3,89)	3739.4273.P46	
269	(1)	4242 5591579618 7428893811.P57	
271	(1)	1627.11541796 6565804897.46 3526001587 3357770993.P40	
273	(1,3,7,13,21,39,91)	547.10 5310750819.P30	
275	(1,5,11,25,55)	P61	
277	(1)	2579 2643401363.P70	
279	(1,3,9,31,93)	26227.11 9232435043.8538 4915399027.64443 6537614061 1199022187	
281	(1)	563.5203536083.P72	
283	(1)	1699.62827.2486265371.6753 5788803713.P54	
285	(1,3,5,15,19,57,95)	1101811.P38	
287	(1,7,41)	1723.8441323 8703660609.433679083 1080504259.P34	
289	(1,17)	72251.79187.1077971.1836 0250452977.19776680 3208315851.P36	
291	(1,3,97)	25609.563696 3037465601.58154660 6903256979.9969550342 7255026561	
293	(1)	587.26371.33403.13453 8907795406 3294533189 2129844577.P42	
295	(1,5,59)	P71	
297	(1,3,9,11,27,33,99)	23761.694387.621 5074747201.P32	
299	(1,13,23)	2393.83449 0119087067.P62	
301	(1,7,43)	43*.P75	
303	(1,3,101)	112102729.P53	
305	(1,5,61)	331841.3134755923 2075126851.P48	
307	(1)	1249678499.431 5199443523.2 1070882506 3558235331.P50	
309	(1,3,103)	619.2473.15451.89620507.240 0744384937.9827 7023988499. .6854585 2036177507	309
311	(1)	64067.P89	
313	(1)	P94	
315	(1,3,5,7,9,15,21,35,45,63,105)	1765891.P38	
317	(1)	326330579.49198112 2308467411.P69	
319	(1,11,29)	12 1333341977.16952351 4238420211.259255 1649443838 2632167017.P31	
321	(1,3,107)	154723.2 0636399209.4806 2571001539 4052365153.P25	
323	(1,17,19)	1779583090 8608814443.32 1158605463 9813621611. .63 1995764203 3539607139.20652 5587851947 5622261353	323
325	(1,5,13,25,65)	3251.5840251.781 2610577851.986094 2209386451.P34	
327	(1,3,109)	666427.6927735019.P50	
329	(1,7,47)	659.76239 4321774681.P66	
331	(1)	5297.2983001129.7520796641.85306742 5084227471 7434530683.P49	
333	(1,3,9,37,111)	304363.985 3387597819.3103132 0083857011.P31	
335	(1,5,67)	93131.P75	
337	(1)	21569.5333388961.96409 4242760707.P72	
339	(1,3,113)	156619.28448881.P55	
341	(1,11,31)	647219.1434929.3736 8615235403.P65	

343	(1,7,49)	2513690593.288358003 0222424891 .P61	
345	(1,3,5,15,23,69,115)	P53	
347	(1)	P104	
349	(1)	131282633.P97	
351	(1,3,9,13,27,39,117)	42477 1330322455 2237738169.P41	
353	(1)	3803909 5720787468 3729509405 1706948091 .P70	
355	(1,5,71)	1552463 5883992211 .P69	
357	(1,3,7,17,21,51,119)	428401 .P53	
359	(1)	3536450843.111067 1633637523.1 9419397456 3158088483.P63	
361	(1,19)	687 4301617534 8275093505 7576845435 6245025403.P61	
363	(1,3,11,33,121)	2179.1948 8182484739.P50	
365	(1,5,73)	581874971.498 3860557465 3477927323 1850742131 .P46	
367	(1)	2203.19819.14626 4881313513.2083706288 5084633147. .460 2336168618 5206616518 0033789571 .P37	367
369	(1,3,9,41,123)	18451.174907.2630 9368807003.P50	
371	(1,7,53)	1835194 5672220987.104718 4633680244 0580575859. .903389 0180249079 3533882683 .P27	371
373	(1)	60427.69457949 7316894264 4256612436 5980637197 2188318857.P60	
375	(1,3,5,15,25,75,125)	2251.199 6377842904 6466946251 .P35	
377	(1,13,29)	13454377.P95	
379	(1)	1501 2732261073.7280409237 2182169758 6308784409.P71	
381	(1,3,127)	3049.3825718 4231365987.P56	
383	(1)	13517 1073178598 1752792617.56091 2281791431 3723820539.P66	
385	(1,5,7,11,35,55,77)	219980531.4 3629892114 2286134032 0935785851 .P34	
387	(1,3,9,43,129)	1090536789 6894030236 4939183451 .P47	
389	(1)	107 4456464321.136937 9108017267.274209 4407638203.P75	
391	(1,17,23)	2347.1578859.194902553.29143833 4156037699. .2911194824 8642861801 .P52	391
393	(1,3,131)	787.7237 4970654455 4305500305 7643920459.P42	
395	(1,5,79)	5531.1415681 .P85	
397	(1)	13499.321571.476401.17414009.P97	
399	(1,3,7,19,21,57,133)	63841.113556903 2520567138 0495907537.P33	
401	(1)	1 8885983617.31786416 0671793549 6778334833. .2 4789994689 9800130782 7521737357 2023257787.P43	401
403	(1,13,31)	6449.18539.576759899.15363 3897920257.P78	
405	(1,3,5,9,15,27,45,81,135)	6481.9721.74967931.2437880491. .44 8217524891.1036 0573664851.196954 3281137041	405
407	(1,11,37)	15467.2248206137.2533006 7076999169. .42897 6890554496 3658268464 0379732099.P44	407
409	(1)	1765960294 5091540865 2219208387. .1879 1937710720 5753057607 2158896678 9412396307.P51	409
411	(1,3,137)	7663507.2017223347.2707079449.P57	
413	(1,7,59)	827.17073597 4773267443.P85	
415	(1,5,83)	116201.134396921 .P86	
417	(1,3,139)	441187.1694689.392856 1315258466 4719123806 6992041449.P36	
419	(1)	5867.5485604 8933689096 0473978059.P96	
421	(1)	4211.3298307 6027612611 .P107	
423	(1,3,9,47,141)	85693033.659 6828416459.P63	
425	(1,5,17,25,85)	91362251.504 6718903451 .P76	
427	(1,7,61)	5 7461778571.1340 2353088548 1150604420 5739394787.P65	
429	(1,3,11,13,33,39,143)	859.8 3403577371 3963728978 6276330761 .P39	
431	(1)	180 7447391779.3745 2571239931 .P104	
433	(1)	2837017.P124	
435	(1,3,5,15,29,87,145)	7060051.23476081.24578371 .P46	
437	(1,19,23)	7867.66821445 2631436913.3 1592975812 5865060721. .1 9059768154 2627360573 3466333451 .P47	437
439	(1)	3740281.5612260289.7 8527789689. .6563213024 2813789128 6402051371 7469284499.P65	439
441	(1,3,7,9,21,49,63,147)	883.3529.22051.311347. .19961876 5653083859 9012839257.P33	441

# 2+(odd)

## Prime Factors

18

443	(1)	48731 · 489333371 · 203682 9768181123 · .20336956 7047358792 5972308539 5687118626 7775970073 · P57	443
445	(1,5,89)	7121 · 13 1865932411 · 408 5315514961 2675915761 · P69	
447	(1,3,149)	1 9687929049 · P79	
449	(1)	194867 · 4332851 · 1792 9395314182 3358107657 · P100	
451	(1,11,41)	20747 · 21737299 · 216 8435713049 · P97	
453	(1,3,151)	907 · 70089067 · 566722821 5161742851 · 13 0221683238 5373385027 · P40	
455	(1,5,7,13,35,65,91)	131041 · 1185685411 · 3953 7592800161 · 17152 5190684121 · P45	
457	(1)	688535756 0205319573 0606338968 0091844825 4904729193 · P89	
459	(1,3,9,17,27,51,153)	3673 · 98227 · 3320491 7536003441 · 57240473 5191016891 · P44	
461	(1)	99577 · 110641 · 477 6428166707 · 10890 2775905377 · .1017228 5871610222 1859893264 2491638987 · P66	461
463	(1)	235675 9188941953 · 768 3496620985 8049526107 · .88119 3079252690 4110741840 4833666787 · P66	463
465	(1,3,5,15,31,93,155)	26041 · 316201 · 364831561 · P54	
467	(1)	33702457 · 4 8919673417 · 951637 5589637513 · 13311632 7626495251 · .7593 5500395270 1949854003 · 27 3123909618 2403838452 9619828691 · P34	467
469	(1,7,67)	40 8335956841 · 3 6231242731 7443674457 · .762077649 5688579527 5897986139 · P59	469
471	(1,3,157)	290137 · 3125517399 3464476009 · 1 1779176005 9111382841 · .2070 8015468421 8888000497 · P26	471
473	(1,11,43)	947 · 8116681 · 430461 3491867393 · .2 3193267908 3345584849 4271717419 · P71	473
475	(1,5,19,25,95)	31453933 9112375003 9342489201 · .23 3525313154 1260692882 3082635851 · P50	475
477	(1,3,9,53,159)	P94	
479	(1)	3833 · 38321 · 72417021 9181001433 2930493433 · .54657255 0482866774 8803316085 1148008819 · P70	479
481	(1,13,37)	1484463163 · 116082946 1657347000 2183237558 3736205537 · P83	
483	(1,3,7,21,23,69,161)	2456410505 4101666518 8014626987 · P50	
485	(1,5,97)	1123834 4415062964 4421472433 2427263086 8644399851 · P70	
487	(1)	2270205511 5491393903 9124941009 · P117	
489	(1,3,163)	2840113 · P92	
491	(1)	153959 5189603332 2050978817 · .3563269486 9776511547 5906202095 0904488457 · P83	491
493	(1,17,29)	4931 · 244529 · 408071 1563727942 9392714717 6542113833 · P91	
495	(1,3,5,9,11,15,33,45,55,99,165)	P73	
497	(1,7,71)	14 5915152433 · 521352656 8247671787 · .8705752 0608031578 1320008699 9866476019 · P60	497
499	(1)	163673 · 825347 · 61176403 · 11924257 9295015787 4662150001 · .15 7558558752 4885013687 3911146842 4415849956 5933913187 · P53	499
501	(1,3,167)	304609 · 223318747 · 113 4974373913 · P75	
503	(1)	20497 4474626356 8646584566 1759083859 0741501232 9005298331 · P97	
505	(1,5,101)	8081 · 223211 · 690 9226326451 · 4639 3668925691 · .14513081 4068214641 · 102569874 0064276331 · 7 2767995659 5455269121 · P29	505
507	(1,3,13,39,169)	1003 0854869257 · 496630024 8405749059 · P63	
509	(1)	1019 · 1171 1759955199 3893463748 6085538049 · P117	
511	(1,7,73)	3191707 · 10435643 · 4452388694 2460772001 · .22310 8638472250 1814286178 3673497419 · P63	511
513	(1,3,9,19,27,57,171)	144667 · 1465129 · P87	
515	(1,5,103)	48111 1547919147 7176958235 4405627641 · .1925631 5368273983 4275094545 1754630611 · P53	515
517	(1,11,47)	220243 · 8 0765938529 · 63515210 1298808699 · .419418789 3609755408 2013916913 · 1 3988771339 9075018153 2404877513 · P46	517
519	(1,3,173)	7348400530 7733779892 8914412909 2395161857 · P64	
521	(1)	501203 · 44 3418473521 · 9 0268296000 1896498686 7810255277 5904610963 · P99	
523	(1)	36667531 · 83207209 · 129175771 · 1 1694270587 · 5 8052548129 · .6280226 6052329939 · P96	523
525	(1,3,5,7,15,21,25,35,75,105,175)	3205651 · 24 7772800801 · .722359 1273619001 · 12926671 1542799251 · 23 1014122231 2973778401	525
527	(1,17,31)	3163 · 4217 · 57818964 8968825099 · P120	



529	(1, 23)	17987.6190092443.863 3301049969.P126	
531	(1, 3, 9, 59, 177)	470656 0382366302 6660218883.P80	
533	(1, 13, 41)	354979.11171 9734852571.P126	
535	(1, 5, 107)	205441.101 5502191705 7853331411. .43 1458267304 9504096186 7363407954 5142558161.P59	535
537	(1, 3, 179)	13963.54408841.1700184749 3570697053 0240356699.P67	
539	(1, 7, 11, 49, 77)	12460603.3110026909 2898119731.P100	
541	(1)	86561.59199467.396588707.51 2917469041.30111 8908380643. .841 6367433669 8854450433.901912542 7422507476 6209510322 4539896393.P54	541
543	(1, 3, 181)	3259.P105	
545	(1, 5, 109)	1091.8619 2661003172 8629577011.P104	
547	(1)	153 3926272849.115148954 5548740064 9824422273.P124	
549	(1, 3, 9, 61, 183)	2146261699.3729 1324871089.16596 3031279777.P72	
551	(1, 19, 29)	304153.400280563.P138	
553	(1, 7, 79)	P142	
555	(1, 3, 5, 15, 37, 111, 185)	1 6975554121.2293 3014202051.3891439271 4281976571.P44	
557	(1)	4457.124769.P159	
559	(1, 13, 43)	32 6667346721.1255 3986510209.10111952 6079159121. .164 0422918232 1439707977.337154 7628302580 3700130451. .6374677 6853588265 4780280209.P36	559
561	(1, 3, 11, 17, 33, 51, 187)	1123.314161.15 3356423089. .2 0561864752 7006690058 3885539731.P47	561
563	(1)	52211408 5011580241.749 0692419407 6922022321.P129	
565	(1, 5, 113)	19211.P131	
567	(1, 3, 7, 9, 21, 27, 63, 81, 189)	56 2873504411.474 4655685883.P74	
569	(1)	10243.223439473.205801 7388830521. .82079370 0834095033 5985340006 3460572205 9739038841.P96	569
571	(1)	9137.7 3205584889.964 0632099001.90 7948623160 2709376885 3899468313.P112	
573	(1, 3, 191)	8437952161.106 3307289553.39052789 7582929297. .294893623 0551432174 4929966859.P47	573
575	(1, 5, 23, 25, 115)	21851.270332801.1567238401.2299609001. .1480777681 9440781028 6646636543 7148576514 8925580001.P52	575
577	(1)	75011.2796392419.1956469940 9833266851.P140	
579	(1, 3, 193)	60217.92641.1036411.3497161.769643857. .3 1370568307 2406514521.1870305 3251338140 3767944747.P38	579
581	(1, 7, 83)	18593.219619.5258 8634980729.P125	
583	(1, 11, 53)	17491.339307.2611841.4929150778 8508089522 6946001921.P111	
585	(1, 3, 5, 9, 13, 15, 39, 45, 65, 117, 195)	1171.65521.2 6959262851. .437255525 3234330347 7113703251.P40	585
587	(1)	2769467.1311977076 5051463547.5 8304599029 5828143461 74509784\ 80 5811323612 5910218633 1890293830 6546239131.P80	587
589	(1, 19, 31)	95419.59512561.20 8431792655 9146687910 5346889451 2489769379.P109	
591	(1, 3, 197)	858840889 7489780521.20 5402154473 4875175323. .171 7420766135 8066885721 2300403179.P46	591
593	(1)	1187.6243 8341552073.69757296 1277548351 7844546731.P134	
595	(1, 5, 7, 17, 35, 85, 119)	208702 2330866411.6 9221828089 7365325531. .1656091 4356165296 2744166091.P54	595
597	(1, 3, 199)	515354 3358319177. .161672 1141393989 4823514477 4006666392 3511303121.P59	597
599	(1)	366994123.P172	
601	(1)	929342429 4571360217.P162	
603	(1, 3, 9, 67, 201)	1460467.533471689.44 8427389805 5819958731.P83	
605	(1, 5, 11, 55, 121)	11*.7157266213 7576998831 0557612811.P102	
607	(1)	115331.20 2769117249.1678086932 6776069043. .16 2294942212 9340362249.1 9567836751 7306258415 5810896697.P96	607
609	(1, 3, 7, 21, 29, 87, 203)	160 2776802691.1753144 8231309625 1408712577. .173964560 9824008224 2545082771.P35	609
611	(1, 13, 47)	82154 6524439369.367533168 3377539444 8156716611. .389 5479947009 8707550322 7548229025 5237164363 0493051193.P71	611
613	(1)	6288254243 9656284776 3602356101 5424303471 2327123864 6163429\ 271 4267317577.P115	613

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## Prime Factors

20

615	(1,3,5,15,41,123,205) P97	
617	(1) 4937.2549322536147.	
619	(1) 12573881599 1080426576 3446600825 2782563180 1224969766 1907431\	617
	.2750740332203 0377199658 6651044091 7146582337 6047109547.P117	
621	(1,3,9,23,27,69,207) 31051.25069771.115 9185064537.552109 4269128307.	619
	.18554155309 1188485307.551281550 1609772761 7011127633.P31	
623	(1,7,89) 59809.333929.390863971.P141	621
625	(1,5,25,125) 61932403 5675566251.2329 8341126492 3603130001.	
	.983 2621662709 1356287799 3411320001.P77	625
627	(1,3,11,19,33,57,209) 52 7119237980 0221868753 4164008761.	
	.97816902 8529917659 4906831708 4025791019.P39	627
629	(1,17,37) 1259.2998322233.3 1438035163.161 4575158577.33519 9740796521.P124	
631	(1) 8309009.2530111867.4882057097.8318853450 9828089497.	629
	.187 1572341734 8972017502 6708502754 1506881240 3108132161.P92	
633	(1,3,211) 312 6092185651 4644012890 3576490694 7922212259.P85	631
635	(1,5,127) 85091.431801.141512291.P134	
637	(1,7,13,49,91) 225499.	
	.48658 5358967104 4882475767 9951992943 3474885874 8304194627.P92	637
639	(1,3,9,71,213) 6977 9014917427.89709484 2396430102 4591994817.P85	
641	(1) 1283.32051.139739.353833.1078163.	
	.738198438 2315474972 6309925820 3143560636 9577820813 5055585507.P110	641
643	(1) 108175 6861144651.P179	
645	(1,3,5,15,43,129,215) 1291.P98	
647	(1) 4570409.9021769.93 2184694939.	C169 647
649	(1,11,59) 72689.580 4125093339.8 5103070830 4492139579.	
	.2489588 3322731461 8649866043.	
	.20 2562054896 4486290862 3959429128 3005510511 2948209849.P59	649
651	(1,3,7,21,31,93,217) 392624346 9330528571.P90	
653	(1) 1307.1 2550478467.7396293982 1546198686 3452049897.	C154 653
655	(1,5,131) 104801.4235167121.529001871 0085175364 8745461411.	
	.17208429 5846396957 2139456919 1520766721.P77	655
657	(1,3,9,73,219) 6571.1754336807 1267913387.	
	.2297469978 2180646194 9873523193.P78	657
659	(1) 67219.284689.	C188 659
661	(1) 206233.4611137.1433 0525250739.366407 0988387756 9115302731.	C148 661
663	(1,3,13,17,39,51,221) 8401537.100 1115859537.6123 1726987393.	
	.1139440 4518417567 7416498327 1590070953.P47	663
665	(1,5,7,19,35,95,133) 7482637214 2978943808 4581826972 8205334531.P91	
667	(1,23,29) 2784059.25276633.7 7954721883.	C161 667
669	(1,3,223) 247531.43 4030154636 2831119363.P107	
671	(1,11,61) 4027.48313.150238243.	C165 671
673	(1) 1330725593.406 1132942857.P181	
675	(1,3,5,9,15,25,27,45,75,135,225) 377204851.57 8348287651.	
	.1 2627431611 6265155801.6355 5888202891 2657106651.P45	675
677	(1) 2920579.6190489.464344418 9241244139.	
	.569759 9730308896 2411797462 4560195467.	
	.222155488 7922930388 1641434232 4245378243.P98	677
679	(1,7,97) 4837 2050082931.486 1364755896 5025358622 7318540449.	
	.20926 3101129304 3814171857 9491487452 7112788657.P83	679
681	(1,3,227) 4419691.4010501617.	
	.21087284 6643006600 8721288692 5064153234 6790007334 3968942243.P63	681
683	(1) 1676083.2 6955961001.P189	
685	(1,5,137) 920641.472748641.22633 8814638851.	
	.2365647 7881255230 0459414801.	
	.1316624887 2913462314 4415287942 6128691804 1120435881.P60	685
687	(1,3,229) 77 9704994617.1 6881360305 8115744761.	
	.815148 6864670450 7393379787.P80	687
689	(1,13,53) 175083169.1 6181916011.	C170 689
691	(1) 4668478921.963375828 4523287289.54566469 3183178636 7242204139.	
	.53568019 1297395026 2324347623 3360296971.P114	691

693	(1,3,7,9,11,21,33,63,77,99,231)	P109	
695	(1,5,139)	323414081.244471 9759493201. .5504854563 3636680923 8043881239 6758392800 6647872401	P93 695
697	(1,17,41)	107339.246739.234292369.	C175 697
699	(1,3,233)	9551137.373746913.5359075 2072775417	P108
701	(1)	P211	
703	(1,19,37)	151849.9621259.9137976433	P174
705	(1,3,5,15,47,141,235)	29611.2708611.305 9396467891.683070 5352239611. .4218 0315565990 6892289931.6672 9542646570 6396181651	P24 705
707	(1,7,101)	1463491.1 6729032587	P165
709	(1)	340321.504558 6197318561.	C192 709
711	(1,3,9,79,237)	711001.377460 6664682589 5604238713 8512734907. .2784647 3132777515 4128598057 3724799363	P64 711
713	(1,23,31)	1427.1993292747.2281 6032820817. .1012570175 7622655276 8717949102 4662141651	P135 713
715	(1,5,11,13,55,65,143)	519091.17 6510711521.16685004 4395914881. .6918033 8847103804 0964238491 6290854761	P74 715
717	(1,3,239)	542487937.46 3307610283 7130131059. .2171 9294766013 5214231281 5916826025 5839743617	P70 717
719	(1)	34513.3138112889.4900402 1019632699 1818036113 0213343099.	C166 719
721	(1,7,103)	8248287587.	C175 721
723	(1,3,241)	4339.153500131.5957570611.1342321 5628953313. .9854248896 2492304565 7501064259	P77 723
725	(1,5,25,29,145)	1451.37293 3190718801.494 6110376200 4289880601. .1161 7226716583 5167280913 6367089201. .1576 4220531866 2155775185 7821413401	P62 725
727	(1)	11633.520684724 4211914451 1578580563. .59803 9967692416 5054507436 1210286131	P151 727
729	(1,3,9,27,81,243)	3*.227862073.311 0690934667. .2168 9251325248 9863991753.11020 9916107596 4924744009	P78 729
731	(1,17,43)	1531693423 1051174801. .1 5797542906 1284119310 8992398119 8031035849	P144 731
733	(1)	39648532 4677401403.60321002 1469084665 5623731769.	C175 733
735	(1,3,5,7,15,21,35,49,105,147,245)	5881	P98
737	(1,11,67)	355635 5492892313.	C184 737
739	(1)	33407751 1117879213 0230681288 2603339179	P185
741	(1,3,13,19,39,57,247)	1483.19267	P123
743	(1)	22291.4343579.6562222067	P203
745	(1,5,149)	2639421761.211385 4074762921.8022 5605531720 2422034838 9258622531. .51383124 5433313985 1139441197 0333527291	P83 745
747	(1,3,9,83,249)	354854881.3049576 5703115017. .2 9004089048 7518370827 7501475595 7683255977	P83 747
749	(1,7,107)	1499.	C189 749
751	(1)	274867.	C221 751
753	(1,3,251)	1307209.1 0212446539.9 5741909371	P124
755	(1,5,151)	54361.28992001.33673001.20476 4382884291	P147
757	(1)	417817067	P219
759	(1,3,11,23,33,69,253)	10627.4036363.442 6119162421 7967508561. .837308 5998359158 6460452561	P74 759
761	(1)	1523.148577828 8798957523.3288826787 7547582651. .591336 1964964505 8522941873	C162 761
763	(1,7,109)	1795 8105295747.7 4709079304 7295291603	P162
765	(1,3,5,9,15,17,45,51,85,153,255)	1531.6121. .33141 8332048281 4219670615 0379164851	P75 765
767	(1,13,59)	10739.42953.1103294219. .6 6213049032 0398954426 5753007379 8459769131	P152 767
769	(1)	36913.77836643.86369467.940 1836358059.6 0214177287 5227166401	P177
771	(1,3,257)	831139.1 5853011980 1167697937. .10414 6006567817 3436164039 6674583500 9927452310 7429396640 0432773827	P65 771

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## Prime Factors

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773	(1) 533371.232063162 2007839640 4383777135 5342619283. .17376 3974263925 4060437861 5213444643 8169582980 2369522859.2 32063\ 16220 0783964043 8377713553 4261928387 0461866110 7966214343 4527093563.P102		
775	(1,5,25,31,155) 4651.28 2519050251.	C166	775
777	(1,3,7,21,37,111,259) P130		
779	(1,19,41) 384827.	C212	779
781	(1,11,71) P211		
783	(1,3,9,27,29,87,261) 1 2745935523. .443677006741 1056146721 3850972770 2937674624 9130734567 8065875601.P80		783
785	(1,5,157) 1571.25121.6412853401.P171		
787	(1) 942827.54053693 6099617873 8798259049. .44773 8411301927 9914803913 6997839721.C169		787
789	(1,3,263) 2559 4406272338 6721566481.P135		
791	(1,7,113) 5 4112378027.	C192	791
793	(1,13,61) 50753.286428 5210191809 4655832541 2679485917 0149406203.P167		
795	(1,3,5,15,53,159,265) 8088331.381199321.10781499 9632867521. .7 4648508328 7310097651.P72		795
797	(1) 875107.1056706494 3347324310 7529297593.	C205	797
799	(1,17,47) 119851.1699 3492187603.81 7785261598 6685170165 4313293617.	C172	799
801	(1,3,9,89,267) 264331.34 4129122172 3107683457. .36045 1236527568 5408664824 5551969409.P98		801
803	(1,11,73) 11243.2148631 4512550902 8597735617.P187		
805	(1,5,7,23,35,115,161) 3303598 1768945891.	C143	805
807	(1,3,269) 11299.3 6934519241 7701052571. .18 6303427023 1582655719 9328264881.466 0470246272 2448021107 6768171369.P73		807
809	(1) 1619.14563.19417.601897.3959 5205804249.P213		
811	(1) 710292 7740195899.7626530492 4973882264 8895115723.	C198	811
813	(1,3,271) 450403.8 8760231089.89718651 6077633497. .111705854 2027740397 3061107961 3870737888 9597893071 4757404139.P71		813
815	(1,5,163) 6521.11411.148331.P183		
817	(1,19,43) 1 5840460057.P218		
819	(1,3,7,9,13,21,39,63,91,117,273) 11467.13503673.P119		
821	(1) 6569.10378663 2191157616 9081957409.P216		
823	(1) 316033.1361 5553872073.	C229	823
825	(1,3,5,11,15,25,33,55,75,165,275) 1 0006979401. .659666841 9738471802 7476767451.P82		825
827	(1)	C249	827
829	(1) 131147801.31 5406949339 7876555121.2751 0961908692 8694988181 6932924433. .7446182219 4443848397 3964572596 1979800147.P147		829
831	(1,3,277) 97103 4308087215 8664398414 9247966467 6774419087 7182055\ 801 1275780034 6489383481.P92		831
833	(1,7,17,49,119) 1667.	C200	833
835	(1,5,167) P201		
837	(1,3,9,27,31,93,279) 2584 5192277364 8099179883.P140		
839	(1) 13770623 7237112689 5706481139.P225		
841	(1,29) 114377.249 2918387059.26 0420754632 1714056580 4312036553.P196		
843	(1,3,281) 28383811.731 7767583121. .116512122 0595973490 0282727898 3561616575 7454893337.P101		843
845	(1,5,13,65,169) 6761.103091.108161.367 0823346804 1380780858 2241279931.C142		845
847	(1,7,11,77,121) 593590 4348495138 3441635753.	C173	847
849	(1,3,283) 6793. .1252478787 4674354369 2481610705 9959926666 9771131677 4071921529.P107		849
851	(1,23,37) 542939.1298528378 0501700403.	C214	851
853	(1) 2465171.715 5452470451.1434382 6193517763.	C221	853
855	(1,3,5,9,15,19,45,57,95,171,285) 6841.198098371. .232 4138957258 5939528171.1175622349 6731894524 2451174930 2390882321.P57		855
857	(1) 252182368 3601252891 8089819907 3630970779.	C220	857
859	(1) 4045891.267946153.7 2068132891.	C233	859
861	(1,3,7,21,41,123,287) 10388827.2 0958338017.7 8390786811. .44 2336463314 2650480377.113068 3183801822 0372427161. .32215 3272098354 4180695988 9495947251.P35		861

863	(1)	53 5070645969.1761771969 3732711808 4628312251. .605471 4103782225 7475394975 1873375051.C183	863
865	(1,5,173)	29923811.603 1375205570 1307811411. C178	865
867	(1,3,17,51,289)	67901521 5511191577.59 1395038231 6342222561.P125	
869	(1,11,79)	15643.27809.140779. C222	869
871	(1,13,67)	9168220907.20 8597663875 5288150171.576 0449988051 8482364227.C185	871
873	(1,3,9,97,291)	1747.22699.92144632 0166308603. .4353509 6250286053 3102854399 0653601637 8722423696 4302573321.P92	873
875	(1,5,7,25,35,125,175)	558251.10022251. C168	875
877	(1)	29819.4235 5831233323.18 9691791362 7664517210 0272388219. .5493451945 3108657523 4909029971 6764102827.C175	877
879	(1,3,293)	42193.P172	
881	(1)	22907.58147.70481.149771.42295049. C238	881
883	(1)	21193.294923.467517108 9162696937.P237	
885	(1,3,5,15,59,177,295)	516266521.87 3791632531.235 4488203481.P107	
887	(1)	5323.260741 1387302489.11 8667786561 3380869048 9654291350 1309901939.C207	887
889	(1,7,127)	19901 5479740190 7244590074 6812468273. C194	889
891	(1,3,9,11,27,33,81,99,297)	7129.35 2246478761.62061 7419930817. .14090333 1387825310 9224688819.2365526241 0102963030 6294196057.P76	891
893	(1,19,47)	1787. C247	893
895	(1,5,179)	14321.121721.14556 0017652641.1043055 7104202241. .507046310 6922154841.16784344 5087730786 1649130441. .298 3602691084 9144367944 9696455011.P97	895
897	(1,3,13,23,39,69,299)	21529.258337.6635453 0124557299. .3173548499 1529375057.84 3764924538 5270023387.P91	897
899	(1,29,31)	21577.6994 8188740643.12780249 3095470979. .575087 6078708904 3634696391 0799123377.P182	899
901	(1,17,53)	105108859.P243	
903	(1,3,7,21,43,129,301)	5757529.7243867. .378717 3766734872 6709726629 1431316313.P103	903
905	(1,5,181)	12 7002291721. C206	905
907	(1)	81569 0878143277 5187914049.292 6949273865 7669549749 8001026561.P216	
909	(1,3,9,101,303)	9091.1 1312395373 6745874552 8018455717 6229738187. .756 6725580973 1248208147 6315648327 6883350707.P94	909
911	(1)	830833.346637323.P260	
913	(1,11,83)	238905 9505456889. C232	913
915	(1,3,5,15,61,183,305)	19895761.3015049441.28884 2216366491. .68207639 7349635633 6137221345 6131836731.P76	915
917	(1,7,131)	P235	
919	(1)	14968673.2014093267.431770434 1862180531. .1852454 8929928583 4957735107.P215	919
921	(1,3,307)	24365977.3 1992843313. C167	921
923	(1,13,71)	C254	923
925	(1,5,25,37,185)	C217	925
927	(1,3,9,103,309)	6 1339736467.39512 5276559977.113 7273214438 4815780057.P137	
929	(1)	8243947.370 6175321483.38959 3452245969.48962 4750530873. .1521188051 7062219326 0551601681.8082 3081657485 2707228222 8058900817.P168	929
931	(1,7,19,49,133)	5684313601.42050291 8802525203. .5714479757 8125846064 7919827630 0869021129.C161	931
933	(1,3,311)	1867.121291. C179	933
935	(1,5,11,17,55,85,187)	7481.22441.192611.4942411.96162881.P165	
937	(1)	1431737.20795779.40172939.196107588 5814321323. .2007 8288538991 4176986808 2345131291.P209	937
939	(1,3,313)	3 5534561977.2 4929852463 0962527080 4406373331.P148	
941	(1)	1738969.506215 5107501579.10 5333601626 1649316809.P240	
943	(1,23,41)	148 4493554507.285 5450113608 9979495033. .1112321273 7055374231 5881007760 2360080577.C192	943
945	(1,3,5,7,9,15,21,27,35,45,63,105,135,189,315)	69931. .535 0270740873 4986203593 6711342201.P93	945
947	(1)	7577.13259.9 1254170041.21 2341461377.8 8120629000 8086216099. .230 1648546180 6757328483.C212	947

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## Prime Factors

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949	(1,13,73)	182209.4 2598203337.	C245	949
951	(1,3,317)	1480727923.	C182	951
953	(1)	1907.42 5796183929.1624700 2794788943 8559877965 5842584377. .3802306 7385494413 2443213909 1271828121. .12 8064886830 1666714448 0257612911 5872060027.C158	C158	953
955	(1,5,191)	276603 7497160081.	C214	955
957	(1,3,11,29,33,87,319)	246907.2398243.14 3241922561. .310692509 9920735897.P128		957
959	(1,7,137)	1726201.1459025 0979416323.2944685412 1733451929.P204		
961	(1,31)	1 2787096753.8457 4094077694 3899258211. .223405 1064751291 5642585947.C221		961
963	(1,3,9,107,321)	315614841 3859611691.P174		
965	(1,5,193)	1931.30881.37420771.5 7252188728 1927268815 6683843001.P186		
967	(1)	440953.	C285	967
969	(1,3,17,19,51,57,323)	1932620113.	C164	969
971	(1)	495211.301996 7621847401.7457 9777362500 2825025979. .249 1229639091 3846106385 9592251764 9613788649.P205		971
973	(1,7,139)	15569.490393.173 8265567571 6231563653 4086604757 8896250851.P198		
975	(1,3,5,13,15,25,39,65,75,195,325)	38626387 9315103401. .1366767780 8819301503 7036862018 4321770343 3450089157 2775415001.P68		975
977	(1)	7817.728843.7128193.952471604 8809932689.P259		
979	(1,11,89)	39161.585443.	C255	979
981	(1,3,9,109,327)	17659.295188787.9676 1365841467.	C169	981
983	(1)	880060241.669 2446515577.450533013 8768309778 9972114796 5761959561.C236		983
985	(1,5,197)	1512961.4213 6857550241.25910146 7678452891. .121200860 6838635171.5 0041324686 9794048734 6607403971.P151		985
987	(1,3,7,21,47,141,329)	513512 3689810129.515 4800594447 7448439636\ 1980298330 5243869440 1533964821 9950040453 5444787331.P78		987
989	(1,23,43)	1979.49451.14407753.19744 3880998681.	C249	989
991	(1)	3060209.5819153.31 2289504052 7689387017.	C264	991
993	(1,3,331)	1987.25819.7 5904445347.	C181	993
995	(1,5,199)	P239		
997	(1)	614153.27557081.	C287	997
999	(1,3,9,27,37,111,333)	23977.5814899281.9 7377658867. .2 4194770787 3451279499.P150		999
1001	(1,7,11,13,77,91,143)	66067.	C212	1001
1003	(1,17,59)	21014857.P273		
1005	(1,3,5,15,67,201,335)	14908171.P152		
1007	(1,19,53)	169177.	C277	1007
1009	(1)	962587.3986502327 5343572161.9950 3550177156 3154298401 6422092411.C244		1009
1011	(1,3,337)	37760873 1632477282 3582837216 9734753939.	C165	1011
1013	(1)	2027.1428494 2415590523.20 2203379146 6488360947.P264		
1015	(1,5,7,29,35,145,203)	6091.316681.395851.4936961. .118310908 1162192341 4755021087 2300654121. .13414 8838212903 4569899071 6477137981 6790203241.P99		1015
1017	(1,3,9,113,339)	146449.457651.2887640788 5213594067.	C173	1017
1019	(1)	313097213 4342573797 2332358633.	C278	1019
1021	(1)	10211.18379.441073.6314 5268487193.21164 2910583695 4764874673. .6950602802 3563619678 7387625147.C225		1021
1023	(1,3,11,31,33,93,341)	6679688731. .809412655 9730787970 8460403908 7771314939.P132		1023
1025	(1,5,25,41,205)	4036451.142958801.124359 5348645401. .2 6815123266 6704881059 2666965226 6381711401.C171		1025
1027	(1,13,79)	6163.16433.14983931.23908561.41 9502198233. .65001 9848845206 3592176409.C223		1027
1029	(1,3,7,21,49,147,343)	8233.3689243 7056956699. .1 7008283446 3067409204 0186897803 1815852569.P117		1029
1031	(1)	79445908 0231178477 1135014606 6567930257.P272		
1033	(1)	2465 1922299337.	C298	1033
1035	(1,3,5,9,15,23,45,69,115,207,345)	21 1104810001. .6971 7454323743 0742710277 7670820910 4594944911 4019397091.P94		1035

1037	(1, 17, 61) 2 3889800393.61 5240811219.	C267	1037
1039	(1) 155851.76264284 7088874611.15029 3020197239 9146277968 5090903481.P256		
1041	(1, 3, 347) 2083.14865481.77910 2442743098 6498793899.	C174	1041
1043	(1, 7, 149) 17747689.	C261	1043
1045	(1, 5, 11, 19, 55, 95, 209) 661333546 7116613731.2165473496 1841342681. .3 0283060129 9346947201.P158		1045
1047	(1, 3, 349) 2 4474001921.P200		
1049	(1) 2099.177 9522099931.2413275664 1778030091.	C281	1049
1051	(1) 2601 5176530521.23 4166918021 1812982298 4892341113 7491270809.	C262	1051
1053	(1, 3, 9, 13, 27, 39, 81, 117, 351) 1016 6476786129.9396171 1110587347.P166		
1055	(1, 5, 211) 101281.	C249	1055
1057	(1, 7, 151)	C272	1057
1059	(1, 3, 353) 3286329043.11759 8477011619. .83787479 6108785109 5647896563 0065403939.P151		1059
1061	(1) 342873632 5987808713.P301		
1063	(1) 11 4584129081.262104885 1811832316 4267329859.	C281	1063
1065	(1, 3, 5, 15, 71, 213, 355) 2131.675310507 2024926404 4979244321. .1 6052588807 9920212258 8437482458 0419144567 0399750291.P87		1065
1067	(1, 11, 97) 8537.2570 5142292017.4 2823468278 8982633446 4447699353.	C242	1067
1069	(1) 7681945177.	C312	1069
1071	(1, 3, 7, 9, 17, 21, 51, 63, 119, 153, 357) 6427.17137.119953.1340000929. .4969716475 2429114523. .107882519 1548640568 1434078411 7374246049 3739682993.P84		1071
1073	(1, 29, 37) 34149299.723 1794763528 0240063695 3428399129.P264		
1075	(1, 5, 25, 43, 215) 6451.32251.	C245	1075
1077	(1, 3, 359) 2 5742490619.6 1965231619.4897190990 7332782346 5690986241.P165		
1079	(1, 13, 83) 110059.28 0664183205 9217497692 0728908193.	C260	1079
1081	(1, 23, 47) 139910 0926820497.17 2944404909 4495656521.P269		
1083	(1, 3, 19, 57, 361) 206283 5090323897.P191		
1085	(1, 5, 7, 31, 35, 155, 217)	C217	1085
1087	(1) 12 1398914459.5901504614 2680340633.1 4428805393 8906556201.	C276	1087
1089	(1, 3, 9, 11, 33, 99, 121, 363) 2779129.P193		
1091	(1) 41 7676772832 2304092689.	C307	1091
1093	(1) 306041.149076457.P315		
1095	(1, 3, 5, 15, 73, 219, 365) 3241201.5665531.1005823201.2437 5654323161. .7558575883 4018224531. .83 9528735475 4937404878 7480932338 8746794701 4370925681.P66		1095
1097	(1) 1237417.993889 9271706737 9719706367 6220796827.	C288	1097
1099	(1, 7, 157) 11661543 9604018153.7192 4691072021 1929911689.	C242	1099
1101	(1, 3, 367) 28627.	C217	1101
1103	(1) 227219.2035422 2567550187.2353105 5927158473. .17 2634405376 5465479516 2809143644 5763552227.C253		1103
1105	(1, 5, 13, 17, 65, 85, 221) 44201.	C227	1105
1107	(1, 3, 9, 27, 41, 123, 369) 36 9560523547.	C206	1107
1109	(1) 314468041.449 8094107721.1147071 9176395975 1382208987.	C287	1109
1111	(1, 11, 101) 151206 1925484570 7358936819. .359 8469760756 3086300749 8752386627.P244		1111
1113	(1, 3, 7, 21, 53, 159, 371) 90972169.740060681 7397019353.	C161	1113
1115	(1, 5, 223) 38255 7003061241.	C253	1115
1117	(1) 7053306 3399945787.P319		
1119	(1, 3, 373) 326208643.3015550 6036528513.	C200	1119
1121	(1, 19, 59) 2243.6088599401.5814209 8448088409. .3590716 4026858234 2735956401.P258		1121
1123	(1)	C338	1123
1125	(1, 3, 5, 9, 15, 25, 45, 75, 125, 225, 375) 9001.11251.13 0147868251. .210449 6060760001.1 9114918482 2837112790 9236272251. .199393 3870783443 3467107535 7457256575 7274335261 0488782001.P61		1125
1127	(1, 7, 23, 49, 161) 773678 6575986931.	C263	1127
1129	(1) 5297035427.	C330	1129
1131	(1, 3, 13, 29, 39, 87, 377) 6131839320 6415264609. .86212 9909267689 2324232743 5267276546 3729913497.C138		1131

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## Prime Factors

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1133	(1, 11, 103)	2267.12945659.	C297	1133		
1135	(1, 5, 227)	7025651.685467361.1046622091.61566	9475808407 5792273361. C223	1135		
1137	(1, 3, 379)	19509095 4822051707.	C228	1137		
1139	(1, 17, 67)	18257.30187 0128784337.120089	3348906161. C301	1139		
1141	(1, 7, 163)	.72252614 6028558523.170606135	3929846091 3312913761.P213	1141		
1143	(1, 3, 9, 127, 381)	2576323.206 1165716371.	.9403580 9272892889 5307269283	1494040201.C172	1143	
1145	(1, 5, 229)	40622 5165149481.735630322	5632068242 1346570851. .3762	2703972445 7716564082 6633613851.P198	1145	
1147	(1, 31, 37)	305771849.	C317	1147		
1149	(1, 3, 383)	P231				
1151	(1)	9209.264731.718 3639052011.80	5708908416 3503088491. C302	1151		
1153	(1)	27673.377 2896236651.18152	2173837889 8021554747. C306	1153		
1155	(1, 3, 5, 7, 11, 15, 21, 33, 35, 55, 77, 105, 165, 231, 385)	9241.18481. .11357	1560808091. .9282	6785914504 8237228203 4390640603	8423584116 7452667731.P69	1155
1157	(1, 13, 89)	117466969.	C319	1157		
1159	(1, 19, 61)	277 9191397441.	C318	1159		
1161	(1, 3, 9, 27, 43, 129, 387)	59301371.1053	4255862017.116 8777403325	1901173729 2886104457. C216	1161	
1163	(1, 5, 233)	179411.9813961.	C297	1163		
1165	(1, 3, 389)	9337.9748 4277202003.459	0859278731 9236096963. C268	1165		
1167	(1, 7, 167)	2339.37409.161323.146083	5167157280 7850092203. .9366227322	8326604483 4451024147.C164	1167	
1169	(1)	25763.84313.P343	.84141600 7270558505	3393085689.C234	1169	
1171	(1, 3, 17, 23, 51, 69, 391)	236947.647674297.408049453	9544536849. C180	1173		
1173	(1, 5, 25, 47, 235)	185651.	C272	1175		
1175	(1, 11, 107)	4950407 8597120643.1664197271	5642472724 1892848411. C274	1177		
1177	(1, 3, 9, 131, 393)	25939.82531.	C226	1179		
1179	(1)	49603.59051.11403737.6	7685946763. .9186599509	8827272622 7976086237	9532536049.P288	1181
1181	(1, 7, 13, 91, 169)	182 5653342995 5747955939.	C260	1183		
1183	(1, 3, 5, 15, 79, 237, 395)	2371.1885937 7449506801.P169				
1185	(1)	6265 2393706472 8884681163.	C334	1187		
1187	(1, 29, 41)	28537.306763.975874	4379744403.P312			
1189	(1, 3, 397)	1819849.43247593.6	4339323043.42 7329609001.	.668 0956469612 0553953329.C180	1191	
1191	(1)	324497.613 2176836553.	C341	1193		
1193	(1, 5, 239)	184087361.	C279	1195		
1195	(1, 3, 7, 9, 19, 21, 57, 63, 133, 171, 399)	778051.1697347.P183				
1197	(1, 11, 109)	44725255 9596639611.2	9825741563 8476586139. .79414490749	4779140961.1996742	1766156212 7504717865 3063503969.P230	1199



Factorizations of  $2^n + 1$ ,  $n = 4k - 2$ ,  $n < 2400$ 

$n$	Prime Factors
2	5
6	(2) 13
10L	(2) 5*
M	41
14L	113
M	(2) 29
18L	(6) 37
M	(2) 109
22L	(2) 397
M	2113
26L	(2) 1613
M	53·157
30L	(6,10M) 61
M	(2,10L) 1321
34L	137·953
M	(2) 26317
38L	(2) 229·457
M	525313
42L	(2,14M) 14449
M	(6,14L) 1429
46L	277·30269
M	(2) 1013·1657
50L	(10M) 101·8101
M	(2,10L) 5*·268501
54L	(2,18M) 246241
M	(6,18L) 279073
58L	(2) 107367629
M	536903681
62L	5581·384773
M	(2) 8681·49477
66L	(6,22M) 312709
M	(2,22L) 4327489
70L	(2,10L,14M) 47392381
M	(10M,14L) 7416361
74L	(2) 149·184481113
M	593·231769777
78L	(6,26M) 13*·313·1249
M	(2,26L) 3121·21841
82L	181549·12112549
M	(2) 10169·43249589
86L	(2) 1759217765581
M	173·101653·500177
90L	(2,10L,18M,30M) 181·54001
M	(6,10M,18L,30L) 29247661
94L	140737471578113
M	(2) 3761·7484047069
98L	(14L) 4981857697937
M	(2,14M) 197·19707683773
102L	(2,34M) 409·3061·13669
M	(6,34L) 1326700741

106L (2) 180143 9824104653  
   M 15358129.586477649  
 110L (10M,22M) 41 5878438361  
   M (2,10L,22L) 363 0105520141  
 114L (6,38M) 131101.160969  
   M (2,38L) 27 5415303169  
 118L (2) 1181.3541.157649.174877  
   M 5521693.10 4399276341  
 122L (2) 733.1709.36 8140581013  
   M 3456749.66 7055378149  
 126L (6,14L,18L,42M) 11 8750098349  
   M (2,14M,18M,42L) 4 0388473189  
 130L (10M,26M) 10814 0989558681  
   M (2,10L,26L) 521.51481.341110701  
 134L (2) 269.42875177.2559066073  
   M 15152453.973 9278030221  
 138L (2,46M) 7033 4392823809  
   M (6,46L) 541 5624023749  
 142L 4999465853.47 2287102421  
   M (2) 569.148587949.5585522857  
 146L 94 4473296560 1851473921  
   M (2) 293.9929.64930 1712182209  
 150L (2,10L,30M,50M) 63901.13334701  
   M (6,10M,30L,50L) 1201.1182468601  
 154L (2,14M,22L) 869467061.3019242689  
   M (14L,22M) 8317.7609 6559910757  
 158L 6044 6290980621 5075725313  
   M (2) 317.3 8136461186 6507317969  
 162L (6,18L,54M) 3618757.4977454861  
   M (2,18M,54L) 106979941.168410989  
 166L (2) 13063537.14806719 7374074653  
   M 997.4 6202197673.20 9957719973  
 170L (2,10L,34M) 1021.4421.550801.23650061  
   M (10M,34L) 722690435 2843746841  
 174L (6,58M) 2217021 4192500421  
   M (2,58L) 349.29581.2 7920807689  
 178L 1069.5790 1779199499 9956106149  
   M (2) 1237940 0392854506 4364330189  
 182L (2,14M,26L) 1093.1093.886108 5190774909  
   M (14L,26M) 4733.55633852 5912325157  
 186L (2,62M) 461154528 3086450689  
   M (6,62L) 373.95108 8215727633  
 190L (10M,38M) 761.241692362 0660807201  
   M (2,10L,38L) 54721.27669663 1250953741  
 194L 389.4657.4959325597.1763 7260034881  
   M (2) 3881.5821.3555339061.39 4563864677  
 198L (2,18M,22L,66M) 42373.1597 5607282273  
   M (6,18L,22M,66L) 235621.846 3901912489  
 202L (2) 9491060093.5342503736 3873248657  
   M 809.521 8735279937.60050 3817460697  
 206L 41201.520379897.47300015 7711296729  
   M (2) 17325013.1170 7009745765 6623005977  
 210L (6,10M,14L,30L,42M,70M) 104181 5865690181  
   M (2,10L,14M,30M,42L,70L) 421.14 6919792181  
 214L (2) 857.378668090 6166005726 4219253397  
   M 843589.817 4912477117.2352 8569104401  
 218L (2) 7432 3515777853.174651885 2140345553  
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 222L (6,74M) 14 5303029800 1690873541  
   M (2,74L) 3109.1398316729.4345052821

226L 10384 5937170696 5511294580 4582584321  
 M (2) 58309.2362153.150 7911621390 1326178369  
 230L (2,10L,46M) 461.5981.3 5900691276 5190408181  
 M (10M,46L) 15096281.1021622741.7834788541  
 234L (2,18M,26L,78M) 7489.37024440 5487013669  
 M (6,18L,26M,78L) 21061.348661.111 2388285061  
 238L (14L,34L) 2381.42841.823481.53629 6539263941  
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 242L (22M) 3389.91961.40369 6258401080 7014809213  
 M (2,22L) 1339 2725398336 6838695892 0468400193  
 246L (2,82M) 802333429.602704 3735173469  
 M (6,82L) 2953.1 2596597697 6392564317  
 250L (2,10L,50M) 5\*.28001.96001.9429186693 2171243501  
 M (10M,50L) 7001.3775501.4797013360 3445383501  
 254L 509.26417.140385293.901 3356691791 3517709497  
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 258L (6,86M) 59516 3196629668 5834686149  
 M (2,86L) 17029.46957.9675877 1543686753  
 262L (2) 642811237.2745098189.3 0854469540 9769427309  
 M 269665073.81 0791440841.1245075181 5271172041  
 266L (2,14M,38L) 1597.4493293862 9223253525 0647435097  
 M (14L,38M) 2129.12684 8469231149.67925 3585011429  
 270L (6,10M,18L,30L,54M,90M) 541.49681.16504 1853060421  
 M (2,10L,18M,30M,54L,90L) 30241.16624293 5471754241  
 274L 189061.921525 7079118405 8739061733 0886362701  
 M (2) 16843 4085820849.2068756 7010495774 4917147613  
 278L (2) 1408349.1 5736774913.49 2717674609.1276 3660054721  
 M 557.1251163891 2999676358 6027250922 9764287909  
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 M (6,94L) 5641.2700 9726848416 7653999069  
 286L (22M,26M) 958673.6615213493 5110533966 8937661297  
 M (2,22L,26L) 25741.3426853.9467173.417016557 0896115649  
 290L (10M,58M) 168781.120045415 0195481108 5302214141  
 M (2,10L,58L) 17401.24 4716883381.390209519 2430070721  
 294L (2,14M,42L,98M) 540961.4054485969 3521152369  
 M (6,14L,42M,98L) 170594 1050473832 3992180849  
 298L (2) 1 2961064789.11011 8089519717 4591531324 2336927641  
 M 1789.1464 1916303149.272433866 0239558843 7243602121  
 302L 285449 5385411919 7621164963 8103526435 8442074113  
 M (2) 43 7368927017 6379261201.1305 3032390189 9210670077  
 306L (6,18L,34L,102M) 2582029.4260133.1245872 3489217613  
 M (2,18M,34M,102L) 613.318194713.23849519 7879143209  
 310L (2,10L,62M) 37201.87421.52597081.2486589969 3834809641  
 M (10M,62L) 8973817381.578058 2874569275 8010628581  
 314L (2) 2790467761.594103 5366826969.22 0394203343 9148343973  
 M 18268770 4666362864 7754612085 5244518477 1578920961  
 318L (6,106M) 207973.300074 5925439318 1618012897  
 M (2,106L) 10177.79718620 0486710330 3293462593  
 322L (14L,46L) 3221.169373.209160253.270 3702811844 8801270021  
 M (2,14M,46M) 1933.298817.11 5927640417.1 7935157473 6387915177  
 326L (2) 653.9781.7807049.4826612561.97161 3420158567 9932947173  
 M 1169201309 8647223345 6294834974 3354261576 4159168513  
 330L (2,10L,22L,30M,66M,110M) 661.3301.8581.1212 7627350301  
 M (6,10M,22M,30L,66L,110L) 39 1249826881.1337 9250952981  
 334L 1 8707220957 8355573530 0716392448 7111268189 2570202113  
 M (2) 75005713.2739532 5377910797.182082 6078119015 6536114609  
 338L (26M) 677.61594 6323850313.2156563293 8289155092 0192462661  
 M (2,26L) 180201997.125 9036730797.4089468 7672970399 2293841657  
 342L (2,18M,38L,114M) 4598533.414356 0637122783 5355919073  
 M (6,18L,38M,114L) 25309.5675149.39291697.9946 3730244517

346L (2) 1 3625405957.17 5739665310 5057529688 7774035031 3227534889  
 M 715 2893721041.1673815085 1865747003 2217423206 9942181681  
 350L (10M, 14L, 50L, 70M) 701.2430 0659246935 1719855032 2751963101  
 M (2, 10L, 14M, 50M, 70L) 1038213 7934478419 4090829335 5871461401  
 354L (6, 118M) 709.12037.29952400 8711790907 8735942093  
 M (2, 118L) 31153.5397793.94789873.2084785 8316750657  
 358L (2) 31815461.4 1611501383 0990336221.115757 0933663659 5278866333  
 M 1301260549.58885 0381287433 0282790841 1047440018 1861465037  
 362L (2) 9413.17892 5762979037.383053 8323149121.9501637613 5553173181  
 M 2873 9737348957.10 6646454159 1577895336 8533937767 9881781493  
 366L (6, 122M) 5080081.420 9508589941.1912555 6519918081  
 M (2, 122L) 1283 6737570021.4141 9495873379 6530899181  
 370L (10M, 74M) 1392776941.496416 6554103541.125871072 5115650761  
 M (2, 10L, 74L) 29246281.567471221.42998818 3417207835 0686174001  
 374L (2, 22L, 34M) 2 6509131221.3515507 7044989397.40 2929206562 9191839853  
 M (22M, 34L) 5237.551353793.181 9762572673.1353 2204591711 8601273437  
 378L (2, 14M, 18M, 42L, 54L, 126M) 757.4563764310 5362633947 3533320957  
 M (6, 14L, 18L, 42M, 54M, 126L) 304 8327561958 6522928480 7891468769  
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 386L 773.6 3528368960 3233836449.25564 7743603632 1274038224 7547878573  
 M (2) 3089.148997.1440203064 4704405877.3787913000 2708963567 7652285973  
 390L (2, 10L, 26L, 30M, 78M, 130M) 2341.723447661.892527 8993793241  
 M (6, 10M, 26M, 30L, 78L, 130L) 468781.7204 5377242751 8446437641  
 394L (2) 4729.1079423677.15 2874915601.51480 3697091705 0130439411 8553664009  
 M 52009.38621 6338580579 8697201354 7951946615 1272644136 4448411929  
 398L 797.10081167 1534441046 1444141839 6101802392 2317850375 1442552629  
 M (2) 7655 4648784441.209907 3106303095 0253038854 6087971791 8033130293  
 402L (6, 134M) 3217.192961.214473433.7 1848008781.17 5132692529  
 M (2, 134L) 10453.132661.15 7049009596 5129377427 0521395753  
 406L (2, 14M, 58L) 29\*.2847408367 6894571496 7262803488 9135424066 1831606009  
 M (14L, 58M) 981 0958633253.21597468 5494939586 6490250433 1670645757  
 410L (2, 10L, 82M) 6121 3422340181.76401 5570526610 7026640534 0180269721  
 M (10M, 82L) 41\*.821.269896441.8277772 0757144341.75839980 1407611361  
 414L (6, 18L, 46L, 138M) 829.853669.2 6785337149.4 9681708110 9150685921  
 M (2, 18M, 46M, 138L) 3313.18217.318781.6542857.2539538214 1805460457  
 418L (22M, 38M) 885 7714771093.306629041 1598855013.272 9081289312 0485231161  
 M (2, 22L, 38L) 6689.2039731321.14983275 0683283097.19373 8524141656 4065603093  
 422L (2) 95110361.69204 0084811035 9047653995 0576249413 6748583495 4585997077  
 M 1845 5044087121.1 7832572488 6188112393 5734764584 8296525678 2477560753  
 426L (2, 142M) 266677.1396429.18369973.4 0524027877.2011 1008087273  
 M (6, 142L) 853.189997.2646 1853284868 5412969316 9911139349  
 430L (10M, 86M) 129001.113183 2377932535 1241891247 8798890586 0893840561  
 M (2, 10L, 86L) 370661.1952201.4538991421.26012 5854015641.140134 5270171101  
 434L (14L, 62L) 8679 8856474727 4927163124 8681278986 5797648931 3137639569  
 M (2, 14M, 62M) 31249.7767 2966850700 5203702993.1393355 4603291368 1584758997  
 438L (2, 146M) 877.1013533.70 4710824913.1424 0686876552 5436670617  
 M (6, 146L) 37 1335727233.18 4786091137 1012202355 0126425157  
 442L (2, 26L, 34M) 667091492 5963435577.2380142106 5091222001 2734588581 9001687213  
 M (26M, 34L) 1210509821.229 1059412513.1118498 4408988805 6206295917 7194663477  
 446L 95768689.5201643 5676012089.270 5981985587 5271918527 5232579507 6108854553  
 M (2) 11597.6530333.691201046 4887165201.P37  
 450L (6, 10M, 18L, 30L, 50L, 90M, 150M) 41315 0254353901.31 9226150421 6112476901  
 M (2, 10L, 18M, 30M, 50M, 90L, 150L) 695701.30711 6398490301.626998 9892198401  
 454L (2) 45657954 1250072512 8240734773.P40  
 M 5449.83132849.694512857.5661492593.P39  
 458L (2) 2749.5523481.8 4948746297.621 1454306149.P35  
 M 602633653.3 3074236421.441 8552078989 4155033573.P27  
 462L (6, 14L, 22M, 42M, 66L, 154M) P37  
 M (2, 14M, 22L, 42L, 66M, 154L) P36

466L 30757·1557697434 8063186977·253 3659497537 4725568037·P25  
   M (2) 3108221·P63  
 470L (2,10L,94M) 941·894434441·335 7909154141·3842 5816980821·72250180 9616926841  
   M (10M,94L) 8 7255998201·323781 1125343321·P29  
 474L (2,158M) 151681·P43  
   M (6,158L) 1889033105 7055511701·P28  
 478L P72  
   M (2) 7 7852679293·P61  
 482L P73  
   M (2) 2640397·15594629·7611 9208744309·P45  
 486L (2,18M,54L,162M) 333 3950193493·P37  
   M (6,18L,54M,162L) 2917·4861·2612 9603777437·P29  
 490L (2,10L,14M,70L,98M) 30617 8659371201·137222 6516822701·P22  
   M (10M,14L,70M,98L) 7439220181·P41  
 494L (26M,38M) 515737·P60  
   M (2,26L,38L) 104729·2638949·53145 5155350809·P40  
 498L (6,166M) 136453·218166829·4 1732461753·57914 8740542722 8378717709  
   M (2,166L) 1993·8048516651 4184335373·P27  
 502L (2) 1912621·5 7762875981·197 2386557777·3850 8212572597·P32  
   M 5021·450631 8024012806 6017730357·P47  
 506L (2,22L,46M) 699404 2018866541·P51  
   M (22M,46L) 25301·109297·756550961·2569737193·9623862953·  
     .15 6296877661·10102736 0307659633 506M  
 510L (6,10M,30L,34L,102M,170M) 51001·2949879781·61 1787251461·1545 5023589221  
   M (2,10L,30M,34M,102L,170L) 15571321·P31  
 514L 2 2988734297·P68  
   M (2) 28564009·360197837·P61  
 518L (2,14M,74L) 203525988 4744589189·P48  
   M (14L,74M) 6217·P61  
 522L (2,18M,58L,174M) P51  
   M (6,18L,58M,174L) 7309·P47  
 526L 4319546 4658778477·801818 5473877547 1107692957·P37  
   M (2) 119929·731141·9 9972364781·P57  
 530L (10M,106M) 1061·3181·P56  
   M (2,10L,106L) 51941·24082141·3121 3331016701·P38  
 534L (2,178M) 3401264941·1 1221454641·P35  
   M (6,178L) 2137·928574737·P41  
 538L (2) 2153·3229·5381·4273873·163 3401082697·39186 9517930421 4327885157·P27  
   M 8609·1225752215 5068235430 2309961053·P48  
 542L 10474693·104167 7554991686 9669374386 7494211841·P40  
   M (2) 97561·P76  
 546L (6,14L,26M,42M,78L,182M) 503413·46 7811806281·P27  
   M (2,14M,26L,42L,78M,182L) 1948129·P37  
 550L (2,10L,22L,50M,110M) 12101·35201·69 8617420601·1873521 6413769901·P24  
   M (10M,22M,50L,110L) 19059 1117813882 4081520901·P37  
 554L (2) 1109·98787998 4327104437·P62  
   M 232681·98002601·1093620377·434 3215646437·36588378 5511434081·P31  
 558L (6,18L,62L,186M) 1117·140617·P47  
   M (2,18M,62M,186L) 77 5844757937·P43  
 562L 91568909·P77  
   M (2) 3373·3827221·58 3814409739 3452251044 4290213069·P43  
 566L (2) P85  
   M P86  
 570L (2,10L,30M,38L,114M,190M) 185821·247381·3996146881·P23  
   M (6,10M,30L,38M,114L,190L) 145777 2869697961·P29  
 574L (14L,82L) 2297·16073·P65  
   M (2,14M,82M) 10333·383 9331472313·1716 0693383233·P43  
 578L (34L) 7698961·21886549·11 3478990853·P57  
   M (2,34M) 936361·8540962 7558953934 1506608949·P49  
 582L (2,194M) 580837·856752889·P44  
   M (6,194L) 757039 0327211773·6918656 2412120809·36875 3186143805 2950582913

586L	(2)	22396921.1 2377633813.79 6088615657.49803 9116406053.P44	
M		5861.12893.60488093.6 4446752010 7517023949.P52	
590L	(10M, 118M)	677321.824821.533194801.P49	
M	(2, 10L, 118L)	3474759 9647361961.P54	
594L	(6, 18L, 22M, 54M, 66L, 198M)	529 2250152949.P42	
M	(2, 18M, 22L, 54L, 66M, 198L)	2377.22573.15 5399494141.471 2151755917.P23	
598L	(2, 26L, 46M)	6542689297.20825 7309828865 8487833056 1061323409.P36	
M	(26M, 46L)	20333.956801.15595841.1 9294368341.633984 0806910833.P36	
602L	(2, 14M, 86L)	P77	
M	(14L, 86M)	4817.18061.2789669.5956189.23 6344687097. .2600756115 5890556369.4612 9120326545 7936024109	602M
606L	(6, 202M)	1213.10838917.4 8260169439 8006137569.P29	
M	(2, 202L)	1896781.12753877.27 9393856326 4652590777.P26	
610L	(10M, 122M)	7321.289541381.6978 3494046481.P46	
M	(2, 10L, 122L)	42701.211061.183102481.162147 4400951381. .52512218 1762140401.40 2381691094 9111979881	610M
614L	(2)	93329.1021697.P81	
M		1229.7369.254197.201846361.30275 6422009117.1780398 4478124349.P42	
618L	(2, 206M)	539455909.40911 0293612180 5539709429.P29	
M	(6, 206L)	1237.P58	
622L		6221.21149.P86	
M	(2)	889299 2859964273.25 0296080860 6492609801.P56	
626L		42569.681089.6386453.59593 5893598452 7488648293.P53	
M	(2)	1933526201.30 7168226569.33843 1049916629.P59	
630L	(2, 10L, 14M, 18M, 30M, 42L, 70L, 90L, 126M, 210M)	2521.P41	
M	(6, 10M, 14L, 18L, 30L, 42M, 70M, 90M, 126L, 210L)	1711081.430839361.P29	
634L	(2)	6 3799650128 6702584141.7682 3960710503 7206095941.P51	
M		344759057.41 0590256720 9832582077.3460215920 5085758779 9867500257.P36	
638L	(22M, 58M)	P84	
M	(2, 22L, 58L)	1277.181193.945 8426345106 0203297797. .746942 9548715174 1747603533.P28	638M
642L	(6, 214M)	1016929.9512986513.1 6612568137 1619629161.P28	
M	(2, 214L)	57781.9763322857.8725 1820842149.15750013 0135806013. .339610376 6435902981	642M
646L	(2, 34M, 38L)	10337.5779117.P77	
M	(34L, 38M)	P87	
650L	(2, 10L, 26L, 50M, 130M)	1301.666901.1 7812009801.P53	
M	(10M, 26M, 50L, 130L)	500501.667 4103748838 5925405181 0171126401.P34	
654L	(6, 218M)	5233.9157.P57	
M	(2, 218L)	2617.285433069.119 3312900149.727351328 1851561317.P23	
658L	(14L, 94L)	1198877.P77	
M	(2, 14M, 94M)	2633.6581.1822661.165989713.529 3859911206 7767917869.P39	
662L	(2)	589181.P94	
M		432655397.5 1861618869.17 8005165204 0095043377.P60	
666L	(2, 18M, 74L, 222M)	8271721.13441213.44 9818591141.P40	
M	(6, 18L, 74M, 222L)	37*.1 9467440249 1792252193.P44	
670L	(10M, 134M)	14271001.P72	
M	(2, 10L, 134L)	32 2495062136 9762729981.P59	
674L		683437.30499849.P89	
M	(2)	5393.32353.2549069.15 6778842728 5810782881.P65	
678L	(2, 226M)	2713.654 1323708817.P52	
M	(6, 226L)	972239797.P58	
682L	(2, 22L, 62M)	162 6518693141.6302977 5697163441.4991 6029455783 0061662001.P39	
M	(22M, 62L)	2729.9968113.3 5547685493.156565 7514926957.P54	
686L	(14L, 98L)	1516061.14183737.2876 6422491720 1632616069 6843982089.P42	
M	(2, 14M, 98M)	1373.106301189.P78	
690L	(6, 10M, 30L, 46L, 138M, 230M)	942 6998044141.468750001 9013509441.P22	
M	(2, 10L, 30M, 46M, 138L, 230L)	1381.475904041.12 4398214921. .223 6879829941.10154500 5972588481	690M

- 694L (2) 5575597.60988721.5237357057.3419 5523753509.  
.1154415 9832121397 7591105829.P40 694L  
M 2777.1 8223420687 5674913613.42992 7788447751 2812338461.P57
- 698L (2) 8377.763613.2754 7678215997.15766 1163902833.11483591 4561123841.P50  
M 19634 2372356257.1163229 3942370469.P75
- 702L (6,18L,26M,54M,78L,234M) 7011385057.2145 5171100793.P42  
M (2,18M,26L,54L,78M,234L) 9829.59012929.52037 8545363301.P39
- 706L P107  
M (2) 54102824 9071570661.363408 4258617465 0879031363 9089881017.P53
- 710L (2,10L,142M) 5039581.P79  
M (10M,142L) 6561576218 5579629181.P65
- 714L (2,14M,34M,42L,102L,238M) 107445577.P50  
M (6,14L,34L,42M,102M,238L) 12853.45697.242888 0150373517.P35
- 718L 585889.5199757.19 5352923041.62734125 5004753577.P67  
M (2) 4909342 7230218193.287 6957196545 8458648037.P69
- 722L (38M) 47653.59961 8935673335 5044555777.456317820 7350998102 5650312961.P45  
M (2,38L) 26980101 3130578289 2600265853 6748515187 8717233637.P56
- 726L (2,22L,66M,242M) 1453.11617.4124265157.1 0494482658 8233689949.P30  
M (6,22M,66L,242L) P67
- 730L (2,10L,146M) 16061.20441.454061.P74  
M (10M,146L) 844 8942064460 3064685541.P64
- 734L P111  
M (2) 9252530 3484856757.P93
- 738L (6,18L,82L,246M) 2 7303986737.117 5968411417.P50  
M (2,18M,82M,246L) 110069749.233957809.P56
- 742L (2,14M,106L) 4207141.P88  
M (14L,106M) 752201 4358008949.7968576 1538122350 2399146729.P51
- 746L (2) 1493.699640 2304983061.P93  
M 1 0856405213.P103
- 750L (6,10M,30L,50L,150M,250M) P61  
M (2,10L,30M,50M,150L,250L) 3001.791058001.16806 9194932501.P34
- 754L (26M,58M) 10 7134819481.P90  
M (2,26L,58L) 6576389.852121037.3 0084532141.P76
- 758L (2) 4549.10219357.27341 7303839929.P89  
M P115
- 762L (2,254M) 19816 8459411337.P63  
M (6,254L) 124347733.11899 6959723157.645 0243401921 5168363033.P31
- 766L 13789.111650629.16 0613346430 7410656290 2609963477.P72  
M (2) 4597.210 9242532781.429 3744999756 3729850241.  
.83938 9895387301 1112551573.P52 766M
- 770L (10M,14L,22M,70M,110L,154M) P73  
M (2,10L,14M,22L,70L,110M,154L) 1823 0707209829 4717589401.  
.14235 6688182500 6865551221.23359 2820429265 6509957961 770M
- 774L (2,18M,86L,258M) 147835549.1868 0859000948 8458594153.P45  
M (6,18L,86M,258L) 1549.6043393.121717693.1451 2828061449.P45
- 778L (2) 17117.51349.2852149.13576 4017104229.P87  
M 7461759101.P108
- 782L (34L,46L) P106  
M (2,34M,46M) 3898 4039641073.91022 8332911141.223995 6782073053.P63
- 786L (6,262M) 14149.33013.1994869.1865269177.220310750 6077035781.P36  
M (2,262L) 12577.39301.342697.7261434 8401770282 2117388229.P38
- 790L (2,10L,158M) 1 2769755739 6400084281.P75  
M (10M,158L) 22 2895231858 6839413441.14 2762049959 6597354935 3488548021.P42
- 794L (2) 11117.7 0290725429.296 9043149112 0476836186 6863639017.P72  
M 14293.25409.6312301.P105
- 798L (6,14L,38M,42M,114L,266M) 25537.568177.12828649.10 4038692997.  
.8435068 4843543413.1 8515569129 4150619421 798L  
M (2,14M,38L,42L,114M,266L) 186733.37137 1482910511 3122459933.P35
- 802L 42425 8268183989.2 4146400346 6457649643 1927438433 8661119475 4374657421.P56  
M (2) 3209.322 2399621281.92 3607294368 7123019337 9118006301.P73

806L (2, 26L, 62M) 25793.P105 M (26M, 62L) 3604799537.2482993 0066167773.2 0772889861 6807400249. .70 8321664526 7849385001.P40	806M
810L (2, 10L, 18M, 30M, 54L, 90L, 162M, 270M) 1621.1511474581.989 3662806061.P40 M (6, 10M, 18L, 30L, 54M, 90M, 162L, 270L) 6876901.2458695061.3934029061.P40	
814L (22M, 74M) 18217 62306722267 9835497610 7737040389.P74 M (2, 22L, 74L) 24421.25465177.285298861.567115429. .6195 2596147798 2276740749.P56	814M
818L 1637.9817.887 8514532229.6947 8655030362 2241850993.P80 M (2) 4909.1531297.1856861.2920693541.34835590 1370793093.P80	
822L (2, 274M) 17026909.43 5700800793.53 6097283051 1237186105 1024218617.P32 M (6, 274L) 103573.681 2020940897 2507562389.P54	
826L (2, 14M, 118L) 1908628 4787228608 5346690729.P79 M (14L, 118M) 369788888 4800902289.856 4919928689 3829987711 9627656209.P54	
830L (10M, 166M) 300 6223089184 1609742650 9812306269 9840591301.P56 M (2, 10L, 166L) 15188 5505618086 0747273812 1395023341.P66	
834L (6, 278M) 1669.10009.8468437.575 5632532254 0264790905 4046710513.P36 M (2, 278L) 61941520273.263 5018202833.P61	
838L (2) 63689.356989.1 6651785611 5024467733 1682477892 1195502289.P75 M 53633.186037.86 0166859801.362 9006995613.2124 9026860157.P79	
842L (2) 31142213.3457679737. .16430914 4186724605 8226041071 6166347479 9516846681.P62	842L
M 5442059869.1300902386 9226815161.P98	
846L (6, 18L, 94L, 282M) 8499 5141991620 2422143761.P60 M (2, 18M, 94M, 282L) 1693.8461.500715223 2772194889. .2152814 1269055821 4223757449.P31	846M
850L (10M, 34L, 50L, 170M) 5101.P93 M (2, 10L, 34M, 50M, 170L) 8501.504123101.164 2180113401.P72	
854L (2, 14M, 122L) 11 7955793453.5 8173423339 7519028692 3081347291 4416283229.P57 M (14L, 122M) 5124001.700853 1058606134 3663513542 0807573041 7605687061.P56	
858L (2, 22L, 26L, 66M, 78M, 286M) 3433.1148134 3507470409.2177085203 7342601909.P33 M (6, 22M, 26M, 66L, 78L, 286L) 360960601.1151 7089006281.1289 2407528001. .10296 8399238277.10904 4656340314 7928146313	858M
862L 91373.3754873.1096464158 4403141057. .293570 1687054949 9500380868 0954965317.P64	862L
M (2) 1289 5071553121.P116	
866L 1733.5197.P124 M (2) 31177.239017.26206346 8403105021.P103	
870L (2, 10L, 30M, 58L, 174M, 290M) 789961.4818061.11 4082022941.443 1960464101.P31 M (6, 10M, 30L, 58M, 174L, 290L) 1741.P65	
874L (2, 38L, 46M) 32 5096053553.P109 M (38M, 46L) 35591029.2968523521. .4 5818248313 2499053328 6431977728 1951332281.P62	874M
878L 695377.36297785 7081457472 4017301853.P99 M (2) 15 0554282629.4421 0591644829.15 6897117024 9692917853.P86	
882L (6, 14L, 18L, 42M, 98L, 126L, 294M) 85225897.P68 M (2, 14M, 18M, 42L, 98M, 126M, 294L) 720636337.P68	
886L (2) 2086650224 7259130263 4938023901.P104 M 77 3339215189.137589 7917513661.P107	
890L (2, 10L, 178M) 9867209 5457750041.P90 M (10M, 178L) 87221.1153441. .55914 1875690047 6022231964 0717462096 6113027521.P50	890M
894L (6, 298M) 107173 6941969853.11 5712304912 8856803853 5595405733.P43 M (2, 298L) 9177656424 7913969107 0722713534 2022959333.P50	
898L 3615349.111190361.6235 6600805137. .8 6420054428 2117054232 3275703407 9819511061.P66	898L
M (2) 3593.165233.14 8061155217.48188915 9039762177 9692694053.P87	
902L (2, 22L, 82M) 66749.5957537 0467415918 0615519593.P90 M (22M, 82L) 5413.440177.547 5904622663 3791814015 3285718193.P78	
906L (2, 302M) 1398353017.P82 M (6, 302L) 5437.23557.61109541 9792177937.1 4735064051 3623971909.P44	



910L	(10M, 14L, 26M, 70M, 130L, 182M) 2273429341.1299750 1575909761. .1398648 1040036186 7053688001.P36	910L
	M (2, 10L, 14M, 26L, 70L, 130M, 182L) 50436 0902692921.P72	
914L	P138	
	M (2) 71293.6196 3339792346 7946602186 4314534473. .584529625 7595668545 5249699376 9750792368 2374822769.P50	914M
918L	(2, 18M, 34M, 54L, 102L, 306M) 27541.142 6465062181.215220 4823142217.P55	
	M (6, 18L, 34L, 54M, 102M, 306L) 67135177.4875 2128660789.P66	
922L	(2) 14753.7278269.2 5002764653.P117	
	M 226813.21102737.44089 6496421649.44089 9435059844 7800331911 2411840301.P77	
926L	1 6694937341.1054 7461581281.9227 3133899101. .384481 5826238691 0553851972 9859671451 5071097181.P57	926L
	M (2) 46475941.P132	
930L	(6, 10M, 30L, 62L, 186M, 310M) 7 6712902561.10341 0510721501.P48	
	M (2, 10L, 30M, 62M, 186L, 310L) 1861.102301.4242661.1 1292210661. .384333673 6934094661.P28	930M
934L	(2) 13453337.27 9037459866 2529629911 8201729068 0305257169.P92	
	M 252181.1372981.P130	
938L	(2, 14M, 134L) 8158354429.2 9782911970 6021674037. .2 0507066557 4211000839 2345075817.P59	938L
	M (14L, 134M) 1877.P116	
942L	(6, 314M) 5653.167677.5 4994615633.376 8143933833.P62	
	M (2, 314L) 3769.154 2530589829.4974427586 2735900818 3994483801.P50	
946L	(22M, 86M) 9461.38629983 5479975297.5880 7360051860 2649955549. .3685966951 1618643471 4529041561.P52	946L
	M (2, 22L, 86L) 109 6710113137.353 0395687588 7883008321. .322728 7178880200 4477006473.P67	946M
950L	(2, 10L, 38L, 50M, 190M) 1901.P105	
	M (10M, 38M, 50L, 190L) 4016 3004754501.P95	
954L	(2, 18M, 106L, 318M) 861 9619038134 4385442209.P71	
	M (6, 18L, 106M, 318L) 28621.4439299717.P81	
958L	6380281.39557737.79190197.2 0447266728 4853311874 8512612521. .1084189530 3773125040 7515741079 9939962357.P53	958L
	M (2) 70309537.344713309.9148411421.4 6121007006 2342745541. .882 6201527535 3805633103 5832702581.P64	958M
962L	(26M, 74M) 481001.1644 1275231629.P111	
	M (2, 26L, 74L) 2582009.114389497.258190 3893652794 4611398599 9067417377.P81	
966L	(2, 14M, 42L, 46M, 138L, 322M) 378600 5537047189. .426737559 8171065492 1991317497.P35	966L
	M (6, 14L, 42M, 46L, 138M, 322L) 25117.83077.625969.927361.20527501. .1 1706990709.3464715360 9626757361.84 2045142092 0740248349	966M
970L	(2, 10L, 194M) 46948001.8835219781.678 4358150187 4371319121. .11948666 3830373584 2185457565 2337185701.P39	970L
	M (10M, 194L) 145501.3140861.232136521. .7494507 6544223461 9275537511 1824820641.P59	970M
974L	1949.7651273904 0807565074 3952748313. .4 3606879892 4858636311 9735607827 8763527729.P73	974L
	M (2) 7793.890237.1506459 1396749221.785728 7903500369 3344205781.P94	
978L	(6, 326M) 23473.12799 6604801206 6420189837.P69	
	M (2, 326L) 16 8007642969.P87	
982L	(2) 3 9177439921.330 3581302573.2109274 8383123969. .154 1329369352 7703852730 9886275715 6143027753.P66	982L
	M 3929.34631213.1748832017.249353 2754808701. .2315 5466613303 7316219458 2208321642 5083536307 7969665249.P59	982M
986L	(2, 34M, 58L) 1973.18872041. .58160045 2099029650 6434032498 7869923863 2906101009.P77	986L
	M (34L, 58M) 93 3985597217.565 9514797721.22700 9328902320 8850095397.P86	
990L	(6, 10M, 18L, 22M, 30L, 66L, 90M, 110L, 198M, 330M) 162938144 7071722081. .31471 7574384073 6588737901.P30	990L
	M (2, 10L, 18M, 22L, 30M, 66M, 90L, 110M, 198L, 330L) 7 8061555441.P62	

994L (14L, 142L)	33797.3 0847666781.187 8507528353.636 6714750257. .413 5158124929 4313852093.P64	994L
M (2, 14M, 142M)	371805701.1 0786013281.P109	
998L (2)	43913.1179637.823727 9052304889. .3 0596612236 5443084273 2230922240 4949749049 5035605409 1133804913.P63	998L
M (2)	1997.2206 1306071789.11075 8371371929. .234792 2294282923 5644294920 9158283361.P85	998M
1002L (2, 334M)	6 8488673941.7 7510291046 8546720718 9451891583 0832016429.P49	
M (6, 334L)	857713.5 8152051961.7925986 1740715737. .11 0162093098 9311809850 5744897029.P35	1002M
1006L (2)	6037.10061.5798167517. .31040 9448422247 0608516824 8565214869 4686802345 5696697717.P80	1006L
M (2)	35 0862114989.P140	
1010L (10M, 202M)	98981.27338681.316273421.8284 5386590381. .2429 6994257808 7732337791 1266793981.P52	1010L
M (2, 10L, 202L)	32321.369661.432281.40 6188130940 2353667921. .48301 5647212121 7145581641.P59	1010M
1014L (2, 26L, 78M, 338M)	5270773.40318669.165902090 4838638433.P62	
M (6, 26M, 78L, 338L)	13*.2029.795557710 1083457851 4483494605 9455614837.P51	
1018L (2)	103837.2 9297608369.4304432101 0100086325 3503312757. .870 0072752606 3668702562 5654066442 5172655971 3155616893.P55	1018L
M (2)	4073.13350053.82384622 0420458757. .520829 8499888892 8182021581 6258562729.P89	1018M
1022L (14L, 146L)	6133.136949.2967 3421931954 7615227369 3588914270 8934673077.P78	
M (2, 14M, 146M)	38780813.58775221.125 3161372513.202 8060820549.P91	
1026L (6, 18L, 38M, 54M, 114L, 342M)	2053.8209.3311929. .1 2279445240 0182217239 3353063497.P54	1026L
M (2, 18M, 38L, 54L, 114M, 342L)	16417.68897953.645106 3913299122 8987740813.P60	
1030L (2, 10L, 206M)	18541.5 9411261081.40824 9548543821.P94	
M (10M, 206L)	43214788 6392149801.3713 4042981653 6026068221.P82	
1034L (2, 22L, 94M)	2069.8273.136624489.1 5709397621 6637466381. .128357036 6802434228 9606276801.P76	1034L
M (22M, 94L)	49633.97539 1949683066 4355860441. .4198290 7768571099 9814594461.60 6821377656 9258563803 5411639241.P51	1034M
1038L (6, 346M)	173622109.P95	
M (2, 346L)	41521.332161.1 1065889641.P84	
1042L (2)	89353834081.293 2551327184 1158911701.374564 9296296417 3214784249.P98	
M (2)	16673.62 7186185377. .1655 7976115131 2296194143 4005140879 9100211921 6371476353.P87	1042M
1046L (2)	8369.351457.54 7912280753.476 4361120086 0147977473.P113	
M (2)	1051 7093353577.127532599 0422611449 7812548454 4688931081.P107	
1050L (2, 10L, 14M, 30M, 42L, 50M, 70L, 150L, 210M, 350M)	7436896275 9708115735 3277424901.P43	1050L
M (6, 10M, 14L, 30L, 42M, 50L, 70M, 150M, 210L, 350L)	6301.P69	
1054L (34L, 62L)	1306961.5261 1908195653.24263560 6517096040 0939317557.P97	
M (2, 34M, 62M)	193937.37 8348540841.3241 6257540349.P115	
1058L (46L)	64357 9915284121 1081200083 9152450752 3893004054 2250409178 8\ 503223673 6487628129.P78	1058L
M (2, 46M)	730021.425654561.8668570649.1229329487 1336138568 1433796429.P99	
1062L (2, 18M, 118L, 354M)	P105	
M (6, 18L, 118M, 354L)	73505269.439487358 7866112297. .736469133 2765774569.1557951361 5042163909.P41	1062M
1066L (2, 26L, 82M)	149263453.463737783 4385724793. .1111 6024594457 7905963264 0316049501.P86	1066L
M (26M, 82L)	559868569 0470790115 1366468901 8605259554 4287930857 6508528221.P86	
1070L (10M, 214M)	21401.22254797 2096532691 9430030621. .6 2747189326 2990390212 0853052261.P65	1070L
M (2, 10L, 214L)	2141.6421.115561.56 2285164781.28475810 5146677801. .824357430 0923936588 4911622721.P58	1070M

1074L	(6,358M)	1848265933.56325 9857998708 5336788726 2701680533.P63	
M	(2,358L)	111697.551680693 2793609092 4187079613. .4176706319 8704058874 8337613157.P45	1074M
1078L	(2,14M,22L,98M,154L)	10781.81929.90317 5120803986 8350950718 0285854441.P83	
M	(14L,22M,98L,154M)	213 6469147429.111 2069160977 7972893205 1224808777. .1297662 9951234799 6575293631 9854262257.P46	1078M
1082L	(2)	1281089.10393693.8352693761.7 1921241032 7043387693. .39068470 4255023993 2867833269.85313 8141986337 5697017583 2902213497.P56	1082L
M		262302769.717363122 8267151597.4703 5620307262 5792142480 7731395517.P102	
1086L	(6,362M)	P108	
M	(2,362L)	23893.9 2973179860 1457857977.1518789 3233965674 0319930861. .39401102 5965773601 9867352093.P30	1086M
1090L	(10M,218M)	7377331 7152282961.P113	
M	(2,10L,218L)	529741.19 62550050621.603 7514298961. .54736662 1242786875 0478333481 3261940566 4230177381.P54	1090M
1094L	(2)	67887077.540893293.771138721.29828214 2987952117 3616805750 3181875257. .5739192789 9330786561 7653419476 3447207172 6676896341.P52	1094L
M		4523 2564075409.5466904460 5171143533. .625015 9249928205 0390518561 9758164780 7719688397.P86	1094M
1098L	(2,18M,122L,366M)	402023 2836240289.229 2714707754 1188200231 4404819941.P61	
M	(6,18L,122M,366L)	13177.72469.57458341.P92	
1102L	(38M,58M)	18775877.2052 0104153306 3878539949. .177203248 8753601493 8379267081.215525342 9227888997 5789265257.P65	1102L
M	(2,38L,58L)	99181.P148	
1106L	(14L,158L)	398 4238283369.2773 7993550233.P115	
M	(2,14M,158M)	2213.86269.245 4574823653.P121	
1110L	(2,10L,30M,74L,222M,370M)	115169907 1895212081.1 4190357393 1683412021.P48	
M	(6,10M,30L,74M,222L,370L)	2221.4441.6661.31081.6774790 3280789101.P56	
1114L	(2)	P167	
M		9 1441702997.14206648 2414807053.302480 6763319187 7840469313. .425633676 7013448212 6879584738 2936298988 1897408337.P66	1114M
1118L	(26M,86M)	43386 9082773756 1511492583 9648653328 9254338302 5255328\ 816 9968186496 5988739409.P77	1118L
M	(2,26L,86L)	2237.830182081.5689562898 4182809549.141 5875647329 3001559237. .57 4834143264 9049057900 7003601614 8694273021.P57	1118M
1122L	(6,22M,34L,66L,102M,374M)	56101.365773.4696014313. .1018181 1482233762 2659422429.P51	1122L
M	(2,22L,34M,66M,102L,374L)	10118197.350575633.1274 9191040653. .912098 0814730753.3705 7851231224 7796290757.P28	1122M
1126L	(2)	P169	
M		51797.133489553.13 2585943757.4168 9837869941 1632562113.P122	
1130L	(2,10L,226M)	2387230 1345988040 8984186131 2230726458 8432626097 5958328245 9944345181.P69	
M	(10M,226L)	527323541.23534022 6966187083 9914687981.P99	
1134L	(6,14L,18L,42M,54M,126L,162L,378M)	23191 5937998781. .5 6200725327 4813199701.P63	1134L
M	(2,14M,18M,42L,54L,126M,162M,378L)	2269.13088629.20783953. .151 6337278699 4713185661.2213395 6792820850 1936257661.P32	1134M
1138L		37690561. .58 4292780688 2688914391 9642664703 4627936347 3081340409 0903757913.P102	1138L
M	(2)	47797.170701.257189.4540995541.2848047326 0248220090 2883663813. .4258732 1418934907 4745982247 0559036525 3755277141.P70	1138M
1142L	(2)	2384497.5536417.94600997.P151	
M		36 7032005101.38 6111803369.2153467077 6594014389 2464882933.P120	
1146L	(2,382M)	2293.36875989.21356408 0496568486 1915149909.P77	
M	(6,382L)	2392849.22312621.P101	
1150L	(10M,46L,50L,230M)	425501.646301.13220401.385231601.15710 0602804501. .726424446 3759579701.6884 0040980271 0748146950 8147048501.P39	1150L
M	(2,10L,46M,50M,230L)	P133	

1154L	2309.92936237.1 7473219453.1328743 9049014069.1229317 3128342921 1231592321. .59941465 1787330278 3552221009.31 7373985524 4701997649 4669130549.P51	1154L
M (2)	30746 5524354077.34483 2377364549 9468855546 9910052333. .733682355 9794508717 3002261521 6673064893.P86	1154M
1158L (2,386M)	222337.349717.5 8789629528 4829729761 9586250612 7739755393.P65	
M (6,386L)	5 7760432815 2374586516 3771347977 1214237122 2569427313.P65	
1162L (2,14M,166L)	4649.39509.6804804469.1529 3148196817. .1529 9116680410 8075380869.P94	1162L
M (14L,166M)	12902849.882 1093329813 2009685601.P118	
1166L (22M,106M)	2333.59672 0894582957.1510016481 6288253924 8423272681. .22 9056579832 9686623762 9196250169.P78	1166L
M (2,22L,106L)	6997.70823235 7842915049.P136	
1170L (6,10M,18L,26M,30L,78L,90M,130L,234M,390M)	145332 4328230321. .7405 2071445243 5045829181.P48	1170L
M (2,10L,18M,26L,30M,78M,90L,130M,234L,390L)	11701.1736281. .1024 8564275821.P64	1170M
1174L (2)	35221. .3942261843 4983024679 2353594915 5536691414 8016307620 8147970769.P112	1174L
M	13658317.243 4616217281.P158	
1178L (2,38L,62M)	2357.4813309.83489573.25775 6820993233. .4 2247652222 5569289589.80 0534177047 6454286518 0196315461.P79	1178L
M (38M,62L)	10781948 4952431299 3921613457.P136	
1182L (6,394M)	45 5828392477.1385 2613550949.P93	
M (2,394L)	21277.3 7614046069.2883027 7923736275 4213152217.P78	
1186L 88 7672734753 6580949428 7801750133.15 0797555511 2612582371 791046\ 5843 4573990482 8259811543 0090769305 7510551177.P76	1186L	
M (2)	233601 9034386345 5255753897.2622476 8163893028 0556661848 2868567341. .433 3842025097 1406611206 3409814419 0031735501.P74	1186M
1190L (2,10L,14M,34M,70L,170L,238M)	1408695661 3007413540 5157253141.P86	
M (10M,14L,34L,70M,170M,238L)	14281.P112	
1194L (2,398M)	2389.121789.P112	
M (6,398L)	11941.1162957.2008309.120424453.24 4109159209.P83	
1198L 306689.9385133.19 2262593657 6797346329. .17032 5907583356 7498448523 1169885755 9921160850 8810887317.P93	1198L	
M (2)	4793.86257.P172	
1202L 7213.3221913 3649894632 9196503049 4753225645 5867715455 818968809\ 8 3249589434 3387645769 3205092709.P91	1202L	
M (2)	79333.685141.P170	
1206L (2,18M,134L,402M)	171253.262909.122208724 7486540569. .723507290 6255562457.P72	1206L
M (6,18L,134M,402L)	482401.7986133.8800285717.P97	
1210L (2,10L,22L,110M,242M)	4 2067554231 4507855321. .398064000 0751780092 8189621561.349606207 4618411064 3754436677 7324120641.P45	1210L
M (10M,22M,110L,242L)	705313841.23709 0382248281.P110	
1214L 639 1568743817.236606 9394177173. .228 0045643161 7079613000 0358001103 6179865373.P113	1214L	
M (2)	7889023609.69 5864724733.P161	
1218L (6,14L,42M,58M,174L,406M)	2437.102 0353649169.89878 5760385437. .1 5816048629 9350364173.P52	1218L
M (2,14M,42L,58L,174M,406L)	2745373.P95	
1222L (2,26L,94M)	1363753.390941529 3164146554 2385449208 3019690148 253\ 1035005 9079405831 3678419233.P92	1222L
M (26M,94L)	4889.7333.21997.5956 8177402910 2364002485 9734331909.P121	
1226L (2)	P184	
M	17458241.1820141 6023204829.220 6140518213 1487143329.P139	
1230L (6,10M,30L,82L,246M,410M)	83 3434217952 1862957161. .263624 5058629795 6200239291 8766778961.P40	1230L
M (2,10L,30M,82M,246L,410L)	3639939001.1 2982379401.P76	
1234L 232281 7005065617.1 1555101602 5898845629.P151		
M (2)	86381.7367588 5758484118 0276859765 3205046693. .250303 6353481718 5101957125 0060477510 3045487447 8028239473.P88	1234M

1238L	(2)	114519953.121941631 3117078333.	C160	1238L
M		2477.103993.284741.35147355 7598382337 8579684829.	C145	1238M
1242L	(2,18M,46M,54L,138L,414M)	4969.119233. .24562721 9111827348 9065950317.371971784 6059449725 2645353541.P55		1242L
M	(6,18L,46L,54M,138M,414L)	P120		
1246L	(14L,178L)	72269.3 4870850057.4 6339851433.450131 3430014381. .22622 4076308652 7047749989. .554278 0706199459 7652368186 3658722415 4569405629.P47		1246L
M	(2,14M,178M)	89349398 5630470339 5663407601 5148710969.P122		
1250L	(10M,50L,250M)	37177501.831172501. .633746 6721165966 5827653351 7443227501.P99		1250L
M	(2,10L,50M,250L)	5*.1 4321535001.P140		
1254L	(2,22L,38L,66M,114M,418M)	12541.4242 6325022797.P91		
M	(6,22M,38M,66L,114L,418L)	13039 2427184391 7073922190 0361385547 6214730481 5595643977.P55		
1258L	(2,34M,74L)	42773.332113.415141.51 6036294857.P147		
M	(34L,74M)	347209.4398008 6132460853. .153915 4458793030 5813854867 7064819441.P116		1258M
1262L	1052 3982032237.		C177	1262L
M	(2)	328121.651193.	C178	1262M
1266L	(6,422M)	P126		
M	(2,422L)	20699101.262 9065686029. .20884355 0273990746 4342229632 5180908469.P70		1266M
1270L	(2,10L,254M)	3725804081.167899 4168010376 7514757241.P118		
M	(10M,254L)	121921.14142721. .94709 6618490765 0497602188 9161151507 7182198170 7767567299 8376309901.P75		1270M
1274L	(2,14M,26L,98M,182L)	665029.231 5023007259 0958421368 2219976961. .310920 9778162554 6003941991 3999757093.P79		1274L
M	(14L,26M,98L,182M)	2549.4 1202153721. .18 2873213639 0861007107 3414302067 4129520366 3745501269.P87		1274M
1278L	(6,18L,142L,426M)	25561.1 2660182389.45 8731140013. .43823890 3317699710 9182093871 4185416663 4457637249.P53		1278L
M	(2,18M,142M,426L)	2557.P123		
1282L	95358 2699783512 1339423258 7959660153.P158			
M	(2)	62248793.813 4281864895 5422234009 5640950541.P152		
1286L	(2)	7981661881.606108 1064769509 5186609057.59260258 7269368863 6842717229. .3904558 4120023503 7764491873 9335472321. .546212 6032610838 3224160940 4810125380 5830098277.P48		1286L
M	870 1088175747 3495441157.26300 0745013011 3902960754 3064193681. .289139 2071775232 0572528587 0791508089. .440 2566526102 6659511101 5316216445 1383880029.P59			1286M
1290L	(2,10L,30M,86L,258M,430M)	7741.3636776 0795657398 2028400928 2897762821.P60		
M	(6,10M,30L,86M,258L,430L)	15 1874081341.443 3672767861.P78		
1294L	144563093.		C187	1294L
M	(2)	854041.9679121.6312740 8949237622 6672399593. .3 6484622801 2123353996 9405866471 8840029121. .5672396 9466541850 0647536873 8164191746 1377169977.P68		1294M
1298L	(22M,118M)	4898653.72103901.P160		
M	(2,22L,118L)	173933.8742582842 4449969917. .818 6287309036 8159284477 1088898401.P117		1298M
1302L	(2,14M,42L,62M,186L,434M)	2087361782 8595205913. .451 6512358179 4832079829.P66		1302L
M	(6,14L,42M,62L,186M,434L)	P109		
1306L	(2)	262142209 1203700761 6369852597. .244 4038758180 9709320543 0142765958 4157488373.P126		1306L
M			C197	1306M
1310L	(10M,262M)	6911561.511989 0907438001.P134		
M	(2,10L,262L)	2621.8 3492003741.150346 2862234972 5327496801. .457 8376497845 5457424079 8734875475 8713076681.P75		1310M
1314L	(6,18L,146L,438M)	10513.410801077.P118		
M	(2,18M,146M,438L)	76213.192279019 1163843790 4095974997.P97		

# 2LM

## Prime Factors

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1318L	(2) 5273.52529 9783447107 4257092065 0521164157. .3114 2777780540 3407965391 2614230139 5656890333.P116	1318L
M	1534153.38 1774141689.17 0556606741 3732555673. .268377 3951307351 1818075277.C134	1318M
1322L	(2) 2272 5574006237.6 6088065530 3871026951 0748680377. .118 2245665252 9754284127 9813092349.P123	1322L
M	9 3405283373.3637 1821254913. C175	1322M
1326L	(6,26M,34L,78L,102M,442M) 15913.2905039984 4952487118 6054641477.P83	
M	(2,26L,34M,78M,102L,442L) 18009 4835025613.35 6937545120 9989130113. .81 5768566717 4285670949.P58	1326M
1330L	(10M,14L,38M,70M,190L,266M) 22229621.2 6215294841.23 4340733201. .105702 9405859421.5991 6956271254 5924071281.196651 4598664949 5362349061.P38	1330L
M	(2,10L,14M,38L,70L,190M,266L) 20789 0062813500 1173533680 8422445873 5383017901.P86	
1334L	(2,46M,58L) C186	1334L
M	(46L,58M) 47 3384706747 8775940624 1015227981. .84 2307497264 0008304119 4644865366 3441618497.P112	1334M
1338L	(2,446M) 13381.16057.454921.229 5666726811 7433010417.P98	
M	(6,446L) 2677.240841.P125	
1342L	(22M,122M) 13421.1535249.	C170
M	(2,22L,122L) 361558957.7056974101.39 4583992441.1888 1530641689. C138	1342M
1346L	2693.26921.419953.4118761. C183	1346L
M	(2) 3 4549741777.30949 8021695021.56591906 1885282241. .224 2642075701 5595490380 4405153717. .9417721 7744902722 4661637281 1595314896 3505947619 6538528721.P70	1346M
1350L	(2,10L,18M,30M,50M,54L,90L,150L,270M,450M) 32040901.2 2873797901.P91	
M	(6,10M,18L,30L,50L,54M,90M,150M,270L,450L) 110053 8522333110 2860132301. .2573404865 7439450057 4603230201.P54	1350M
1354L	(2) 5417.48017017 2376488257.P182	
M	3495803237.P195	
1358L	(14L,194L) P174	
M	(2,14M,194M) 13 4409524789.524051 7008024021 9239513104 3175452901\ 9208488034 6691212468 1960196189 5289984669.P87	1358M
1362L	(6,454M) 239310246 2756185953 8330376625 3018023798 9024296581.P88	
M	(2,454L) 108961.4543573771 2135779825 2962690889.P102	
1366L	(2) 195 1402384429. C193	1366L
M	5965540650 4682930077. C186	1366M
1370L	(2,10L,274M) 68501.1422061.32197741.36 7116708001.365814 7051099901. .595 3275730721 1753085516 1987820721.P86	1370L
M	(10M,274L) 2741.2 7903332521.425615 9466546321 6927619561. .191549 8877705218 4768372641.696754212 5592813698 1769670553 9549641141.P60	1370M
1374L	(6,458M) 10993.75826080 2584066297.1884 9601819949 0595752269. .145 9074655225 1089472626 9329310477.P60	1374L
M	(2,458L) 367 8659056693. .1 8494387365 1573640272 2126846511 0495985923 2223437201.P76	1374M
1378L	(26M,106M) 53*.13781.31944797.P175	
M	(2,26L,106L) 112536 3775759549. C174	1378M
1382L	(2) P208	
M	11057. C204	1382M
1386L	(2,14M,18M,22L,42L,66M,126M,154L,198L,462M) 6 1262261677.566 9488462177.P86	
M	(6,14L,18L,22M,42M,66L,126L,154M,198M,462L) 30493.279 9652196881. .32016 0637826569.3 9273997150 0511407081.P57	1386M
1390L	(10M,278M) 79991005 2704127730 8227936769 1810787904 8659982598 9737123281 4181525061.P98	
M	(2,10L,278L) 29776 2786963675 5197817701.P143	
1394L	(34L,82L) 178 2642573673 6203762737.276 0706098195 5863627575 3195671257. .1 0891895405 8656483024 0224622201 0428766929. .1707 7331624321 1226963892 0312732818 2273838873.P55	1394L
M	(2,34M,82M) 2789.6 5188447249.18 7454737489.34 0699903669. .19249093 0402101389.3350 0493281296 6314843630 7621287413.P106	1394M

1398L	(2, 466M)	1221853.6785893.P128		
M	(6, 466L)	2797.8389.1165933.107972417 3577684725 0538834733.P98		
1402L	(2)		C211	1402L
M	(1649929681.484 6812462461.1218382832 8909342254 6720997417.P161			
1406L	(38M, 74M)	362749.22773 6214726041 1119108772 1187593281.	C155	1406L
M	(2, 38L, 74L)	2837702 9766703740 7865613613.	C170	1406M
1410L	(6, 10M, 30L, 94L, 282M, 470M)	16921.606301.13042501.		
M	(2, 10L, 30M, 94M, 282L, 470L)	.1900 1168479114 2824004209 7305733313 0463856541.P51		1410L
		7883602 1381216549 0704037767 3540031014 5996791221.P64		
1414L	(2, 14M, 202L)	5657.33937.1324280 7484763948 9060320753.		
M	(14L, 202M)	.11933784 2373025889 2088506741.1 1884802805 1552238693 1268536269.P90		1414L
1418L	(2)		C213	1418L
M	(2837.53649 0644259457.870 7329215360 2373975480 7103419461.		C163	1418M
1422L	(6, 18L, 158L, 474M)	2681893.2711 7844710942 2517655093.P112		
M	(2, 18M, 158M, 474L)	918613.6546889.6834133.22877495 1370201069.P104		
1426L	(46L, 62L)	4564 7342873108 7987364139 4282468773.	C165	1426L
M	(2, 46M, 62M)	3402437.765740396 4605692248 3053365596 7395782501.		
		.11 7382771591 9754044250 7779720720 6627362457.P113		1426M
1430L	(2, 10L, 22L, 26L, 110M, 130M, 286M)		C144	1430L
M	(10M, 22M, 26M, 110L, 130L, 286L)	2861.560561.4 9267878661.		
		.311 7322107826 5534256376 1757374135 1688171461.P83		1430M
1434L	(2, 478M)	P144		
M	(6, 478L)	7832509.1 9266397866 3261197929.P116		
1438L	(98099 6410232957.398144 8614279812 4464418541.P176			
M	(2)	8629.31072 3527776374 6985831018 3672941789.		
		.155046904 3715183831 3446003622 4501936457.P140		1438M
1442L	(14L, 206L)	278305 6526435417.1259 2589174596 6089707777.		
M	(2, 14M, 206M)	.47 4218816557 7925048011 5864935012 0439135477.P104		1442L
		.31 3746702462 1943585066 1199575959 3899050877.P99		1442M
1446L	(2, 482M)	83869.18829813.13108 3412582713.71 3069140712 2243556677.		
M	(6, 482L)	3204570253.139679 5475757457.30016934 2181400173 6596239433.		1446L
		.408818358 1970539425 8761789777.P64		1446M
1450L	(2, 10L, 50M, 58L, 290M)	2662201.1289862001.4 9668095528 5030838701.	C133	1450L
M	(10M, 50L, 58M, 290L)	5801.266801.10 0217132801.74493 5396862001.		
		.7142506 0534308301.2 8226351017 2056765967 5172141172 4002863501 1954899001.P67		1450M
1454L	(2909.862 3813357177.68 1907085444 8194030313.		C181	1454L
M	(2)	4 6354659937.	C208	1454M
1458L	(6, 18L, 54M, 162L, 486M)	4350673.185 5301844889.591 7464834049.		
M	(2, 18M, 54L, 162M, 486L)	.7655029298 6848242804 4522560409.P85		1458L
		.1575 6367092121.23 1044860678 9649285233.		
		.98187 5901045517 9465532594 6978063569.P77		1458M
1462L	(2, 34M, 86L)		C203	1462L
M	(34L, 86M)	5849.3456169.110577633 7262654129.3 9949063132 8637643761.		
		.1370 1202218139 3232206253.C130		1462M
1466L	(2)		C220	1466L
M	(627449.P215			
1470L	(6, 10M, 14L, 30L, 42M, 70M, 98L, 210L, 294M, 490M)	1484701.3298681.		
M	(2, 10L, 14M, 30M, 42L, 70L, 98M, 210M, 294L, 490L)	.8346853568 0255056381.5 2001576940 8683617721.7 4429825431 7046214381.P28		1470L
		.1013 7296444101.P70		1470M
1474L	(22M, 134M)	5897.32429.61909.2985338 0696418401.5168673210 7634400481.		
M	(2, 22L, 134L)	.806 9970082210 7987325386 1254039134 3336685633.P107		1474L
		.2638262922 0128000826 9004860466 7428700453.P124		1474M
1478L	(2)	523213.170756297.440074501.7880920300 2218382049 3369752421.	C170	1478L
M	(2957.6139613.38 0765792843 4210336704 2880439853.P181			

1482L	(2, 26L, 38L, 78M, 114M, 494M) 8893. P126	
M	(6, 26M, 38M, 78L, 114L, 494L) P131	
1486L	260683037. P216	
M	(2) 1126545517. 15858837 6727304628 7425657193. .1794736877 6748552376 2057078149. 82 9045140091 2997358084 6869626857. P126	1486M
1490L	(10M, 298M) 12149461. 31759643 1444133301. C154	1490L
M	(2, 10L, 298L) 8941. 1 5472037821. 1 9597338228 2821775041. P145	
1494L	(2, 18M, 166L, 498M) 201920077. 2024367013. .25545 0160174472 1232505102 6538118260 0544409941. P86	1494L
M	(6, 18L, 166M, 498L) 842617. 4567147765 6545777694 7610460261. P113	
1498L	(2, 14M, 214L) 32957. 407 1247577461. P175	
M	(14L, 214M) 8610917449. 2 0882647297. 116878 1887512373. .31 9232900578 5808731941 4543412049. 10100 6172052005 4066861944 5903235817. .2068214 6952112818 1117676888 2056531481. P55	1498M
1502L	19507 4519591093. C212	1502L
M	(2) 9013. C222	1502M
1506L	(6, 502M) 9421537. 7 0906046209. 4 3766902980 9782399804 8670169409. P102	
M	(2, 502L) 1563229. 414 3203111865 8520623317. .1015015 8217963770 9497403340 0280350597. P87	1506M
1510L	(2, 10L, 302M) 10284066 9213137196 7011746434 4952798481. .764631495 9368848394 4866753570 7888361467 6365385821. P96	1510L
M	(10M, 302L) 673 1030511001. 2252 4246248701. P155	
1514L	(2) 8394035445 9118810481. P208	
M	1278270 3425963929. 15 5461962797 9428074907 5061880957. P181	
1518L	(6, 22M, 46L, 66L, 138M, 506M) 3037. 6073. 9109. 176089. 13652893. .8073472 3637871997. 4890980423 8722525964 9653667510 7089149541. P53	1518L
M	(2, 22L, 46M, 66M, 138L, 506L) 40 7997301669. 8984124 3813164449. .1555531117 9383169261. 1320 9152391521 1513329293. P61	1518M
1522L	82189. 529657. 1567661. 40792 6786285441. 116845738 7724788393. .159732 6665111466 0174431016 1030566437. .135263 4701194560 8970006460 6677798904 1799189313. .4583511 8187315186 9482378811 2251116316 2916683061. P53	1522L
M	(2) 9133. 97539231 2590881402 4338488617. C197	1522M
1526L	(2, 14M, 218L) 167861. C191	1526L
M	(14L, 218M) 228901. 89585357. 11 9376955701 4682568929. .26949677 9485609564 1855543404 1273937193. .5802394077 5396337496 0883175499 7301623429 5004562061. P74	1526M
1530L	(2, 10L, 18M, 30M, 34M, 90L, 102L, 170L, 306M, 510M) 36721. 70381. 965133181. P98	
M	(6, 10M, 18L, 30L, 34L, 90M, 102M, 170M, 306L, 510L) 25319 0737566001. .358689 4001914682 1356818901 4966376501. P66	1530M
1534L	(26M, 118M) 2602289873. 1 4878594277. 69728856 4688146289. C172	1534L
M	(2, 26L, 118L) 32554549. 130 1673138221. 139 1657728553. 1026105 9495917413. .1745743206 3319084433 4669825437. C133	1534M
1538L	1508116661. 72 8725553653. P211	
M	(2) 4878 5444046123 6965376721. C208	1538M
1542L	(2, 514M) 293171209. 775241 2975359697. 340 0665543115 3696530841 7882742061. P98	
M	(6, 514L) 55221 8538342469. .6085412 4605879300 8390355358 3244932908 3330697289 6110069522 6000917581. P73	1542M
1546L	(2) 9277. 961613. 8979169. 28764877. 1286673961. 6144001889. 2 0680804897. .728 8814445552 8365833889. 101 1593924653 3302029127 2490553669. P124	1546L
M	895 0276336541. P220	
1550L	(10M, 50L, 62L, 310M) C181	1550L
M	(2, 10L, 50M, 62M, 310L) 1062889 1724248390 7573395401. P155	
1554L	(6, 14L, 42M, 74M, 222L, 518M) 15541. P127	
M	(2, 14M, 42L, 74L, 222M, 518L) 21757. P126	
1558L	(2, 38L, 82M) 65437. 2841793. 374580 9992085397. P191	
M	(38M, 82L) P217	
1562L	(2, 22L, 142M) 2 5706881578 7496849489. P191	
M	(2, 22L, 142L) 12497. 777877. 1462033. 16684 6452443301 5165835133. .10724437 0163207257 9384549789. 8 2475057062 7639805612 1502653493. P113	1562M



1566L	(6, 18L, 54M, 58M, 174L, 522M)	1005373.90 0238389553.8829 3718850941.P120		
M	(2, 18M, 54L, 58L, 174M, 522L)	18793.1215 7153600764 8069609869.P125		
1570L	(10M, 314M)	1814921.270 4723867921.3542 2803263041.P156		
M	(2, 10L, 314L)	7624643325 1064086729 3939564541.P159		
1574L	(2)	269405 2738902158 6346998869.	C211	1574L
M		47221.406093.14121929.P220		
1578L	(2, 526M)	10453 0192048153.892 7838381659 1944174173. .468 3204796543 9291625888 2359560461. .35467094 6519485416 0033142201 4320230649.P52		1578L
M	(6, 526L)	17759209 5535805413. .20 9464891971 0495444443 7215756673 9020805493.P99		1578M
1582L	(14L, 226L)	113*.6329.9439548 3835364237.36264833 5437701461.	C162	1582L
M	(2, 14M, 226M)	85429.116163097.P190		
1586L	(26M, 122M)	58 2049312001.2696945568 5328761021. .5023403461 3693973669 5391222101.C156		1586L
M	(2, 26L, 122L)	179846057.4 7708294713.3 3858360265 7402514494 7910893473.C168		1586M
1590L	(2, 10L, 30M, 106L, 318M, 530M)	27087241.137 3040346921.528 4407007801. .12102 6987163239 4075226641.683 6077201751 4019201011 1693752601.P36		1590L
M	(6, 10M, 30L, 106M, 318L, 530L)	19081.184441.24 2298446941 1281887781.P95		
1594L	(2)	2097515909.36412924 1317395157.P213		
M		113 1019499249.P228		
1598L	(34L, 94L)	41549.290837.714233205 5234648333.60 9921721390 1879740081.	C171	1598L
M	(2, 34M, 94M)	51137.5394672221.	C208	1598M
1602L	(6, 18L, 178L, 534M)	6565668841.153 9976855861.7291145136 9675792637. .39452 4570331222 2053852257.P93		1602L
M	(2, 18M, 178M, 534L)	141709 7471440314 4763101597.P134		
1606L	(2, 22L, 146M)	50219621.180841 8581560889.9038881 6400944269 3590288077. .1482 3385060322 2287090602 2459128577. .337779 7747004568 1645557709 2228603627 7331973019 9908653015 4776370553.P69		1606L
M	(22M, 146L)	19273.286208370 1562715653.	C194	1606M
1610L	(2, 10L, 14M, 46M, 70L, 230L, 322M)	1581 4901312337 2670109481.	C136	1610L
M	(10M, 14L, 46L, 70M, 230M, 322L)	621630 3835549501.P144		
1614L	(6, 538M)	416413.2621137.962643 8461997334 0856520087 7781060429.P113		
M	(2, 538L)	16141.3 0701107729.4 3932915373.186817 1919242953. .91457 0427675304 3118965104 6038377293 5570463409.P77		1614M
1618L			C244	1618L
M	(2)	6473.25889.1948073.766 0242424577.	C216	1618M
1622L	(2)	22 6993790701.12037536 1925202961.P215		
M		5336381.11 7806318814 0768549097.	C217	1622M
1626L	(2, 542M)	27 3883482277.248687 3948884993.1987797 1769884103 5284255913. .1661993 6712434380 1725628125 6149910093.P74		1626L
M	(6, 542L)	3253.78049.1593481.1475273053.834 7879842927 0328887973. .730442198 5500357410 3778189733. .4713405292 6612163989 8467235349 7652737173.P47		1626M
1630L	(10M, 326M)	45641.1962 3929709044 6416678541. .3707 6424065708 2911483339 3150344141.P134		1630L
M	(2, 10L, 326L)	9248621.7627588261.	C179	1630M
1634L	(38M, 86M)	2091521.1588 6294883461.52857485 2074138628 2105949513. .11811951 2185488716 7363897603 1338702013.C143		1634L
M	(2, 38L, 86L)	382357.6052337.6483713.11637349.17147197.P195		
1638L	(2, 14M, 18M, 26L, 42L, 78M, 126M, 182L, 234L, 546M)	507781.6224401.P118		
M	(6, 14L, 18L, 26M, 42M, 78L, 126L, 182M, 234M, 546L)	P130		
1642L	(2)	44108537 9960554789.356378849 9594419652 9088746931 7261822121.	C191	1642L
M			C248	1642M
1646L		19753.17678041.284732405 7582181573 6340752613.	C208	1646L
M	(2)	9 2450958736 9596772157.P227		
1650L	(6, 10M, 22M, 30L, 50L, 66L, 110L, 150M, 330M, 550M)	1 6434207431 5726836781 9887402736 8959224606 4114457301.P71		
M	(2, 10L, 22L, 30M, 50M, 66M, 110M, 150L, 330L, 550L)	4221 7104570301.P107		

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1654L	(2) 36389.148861.2312293.130582063 4475181105 8406244617 1193488957.	C195	1654L
M	5049 3458584097.29159990 7662880149. .1850744891 8242328920 1833006002 3474649953.	C179	1654M
1658L	(2) 4 6423551258 4146182617.479 3292494340 1576083773 5948908881.	C196	1658L
M	382517367 8485409449.798383862 1160200177.126244 5993282597 2330038421.	C187	1658M
1662L	(6,554M) 9973.112547 0603488333.5168911 4452666429. .6765 6963630265 7152854889.487914335 8841744634 8843198811 2971564897.	P68	1662L
M	(2,554L) 17102862 5446956073.P150		
1666L	(14L,34L,98L,238L) 16661.46649.186837 1709557081.2037804 9054645577. .1 9934400409 9971410597.	C142	1666L
M	(2,14M,34M,98M,238M) 73500589.2 6980673413.44070 3752018377.	P170	
1670L	(2,10L,334M) 430861.3154569881.784 6415030381.226 2560496806 0184427321. .22620 8688276668 7062334641.	P126	1670L
M	(10M,334L)	C200	1670M
1674L	(2,18M,54L,62M,186L,558M) 70309.4081213.1297451663 4838800437 25\ 85629729 4610187704 3623666861 8624801380 8494382873.	P83	1674L
M	(6,18L,54M,62L,186M,558L) 789059989.P154		
1678L	5564249.279387989 9538857933.19 3385004980 0281022877 1062564557.	C197	1678L
M	(2)	C252	1678M
1682L	(58M)	C245	1682L
M	(2,58L) 366677.3727313.1 3866300353.21 3360835453.112751 8158768077.	P196	
1686L	(2,562M) 220 6057267849.	C157	1686L
M	(6,562L) 599 9663863513.P156		
1690L	(2,10L,26L,130M,338M) 1165339501.3 3339812607 8661934421. .10951196 9015345344 9285075581 0091411261. .8500591978 2424732499 2958915563 7812362821.	P82	1690L
M	(10M,26M,130L,338L)	C188	1690M
1694L	(14L,22M,154M,242L) 29018221.3432510 2334425943 0080136457.	C165	1694L
M	(2,14M,22L,154L,242M) 908695481.6202401437.1 3560087157.	C170	1694M
1698L	(6,566M) 3830689.53028541.4 5039969589.240389 8139108413. .969 4344887494 3589381509.	P106	1698L
M	(2,566L) 526381.2212378537.11362 0361303857.	P142	
1702L	(2,46M,74L) 4503 9598473904 9729770917.	P216	
M	(46L,74M) 3466225121.P229		
1706L	(2) 3413.6400 7056091437.11220 4777245919 7542365557. .36703 0097325207 3917081977.	P191	1706L
M	5756 8727236201.	C244	1706M
1710L	(6,10M,18L,30L,38M,90M,114L,190L,342M,570M) 110017981.848129221.	P113	
M	(2,10L,18M,30M,38L,90L,114M,190M,342L,570L) P131		
1714L	470 2664630197.687116 9125116761.885967172 7690991421. .5115816399 1710264101.	C191	1714L
M	(2) 74 9049563091 7903672489.1 1126109198 0665826640 6382986993. .37254915 6813182753 4533903134 0236801161.	C168	1714M
1718L	(2) 82488053.16078331 7963711097.	C233	1718L
M	41233.18970157.	C247	1718M
1722L	(2,14M,42L,82M,246L,574M) 2675989.P138		
M	(6,14L,42M,82L,246M,574L) 44773.82657. .11226524 8764087750 7314303370 4082858121.	P99	1722M
1726L	62137.7682681449.1 2118208029.763630255 0869852997.	C217	1726L
M	(2) 1 2268162909.419 0110941193.417348122 2362374186 1146169997. .466192553 6696232816 7412700221.406 7668372125 0447980411 4509779153.	C147	1726M
1730L	(10M,346M) 13841.	C203	1730L
M	(2,10L,346L) 3461.2971 9705251742 9014237901. .155 2399882742 1659308916 4596199061.	P149	1730M
1734L	(2,34M,102L,578M) 3469.38149.	C156	1734L
M	(6,34L,102M,578L) 83233.6713 3458080301.1528653 1841496313. .7608711 4479348013.	P112	1734M
1738L	(2,22L,158M) 79 9762458411 2404969201 4336050829.	P204	
M	(22M,158L) 10429.59093.7944509 0933123827 2563227097.	P199	
1742L	(26M,134M) P239		
M	(2,26L,134L) 48291969 9751741253.P222		

1746L	(6, 18L, 194L, 582M)	37688510 9765881657.P157		
M	(2, 18M, 194M, 582L)	191815 8604951126 1238746281.4143848071 5993428\		
		321 8955265719 3683851218 1490551329 9886523802 9290237501.P79		1746M
1750L	(2, 10L, 14M, 50M, 70L, 250L, 350M)	21001.9 0984652501.25 9213867501.		
		.6676 9116536501.P141		1750L
M	(10M, 14L, 50L, 70M, 250M, 350L)	52501.304501.P171		
1754L	(2)	136813.1 6485685958 3180674917 0663916587 3936208073.P218		
M	(178909.8045864609.9417793 1835255001.		C232	1754M
1758L	(6, 586M)	3517.17581.	C168	1758L
M	(2, 586L)	70321.3681253.14657513 1031645722 2898312721.		
		.786189 1256042908 1743555453 6817956201.P102		1758M
1762L	292493.28 7799987821.		C249	1762L
M	(2)	990 8497304929.307035208 6706435689.	C234	1762M
1766L	(2)	3533.10597.	C258	1766L
M	(964 2835106981.2185377 3066679313.1 3979979007 1422647276 1369661333.		C207	1766M
1770L	(2, 10L, 30M, 118L, 354M, 590M)	941641.11268837 6490130041.		
		.139580 7887176569 5340080761.P91		1770L
M	(6, 10M, 30L, 118M, 354L, 590L)	P141		
1774L	1982764321.99823632 1929970175 5701813517.			
		.2047754087 0008203492 9780944374 3844453329.		
		.1 3231286310 6351947609 7521600388 6759010777.P151		1774L
M	(2)	1 2067954321.15 4247171201.2463066613 8322356361 9590775949.	C216	1774M
1778L	(14L, 254L)	394717.2901290617.	C213	1778L
M	(2, 14M, 254M)	3557.430277.2 8402945481.	C209	1778M
1782L	(2, 18M, 22L, 54L, 66M, 162M, 198L, 594M)	120726937.21214076 6502632881.	C138	1782L
M	(6, 18L, 22M, 54M, 66L, 162L, 198M, 594L)	2170477.16 8518034037.	C145	1782M
1786L	(2, 38L, 94M)	3639869.9996485 7407017112 4601432769.		
		.4974034658 5637200944 6461144453.		
		.111758423 6152569441 9365496374 9427567569.C149		1786L
M	(38M, 94L)	64610910 8522520037.55737 2162280512 9716149437 9261805713.P197		
1790L	(10M, 358M)	3581.811893881.42 7270019072 4544357721.		
		.682 8621875125 4105873454 9287082001.P147		1790L
M	(2, 10L, 358L)	94622981.98 1882367518 3373550041.		
		.6712771762 6926033400 4380493401.C156		1790M
1794L	(6, 26M, 46L, 78L, 138M, 598M)	7177.P156		
M	(2, 26L, 46M, 78M, 138L, 598L)	1 0684568857.	C149	1794M
1798L	(2, 58L, 62M)	7193.361 7439859037.871 3454341549.10909732 9238284141.	C207	1798L
M	(58M, 62L)	5886653.2 0723877457.4387 5868248089.		
		.395743645 7200158642 4595746349.C194		1798M
1802L	(2, 34M, 106L)	1 1747392973.9110252886 2545665457.P221		
M	(34L, 106M)	1 7404474841 0668549457.2 2420155115 0113268933.P210		
1806L	(6, 14L, 42M, 86M, 258L, 602M)	3613.94673605 6883069749 5500595457.		
		.45757320 4786188957 4760460788 9547060541.P83		1806L
M	(2, 14M, 42L, 86L, 258M, 602L)	4 4619686161.	C141	1806M
1810L	(10M, 362M)	1422661.10371301.62984381.28 4154643710 6680644141.		
		.100 6732826659 1076916445 6015319401.P142		1810L
M	(2, 10L, 362L)	4779887821.2849605 3816048645 4165307301.		
		.1486018 6078885510 5188249397 5787406621.P145		1810M
1814L	(2)	3668496846 8392674349.2673015381 2108005624 7956934369.P224		
M	(2856279634 5198906589 8962757608 4877545889.		C234	1814M
1818L	(2, 18M, 202L, 606M)	938089.215403913.5 4459411697.P156		
M	(6, 18L, 202M, 606L)	3637.1123 9182354817.8971 8779799289.P151		
1822L	109321.425142355 1809614901 5446235113.		C241	1822L
M	(2)	29153.	C270	1822M
1826L	(22M, 166M)	10957.45790 5185813813.91184258 1496373502 0084050069.		
		.758984 0452397654 1436629048 0154514089.C164		1826L
M	(2, 22L, 166L)	43734285 7760433461.31 7222916436 0447585086 1201188341.	C199	1826M
1830L	(2, 10L, 30M, 122L, 366M, 610M)	1712881.		
		.20 9286094074 5803182883 4469293721 8868614221.P97		1830L
M	(6, 10M, 30L, 122M, 366L, 610L)	61*.358681.60 2914116781.		
		.239709650 4835438921.891353666 8445303976 2936076301.P79		1830M

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1834L	(2, 14M, 262L)	18341 · 73361 · 106373 · 337457 · 60248 1460214341 ·	C201	1834L
M	(14L, 262M)	55021 · 1114247 9091341921 · 965 7869720881 8436822981 ·		
		.7300 3974537421 9638260113 · 37 4470279013 1438125451 2721318017 ·		
		.639 7455842917 2886375165 8159947413 · P103		1834M
1838L	15174529 · 150 8449364353 ·		C258	1838L
M	(2)	3677 · 169097 · 270 3022685717 · 107184730 0685268733 ·		
		.2 4567747366 2707941744 9898904657 · P207		1838M
1842L	(6, 614M)	29031 5765280701 4132222997 · P160		
M	(2, 614L)	14737 · 202621 · 670489 · 1924167937 · 202 7744067215 7064961857 · P138		
1846L	(2, 26L, 142M)	38286041 ·	C246	1846L
M	(26M, 142L)	13837 6938119008 7160771760 0062424369 ·	C219	1846M
1850L	(2, 10L, 50M, 74L, 370M)	3701 · 13388 6258536001 · 5906 6306786091 1343898701 ·		
		.866200444 5033072182 4640851652 0037907601 · P137		1850L
M	(10M, 50L, 74M, 370L)	3760458001 · 931271 8358338301 · P192		
1854L	(6, 18L, 206L, 618M)	40184 1732395629 · 10 0171655023 0646020039 1243108137 · P139		
M	(2, 18M, 206M, 618L)	3709 · 7417 · 9 3097809073 ·		
		.15697920 1172750734 8633846956 7634384633 · P129		1854M
1858L	11149 · 319577 · 55 1019709753 · 46098324 5870707915 1039619761 ·			
		.1020789 6739874837 1466943848 5415945837 · P195		1858L
M	(2)	7433 · 85469 · 858397 · P265		
1862L	(2, 14M, 38L, 98M, 266L)	4639388993 · 2 2772885633 · 11 4089637061 ·	C197	1862L
M	(14L, 38M, 98L, 266M)	11173 ·	C224	1862M
1866L	(2, 622M)	3733 · 17962117 · 20408283 4247639533 ·		
		.2867 1342390587 2507744487 0925351109 ·		
		.17178784 6178241745 3882917516 8754535913 5893624733 · P79		1866L
M	(6, 622L)	14929 · 315820022 8129208463 3680717617 · P154		
1870L	(10M, 22M, 34L, 110L, 170M, 374M)	70696 0763753201 ·	C179	1870L
M	(2, 10L, 22L, 34M, 110M, 170L, 374L)		C193	1870M
1874L	54628974 7242387833 · 1 0233844988 9938893229 ·		C245	1874L
M	(2)	802073 · 3021 4971197129 · 52470 4862656309 · 1 0821538743 6410988313 · P228		
1878L	(2, 626M)	3651421693 · 1532046597 2148157576 0771776889 · P150		
M	(6, 626L)	120193 · 2 3208500533 · 48489 4051077157 · 4 7954220275 1565609741 ·		
		.21514 2887116327 9364744084 0947984309 · P103		1878M
1882L	(2)	3383837 · 2 5359946237 · 20793657 8270812095 3451296108 0066477973 · P229		
M		107091347 9895698609 ·	C266	1882M
1886L	(46L, 82L)	11 2410858169 · 3636841 3831997333 · P237		
M	(2, 46M, 82M)	27842 5441482834 6243382561 ·	C241	1886M
1890L	(6, 10M, 14L, 18L, 30L, 42M, 54M, 70M, 90M, 126L, 210L, 270L, 378M, 630M)	7561 ·		
		.457381 · 2143261 · 59 6526861195 2336627502 0034072662 4395569101 · P73		1890L
		438878 8818757216 5151544641 · 5 3557082595 1261650430 9415704562 8806518641 · P64		
1894L	(2)	189401 · 1440383213 · 82046165 8285708924 6514152381 · P243		
M		6522937 · 27227 9643245537 · 8211191 0523258230 1742102514 1068065597 ·	C227	1894M
1898L	(2, 26L, 146M)	1039 0402230053 · 1855718691 2404416485 3371079021 ·	C219	1898L
M	(26M, 146L)	3797 ·	C257	1898M
1902L	(6, 634M)	28927767 7120944777 0340654201 · P163		
M	(2, 634L)	15217 · 3 1877128189 · 77 8680603097 · 348 8331309973 ·		
		.270 6957159237 2896954201 · P130		1902M
1906L	2 0405494957 · P277			
M	(2)	280 9306768001 ·	C274	1906M
1910L	(2, 10L, 382M)	1443961 · 92459281 · P216		
M	(10M, 382L)	57301 · 86418 9637596221 · 3010396359 5594195541 6398544601 ·	C180	1910M
1914L	(2, 22L, 58L, 66M, 174M, 638M)	8 4044040003 6193222729 ·		
		.1 0854499687 5912509332 9919224369 ·		
		.1585333835 4628292314 3815178814 8865056453 · P78		1914L
M	(6, 22M, 58M, 66L, 174L, 638L)	15313 ·	C165	1914M
1918L	(14L, 274L)	7673 · 60 9014465221 · 505 5546728233 ·	C218	1918L
M	(2, 14M, 274M)	16838 8835672177 ·	C232	1918M
1922L	(62L)	113 7450670721 · 218426972 4947805073 ·	C250	1922L
M	(2, 62M)	252792973 · 864219613 · 948729953 · 37 5413585060 7547825823 6735332361 ·		
		.64570584 1686279454 4810962432 8792927541 · C185		1922M

1926L	(2, 18M, 214L, 642M) P192		
	M (6, 18L, 214M, 642L) 3853.	C189	1926M
1930L	(2, 10L, 386M) 1246781.1608921341.356855 3151401081.		
	.5955 6235681407 7003389587 6543735621.P168		1930L
	M (10M, 386L) 23249 2081623941.839271 0322562681.	C201	1930M
1934L	328781.12056557.P279		
	M (2) 47054221.	C283	1934M
1938L	(6, 34L, 38M, 102M, 114L, 646M) 3877.19381.1279081.		
	.12774353 3939839455 2179571323 4563738297.		
	.16750182 0732112305 5631039542 0299476529.P86		1938L
	M (2, 34M, 38L, 102L, 114M, 646L) 9262825170 0788924312 8982867521.		
	.364 8011488087 2169169501 5068296639 8143704581.P101		1938M
1942L	(2) 587761 2181049269.6917838 0045680078 8093836015 1147285081.P239		
	M 19421.	C289	1942M
1946L	(2, 14M, 278L) 38921.87632273.92220941.4484 9676017189.		
	.2 6843568092 4488592979 4686184069.C186		1946L
	M (14L, 278M) 21856 1316364553.	C235	1946M
1950L	(6, 10M, 26M, 30L, 50L, 78L, 130L, 150M, 390M, 650M) 2 4457095001.P134		
	M (2, 10L, 26L, 30M, 50M, 78M, 130M, 150L, 390L, 650L) 45984901.		
	.113 1816004801.10879245 7407671701.P108		1950M
1954L	3 6716449417.4 1531393372 4293297909.P263		
	M (2)	C294	1954M
1958L	(2, 22L, 178M) 10984381.1749046157.1 2769069589.		
	.85404637 9085368610 6162888141.P211		1958L
	M (22M, 178L) 3917.4135297.21467513.5 7717951413.29085 7646356157.P222		
1962L	(2, 18M, 218L, 654M) 109*.1 7951056093.66965 7070334773.P168		
	M (6, 18L, 218M, 654L) 4 9346313013.138 8612680921.	C173	1962M
1966L	4364 4426217789.143174 6688753709.P268		
	M (2) 1 5583712898 7432356781.13661750 4889755166 2825186361.		
	.1323103 7606141473 3289721369 8137697413.P212		1966M
1970L	(10M, 394M) 15761.35461.2214281.4645 6860714927 5146234181.		
	.5818878994 7086492200 7450289381.C168		1970L
	M (2, 10L, 394L) P237		
1974L	(2, 14M, 42L, 94M, 282L, 658M) 57174937.2886085 7283150817.P142		
	M (6, 14L, 42M, 94L, 282M, 658L) 6170683 6445096809.P150		
1978L	(2, 46M, 86L) 7876397.	C272	1978L
	M (46L, 86M) 43977 1371096041.3504984 0713898433.		
	.4633 6564105264 1569312191 4056962535 9563486333.C203		1978M
1982L	47569.70297227 3668806189.2410896648 7910875313.		
	.4422941592 6893141209.1 1344799636 3645096441.P217		1982L
	M (2) 27749.6348867 7307778109.168256196 2574792274 5475011329.	C249	1982M
1986L	(6, 662M) 13302229.2543 0936011753.316144 7698923102 9379232557.		
	.68 9059703375 6118343746 2555868709.3973 9212581763 2305632150 8940165661.		
	.1314098 7161755954 8389813979 9716487493.P51		1986L
	M (2, 662L) 18 3625814209.101876 8450523377.7451918 9014953913.		
	.189893726 3117703473 2892899753.4651772869 9643022616 0539394957.		
	.617 6800575595 2552277868 0709413533.P66		1986M
1990L	(2, 10L, 398M) 250741.	C234	1990L
	M (10M, 398L) 231982047 2567208103 4655436981.		
	.36016 1483551397 1124894008 0869144201.C176		1990M
1994L	(2) 3989.23929.1316041.7905228953.4 5051620043 0246120721.		
	.149156643 1812993101 9226430757 7506850757.P217		1994L
	M P301		
1998L	(6, 18L, 54M, 74M, 222L, 666M) 7 2354413161.122255 3230560433.		
	.5735 5514603785 0219879651 2243143473.		
	.549 7368458116 1801932334 0469462329 9228824873.P93		1998L
	M (2, 18M, 54L, 74L, 222M, 666L) 1012600 1691430741.38259822 8266336189.	C162	1998M

2002L	(14L, 22M, 26M, 154M, 182M, 286L)	20021.1849849.690545857. .4108028059 2351540541.92151 9484665138 9888428137. .3969 8622896633 6374287213 4096701517. .136 2884098660 4456625675 6210318917 4956869669 4946387077.P68		2002L
M	(2, 14M, 22L, 26L, 154L, 182L, 286M)	8009.1203988 4736627749.	C197	2002M
2006L	(2, 34M, 118L)		C280	2006L
M	(34L, 118M)	4013.	C276	2006M
2010L	(2, 10L, 30M, 134L, 402M, 670M)	1161781.4371458967 1758035101. .7202139206 8090524007 1420322773 6498330521.P93		2010L
M	(6, 10M, 30L, 134M, 402L, 670L)	4021.655261.131 5427340838 1894504101.P129		
2014L	(38M, 106M)	2 3704361089.234 5207504177.445 9814982973 7613346817.P237		
M	(2, 38L, 106L)	2211373.2743 4003249209 2993407274 7900058453.P243		
2018L	12109.		C300	2018L
M	(2)	242161.95295 7298276617.	C283	2018M
2022L	(2, 674M)	8089.3546589.292 2737792281.31810 7521626142 9729586653.P156		
M	(6, 674L)	7372 6793191951 3717708801. .397490855 7331136306 1334863000 3685291009. .17097 0754136725 7221599398 0526641799 8571170101.P96		2022M
2026L	(2)	33449261.2 6448400472 9713012553.3 9932118604 9288505641. .95 6936627523 6970401002 4800387723 7301005401.P214		2026L
M			C305	2026M
2030L	(10M, 14L, 58M, 70M, 290L, 406M)	613061.85 5973658058 0153115140 5792561041.C165		2030L
M	(2, 10L, 14M, 58L, 70L, 290M, 406L)	36541.357281.P192		
2034L	(6, 18L, 226L, 678M)	407785 0171122577.	C187	2034L
M	(2, 18M, 226M, 678L)	856216369.31813201 5893843401. .211472 7155940020 4090224749.454 3998009580 3046421776 1866249437. .1065 8564036715 2826352587 0130273753.P85		2034M
2038L	(2)	61141.207877.715089 7365985729.2230303 5355268668 7144432969.P254		
M			C307	2038M
2042L	(2)		C307	2042L
M		88557457.	C300	2042M
2046L	(6, 22M, 62L, 66L, 186M, 682M)	4093.1030 8836566117.9 0926250176 0934950641.C144		2046L
M	(2, 22L, 62M, 66M, 186L, 682L)	43 1919189109.459 8203364409 3624122893.P146		
2050L	(10M, 50L, 82L, 410M)	65640072 0309944201. .39701 6399433632 3235291540 8020280101.C189		2050L
M	(2, 10L, 50M, 82M, 410L)	3527365301.P232		
2054L	(2, 26L, 158M)	308101.24775349.10574824 1031224273. .24187 8371050090 9277623355 0365107217.P218		2054L
M	(26M, 158L)	482805 0703567261.P266		
2058L	(2, 14M, 42L, 98M, 294L, 686M)	127597.768755496 0386019181. .5200377099 1385964409.2 2585643798 1597749889 8119074673. .359714423 3806004789 4034023690 4806333157.P65		2058L
M	(6, 14L, 42M, 98L, 294M, 686L)	3346309.541700782 1989854721.P152		
2062L	181457.		C306	2062L
M	(2)	32993.	C306	2062M
2066L	622097393.1606410037.23023097 6895361670 5880653781.		C266	2066L
M	(2)	4133.78509.764610073.	C293	2066M
2070L	(2, 10L, 18M, 30M, 46M, 90L, 138L, 230L, 414M, 690M)		C160	2070L
M	(6, 10M, 18L, 30L, 46L, 90M, 138M, 230M, 414L, 690L)	12421.45541.	C150	2070M
2074L	(2, 34M, 122L)	8297.4674797.1 4475794101.95 1533052762 0650472517. .423 0823502924 7467507951 1971763937.P215		2074L
M	(34L, 122M)	24889.67591661.1 9245413381. .28 5076753950 1642620937 9265459437.108418 7766981138 1401617266 8034087889. .2 9372667805 5166201614 6400123006 3579445161.C160		2074M
2078L	4157.47577889.257 8233152295 1529761073.5076444 8802478773 4242019373.			
M	(2)	144 8814932402 4190026923 2403148013.C221		2078L
2082L	(6, 694M)	6071113.4228 8273231097.92071 1247257749.5622906567 5693116237. .2338 4866763414 5317702040 8848488764 7243643341. .62 1220849879 1522443680 8604640578 8655164207 4217423393.P58		2082L
M	(2, 694L)	8329.112429.1557337.59 2686737569.686757489 0898053457.P164		

2086L	(2, 14M, 298L) 12517 · 33377 · 19885782 7144683169. .1926620590 0335123711 6611761079 6118373573 · C203	2086L
	M (14L, 298M) C268	2086M
2090L	(2, 10L, 22L, 38L, 110M, 190M, 418M) 6029645821 · P207	
	M (10M, 22M, 38M, 110L, 190L, 418L) 14145855 0058771977 5570810281 · C191	2090M
2094L	(6, 698M) 2065299637 · 4056 2442707197 · 961768 7207378317 · P171	
	M (2, 698L) C211	2094M
2098L	4640777 · 8 3011968817 · C299	2098L
	M (2) 12590 8547566485 5151668402 1495487769 · C281	2098M
2102L	(2) 92489 · 2030533 · 2076 1985532007 9870004881 · C282	2102L
	M 1513441 · 77933753 · 12000321 7560112501 · P286	
2106L	(2, 18M, 26L, 54L, 78M, 162M, 234L, 702M) 511421041 · C187	2106L
	M (6, 18L, 26M, 54M, 78L, 162L, 234M, 702L) 15093 7180544593 · .236405 4339672174 2414157469 · P156	2106M
2110L	(10M, 422M) 7313261 · 106 0955698661 · 82077746 8994193745 9483922881 · P206	
	M (2, 10L, 422L) 274301 · 163031261 · 351892 0881831461 · .7798 2410261295 0382766003 7110146961 · C191	2110M
2114L	(14L, 302L) 36460926 0198900118 6525363589 · .46407610 2764674407 8078433234 8683797989 · P206	2114L
	M (2, 14M, 302M) 4229 · 9817417 · 1 3093972249 · 2523290 9840405836 4830457653 · .10639761 3479021315 3556087433 · C198	2114M
2118L	(2, 706M) 155 9123581453 · 804 2292377740 5534042337 · C178	2118L
	M (6, 706L) 2750 3548942141 · 2885 2995339693 2728560877 8291701629 · P165	
2122L	(2) 49459577 · 230876 6446154677 · P296	
	M 434974 7973698382 8850647753 · P294	
2126L	4253 · 119057 · 2351357 · 11 8640804957 · P294	
	M (2) 6262064969 · 517 9922696689 3295289509 · 51 1143585327 5815318287 6066459473 · .1603777 1529008275 2160797640 2498110749 · C219	2126M
2130L	(6, 10M, 30L, 142L, 426M, 710M) 4261 · 46861 · 149101 · 77554852 2986795641 · .144 3478900141 4900976541 · P116	2130L
	M (2, 10L, 30M, 142M, 426L, 710L) 8521 · 9883201 · .935670834 1910203415 1484227581 7603083341 · .80586333 7960228852 9515205971 8287766410 3305518701 · P71	2130M
2134L	(2, 22L, 194M) 819457 · P284	
	M (22M, 194L) 115237 · 8670835 6421489792 1071559504 3749314093 · P247	
2138L	(2) 25657 · 12099 5596673449 · 397 6951537340 2823701741 · .256283024 5526970093 6935750561 · P252	2138L
	M 99 0069351973 1369541341 · 59623715 9037766664 0968613768 2448042581 · P263	
2142L	(6, 14L, 18L, 34L, 42M, 102M, 126L, 238L, 306L, 714M) 94 6553751623 3995317524 3922917053 · 1678 0124011097 5934969711 1520625113 · .1 0884302810 4327227902 7253298133 3469685512 7583727517 · P58	2142L
	M (2, 14M, 18M, 34M, 42L, 102L, 126M, 238M, 306M, 714L) 4198321 · C168	2142M
2146L	(58M, 74M) 5240533 · 1179926597 · 25 8921638441 · 689909930 4599325137 · C258	2146L
	M (2, 58L, 74L) 10554029 · 17507069 · 41 3985642257 5882915981 · C268	2146M
2150L	(2, 10L, 50M, 86L, 430M) 7480658401 · P243	
	M (10M, 50L, 86M, 430L) 4841801 · 839549620 6695366401 · C228	2150M
2154L	(2, 718M) 8193817 · P210	
	M (6, 718L) 4133482921 · 198349 5403218423 4326547315 8857156629 · C171	2154M
2158L	(26M, 166M) C296	2158L
	M (2, 26L, 166L) 1281853 · 46 8324126295 2304822589 · .12168 6964481951 5145377777 · C245	2158M
2162L	(46L, 94L) 12973 · 1522049 · 10797029 · 77 7589754233 · 14424491 4186471029 · C258	2162L
	M (2, 46M, 94M) 84032617 · C298	2162M
2166L	(2, 38L, 114M, 722M) 108301 · C201	2166L
	M (6, 38M, 114L, 722L) 5716032168 9457349811 1230101335 1337476653 · P167	
2170L	(2, 10L, 14M, 62M, 70L, 310L, 434M) 156241 · 3670177421 · .14 7099130461 4750173667 3218448905 1451254241 · C161	2170L
	M (10M, 14L, 62L, 70M, 310M, 434L) 34721 · 399281 · 16999781 · 54627581 · P192	
2174L	1 8241890517 · 2 8221633169 · 479234 3120992181 · 621587188 3210370333 · C273	2174L
	M (2) 4349 · 182617 · 887735509 · C309	2174M

# 2LM

## Prime Factors

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2178L (6, 18L, 22M, 66L, 198M, 242L, 726M)	7692697.15891 4152241813. .7550844860 4296462305 3695739861.P148		2178L
M (2, 18M, 22L, 66M, 198L, 242M, 726L)	4357.1028017.21366181. .10574526 3384890463 3973879093.P155		2178M
2182L (2) 13093.2305 8378159152 9788399739 8826188721.P291			
M 2070456161.120685 0555657249.4759 8904612156 3895183917.		C281	2182M
2186L (2) 13155349.		C322	2186L
M 4373.2680084093.76 5052415354 5491153109.		C295	2186M
2190L (6, 10M, 30L, 146L, 438M, 730M)	25 0975213261.	C163	2190L
M (2, 10L, 30M, 146M, 438L, 730L)	48906 0866029466 3498626741.P148		
2194L 4541645821.8789434 3384213957.		C304	2194L
M (2) 114089.79321877.2724439 6967751097.		C301	2194M
2198L (2, 14M, 314L)	4397.35062 7949550178 3659675282 6831321813. .2659583415 8560420531 6387778199 1246706041.C205		2198L
M (14L, 314M)	30773.3064013.P271		
2202L (2, 734M)	4020 1011439837.383123 2706825413.3 7490072724 8428800313.	C172	2202L
M (6, 734L)	7170258097.P210		
2206L 132361.2368783 4930522629.10 2885297975 2817834773.		C290	2206L
M (2) 525029.3719161618 5794836393.6974 9021051575 5486688501. .1659188 7574124107 2476219693.C256		C256	2206M
2210L (10M, 26M, 34L, 130L, 170M, 442M)	9007961.5 9234660941.3179 5116701141. .3237 4193806536 0073352861.P177		2210L
M (2, 10L, 26L, 34M, 130M, 170L, 442L)	113850361.406 7383975981.	C211	2210M
2214L (2, 18M, 54L, 82M, 246L, 738M)	7560043 1606582156 4119228881.	C190	2214L
M (6, 18L, 54M, 82L, 246M, 738L)	36336169.	C210	2214M
2218L (2) 13309.3828205897.629543 8698503197. .65811 0836012601 2651927237 8671163489. .2377 5104651520 0022900753 5692597546 8138328933.P226			2218L
M 115337.88419424 2639628957.4350 1442552183 8380022061. .312783 0276794379 4898000377.C262		C262	2218M
2222L (22M, 202M)	17353 6925472691 0741771239 8470333081. .600642331 0035789442 9034365935 4472393377.C228		2222L
M (2, 22L, 202L)	679933.10576721.	C289	2222M
2226L (6, 14L, 42M, 106M, 318L, 742M)		C189	2226L
M (2, 14M, 42L, 106L, 318M, 742L)	347257.28 6867892221.105 7320723649. .30131 9905573933.C144		2226M
2230L (2, 10L, 446M)	16399421.873128131 2998970738 9666674041.	C232	2230L
M (10M, 446L)	829561.1016881.81345941.749 2614787462 2258725821.	C225	2230M
2234L (2) 67021.2 5078232910 4747870229.2 8020761784 5230614289.P290			
M 40213.71514809.P324			
2238L (6, 746M)	22381.2957625513 0269968537.	C200	2238L
M (2, 746L)	9985563919 2179303214 2257083493. .8188933 8246606129 8453585018 1113325193.C158		2238M
2242L (38M, 118M)	120 4142232740 7135159361.51523 5862481876 2552412257.	C268	2242L
M (2, 38L, 118L)	341851193.P307		
2246L (2) 40429.722411327 1397534157.3 5894422523 9163622577.		C294	2246L
M 4493.597437.115 7722594009.590 3190099601.2423375 9097340549.		C288	2246M
2250L (2, 10L, 18M, 30M, 50M, 90L, 150L, 250L, 450M, 750M)		C181	2250L
M (6, 10M, 18L, 30L, 50L, 90M, 150M, 250M, 450L, 750L)	1799059501.P172		
2254L (14L, 46L, 98L, 322L)	22541.108193.27088 9143560029. .119 6993300107 9298510777.C233		2254L
M (2, 14M, 46M, 98M, 322M)	1065 1266956177.27 9652179650 9427468413. .1774 4065273182 2006259181.P221		2254M
2258L 279811361.P332			
M (2) 4517.3168 7253327909.8 4586074304 1780788841. .3168 9619800272 7067577290 3049581441. .610169 7975058520 6316791292 9664486129.P232			2258M
2262L (2, 26L, 58L, 78M, 174M, 754M)	9049.153817.22203793.5877527 9454393529.	C169	2262L
M (6, 26M, 58M, 78L, 174L, 754L)	22321 4314610724 8761501297.P179		



2266L	(2, 22L, 206M)	13597 · 5791897 · 4 1143843577 · .10 0079652732 7590486747 1368225133 · C255	2266L
	M	(22M, 206L) 90641 · 13199 9104519176 2036137969 · P278	
2270L	(10M, 454M)	3979941061 · 34 1947385586 7959334298 9124400027 1614659521 · P221	
	M	(2, 10L, 454L) 514854161 · 185236 0842230441 · .1 1854787490 2859631596 5454808859 0829070481 · C209	2270M
2274L	(6, 758M)	245593 · P222	
	M	(2, 758L) 45194 2901656777 · 5070 1771025004 2219226541 · P190	
2278L	(2, 34M, 134L)	82009 · 2924953 · 7198481 · 70 2133429141 ·	C289 2278L
	M	(34L, 134M) 57610621 · 102 6114653093 · 831 8132275894 9952160061 ·	C275 2278M
2282L	(2, 14M, 326L)	13693 · 3340849 · 1999940237 · 5021162189 ·	C264 2282L
	M	(14L, 326M) 873 4996205489 · 2 5408991048 2240077841 · .193 1620812742 9292514130 2977259421 · P227	2282M
2286L	(6, 18L, 254L, 762M)	68581 · 30957013 · 241 725 6810733215 9475316053 · .3698 3739239549 5196803418 1104581513 0322384077 · P147	2286L
	M	(2, 18M, 254M, 762L) 18289 · 662941 · 297 7460232013 ·	C205 2286M
2290L	(10M, 458M)	1 8967080721 · P264	
	M	(2, 10L, 458L) 9161 ·	C272 2290M
2294L	(2, 62M, 74L)	16631501 · 1312893 0562413899 8115419201 ·	C293 2294L
	M	(62L, 74M) 18353 · 156129641 · 439447 2473673341 4934459601 ·	C287 2294M
2298L	(2, 766M)	25 9324769473 1387242657 · 1485 4083433337 6678799373 · P187	
	M	(6, 766L) 208951977 8841028073 1804361141 ·	C202 2298M
2302L	7896 0215773801 · 173922 9066659377 · 143155 3193878885 1695592513 ·	C293	2302L
	M	(2) 36833 · 5 8727643349 · 13321 7558269163 2116991109 · P307	
2306L	152197 · 67796401 · 48 7690428661 · 375990 3766572307 3967700902 7023959553 · C287		2306L
	M	(2) 10 9361035361 · 108 3060417437 · 143 4915902261 · 85 5649152078 0190213657 · .6 3139288635 1551447405 1949065037 · C259	2306M
2310L	(2, 10L, 14M, 22L, 30M, 42L, 66M, 70L, 110M, 154L, 210M, 330L, 462M, 770M)	40 7861310781 · 327654172 2830542321 · .235974018 3446742670 6706676657 4443414292 6705478881 · P67	2310L
	M	(6, 10M, 14L, 22M, 30L, 42M, 66L, 70M, 110L, 154M, 210L, 330M, 462L, 770L) 4621 · .46491061 · 17 0114256510 7331378341 · 9963931120 7533492973 6912485201 · P82	2310M
2314L	(2, 26L, 178M)	9257 · P315	
	M	(26M, 178L) 217517 · 14647621 ·	C306 2314M
2318L	(38M, 122M)	27817 · 679697869 · 437587747 1939948309 · 3 4409981495 3387082089 · .390994992 9551716434 0521270869 · C244	2318L
	M	(2, 38L, 122L) 4637 · 152989 · 580881529 · 168 4427935189 ·	C296 2318M
2322L	(6, 18L, 54M, 86M, 258L, 774M)	9 5851347301 · 3720964 5369951841 · .64960731 7463017978 2608508433 · P173	2322L
	M	(2, 18M, 54L, 86L, 258M, 774L) 595788049 · 1 0635930289 · .2017 3378451099 5734472837 · P186	2322M
2326L	(2)	37217 · 37453253 · 14154 2461666452 4411792669 · .1577053 0478516072 5584866573 · C287	2326L
	M	3402398369 · 12 1677098069 4514403493 6348279437 · P310	
2330L	(2, 10L, 466M)	1558349678 0908814321 ·	C261 2330L
	M	(10M, 466L) 511 9669749897 9519481710 9952829201 · .8565602 4493588003 6865387384 5874585921 · C210	2330M
2334L	(6, 778M)	2319997 · 2973517 · 3737551 7995862570 6510646037 ·	C194 2334L
	M	(2, 778L)	C235 2334M
2338L	(14L, 334L)	1122241 · 1258 6300846981 · 217133097 1780639353 1167754789 ·	C253 2338L
	M	(2, 14M, 334M) 14029 · 28057 · 254678341 · P284	
2342L	(2)	13152673 · 238497064 7060589977 · P327	
	M		C353 2342M
2346L	(2, 34M, 46M, 102L, 138L, 782M)	84457 · 1468398937 · 7445 1396803531 4938427361 · C174	2346L
	M	(6, 34L, 46L, 102M, 138M, 782L) 41 6806406641 · .2931387851 5876516752 7809171241 · P172	2346M
2350L	(10M, 50L, 94L, 470M)	263201 · 347801 · 24312 2046577775 2225890601 · .2834019 0045141787 2053764801 · 6 9116427912 1773919589 8769605801 · P185	2350L
	M	(2, 10L, 50M, 94M, 470L) 1501 2093905101 · 521637 3323605901 ·	C248 2350M
2354L	(22M, 214M)	103577 ·	C314 2354L
	M	(2, 22L, 214L) 409597 · 5134243489 · 2696 7635413120 6198315742 1198040561 · C271	2354M

# 2LM

## Prime Factors

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2358L	(2, 18M, 262L, 786M)	9433.3051253.78997717.	C217	2358L
M	(6, 18L, 262M, 786L)	80173.29853437 5738480187 3236775426 4926734261.	C193	2358M
2362L	(2)	80715019 6662013487 6289473357.	C327	2362L
M		1369961.9178733.7493076529.746 8243693965 7249341097.P310		
2366L	(14L, 26M, 182M, 338L)	8 1058592161.674942387 8264140893.P253		
M	(2, 14M, 26L, 182L, 338M)	14197.94190461.159195 0268614161.P255		
2370L	(6, 10M, 30L, 158L, 474M, 790M)	31 0358259241.	C177	2370L
M	(2, 10L, 30M, 158M, 474L, 790L)	2678101.		
		.3655 4166084726 6920227853 3979576601.C148	C148	2370M
2374L	(2)	9497.151937.1 9078157209.180496003 1905948702 0771408069.	C309	2374L
M		383215829.140198 0222664869.P334		
2378L	(2, 58L, 82M)	71341.989249.1 9372762237.95 2283431069.	C305	2378L
M	(58M, 82L)	409482089.1566641833 2748295461.191 6292182408 3567371081.		
		.59 6783231070 8464351988 9387415017.338 2565947665 6325784883 9493358293.P223		2378M
2382L	(6, 794M)	986149.407144 0539738430 3849864869 3671401041.	C197	2382L
M	(2, 794L)	161977.228222 7514761573.	C219	2382M
2386L		5 5665356141.619286426 3277076981.192760313 6574086642 6115587917.	C302	2386L
M	(2)	29373 1580424649.16 2420334396 1766495413.		
		.14128104 4414555356 7161915193.P296		2386M
2390L	(2, 10L, 478M)	19121.33461.219881.	C273	2390L
M	(10M, 478L)	2586 4061833661.4383 3713434081.	C260	2390M
2394L	(2, 14M, 18M, 38L, 42L, 114M, 126M, 266L, 342L, 798M)	4789.		
		.5180 9220000840 2765133120 4969715053.P158		2394L
M	(6, 14L, 18L, 38M, 42M, 114L, 126L, 266M, 342M, 798L)	1140784093.	C186	2394M
2398L	(22M, 218M)	23981.3995 1574500459 9788120518 1480047421.P287		
M	(2, 22L, 218L)		C326	2398M

$$2^{2h} + 1 = L.M, \quad L = 2^h - 2^k + 1, \quad M = 2^h + 2^k + 1, \quad h = 2k - 1.$$

2+(4k)

Factorizations of  $2^n + 1$ ,  $n = 4k$ ,  $n \leq 1200$

$n$	Prime Factors
4	17
8	257
12	(4) 241
16	65537
20	(4) 61681
24	(8) 97·673
28	(4) 15790321
32	641·6700417
36	(4,12) 433·38737
40	(8) 4278255361
44	(4) 353·2931542417
48	(16) 193·22253377
52	(4) 858001·308761441
56	(8) 5153·54410972897
60	(4,12,20) 4562284561
64	274177·67280421310721
68	(4) 17*·354689·2879347902817
72	(8,24) 577·487824887233
76	(4) 1217·148961·24517014940753
80	(16) 414721·44479210368001
84	(4,12,28) 3361·88959882481
88	(8) 229153·119782433·43872038849
92	(4) 291280009243618888211558641
96	(32) 18446744069414584321
100	(4,20) 401·340801·2787601·3173389601
104	(8) 78919881726271091143763623681
108	(4,12,36) 33975937·138991501037953
112	(16) 449·2689·183076097·358429848460993
116	(4) 59393·82280195167144119832390568177
120	(8,24,40) 394783681·46908728641
124	(4) 290657·3770202641·1141629180401976895873
128	59649589127497217·5704689200685129054721
132	(4,12,44) 7393·1761345169·98618273953
136	(8) 383521·2368179743873·373200722470799764577
140	(4,20,28) 84179842077657862011867889681
144	(16,48) 1153·6337·38941695937·278452876033
148	(4) 20988936657440586486151264256610222593863921
152	(8) 27361·69394460463940481·11699557817717358904481
156	(4,12,52) 84159375948762099254554456081
160	(32) 3602561·94455684953484563055991838558081
164	(4) 13121·8562191377·12243864122465612155106392056552353
168	(8,24,56) 2017·25629623713·1538595959564161
172	(4) 3855260977·64082150767423457·1425343275103126327372769
176	(16) 5304641·275509565477848842604777623828011666349761
180	(4,12,20,36,60) 168692292721·469775495062434961
184	(8) 43717618369·549675408461419937·3970299567472902879791777
188	(4) 1198107457·23592342593·4501946625921233·181352306852476069537
192	(64) 769·442499826945303593556473164314770689
196	(4,28) 7057·273617·1007441·375327457·1405628248417·364565561997841
200	(8,40) 1601·25601·82471201·432363203127002885506543172618401
204	(4,12,68) 8161·40932193·1467129352609·737539985835313

208	(16)	928513.1 8558466369.2 3877647873.2131 6654212673.71566847 0267111297	
212	(4)	1692645313.109 2051360401 8498900801.20 9460015914 2901219928 1424246257	
216	(8, 24, 72)	209924353.4261383649.249290 6081826536 0451708193	
220	(4, 20, 44)	109121.148721.3404676001.1103 5465708081.254671 7317681681	
224	(32)	1677 7388527684 9215533569.37414 0571613223 7595740814 8834323969	
228	(4, 12, 76)	90289.9036489073.290340571 6492099337 9000074993	
232	(8)	929.5569.8353.39594977.P50	
236	(4)	1889.11329.84961.765373489.P49	
240	(16, 48, 80)	23041.P35	
244	(4)	977.3 7831175201.48 8994002930 9876547089.P37	
248	(8)	8929.P69	
252	(4, 12, 28, 36, 84)	1009.21169.2627857.269389009.14 7520467919 0128571777	
256		123892 6361552897.P62	
260	(4, 20, 52)	42641.5746001.2400573761.6 5427463921.P27	
264	(8, 24, 88)	1687508 1675650881.P32	
268	(4)	75041.33380 8138537249.P61	
272	(16)	5441.335631 8270467982 4541060373 0138717057.P38	
276	(4, 12, 92)	57 7033894648 1798744593.P32	
280	(8, 40, 56)	4481.557761.736961.P43	
284	(4)	2273.1433633.P75	
288	(32, 96)	3457.816769.15 6298590135 0085709953.P28	
292	(4)	1960288071 0043505617.P68	
296	(8)	80513.P82	
300	(4, 12, 20, 60, 100)	P49	
304	(16)	7798338113.17 9781388993.8488 5296460737.64396 6863870017. .2736225 4540091201.2 3715782724 3967596481	304
308	(4, 28, 44)	13553.7 4153335873.P58	
312	(8, 24, 104)	4993.94849.P50	
316	(4)	504337.994769.P83	
320	(64)	286721.446960641.9 6645260801.344240405 1886487041.P34	
324	(4, 12, 36, 108)	1297.3889.30433969.1164777409.371 8266498433. .13492 1168163073.117402 9487714513	324
328	(8)	1223 9719573537.1809392703 9368350337.2539452441 5842506913.P45	
332	(4)	11953.1476 7689550320 1728087421 7482806234 7720350769.P52	
336	(16, 48, 112)	47886721.P51	
340	(4, 20, 68)	1361.12717361.139 2971637361.80 8822074662 7020943841.P33	
344	(8)	4129.P98	
348	(4, 12, 116)	82129.1038947 6529713761.593 7202117116 4475019217.P24	
352	(32)	1409.1258753.4 4199554137 8330835457.P67	
356	(4)	P106	
360	(8, 24, 40, 72, 120)	8369281.P51	
364	(4, 28, 52)	59391 4915675537.P72	
368	(16)	7639 2570609857.1335 5703465746 3136395439 0476479681.P59	
372	(4, 12, 124)	1489.29761.2241539 8357688737.P49	
376	(8)	3308801.3853249.4 8707339993 9357470433. .1638 7553063670 2837695009.26739 8978418337 8728255297.P30	376
380	(4, 20, 76)	3435950 2103163357 2415775800 0789490561.P51	
384	(128)	3496218393 2692179569 4385454593.P48	
388	(4)	25507121.P109	
392	(8, 56)	3137.50177.101921.258721.P83	
396	(4, 12, 36, 44, 132)	31 1712063697.P61	
400	(16, 80)	339942637 7632056001.48504 8422208437 1979240001.P54	
404	(4)	41266315 3396961075 2526181761.P93	
408	(8, 24, 136)	P78	
412	(4)	454849.667441.40151873.5231 7884766401.14250 0609730433.P76	
416	(32)	4940417.1 1342687617.P99	
420	(4, 12, 20, 28, 60, 84, 140)	127681.1130641.755667361.P38	
424	(8)	1697.P122	
428	(4)	4209809.13012913.99200 5069953996 7220267559 7968630366 8059315249.P69	
432	(16, 48, 144)	6801 6300334849.P73	

436	(4) 598193·356953382 3352397266 9330604417. .576694 8297623307 9456896113 9476826913.P60	436
440	(8,40,88) 47521.89119361.12 7886114126 2967442217 9666038021 5073025601.P43	
444	(4,12,148) 92353.126097.532801.854257.8533723219 6804809313.P46	
448	(64) 1489153.P110	
452	(4) 9041.3050 0013280577.P118	
456	(8,24,152) 145957459 4862075553.3205 0776819669 0588004609.P46	
460	(4,20,92) 254 6972959095 7320495487 0539927521.P74	
464	(16) 748264961.2245984577.23968 6663718401.159296 1959112752 0827829953. .6033 3121717210 3503165131 5652130497.P44	464
468	(4,12,36,52,156) 1873.644 0452782193.62329318 2848475361.P53	
472	(8) 253 4260503766 6235678081.P118	
476	(4,28,68) 94994369.158 0019259393.11584665 1946400929. .2488 1968815827 3413590473 3409191377.P45	476
480	(32,96,160) 26881.4855681.610548481.13 7603804161.P47	
484	(4,44) 209089.33186913.1251287137. .3860897986 9428210686 5593303626 3824535533 5498797441.P61	484
488	(8) 103581787 7926014488 5871338184 9197675938 9034764353.P97	
492	(4,12,164) 62966161.P89	
496	(16) 5953.251969.193 0185547865 5894221313.322063 5901036452 8536290817. .1562 4307475317 8161302047 5545228900 7981717441.P45	496
500	(4,20,100) 4001.1074001.2020001.22624001.148 1124532001.P85	
504	(8,24,56,72,168) 34273.P83	
508	(4) 3108961.1 7664039857.3573 1996675882 4298104849. .32843053 1712680864 6829056321.788293419 7421508722 9120114369.P55	508
512	2424833.745560282 5647884208 3373957362 0045491878 3366342657.P99	
516	(4,12,172) 328177.359137.5254767099 6812050561. .7 2774730365 0476041048 8618498577.P40	516
520	(8,40,104) 2081.1 9868746561.337754 9010888001.75 8082724184 3270677601.P65	
524	(4) 127133 2666556177.364 4167415582 4796521521. .88628235 1475389693 8587428147 2055436801.P81	524
528	(16,48,176) 1632064897.19050 7963147393. .44250 6742691983 4420089898 1420091393.P39	528
532	(4,28,76) 169 2116131441.1 3906500625 6539545729.P98	
536	(8) 4289.3115327 2309003500 2320027134 5885511764 4847166643 5989092897.P99	
540	(4,12,20,36,60,108,180) 2161.21601.20 1519653761.111718 0440577441.P53	
544	(32) 15233.143617.44 3069456129.P134	
548	(4) 38226289.1 5164972751 7181655387 1728873921 9937057169.P116	
552	(8,24,184) 267457249.P98	
556	(4) 6673.777646171 1281745642 1627629713. .1 7163190403 6503439779 0860195913 3030216639 1547109647 4850983729.P74	556
560	(16,80,112) 16824641.86800001.4039609 2614384641. .408 0906523318 4155116161.P62	560
564	(4,12,188) 20177 7278450257.44094868 8323898986 4703786561. .385730922 5717855030 7394862497.P41	564
568	(8) 1 4254355329.8037 7573236449.134254 6422242330 4875744449. .110 9111337665 5556595890 9906794820 9967918198 9410614081.P68	568
572	(4,44,52) 145143857.31119525 1370951377. .1614501 7838814448 7169581432 8568586673.P83	572
576	(64,192) 17047297.62 8582818817.P97	
580	(4,20,116) 6961.9281.16785 9997042321.P113	
584	(8) 3287118602 9052837857.797 7888172628 1213651073.P131	
588	(4,12,28,84,196) 84673.26554 9217634074 7703865734 8986359282 7112366481.P52	
592	(16) 3147 4859175390 1537351078 5605977687 6864094488 9135626234 09\ 37740292 2304455233.P100	592
596	(4) P179	
600	(8,24,40,120,200) 4801.55201.P88	
604	(4) 2417.4363297.730685377.77 5168188161.P150	
608	(32) 14593.671233.62006 6693671553. .72 9570376075 1622529041 9063617993 8565056499 1530762069 0006389889.P87	608
612	(4,12,36,68,204) P116	

# 2+(4k)

## Prime Factors

616	(8,56,88)	29569.110881.P135	
620	(4,20,124)	63388 4052132076 3912823441. .89722882 1320872623 7756413079 8255570662 1301549436 6305516001.P62	620
624	(16,48,208)	792584833.915584 1480185089.P91	
628	(4)	7537.118528721.26 2400181553.9920 0032453479 3042722401. .2 0605715069 8152191326 2536474503 8097331729. .27743 3242225210 5329557117 8395744381 9730099281.P56	628
632	(8)	28 6297736737. .471211 6689183015 6151548920 8246219513 3334266799 5318746814 8445645729.P111	632
636	(4,12,212)	12721.239372593.20830 6541869009.97147639 6313002897.P81	
640	(128)	32 8841628134 9499632641.7 7716463174 7163559325 6655841281.P102	
644	(4,28,92)	53632321.508 2941855495 8045844168 7901500833. .1 8734888091 0146760908 2029530468 4135617056 1257966417.P69	644
648	(8,24,72,216)	10369.259201.18 2404536614 5909775041. .5248 3309484962 4730914401.P76	648
652	(4)	2609.10433.1322257.28322881.P175	
656	(16)	7873.47402561.59110035 0038949953.16 6857646900 5068046209. .506060190 8322077796 9485027081 6882633281.P104	656
660	(4,12,20,44,60,132,220)	14736481.51 4210163281. .6498176028 5228935860 5542163521.P48	660
664	(8)	35 0842855608 3287152033.P176	
668	(4)	482851777.670297921.375283 4464863443 6546180783 8534613233.P147	
672	(32,96,224)	494968321.663239809. .292538440 0770993343 0495636452 6015576429 9463512577.P50	672
676	(4,52)	210913.47925697.455986337.17807 7806451169.P152	
680	(8,40,136)	496304801.1 0008321601.3391 0825580641. .101460 3201108417 2688350401.18741 4570270561 9946070176 8016571521.P63	680
684	(4,12,36,76,228)	12407761.1953842221 2886289080 8684507352 0488081169.P84	
688	(16)	2753.1755145793.180 9020600362 0308180353. .3 3744939642 0331471675 5629762689. .7741132990 7915702977 8976698862 0315813737 6728020417.P87	688
692	(4)	P208	
696	(8,24,232)	75169.1185335329.217 5937261441.394 5720769057. .4342075673 2422994369.2477160710 0529573152 7406385377.P47	696
700	(4,20,28,100,140)	2801.P142	
704	(64)	602992598 4568982202 8046342401. .3210843755 3243671192 5802775266 1239735297.P125	704
708	(4,12,236)	95 6468858444 3320317677 5508160481.P108	
712	(8)	290497.59170049.9497407873.133 4056289569. .2 5222813432 5499071202 0321975247 0337287201.P137	712
716	(4)	94513.1 0240246321.6249618 8903126496 0571243265 9622854257.	C163 716
720	(16,48,80,144,240)	37441.170251201.3220 2927231899 7936286081.P80	
724	(4)	2897.304081.55878 6628009681.1486 4310030218 9793374401. .3289754 6684878017 5121210941 8730038529.P134	724
728	(8,56,104)	145601.9828001.3203 8310825249.P148	
732	(4,12,244)	P145	
736	(32)	3689800577.669 9561451777.42889560 0365702401.	C172 736
740	(4,20,148)	1744633866 5719151603 3932614401.P145	
744	(8,24,248)	915 5618701647 8788158721. .22955297 3887168678 2981597056 2685902250 6774757743 8438859809.P65	744
748	(4,44,68)	738395681.1699887 1173904049. .19943 1288499235 1215831688 3777886467 9060668081.P124	748
752	(16)	4087873.481071690 7835700161.P197	
756	(4,12,28,36,84,108,252)	P131	
760	(8,40,152)	3041.47782228 4525893121.	C153 760
764	(4)	827467009.	C220 764
768	(256)	21278001 5855109121.22208 4264428498 4664160257. .17966 0292389934 2630768062 0195045770 5678288473 6988571649.P59	768
772	(4)	4346434 0002838801.	C215 772
776	(8)	782209.37 2454540993.212 5457487809.204 6800978429 0989308737.	C180 776

780	(4, 12, 20, 52, 60, 156, 260)	1928161. .16666882 5096179161 1383075804 7143439903 6535876481.P63	780
784	(16, 112)	689921.6630805 6470365249.P180	
788	(4)	72497.305 0841968833.	C219 788
792	(8, 24, 72, 88, 264)	3169.3665377.12925441.52386049.P120	
796	(4)	8214796 8529064774 1589953094 1807101361.P202	
800	(32, 160)	P193	
804	(4, 12, 268)	209898673.692 5799047681.2949333879 9546784993. .1333045405 8017528031 9733184641.P90	804
808	(8)	203617.P236	
812	(4, 28, 116)	56294 3995510177.1590234 7075274017. .116248 6630167011 5050911582 8530608561.P137	812
816	(16, 48, 272)	959617.5 9714975218 7286607489.471 9281877133 2809681089. .4 8734995441 0239438251 5365954826 6541432641.P65	816
820	(4, 20, 164)	141041.1 1109333761.2100852 2430395916 3308751601.	C152 820
824	(8)	19777.88993.	C237 824
828	(4, 12, 36, 92, 276)	1523521.25795 2400029937.P139	
832	(64)	3329.	C228 832
836	(4, 44, 76)	236882 2395648721.304012 4117151617. .11285 0495006238 3934670257.C162	836
840	(8, 24, 40, 56, 120, 168, 280)	13441.4841172001.158 6308510081.P90	
844	(4)	91185761.P245	
848	(16)	52 8209783809.3408 8185055658 3497822438 3921527937.P206	
852	(4, 12, 284)	13633.3114 1397544886 4087226366 8675964421 6932367969.P121	
856	(8)	1489441.2296348 6987966898 4791701633.	C223 856
860	(4, 20, 172)	557281.	C197 860
864	(32, 96, 288)	1718990209.814 8919324033. .672915 3911359354 0226991648 2777538049.P116	864
868	(4, 28, 124)	334853569.7 1153008417.1517469 8834406721.92262654 3715132033. .10 4294921195 4459511633.P143	868
872	(8)	175478350 7398509634 3806660481.P232	
876	(4, 12, 292)	45553.52561.241378644 7842826657 2422421526 9676274193.P126	
880	(16, 80, 176)	32655041.37487 1146580481.3658936991 7525430721. .212669 6373821981 2752041147 4271156481.P116	880
884	(4, 52, 68)	17681.572833.3327377.58 8201030275 7468387457. .5075 0380818282 9478517537.1 5215902463 6701626025 6977648481. .949 0550620859 9836997560 0448252853 2989220017. .45998843 4780718651 5471465751 5008888058 6568119521.P49	884
888	(8, 24, 296)	1079809.117 4047124321. .12988 7637532703 8851755693 4650016433 9384596481.P112	888
892	(4)	267601.1391521.1345517777.P247	
896	(128)	10753.4 8919385089.3925723339 4241687553. .328516339 8869581714 1948285796 1643272193. .1291 4340854285 0794337827 7572616180 3964147713. .7733 8582801985 5560335958 1434066664 8061420033.P72	896
900	(4, 12, 20, 36, 60, 100, 180, 300)	580 7380901690 0483059709 6274846254 7129404401.P102	
904	(8)	3617.65089.	C262 904
908	(4)	83537.	C268 908
912	(16, 48, 304)	32833.299137.1745 3513851098 0012221761. .107 4644470846 0091984745 4485663361.P109	912
916	(4)	2406028 3912401409.	C259 916
920	(8, 40, 184)	18401.6 6083546765 9820859511 8019094275 2889927681.P167	
924	(4, 12, 28, 44, 84, 132, 308)	3697.1027489.97374817.3952260 2650168177.P111	
928	(32)	189546985 7654895330 9516982910 8497477761. .497 1141705173 8761561492 9055955501 6352907777.C189	928
932	(4)	74561.8545841 7577408481.	C258 932
936	(8, 24, 72, 104, 312)	26391457.545734 9138721850 0862753537. .174989 6789723383 4172854412 9375449953.P105	936
940	(4, 20, 188)	13885681.5628794 3657879761.P198	
944	(16)	33803 2037089130 8957923866 0220728641.P245	

# 2+(4k)

## Prime Factors

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948	(4, 12, 316)	3793.2707489.P178		
952	(8, 56, 136)	P232		
956	(4)	76 5459043457.8806289 6436414834 1298338786 1556412577.	C238	956
960	(64, 192, 320)	49921.P150		
964	(4)	1602657713.	C280	964
968	(8, 88)	30977.2555521.20445 2543956321.558891896 4965108257. .3254976976 1659600998 7280148601 1429794721.P182		968
972	(4, 12, 36, 108, 324)	26232337.1 3655624113.	C178	972
976	(16)	361526017.212518364 8753765364 6842236161.P253		
980	(4, 20, 28, 140, 196)	7841.35281.141121.4653041.60893281.438 7897103521.C162		980
984	(8, 24, 328)	349107457.628217089. .30220180 0229531604 5345785638 7777914721.C138		984
988	(4, 52, 76)	189697.167659649.1482371489.645 0973392449.993 1868988289.C212		988
992	(32)	520 1080300033.308539 7990461441.5349719041 1184131713. .243889 0017863612 5824325448 8269457409.P206		992
996	(4, 12, 332)	P198		
1000	(8, 40, 200)	76001.42144001.29 3543676001.	C217	1000
1004	(4)	P302		
1008	(16, 48, 112, 144, 336)	423319681.4940773 9156397039 0335488001. .7201935 3296923637 2884427429 6784241409. .100654 5610655423 0078177800 1876573980 1419395841.P57		1008
1012	(4, 44, 92)	1440 5614244209.92427 8616131729. .36931698 1947787319 2220694097.C210		1012
1016	(8)	13 1101681409.5342 8165972513.843130 9118401633.58136769 4924545281. .3130331 6885606287 8953819009.P219		1016
1020	(4, 12, 20, 60, 68, 204, 340)	17166468 6650370481.12 3041227078 6066204321.P116		
1024		45592577.6487031809.4659775785 2200185432 6456074307 6778192897.P252		
1028	(4)	268510786 0437307121.2664 7313997124 8960398417. .392684 3815894658 1131254913.C241		1028
1032	(8, 24, 344)	2 4219373916 5634585377.7 0238933473 0574219713. .13298 4285729914 2484070701 7555082369. .366266878 5050561460 4412773067 6100332150 2356238369.P79		1032
1036	(4, 28, 148)	136753.	C255	1036
1040	(16, 80, 208)	20121907 7319973441.1 4930887903 8162976273 0439505281.	C184	1040
1044	(4, 12, 36, 116, 348)	1 1514589201.1009453334 9991037489. .3 3713819088 9530707009.C153		1044
1048	(8)	1211489.45529313.454261889.4105151 0705693529 1714767361.	C265	1048
1052	(4)	2262527 1329336833.	C300	1052
1056	(32, 96, 352)	155852929.1574 7624837121.4671440886 8623938817. .3046 0440236471 1726507676 6795424257.P119		1056
1060	(4, 20, 212)	4241.2 2625755121.37882713 7612775441. .236 7893637548 8328669921.P197		1060
1064	(8, 56, 152)	3404801.3 5868448673.47717 0373761089.78 0205766886 1532450977. .1 0538716399 0698306311 5212651361.4708 2539672707 7882353348 6411429633.C143		1064
1068	(4, 12, 356)		C212	1068
1072	(16)	107201.502 8065709856 6615291051 2123669275 2636100161.	C271	1072
1076	(4)	4037153.4326200033.70737 4699665617.2 0861113323 2063053649. .10342 9804585996 0197619058 7017511281.C238		1076
1080	(8, 24, 40, 72, 120, 216, 360)	6281281.148759201.4518776161. .302634191 6495386817 5425499201.P121		1080
1084	(4)	4337.13009.	C318	1084
1088	(64)	544001.76138241.	C295	1088
1092	(4, 12, 28, 52, 84, 156, 364)	26209.279553.4042 8414868660 8554495041. .15802 0457558522 9261365153. .698642 2606350968 0379988083 3919045864 1569643973 9773112049.P60		1092
1096	(8)	45 7024161409.6307 4817527233.118875585 8465841569.P284		
1100	(4, 20, 44, 100, 220)	567601.277173601.33374 2931196401.	C213	1100
1104	(16, 48, 368)	26497.	C208	1104
1108	(4)	13297.476041121.255 0041661553. .7910906 5815199393 6777267432 4430352577.C271		1108
1112	(8)	93 4309676929.P321		



1116	(4, 12, 36, 124, 372)	1093681.P211		
1120	(32, 160, 224)	853 9067456641.10175 0737670401.114694 6484544001. .5344 3154941490 7493260766 9859871361.	C156	1120
1124	(4)	205107521.149680081 7300278753.	C311	1124
1128	(8, 24, 376)	1078369.734189 8433044801.	C200	1128
1132	(4)	27 5814838289.3620737 3036678544 3780868881.P302		
1136	(16)	9168689293 9245942694 3501269939 0053650369.	C298	1136
1140	(4, 12, 20, 60, 76, 228, 380)	4561.P170		
1144	(8, 88, 104)	25744577.377140193.	C274	1144
1148	(4, 28, 164)	30645407 5222900702 9310550536 9518259537.P252		
1152	(128, 384)	18433.2773 3723987969.87706 4686405217 9729490151 9524699649.	C179	1152
1156	(4, 68)	17*.41617.295937.8373 6716905921.3114844 4724976529. .242869112 8313288513.	P268	1156
1160	(8, 40, 232)	97740357 0406117601.8414 6414358282 9714489281. .572815360 9272515700 9193935521.	P200	1160
1164	(4, 12, 388)	5106360913.	C222	1164
1168	(16)	4673.113794823 5396559809.	C326	1168
1172	(4)	9377.1345457.	C342	1172
1176	(8, 24, 56, 168, 392)	304041 0389842561.50 9154282120 6332688289.	C166	1176
1180	(4, 20, 236)	89681.141601.1250801.13083841.106827761.	C249	1180
1184	(32)	9473.120 2741777537.414581 8550091077 4859679702 8667339521.	P296	
1188	(4, 12, 36, 44, 108, 132, 396)	427681.5900813 4786334273.	C195	1188
1192	(8)	2553 7398034236 6346612993.P334		
1196	(4, 52, 92)	38273.1 4536633697.3691935 7139916161. .147554109 3263465795 0998395089.1 7577448076 7926383346 4910204577. .122 2550245968 8731038401 6956082161.	C197	1196
1200	(16, 48, 80, 240, 400)	9601.57601.1796365 3814841601.P168		

Factorizations of  $3^n - 1$ ,  $n$  odd,  $n < 540$ 

$n$	Prime Factors
1	2
3	(1) 13
5	(1) 11.11
7	(1) 1093
9	(1,3) 757
11	(1) 23.3851
13	(1) 797161
15	(1,3,5) 4561
17	(1) 1871.34511
19	(1) 1597.363889
21	(1,3,7) 368089
23	(1) 47.1001523179
25	(1,5) 8951.391151
27	(1,3,9) 109.433.8209
29	(1) 59.28537.20381027
31	(1) 683.102673.4404047
33	(1,3,11) 2413941289
35	(1,5,7) 71.2664097031
37	(1) 13097927.1 7189128703
39	(1,3,13) 13*.313.6553.7333
41	(1) 83.2526913.8 6950696619
43	(1) 431.38080854 6861411923
45	(1,3,5,9,15) 181.1621.927001
47	(1) 1223.21997.5112661.96656723
49	(1,7) 491.4019.8233.51157.131713
51	(1,3,17) 12853.9 9810171997
53	(1) 107.24169.374760703 1112307667
55	(1,5,11) 11*.1321.56008 8668384411
57	(1,3,19) 229.248749.1824179209
59	(1) 1 4425532687.48976999 3189671059
61	(1) 603901.1052 9331366039 1861035901
63	(1,3,7,9,21) 14454291 8285300809
65	(1,5,13) 131.3701101.11013 3112994711
67	(1) 221101.44 1019876741.47538 4700124973
69	(1,3,23) 277.246124357 6713869557
71	(1) 3754 7332574898 6240197335 7979128773
73	(1) 11243.20149.1 5768033143.946037 5336977361
75	(1,3,5,15,25) 601.9601.209 8303812601
77	(1,7,11) 51457561.7151459701.7 6831835389
79	(1) 432853009.39 2038110671.14517117 7264407947
81	(1,3,9,27) 3889.1190701.1255761 2956332313
83	(1) 167.12119.1036745531.9509 9605962721 0897943351
85	(1,5,17) 266 3568851051.86297065 2262943171
87	(1,3,29) 74821.32234893.15022 4123975857
89	(1) 179.161147 9891519807.50429 3943956599 6049162197
91	(1,7,13) 4011586307.37456 0381200716 6116831643
93	(1,3,31) 1117.262737 0184401531 9144827917
95	(1,5,19) 191.78 9580876946 0932143966 0131899631
97	(1) 76631.254 9755542947.488459628 2802842115 5731228333
99	(1,3,9,11,33) 3186217.128 1243223830 2009985937
101	(1) 33034273.46 5092326319.503167756 6801975930 6202964023

103	(1)	695759652 9882152968 9922252518 3588718147 8451547013	
105	(1,3,5,7,15,21,35)	421.6301.1616161.2 6751945361	
107	(1)	50077.229837.4 8965028505 0451239934 2125040651 6036571557	
109	(1)	1091.521402591.3499901929.23 9789806103.1062434687 5389299603	
111	(1,3,37)	18702169.119779213.696235341 3269964253	
113	(1)	227.1583.2172539.52 6256453012 0639807961 3112732135 4599535039	
115	(1,5,23)	1975931.627 3542442241.523 7034664956 5455417091	
117	(1,3,9,13,39)	4162861.1846794457.282196430 7371847613	
119	(1,7,17)	239.4462680619 1326911791.3978 8183764257 7477902049	
121	(1,11)	11617.398 1923614021.657890 4115452726 4820550284 9240259841	
123	(1,3,41)	51169.1999 8278175173 8704456156 8810795329	
125	(1,5,25)	251.358291751.1 4781691751.39 1632555001.98994 7158849251	
127	(1)	5843.681229.21520151.76082653.301515 3157523008 7423656423 5591357673	
129	(1,3,43)	4129.2199072289.9128515 6566285711 0894244969	
131	(1)	263.6051995885 9114400310 0881306574 4068516602 8842774039 4885828171	
133	(1,7,19)	875794894 1961838067.257 5137762431 5682637927 9929309507	
135	(1,3,5,9,15,27,45)	541.53825041.7736 1813242734 5151923061	
137	(1)	4933.217629707.1080 8180977383 9995188256 8004991415 4368439303 5450350551	
139	(1)	1669.5430731.P57	
141	(1,3,47)	16 1969595577.203 1161085853.1 6530147394 2399079669	
143	(1,11,13)	P58	
145	(1,5,29)	P54	
147	(1,3,7,21,49)	47041.P36	
149	(1)	7451.177941761.P59	
151	(1)	1511.6263783.6 4745079361.P51	
153	(1,3,9,17,51)	6213394261.3 5106034213.P26	
155	(1,5,31)	311.3586225081.P46	
157	(1)	9421.338 1925092493.989110912 5337566719.P40	
159	(1,3,53)	71255 0912937217.P35	
161	(1,7,23)	P63	
163	(1)	522 7348213873.888281 1705390167.P49	
165	(1,3,5,11,15,33,55)	50821.P34	
167	(1)	58451.88177.1767863.1006306 0897082377.P48	
169	(1,13)	2029.16 3264150141.P60	
171	(1,3,9,19,57)	119701.P47	
173	(1)	347.762239.212 5048865543.P62	
175	(1,5,7,25,35)	109201.143012 8198787051.P38	
177	(1,3,59)	709.222489815 9852613649.P34	
179	(1)	359.56207.100957.19510643.29106 6066130451.677996364 4378513811.P33	
181	(1)	90863.890159.P76	
183	(1,3,61)	733.97806913.242 1854958301.P34	
185	(1,5,37)	2221.17761.35521.146891.228082801.4 9804972211. .8784 1814842081.165423591 1196704741	185
187	(1,11,17)	6359.127275 3542934479.341192 6755457243.P42	
189	(1,3,7,9,21,27,63)	4988864145 4623789553.P32	
191	(1)	383.311713.9593931911.P73	
193	(1)	6563.29723.234 6066378779.2182460 9477260164 2186973037.P45	
195	(1,3,5,13,15,39,65)	2341.39838501.P35	
197	(1)	9851.74101933 4164502879.114725 7496199447 7441469621.P47	
199	(1)	1360648969.2933664301 3193035381 1221418233.P57	
201	(1,3,67)	1089421.P57	
203	(1,7,29)	2843.735673.P71	
205	(1,5,41)	6971.31981.P68	
207	(1,3,9,23,69)	829.1657.4969.P54	
209	(1,11,19)	419.2927.9938 1983898121.3408381 8556068104 3030809047.P40	
211	(1)	2111.96 2188370639.5404 6656969013.567668737 4958905209. .16959 4940906006 4182746451.P29	211
213	(1,3,71)	5113.2271 6867932413.11526 4393627813.361351 2804721129. .8966558866 4737776553	213
215	(1,5,43)	8477881.144911 2548109132 0910774351.P48	
217	(1,7,31)	20399.2 4040333283.205456 9869883991 7414079969.P46	

219	(1,3,73) 135781.P64	
221	(1,13,17) 443.P89	
223	(1) 544730 9720495081 9531444809.P81	
225	(1,3,5,9,15,25,45,75) 116101.875701.28687 0274711101. .51500 9259868501.11963496 9443826601	225
227	(1) 1 9907051929.86695423 7255898858 0369574229 6342497463.P60	
229	(1) 804 7106008391.3235656139 9076305309.2 8466399663 0519253661. .6 3453854187 9036040523.P36	229
231	(1,3,7,11,21,33,77) 3697.7 3155606217.P43	
233	(1) 467.2759917269 1870182517.63 5497925216 2209284471. .382 4748201676 5032274959.P45	233
235	(1,5,47) 5171.11321831.1287586151.301682055 4553522418 5322498361.P40	
237	(1,3,79) 37520893.528021312 8248296600 1751707837.P38	
239	(1) 479.17209.4 3301964055 6355333339 4574553310 6128044213.P67	
241	(1) 553788 7187071221 9875186142 5724478919.P79	
243	(1,3,9,27,81) 70957.6627097.218354731 6244845481 9220238921.P38	
245	(1,5,7,35,49) 32341.P76	
247	(1,13,19) 14327.5 0427403417.853368 8951691833 3646696709.P63	
249	(1,3,83) 3588 2730354181.P65	
251	(1) 503.5894996 1625091488 5236525744 6042626007.P80	
253	(1,11,23) 23*.386369 0516868071 4294388463.P78	
255	(1,3,5,15,17,51,85) P62	
257	(1) 120277.1329772 6629335241 1250231045 3951741137.P82	
259	(1,7,37) 2591.18131.P96	
261	(1,3,9,29,87) P81	
263	(1) 53653.78901.275 0510656513.6539 7307474141.15357290 5037740933. .3 5243674932 4038579121.P52	263
265	(1,5,53) 3181.184747 7794073617 4884324451.34493137 0794232249 4318140511.P43	
267	(1,3,89) 850666273.2270061 7220008799 6883997658 3683542421.P39	
269	(1) 10223.262007.116075653.7630 5384036997.29947 0647963251.P83	
271	(1) 3253.8916443.49054 3245624181.270960082 5365281117.P86	
273	(1,3,7,13,21,39,91) 30577.163 6991658121.21 4892035618 2437964673.P31	
275	(1,5,11,25,55) 1210 8337254149 1664042201.P73	
277	(1) 15801743.47 8803193369.P113	
279	(1,3,9,31,93) P86	
281	(1) 563.3373.422063.434989.1000081249.3801 2519036699. .12420 5327610431.5 4361500791 5184215523.23 9721223634 4676495763.P38	281
283	(1) 133227911.1830824353.30 6487563493.125760294 3398454563.P88	
285	(1,3,5,15,19,57,95) 5731756981.P60	
287	(1,7,41) P115	
289	(1,17) 44507.1088953.P120	
291	(1,3,97) 189733.1693621.80640757.18481268 4901540537.P55	
293	(1) 587.6491161205 1881874971.P117	
295	(1,5,59) 739861.31 1834125441.12437049 7539714276 1851514391. .15 8007579827 3811372853 1939755751.P35	295
297	(1,3,9,11,27,33,99) 1182737161.7899901813.37023 1459035769.P53	
299	(1,13,23) 599.10997221.288638107 3947332989.86 6196571451 2154562493.P76	
301	(1,7,43) 8127001.92 1928537909.315751 1069077510 1163983809. .29546962 8334737033 9434959009.P49	301
303	(1,3,101) 1213.46 4114346100 9716702610 3035487898 1449019613.P51	
305	(1,5,61) 65881.491 9054377091. .4 6229214937 0489759011 7573220711 7334435811.P57	305
307	(1) 1061054224 2923144869.12093 5840335015 3553775181.P104	
309	(1,3,103) 1237.16069.P90	
311	(1) 3733.1 2460588823.8 7306950204 1694941443. .224 1207330424 8506685860 8236118508 1412667449.P72	311
313	(1) 2370037.3 7598977521 5365330294 1126019779. .271467 5534408576 0464093169 8215106830 3918417599.P67	313
315	(1,3,5,7,9,15,21,35,45,63,105) 1571221.P63	
317	(1) 349 3595928049.1990574 4004289816 3364095413.P113	
319	(1,11,29) 3191.11 3164935467.2 6425387421 4904711887 9373476317 7943613329.P79	

321	(1,3,107)	3853.6421.127 6775957917.P82	
323	(1,17,19)	647.1600789.39039719.2913 4285181591.P108	
325	(1,5,13,25,65)	2175 2026148805 6211634951. .27612 4011614962 6792553752 4217847751.P57	325
327	(1,3,109)	122953.1340701.5 5471745029. .714322353 8312838909 0355926573 5120995717.P43	327
329	(1,7,47)	659.16451.9 4041956807.P114	
331	(1)	1581832451.1 6312845121. .53065446 4353667468 0921694512 4588874436 5152829791.P91	331
333	(1,3,9,37,111)	1179099721.262835417 3876461837.P76	
335	(1,5,67)	279111 0259168381.P111	
337	(1)	8089.33 8861091937.73 6092762241.P134	
339	(1,3,113)	5 1017244973.28327488 7324515433.P79	
341	(1,11,31)	4093.94845460 4017084448 1070590623.P112	
343	(1,7,49)	24697.385540919.4551588049.846572831 0029191083. .234 5144689656 0788630183.323 1201526560 9073916797.P54	343
345	(1,3,5,15,23,69,115)	1381.9661.31741.6784081.76675561.P58	
347	(1)	291481.115 0057146229.18549 8348145073.32800315 3456707623. .2091201080 0475074747.33844 4484846428 4605409520 2148071217.P63	347
349	(1)	9404285088 9984510998 2891523204 3854179853 2018021653 95628374\ 11 9321165402 5280185459.P87	349
351	(1,3,9,13,27,39,117)	244297.50345 7454452889.P83	
353	(1)	509027.408 8777503007.P150	
355	(1,5,71)	734346611.668 2415759518 6257988571.P102	
357	(1,3,7,17,21,51,119)	2000145949 1011594009.P73	
359	(1)	719.16 9998846011.4709 2089922710 7034926837. .419962 9082558286 3451929997.278 2524683350 2949950082 0080150443.P76	359
361	(1,19)	103969.930643561.154467980 2763873663. .2124 4207651812 9661950839.6758735105 9571562939 6212612371.P78	361
363	(1,3,11,33,121)	1453.49369.31228 4816501197.4600793127 1317089317. .13 7778316892 1566387641.P42	363
365	(1,5,73)	1030031.14 7287451232 3892527561. .1 5473894391 5325955520 3314631096 1760609845 0974126281.P60	365
367	(1)	11665463.667804211.13767321 8986445617.18912058 5817572803. .4123446604 2798529583. .15 1149525784 0070716998 8656940229 3793503992 8231350493.P54	367
369	(1,3,9,41,123)	176721 0188478589.P100	
371	(1,7,53)	743.184857976 0700244247 1500555321. .171 7767299415 9234619140 2074920387 0763105521 2708408339.P66	371
373	(1)	298 5102182914 3310461628 3959755194 4594782446 2348756933 2624\ 663314 4966957389.P106	373
375	(1,3,5,15,25,75,125)	878841 6011598893 3758085617 1754300128 0896024501.P50	
377	(1,13,29)	433816 9506098819.17 2661075234 7421021849.P124	
379	(1)	21 0917324869.151804 9814692403. .20113 3966998725 3732917345 0769572000 6137727092 5662226533.P100	379
381	(1,3,127)	597409.289672438 8952980361.P96	
383	(1)	23747.2835733.26 3172186419.42 8039526143.99960 7767985979. .1 0853637164 8062411539 9141696533.P104	383
385	(1,5,7,11,35,55,77)	225611.868561. .10758904 5563550849 2058703955 8086313081.P67	385
387	(1,3,9,43,129)	30 8842594561.2 6912336376 0531549673.P89	
389	(1)	51349.1940 4514058063. .15 5730167480 4804850391 2224242515 7980007821 0728172109 9399054521.P107	389
391	(1,17,23)	17987.94214579.283744 2021361921.11 3631062467 4027548741. .17 2013233176 8569247939.726 4376050753 6226775553. .947 8134542846 9754529296 7550627029.P42	391
393	(1,3,131)	20835 7422743294 1258356498 3277967503 8562305610 5089493677.P70	
395	(1,5,79)	5531.2310403 6107370941 3931057501.64349432 9143676936 6927146921. .157266442 9740716254 1884251721.5 4788284093 2821605655 8228587181.P32	395
397	(1)	366829.2233523. C178	397
399	(1,3,7,19,21,57,133)	49279693.1068595417.8907619982 8580322541.P67	

401	(1) 90932 8968322000 8692689116 4728383761. .5865500 9739360607 2943115498 8451238023.P120	401
403	(1,13,31) 12167 4645534469.143924553 1309681223 9313539411.P130	
405	(1,3,5,9,15,27,45,81,135) 155521.285121.282 0618974881.P80	
407	(1,11,37) 18354073.186240044 9807666627.P147	
409	(1) 20720759.1 4572485139 0704755159.1492019 3533330125 0525828683.P142	
411	(1,3,137) 2115829.634432753.685934341. .113 9388291348 8022495414 2892526477.P74	411
413	(1,7,59) 827.4957.48301177.3 6643803252 8092142507. .3721114 3592148741 5423131988 9680078283. .3769875 4823547437 1888830254 4867582005 1387027651.P48	413
415	(1,5,83) 363541.1333811.223210122 3348881982 9203441926 3747875011.P107	
417	(1,3,139) 43302949.2016598657.2013601123 8172476709 6677592621.P86	
419	(1) 839.59 6113491371.21515060 5305873583 8822709777. .6548858914 7614101616 5461375447.1593 2047940952 3134849188 0857761413. .496097 1340875216 4639661893 5298341361.P59	419
421	(1) 1206587.6804488281.12 9208238531.302896 4523574056 4742379791. .46356940 6247659963 6809044531.10722 2714755538 0448222798 1559844589.P87	421
423	(1,3,9,47,141) 55837.57529.27115993.35675821.P108	
425	(1,5,17,25,85) 49354 9578424915 6950998027 4834655501. .445538977 3129571534 8592319032 2961189401.P80	425
427	(1,7,61) 9 8386025627.56 2686760931.844 0457044844 4086183953. .35560688 4187122505 4499505739.P99	427
429	(1,3,11,13,33,39,143) 2175889.6413 9087689249.1 0330459914 4666396621.P75	
431	(1) 863.31033.	C198 431
433	(1) 218233.79453 1651250141 3421855357.61522507 1375846114 8996890901. .3336469 6150608633 9336330519 5427888169.P112	433
435	(1,3,5,15,29,87,145) 3411 8036879281.2214857 1105259456 4349712441.P68	
437	(1,19,23) 440014023 9259780643.1562714938 6345831933.	C151 437
439	(1) 329834659 1256657182 1412548179.P181	
441	(1,3,7,9,21,49,63,147) 220427792 9951182849. .4 0788843142 6111186599 6005834462 8771163410 1230416829.P52	441
443	(1) 887.298583.44457709.213177803.	C187 443
445	(1,5,89) 47 7126751861.291233 3801178961.P141	
447	(1,3,149) 17881.P137	
449	(1) 14112071.88 1733955481 8836643818 9921318359.	C175 449
451	(1,11,41) 47807.6704567.529 5342260891.	C167 451
453	(1,3,151) 2689557037.2 0851551949.882469121 5488669109. .22102 5298679097 8093597221.P80	453
455	(1,5,7,13,35,65,91) 911.38 6134706231.224780989 0905959594 5200318151. .1435809872 1335061276 9699274854 9282318301.P57	455
457	(1) 17 6540143789.1097 6741555411.79011276 8389761097. .44526 9165286661 5264275724 7913322427.P141	457
459	(1,3,9,17,27,51,153) 3673.23 0736771829.88 9501314241. .117867 7281477587 7294179029.122 2177546763 2653120010 6433310349.P54	459
461	(1) 11987.11816456 8780375261. .120 3473922272 3039662822 3644533779 2145487543.C157	461
463	(1) 11113.83341.155569.176 7202459333.P195	
465	(1,3,5,15,31,93,155) 146941.4307761.618458289 1232396881.P85	
467	(1) 2783 6167022857.P210	
469	(1,7,67) 1306456 8572319273 2933134168 2365113787.P153	
471	(1,3,157) 952329919 6159010516 1615580822 3368923119 9818916357 1236402837.P90	
473	(1,11,43) 947.181 5542308537.12 6118323579 5048844037. .201 9720844909 4114683600 6403755873.P132	473
475	(1,5,19,25,95) 2057701.449008024 3969653901.P147	
477	(1,3,9,53,159) 3 9365302681.9544581 2049221683 7136711901.P112	
479	(1) 2017549.5213 3736060349.25762059 8280719473. .10332092 1853281948 8876650572 8921146249.P154	479
481	(1,13,37) 709957.	C201 481
483	(1,3,7,21,23,69,161) 696032619 7271909185 6659473096 8478467309.P88	

485	(1,5,97) 971.145501.228363878 7489645173 4446934241. .163 1354119648 5791712788 0147033711.P115		485
487	(1) 1 2364016389.	C222	487
489	(1,3,163) 107581.P150		
491	(1) 983.24551.84412401 6018569089.1 5544738533 5258570051.P189		
493	(1,17,29) 13576907 2957854733.	C197	493
495	(1,3,5,9,11,15,33,45,55,99,165) 35669701. .370 7305577074 2955860149 6693579435 8188994208 3408919721.P55		495
497	(1,7,71) 3984424151.43254 7838166529.130956797 2706389369. .4 2869282346 9180744251.138 7299857392 1896220953. .785010 9135237017 3950798567 1014620709.P80		497
499	(1) 1919016277.71633209 3275045781.1 1455131577 9689543877. .322428677 6262670770 2019834661.1242829 5284327794 0819674798 4311772979.P126		499
501	(1,3,167) 218437.4769521.77732462 4268955461.1201536765 8187607573.P110		
503	(1) 7043.12073.3 0311006351.416922659 6195242450 6975231211.P193		
505	(1,5,101) 205031.373293 8536661701. .276878 5874468805 9298907596 6008807841.P135		505
507	(1,3,13,39,169) 13*.2624233.58 0460684077.1395 6160423453. .52 4214858847 3376340853.P95		507
509	(1) 1019.7127.54973.97729.14495303.324927277. .595618243 7357216776 1652488341. .1408323 5920652656 2122960328 2020508687.P146		509
511	(1,7,73) 16347913.2429424817.212691319 1482456609.P172		
513	(1,3,9,19,27,57,171) P155		
515	(1,5,103) 1031.1 3904017381.	C182	515
517	(1,11,47) 1812 1754584561.1156442 1035953127. .195 8234817480 2515746342 2904654781. .439353102 8249114977 5960216612 4705290731.P120		517
519	(1,3,173) 4153.78539233.590769 4552891069.P137		
521	(1) 39400482 2498482103.11131528 7154708327 6871904557.P204		
523	(1) 8321977.4613832781.	C233	523
525	(1,3,5,7,15,21,25,35,75,105,175) 81901.21810 9434619328 3895070901.P86		
527	(1,17,31) 592116121.608 0570194421 9890543261. .35323611 4003997309 9443831088 6415603767.C160		527
529	(1,23) 259211.	C237	529
531	(1,3,9,59,177) 3030949.31 8413423593.5248 2008124253. .179197 5880571098 2439288098 8379522349.P100		531
533	(1,13,41) 218531.13847341.193003 7901921949.	C202	533
535	(1,5,107) 5351.18191.467591.1 2476029871.135799169 4228074281.P161		
537	(1,3,179) 4297.7 4935252328 4764318713.85 689325269 5444750981. .47 5397205540 9536870281 0459051367 7195842929.P82		537
539	(1,7,11,49,77) 20483.	C197	539

3+

Factorizations of  $3^n + 1$ ,  $n \leq 540$   
L,M for  $n = 6k - 3 \leq 1077$

$n$	Prime Factors
1	2.2
2	2*.5
3	(1) 7
4	2*.4 <sup>1</sup>
5	(1) 61
6	(2) 73
7	(1) 547
8	2*.17.193
9	(1,3) L.M
L	19
M	37
10	(2) 5*.1181
11	(1) 67.661
12	(4) 6481
13	(1) 398581
14	(2) 29.16493
15	(1,5) L.M
L	(3) 31
M	271
16	2*.21523361
17	(1) 103.307.1021
18	(2,6) 530713
19	(1) 2851.101917
20	(4) 42521761
21	(1,7) L.M
L	(3) 7*.43
M	2269
22	(2) 5501.570461
23	(1) 23535794707
24	(8) 97.577.769
25	(1,5) 151.22996651
26	(2) 53.4795973261
27	(1,3,9L,9M) L.M
L	19441
M	19927
28	(4) 430697.647753
29	(1) 523.6091.5385997
30	(2,6,10) 47763361
31	(1) 6883.22434744889
32	2*.926510094425921
33	(1,11) L.M
L	176419
M	(3) 25411
34	(2) 956353.1743831169
35	(1,5,7) 374857981681
36	(4,12) 282429005041
37	(1) 18427.107671.56737873
38	(2) 5301533.25480398173



- 39 (1,13) L.M  
 L 157.10141  
 M (3) 79.2887
- 40 (8) 14401.128653413121
- 41 (1) 33703.270547105429567
- 42 (2,6,14) 2857.109688713
- 43 (1) 82064241848634269407
- 44 (4) 89.2382953.56625998353
- 45 (1,3,5,15L,15M) L.M  
 L (9M) 387631  
 M (9L) 755551
- 46 (2) 12553493.70601370627701
- 47 (1) 16921.256057.1534179947851
- 48 (16) 76801.24127552321
- 49 (1,7) 857643277.127522693159
- 50 (2,10) 5\*.101.394201.61070817601
- 51 (1,17) L.M  
 L (3) 613.30091  
 M 129159847
- 52 (4) 2093124281.37644053098601
- 53 (1) 78719947.61557605176233223
- 54 (2,6,18) 150094634909578633
- 55 (1,5,11) 659671.24472341743191
- 56 (8) 113.19489.36214795668330833
- 57 (1,19) L.M  
 L (3) 3079.53923  
 M 1162320517
- 58 (2) 12413.37945127666529000523013
- 59 (1) 3187.1108439448677340328268341
- 60 (4,12,20) 241.298801.26050081
- 61 (1) 367.86630432442539925437931403
- 62 (2) 1403808961.2860659169.9500438809
- 63 (1,3,7,21L,21M) L.M  
 L (9M) 127.883.2521  
 M (9L) 550554229
- 64 2\*.1716841910146256242328924544641
- 65 (1,5,13) 105919308797935444986721
- 66 (2,6,22) 13490012358249728401
- 67 (1) 5390821.4299412981246169975118907
- 68 (4) 137.6458150122561.3833564416504313
- 69 (1,23) L.M  
 L 139.5107.132619  
 M (3) 9109.1476463
- 70 (2,10,14) 28596961.32839661.94373861
- 71 (1) 853.2131.82219.3099719989.4052490063499
- 72 (8,24) 1418632417.56227703611393
- 73 (1) 439.38488154120055537150068589763279
- 74 (2) 149.953861.142659759801404920771391593
- 75 (1,5,25) L.M  
 L (15M) 26251.119101  
 M (3,15L) 2551.1530601
- 76 (4) 761.31769.3302353.278733912072436804273
- 77 (1,7,11) 56495392933101222275861053369
- 78 (2,6,26) 325729.271722723752757889
- 79 (1) 66361.327220181191.567239060331150635317
- 80 (16) 8194721.700984481.597747428754241
- 81 (1,3,9L,9M,27L,27M) L.M  
 L 163.208657.224209  
 M 1297.5879415781
- 82 (2) 2088869.110767897.574933708017116710865237
- 83 (1) 499.997.2466097.813201725710097952736361977

- 84 (4,12,28) 337.673.1009.167329.2108826721  
85 (1,5,17) 1531.224401.132 7136225783 2586268931  
86 (2) 173.470593.2641485701.5 5473422113.90 3239908009  
87 (1,29) L.M  
L (3) 261697.37464463  
M 349.142159.1383301  
88 (8) 6922081.1565 6839738849.136362013 7403810529  
89 (1) 264331.1125706177.24443226 4141533135 5533344283  
90 (2,6,10,18,30) 176401.45280844 1334403281  
91 (1,7,13) 8737.595141.235 4116499281.245 2788561133  
92 (4) 1289.743170846 3054117564 4782850494 1347481129  
93 (1,31) L.M  
L (3) 8823 9050462461  
M 373.541447.3058399  
94 (2) 56 3838649753.125 3842831322 0526578547 7849439329  
95 (1,5,19) 39901.2 9574984661.2534995630 7509384561  
96 (32) 7297.68737.96948097.7061 3232600577  
97 (1) 459991849.50 3803759819.205916 0392685737 7806745611  
98 (2,14) 197.16661.251325313.42 6712077457.3401 3149495921  
99 (1,3,11,33L,33M) L.M  
L (9L) 199.4357.337448233  
M (9M) 397.37 8450588583  
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- 138 (2,6,46) P43
- 139 (1) 2 6436515641.11 1362650620 3380968993.P35
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- 143 (1,11,13) 53197.P53
- 144 (16,48) 7782 6286120321.P32
- 145 (1,5,29) 59086051.2 5481953741.315942 1788711031.7645579624 3959454561
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- 151 (1) 472027.645979.135286639.P52
- 152 (8) P69
- 153 (1,3,17,51L,51M) L.M  
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- 155 (1,5,31) 1861.3313155 5630426311.31862042 1994509961.1 2146298245 1478217731
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- 157 (1) 252457.15942052 4134654609.321294 3433747504 9222622287.P27
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- 162 (2,6,18,54) 8243461939 4313344569.P32
- 163 (1) 8483499631.49 5647059198 0320134353.P46
- 164 (4) 41\*.2297.32326369.P64
- 165 (1,5,11,55) L.M  
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- 167 (1) 4 1332144291.19 6098784741.P58
- 168 (8,24,56) 13441.P42
- 169 (1,13) 4057.351859.733693 2438768271.P50
- 170 (2,10,34) 7674481.P55
- 171 (1,3,19,57L,57M) L.M  
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- 173 (1) 993367.14427163.12533 0011023211.15602641 7563831897.P38



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264	(8, 24, 88) P77	
265	(1, 5, 53) 43620060 3555041251.45023598 0033427820 9442352001 2240471861.P45	
266	(2, 14, 38) 144173.17837429.7755867337.71 9738936617.P69	
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275	(1, 5, 11, 25, 55) 669901.1067981089 6242619199 7633771900 9583271701.P51	
276	(4, 12, 92) 4897293 1186135304 7590941283 5121446993.P48	
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336	(16, 48, 112) P92	
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363	(1, 11, 121) L.M	
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	M (3, 33M) 959773.P47	
364	(4, 28, 52) 103793 1263948489.2699198977 4201983441. .80202 6805200667 2644765857.460991 2148703593 8900247761.P53	364
365	(1, 5, 73) 5391 6798151651.P124	
366	(2, 6, 122) 4315877857.912090 4794443833. .1514238 3899497189 5970075186 6370326369.P53	366
367	(1) 2203.127717.1684531.237844627.1663595587.P143	
368	(16) 5153.359750177.405709 1512834561.P141	
369	(1, 3, 41, 123L, 123M) L.M	
	L (9M) 2953.5167.21328201.108348733.3137764 2884995717.118525642 9685687017	
	M (9L) 739.3691.379333.14486905 8547782823.P29	



370	(2, 10, 74) 438 1676976961. 27 5073912489 1405236961. .27 9481701520 7363367454 7788754515 2354693836 5257447941. P52	370
371	(1, 7, 53) 1635876271. .14476 9058919458 5103200603 5757941878 6398249085 9076589087. P86	371
372	(4, 12, 124) 1489. 8929. P108	
373	(1) 23051401. 47264323. P163	
374	(2, 22, 34) 1 9811626811 7793364489 3386577644 4612053732 9949975671 1793291673. P93	374
375	(1, 5, 25, 125) L.M	
L	(3, 15L, 75M) 751. 1328097751. 2 1064949251. P26	
M	(15M, 75L) 19315501. 396984751. 10 4194346251. 6 4506329835 0892992751	
376	(8) 3 4661148934 2975094643 1810917457 7647787217. P136	
377	(1, 13, 29) 20359. 235625297 5255061850 9706405404 4982424373. .15 2331777159 6322836437 0910668786 3619142669 4214726481. P67	377
378	(2, 6, 14, 18, 42, 54, 126) 46652761. 1 7135190577. 19205 9200375688 9342201617. .13281797 9467416281 3276442193. P34	378
379	(1) 54577. 404773. 1 6367342401. 1364267766 2261846929. P141	
380	(4, 20, 76) P138	
381	(1, 127) L.M	
L	(3) 2287. 9044179. 239803687. 11523406 9559915311. 9822 6629000258 3483831641	
M	25312879. 4175 7061638619. 39916 4334498031. 93148 5600498622 3962601399	
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383	(1) 16087. 66643. 2665075 5183610275 4532873191. .35548 3442078915 6304338960 5694229601. P113	383
384	(128) 96562177. 1 4674490535 9829703705 4624388609. P84	
385	(1, 5, 7, 11, 35, 55, 77) 267961. 8671391191. P100	
386	(2) 773. 10037. 383882275 3555017509. .5 8830475411 2883678447 4215520186 2596737166 1805985600 4866883157. P97	386
387	(1, 3, 43, 129L, 129M) L.M	
L	(9M) 2714419. 145 6674304231. 1845670 0293426547. P26	
M	(9L) 113779. 219461509. 2877580297. P38	
388	(4) 3881. 1371903593. 1589 3923613753. 8224 6428662353. 355701 2689748017. P128	
389	(1) 9272983. 1 0481906411 1378773911. P159	
390	(2, 6, 10, 26, 30, 78, 130) 29641. 4598 7689333080 7555241601. .25 6034790489 8140291876 7053418641. P33	390
391	(1, 17, 23) P169	
392	(8, 56) 4013297. 14 6474084177. 38024402 0587260397 4671499998 2993724241. P105	
393	(1, 131) L.M	
L	1059084 2001576743 3134846003. P37	
M	(3) 751 8277682653. 10801 1509521661. P35	
394	(2) 4729. 3769069 5169559602 3389047257. 267492722 4569187085 6668118709. .3468634 7429027819 7160179226 2323656541. P92	394
395	(1, 5, 79) 1512896611. 22471 0401159091. 9055134918 2041304581. .2482311 9671322298 2912577249 3069685781 4714635721. P60	395
396	(4, 12, 36, 44, 132) 3169. 202753. 251857. .64059 8969316888 3922895108 6903228995 4861745217. P56	396
397	(1) 2383. 20750 0138140457 4195288577. C162	397
398	(2) 797. P186	
399	(1, 7, 19, 133) L.M	
L	(21M, 57M) 101347. 68484 3574367443. P32	
M	(3, 21L, 57L) 22536 8649712249. P38	
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401	(1) 67369. 90728 4546446671. P171	
402	(2, 6, 134) 102913. 2450593. 359904169. P107	
403	(1, 13, 31) 1380679. 5643613. 58505186 1510921949. 1171444424 2841726569. P123	
404	(4) 809. 19383113. 9582 2765807521. 2045949 9102752483 3661928649. C141	404
405	(1, 3, 5, 9L, 9M, 15L, 15M, 27L, 27M, 45L, 45M, 135L, 135M) L.M	
L	(81M) 811. 8101. 199 6174311913 5831696601. 257 8322796210 3389358961	
M	(81L) 4051. 21871. 1 8229028941. P34	

406	(2,14,58)	29*.11575061.527408617.6993945340 0809619397.P124	
407	(1,11,37)	10516 5858391660 3554691273. .3893975392 3942349791 7705875902 6329248057 1631125599 3968038353.P89	407
408	(8,24,136)	6529.40801.205633.38 5090502977.2622 6987237313. .41354119 7617738591 0417311937.P56	408
409	(1)	4499 0594652186 0298675348 2277322389.	C161 409
410	(2,10,82)	821.48481 7063231279 9574471537 7307892089 3674467718 855\ 6928212 7854094521 8943780321.P76	410
411	(1,137)	L.M	
	L (3)	4111.5729341.42526171.P47	
	M	823.236737.435441 4202063707.P42	
412	(4)		C195 412
413	(1,7,59)	7842871.56306 4170179125 2401779091. .166504 4823061670 8601288427 1297249970 8964087426 7332635238 8419438037.P70	413
414	(2,6,18,46,138)	P126	
415	(1,5,83)	2514291180 0287768941.540057 0497228615 2865526836 3133642241. .2680 6927832383 5106581968 0276840547 0120785821.P59	415
416	(32)	4993.P180	
417	(1,139)	L.M	
	L (3)	283424059.1 0609220593.P47	
	M	7507.5699 7555455089.P49	
418	(2,22,38)	389877797.655485029. .2534443310 3299980839 3913682337 6913635978 4966146017.P105	418
419	(1)	105821803.351391142 1453530857.	C173 419
420	(4,12,20,28,60,84,140)	162410641. .12 0269035510 4239137746 7167792800 7008342081.P43	420
421	(1)	47610049.5 0211565461 3630819781.P172	
422	(2)	7670841701.22387337 4213734957.	C174 422
423	(1,3,47,141L,141M)	L.M	
	L (9L)	115587289.P58	
	M (9M)	1693.5077.P59	
424	(8)	10177.3866289 1961096369.92 1944620625 5272753793.	C156 424
425	(1,5,17,25,85)	43 3452873332 0723137260 4231559752 2124552527 7078805593 3177518001.P92	
426	(2,6,142)	586611 7885007113.173421781 5959742035 4920598611 1838880593.P80	
427	(1,7,61)	7687.4143 0759177008 7139357807 3601501739 9172186159.P125	
428	(4)	857.344969.1638707569.5518555817.P175	
429	(1,11,13,143)	L.M	
	L (33L,39L)	859.20593.33531499.P43	
	M (3,33M,39M)	1680823.2 0734454782 8773831191.P32	
430	(2,10,86)	10321.P157	
431	(1)	56893.93097.400 4945559757.P183	
432	(16,48,144)	295548481.17558 3305105982 6262077377. .49 6666813922 4533741291 8788359561 2533403009.P63	432
433	(1)	5197.25981.1 0986786121.2545 6411101231 8168303877 7028652229. .4078872265 9547529901 9820596411 3561121059. .487198 0217050296 4448205757 2922940672 1583796327 5487416471.P60	433
434	(2,14,62)	6901360369.2 0367228533. .12 2071152215 5420008997 3694506383 7803793849. .74755 0150409735 2391068612 5964808828 9633705094 7716562757.P56	434
435	(1,5,29,145)	L.M	
	L (15M,87M)	1741.241485153 2956058641.P32	
	M (3,15L,87L)	117732751.176 9737810303 4098194871.3434 7704879594 4439672921	
436	(4)	679 7644660321.	C194 436
437	(1,19,23)		C190 437
438	(2,6,146)	73*.1753.277 9774652737.9351 8312848897.23387 1539094553. .339342 5731509203 5052192529 1350005172 9653155129.P47	438
439	(1)	13171.2724377809.P196	
440	(8,40,88)	881.8665361.1695 7699255201.18671837 9800641041.P113	

441	(1, 3, 7, 21L, 21M, 49, 147L, 147M) L.M		
	L (9L, 63M) 7057.50987787 1418877193.P39		
	M (9M, 63L) 9 8502708151.1223133 5108297593.P34		
442	(2, 26, 34) 15913.469162 8515400581.4613549991 4463796800 7494516453.	C134	442
443	(1) 163897597.1564046941.8223046627. .2138789 4903954968 8200498840 6468166957. .12 1903715323 3231249505 1231590589 2210073619.P107		443
444	(4, 12, 148) 1777.26641.3118657.3001750 8771174721. .623143 7011177476 0591818641.5470240 0492789876 3001725441.P55		444
445	(1, 5, 89) 2671.387151.2406276091.113 7421775551. .1 6921751616 9782452347 2176854691. .7404003964 8368445301 6635136785 8325937021.P68		445
446	(2) P212		
447	(1, 149) L.M		
	L (3) 15199.P67		
	M 1789.1888129.1533661 6994395573.P46		
448	(64) 9857.P180		
449	(1) 490309.P208		
450	(2, 6, 10, 18, 30, 50, 90, 150) 444729601.P106		
451	(1, 11, 41) 3447 0854184059 3714474142 9325166536 1355258439.P148		
452	(4) 567550405 5555452009.	C195	452
453	(1, 151) L.M		
	L (3) 907.124123.1112112283.812 4780428931 0388928683.P32		
	M 527707 4253352507.87276 4883169167 7022518793.P32		
454	(2) 34622041.1 5911582689 3295896177.P188		
455	(1, 5, 7, 13, 35, 65, 91) 8191.1163162 3231051226 0008605351. .232 6772857561 3078082503 4268661441. .4146529 4801410855 5285696033 1478872471.P39		455
456	(8, 24, 152) 3607 5741132577.19384079 5905614047 8925730113.P97		
457	(1) 13711.3 5545368601.P203		
458	(2) 19039061.P211		
459	(1, 3, 9L, 9M, 17, 51L, 51M, 153L, 153M) L.M		
	L (27M) 889321681.P60		
	M (27L) 54163.78031.1309455397.P50		
460	(4, 20, 92) 207893 0296693441.P153		
461	(1) 29790 5117118757.1092507454 9964550223 6209994501.P176		
462	(2, 6, 14, 22, 42, 66, 154) 80554321.848 6679729529.2674 6675457856 4573944913.P71		
463	(1) 6 1490892007 7491091197.	C200	463
464	(16) 929.5569.22273.218081.1330317697. .706859 6009480324 1918468195 8214604001.P153		464
465	(1, 5, 31, 155) L.M		
	L (15M, 93M) 103 4275595120 7581907331.P35		
	M (3, 15L, 93L) 31*.86491.368007511.3366573961.1 1053051861.P24		
466	(2) 373300 8450772109.3240344 4713283317 2294865909.	C180	466
467	(1) 2803.70051.109279.910829329.2670 8093498791. .365 4859061846 7087946411.P164		467
468	(4, 12, 36, 52, 156) 1873.6550129.1179103537.280 6926872257.P106		
469	(1, 7, 67) 433357.6343 6321186255 4720034763. .178106 0836216605 2244563493 6018175969. .74687736 9350579418 3998739424 5443159578 0924233987 1631765809.P67		469
470	(2, 10, 94) 941.19857447 1781867981.2308 8848006055 8520166964 3273722801.P122		
471	(1, 157) L.M		
	L 3769.15073.1784 1610629967.P54		
	M (3) 207241.366439.60823 6750751538 9017346631.P39		
472	(8) 4721.50033.322849.6728833.17266 7088595999 7098473137.P177		
473	(1, 11, 43) 17029.771937.	C191	473
474	(2, 6, 158) 43609.140144737.3363 4269059857. .99013 3959353211 4183715940 7448042998 3472483593.P78		474
475	(1, 5, 19, 25, 95) 21 1442241001.863 3531821351.1148 3171111101. .685897867 6339837818 2263352281 9673527898 9366499151.P86		475
476	(4, 28, 68) 953.12377.169 7906858240 6612342641.	C154	476

477	(1,3,53,159L,159M) L.M		
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M	(9L) 6679.P71		
478	(2) 5737.585073.98741192453548571832043875807001. .275079728776659654087282311943749255119521753433.C139	478	
479	(1) 158071.7167757.7759574882776161031.	C197	479
480	(32,96,160) 16753580048641.P109		
481	(1,13,37) 418471.P201		
482	(2) 41453.2024047465201.189787159988574015580249. .12366450788131699422047519161.P161		482
483	(1,7,23,161) L.M		
L	(3,21L,69M) 110518527466568527241514727.P38		
M	(21M,69L) 300427.4648427619401077.P42		
484	(4,44) 359129.2396144957913940993.1718605451591840592561881.P162		
485	(1,5,97) 34943262090580584961588238939911.	C152	485
486	(2,6,18,54,162) 139969.6858433.289852621958953. .748477597621757461034460325306597570139487404598795720554449.P69		486
487	(1) P232		
488	(8) 977.17569.6201778675681.102893413314660553505033526892798001.P174		
489	(1,163) L.M		
L	(3) P77		
M	P78		
490	(2,10,14,70,98) 10781.11139181433126881.42616540594017306841. .1939897538167586914233386033412974841301862291509811887541.P64		490
491	(1)	C234	491
492	(4,12,164) P153		
493	(1,17,29) 11833.	C210	493
494	(2,26,38) 3131049661742425528068232396297.P176		
495	(1,3,5,11,15L,15M,33L,33M,55,165L,165M) L.M		
L	(9M,45L,99M) P58		
M	(9L,45M,99L) 2971.650229042030120136981.P33		
496	(16) 135752657940481.29572149681736256801. .14697881508142957864698198881.C168		496
497	(1,7,71) 23857.1010899.	C191	497
498	(2,6,166) 15937.6623401.7160040632843551703449. .216620436604313043566475914989777. .3827781058655183126205789289853376790116016057.P46		498
499	(1)	C238	499
500	(4,20,100) 150001.292503690001.36502594199089001.P158		
501	(1,167) L.M		
L	8017.44089.P72		
M	(3) P79		
502	(2) 1017977689.P230		
503	(1) 3019.36217.148601137514445965937491402579869.P200		
504	(8,24,56,72,168) 2017.3340002808701217.P119		
505	(1,5,101)	C191	505
506	(2,22,46) 1013.163383816509.	C196	506
507	(1,13,169) L.M		
L	(39L) 1123288921.P66		
M	(3,39M) 2004679.23944746073.57337058923.677975281092877.P33		
508	(4)	C241	508
509	(1) 39115633.1644550169868135799.	C217	509
510	(2,6,10,30,34,102,170) 1221260165462288630183115844288801. .28035931589952039775691912430255721.P55		510
511	(1,7,73) 3067.14980477.118595256151.595010167626673. .811585543251277560120467057191.3865306830584167073127171461490704904967. .10793217203542650706249328961410064151855304581.P55		511
512	*.134382593.22320686081.12079910333441.100512627347897906177.	C193	512
513	(1,3,9L,9M,19,57L,57M,171L,171M) L.M		
L	(27M) 13339.2370225727729.18922857792733.P48		
M	(27L) 2053.796177.36441469.366009862219342685069818843.P34		

514	(2)	149789881.1391013511 9037034721.	C217	514
515	(1,5,103)	3490445461.	C186	515
516	(4,12,172)	3078 3585638170 6655023029 4877573355 3745441793 3070976\		
		260 0363328216 1500251889.P87		516
517	(1,11,47)		C220	517
518	(2,14,74)	1230769.979486201.3 4380007061.	C181	518
519	(1,173)	L.M		
	L	(3) 1039.89269.3420017971.4 8064711119 3166117297.P44		
	M	1 6420688749.P73		
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		.812 2589491866 4808937256 9344417399 1689595601.P52		520
521	(1)	162553.842145186 0752373577.	C224	521
522	(2,6,18,58,174)	2089.5795 1947043609 5816296129.		
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		.2738 0528417882 5576861122 7564712946 1671050857.P57		522
523	(1)	1146386713.P240		
524	(4)	1049.177113.	C240	524
525	(1,5,7,25,35,175)	L.M		
	L	(3,15L,21L,75M,105M) 12571651.368748451.1 0926062701.5 2316163901.P21		
	M	(15M,21M,75L,105L) P58		
526	(2)	36821.P246		
527	(1,17,31)	619753.8 5310191396 4277975211.P203		
528	(16,48,176)	2113.59207 0831406883 0278113737 9380689029 4756873473.		
		.26270733 7319860778 2564265947 2435411723 2793156673.P58		528
529	(1,23)	P242		
530	(2,10,106)	1061.2660013821.3976724621.72 5413727484 1765833361.P155		
531	(1,3,59,177L,177M)	L.M		
	L	(9L) 1953 8371812403.P70		
	M	(9M) 1063.59473.174169.P70		
532	(4,28,76)	56708009.57 3459238801.P187		
533	(1,13,41)	1 8795926994 2189179513.42142 1222539025 5809011297 2368111079.C175		533
534	(2,6,178)	46993.741193.2706313.15733777.42487177.		
		.1 2051201553 2869945521.891 4513728464 3184873516 2460907849.P84		534
535	(1,5,107)	P203		
536	(8)		C252	536
537	(1,179)	L.M		
	L	25921693 8551414773 0111519261.P58		
	M	(3) 16111.556332001.2192254171.5 0184671268 6893762203.P42		
538	(2)	26 2192073059 5608239277.	C235	538
539	(1,7,11,49,77)	78252580 4283438601.282 1773462138 9695902213.		
		.540 3248848002 3447217247 4265352251.P128		539
540	(4,12,20,36,60,108,180)	P138		
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543	(1,181)	L.M		
	L	1087.551689.19200481.5 1815235259.P60		
	M	(3) 16617973.3364378 9547415373.137056 7529930144 0100413601.P37		
549	(1,3,61,183L,183M)	L.M		
	L	(9L) 668569 7047209949.P71		
	M	(9M) 222733945 8166602220 3950859117.P58		
555	(1,5,37,185)	L.M		
	L	(3,15L,111M) 4441.1487523211.120279530 0401566511.P39		
	M	(15M,111L) 1107781.17939821.79705 3985929838 8628345851.P30		
561	(1,11,17,187)	L.M		
	L	(3,33M,51L) 1123.P74		
	M	(33L,51M) 1 1849045357 7585218795 5082288041.P46		
567	(1,3,7,9L,9M,21L,21M,27L,27M,63L,63M,189L,189M)	L.M		
	L	(81M) 28408969.P70		
	M	(81L) 2305458 7993795681.P61		

- 573 (1,191) L.M  
 L 2293.7744669.36128797.18 2167354724 3978116789 0822031947.P43  
 M (3) 515701.472343383.2860788451.2918238 6445021501.  
 .19 7168881913 9946257137.P29 573M
- 579 (1,193) L.M  
 L P93  
 M (3) 12739.251287.P82
- 585 (1,3,5,13,15L,15M,39L,39M,65,195L,195M) L.M  
 L (9M,45L,117M) 40763971.13482 5306053231.P48  
 M (9L,45M,117L) 16381.P65
- 591 (1,197) L.M  
 L (3) 10639.1950368 3851411374 8972287141.P63  
 M 4305 0380402116 2564249547.P71
- 597 (1,199) L.M  
 L (3) 11941.188653.334 7561789826 7731167713.P63  
 M 29851.1319 2248510319.6 6344717601 6922740823.P57
- 603 (1,3,67,201L,201M) L.M  
 L (9M) 14592601.419046409.57 4307266483.296 0693160319.P55  
 M (9L) 19932769.613 4598978931.45867 4586623531.P60
- 609 (1,7,29,203) L.M  
 L (21M,87M) 101 2563218857.P68  
 M (3,21L,87L) 2437.99877.29 5132983277 6462049641.P51
- 615 (1,5,41,205) L.M  
 L (15M,123M) 113161.1 8428901811.2073 7470706861.P48  
 M (3,15L,123L) 1231.1 5910442371.2 4299529451.37052155 8779523271.P36
- 621 (1,3,9L,9M,23,69L,69M,207L,207M) L.M  
 L (27L) 60 1686824239.P83  
 M (27M) 352381483.1769 2787399887.373808596 0401704053.P55
- 627 (1,11,19,209) L.M  
 L (3,33M,57L) 21319.15 0368908141.3888632195 6825290098 8590466647.P42  
 M (33L,57M) 140449.237150211.P72
- 633 (1,211) L.M  
 L (3) 103813.50165 5861343941.2635 9241641324 2632502019.P57  
 M 210157.1044 3674741443.114491682 9273864340 6007298913.P55
- 639 (1,3,71,213L,213M) L.M  
 L (9L) 83071.2478047 5516004633 9950230315 8935008498 5539501303.P50  
 M (9M) 1279.37874703 3568494391.P80
- 645 (1,5,43,215) L.M  
 L (15M,129M) P80  
 M (3,15L,129L) 1291.2186551.33530971.4691 4743951431.P50
- 651 (1,7,31,217) L.M  
 L (21M,93M) 4085677.90012469.724905427.204 2545894999.P50  
 M (3,21L,93L) 3907.5209.2190 7225905558 3303411259.P56
- 657 (1,3,73,219L,219M) L.M  
 L (9L) 550246699.17 7530280013.1058 9180944779 0049295835 4359420721.P51  
 M (9M) 50283 9510741577.1169423 6886788911 0665870097.  
 .24928735 4564656503 8715607009.P35 657M
- 663 (1,13,17,221) L.M  
 L (3,39M,51L) 29432 2681812589 2905544757.P68  
 M (39L,51M) 1327.577932 8325617809.2274028 9380659761.  
 .5764761 8688514553 8438910347.P30 663M
- 669 (1,223) L.M  
 L (3) 3 7103918837 9643404841 7989052519.P75  
 M 393373.22084360 1603050849 9618943893.1349219496 4124692984 2999472177.P45
- 675 (1,3,5,9L,9M,15L,15M,25,45L,45M,75L,75M,225L,225M) L.M  
 L (27L,135M) 28351.33751.270001.2443501.166148551.P57  
 M (27M,135L) 7373701.4731797 3274744751.100522 9664190408 0110450401.P38
- 681 (1,227) L.M  
 L 4 4816172799.6 4651199444 0639461432 7660870683.P67  
 M (3) 5449.1 3439720233.8808641186 3544059401.13 1004052796 2707397387.P53

- 687 (1,229) L.M  
 L 2749.72823.1021849 3614783823.P85  
 M (3) 374813879071.50856 8707949460 3710866459.P73
- 693 (1,3,7,11,21L,21M,33L,33M,77,231L,231M) L.M  
 L (9M,63L,99M) 34651.9412658641.1 6811532739.53344075 3503058171.  
 .197405996 4778769407.P26 693L  
 M (9L,63M,99L) 347887.450451.6296599.326840715 6648692773 4971544953.P40
- 699 (1,233) L.M  
 L (3) 205507.21664 4478591019.  
 .433 5257933548 0612959689 3525641388 8403027203.P49 699L  
 M 413 1567084277.5842346372 3552958571.P79
- 705 (1,5,47,235) L.M  
 L (3,15L,141M) 8461.1694821.P79  
 M (15M,141L) 663521836 0523583511.497 8747544747 8272436561.P46
- 711 (1,3,79,237L,237M) L.M  
 L (9M) 10 3019069607 5822904523.37 1046268830 4186508633 9016005581.P59  
 M (9L) 1423.631556143 5974972722 8914496979.P80
- 717 (1,239) L.M  
 L P115  
 M (3) 48757.2 7081394032 5189568943.P89
- 723 (1,241) L.M  
 L 48223 1832428981 7291969211.P91  
 M (3) 1447.5578105 0264403179.981545 6238411667 4301868417.P69
- 729 (1,3,9L,9M,27L,27M,81L,81M,243L,243M) L.M  
 L 2917.1 0021812319.7478 9972644573.  
 .128802173 7014121002 9950570765 8931451317.P51 729L  
 M 1459.P113
- 735 (1,5,7,35,49,245) L.M  
 L (3,15L,21L,105M,147M) 145531.498331.51475 8172908631.P55  
 M (15M,21M,105L,147L) 1 4926003681.7479177 2471622991.P54
- 741 (1,13,19,247) L.M  
 L (3,39M,57L) 1483.3173743 4851689997.P84  
 M (39L,57M) 386214835 7607109294 0921575769.P74
- 747 (1,3,83,249L,249M) L.M  
 L (9L) 4483.303283.11370 2119066171.67830497 9257594887 0710879779.P67  
 M (9M) 80677.32521393.3560259 5168256401 4357529129 2143426798 3606166613.P59
- 753 (1,251) L.M  
 L 542392 2557089335 7477659679 7033821670 6551100947.P75  
 M (3) 27 8917009002 6586683751.47303 7260586313 8117902461.P73
- 759 (1,11,23,253) L.M  
 L (33L,69L) 3037.579877.12798259.344800 6837314355 7889186331.P63  
 M (3,33M,69M) 40844827.42062263.P91
- 765 (1,3,5,15L,15M,17,51L,51M,85,255L,255M) L.M  
 L (9L,45M,153M) 3061.9181.42841.3246751801.4 0013904871.P60  
 M (9M,45L,153L) 279991.P87
- 771 (1,257) L.M  
 L (3) 91 3589773688 5657805029.571122 6497438098 1390422735 0343296963.P65  
 M 13879.78643.14 1034621423.1652541216 9864453773 6573602249.P74
- 777 (1,7,37,259) L.M  
 L (3,21L,111M) 83414059.1779148183.16 5773949223.213301 0034304073.P60  
 M (21M,111L) 1740481.12 7076001907.P86
- 783 (1,3,9L,9M,29,87L,87M,261L,261M) L.M  
 L (27M) 13002499.2 0382462097 5729575719.P93  
 M (27L) 1567.35692 1882778817.5939738 8491670817 8275496891.  
 .2 4868303321 0140152047 3942574497.P46 783M
- 789 (1,263) L.M  
 L 104 3280019867.3297434126 9754568228 4696189325 4254237270 7492068847.P64  
 M (3) 1579.4284004 3160337151.13661 8938812095 3923741077 8809936721.P71

795	(1,5,53,265) L.M	
L	(15M,159M) 2519110141.21915 5971856761.35875263 6951732211. .362047424 0298805411.P39	795L
M	(3,15L,159L) 21 9453256125 0465010638 4598423521.P69	
801	(1,3,89,267L,267M) L.M	
L	(9M) 309344599.23 1121501201.14444123 0687236477. .100510604 8692711751.2 0919389913 5109381487.P51	801L
M	(9L) 95665033.2407170521 9862678529. .81 7576445040 6426848759 7596315740 8264856921.P57	801M
807	(1,269) L.M	
L	(3) 51918633 9794068966 8569933101.P100	
M	54877.25588357.9349454929 8854768677. .1667 4345340784 2287750181 6329924811.P64	807M
813	(1,271) L.M	
L	(3) 1627.58537.2230873.847 5830822135 2123383980 6796255183 2652525613.P72	
M	1386 3159773521.620145646 6196684552 6233585639.P88	
819	(1,3,7,13,21L,21M,39L,39M,91,273L,273M) L.M	
L	(9M,63L,117M) 301869 7947220411.3968591167 8305092747.P69	
M	(9L,63M,117L) 7754293.P97	
825	(1,5,11,25,55,275) L.M	
L	(15M,33L,75L,165M) 3301.2113651.12932701. .282136 9164018545 6610664031 3673268951.P44	825L
M	(3,15L,33M,75M,165L) 42888451.102 0438840301.396 1066561651.P64	
831	(1,277) L.M	
L	1663.114679.1630423.1176 5644789597. .11 9504555178 8710232689 8353494744 7527269739.P64	831L
M	(3) 4407 6407438191.P118	
837	(1,3,9L,9M,31,93L,93M,279L,279M) L.M	
L	(27M) P129	
M	(27L) 6532 4650043539.P116	
843	(1,281) L.M	
L	(3) 5059.20233.17 2911911281.137 5848322657.143030 5826530107 9714689773.P77	
M	35407.559041 5520155419.3299263200 0954655799 3324157253. .9 3889530611 6877907849 7879249934 0162064561.P44	843M
849	(1,283) L.M	
L	(3) 25471. .8 3016114663 1408006954 9501904096 7986472092 1052684321 1654301019.P69	849L
M	1699.6793.2312677.159750 1142432086 5742107785 8031669471 0747482879.P77	
855	(1,3,5,15L,15M,19,57L,57M,95,285L,285M) L.M	
L	(9L,45M,171M) 66969 8075470951.31164267 7077889231.P71	
M	(9M,45L,171L) 4634 3064339361.P90	
861	(1,7,41,287) L.M	
L	(21M,123M) 49939.65437.4041278 2566432403. .237114113 8884085837 6555719164 5881523849.P50	861L
M	(3,21L,123L) 1723.454609.121776397.1719933601. .91763 4846841429 2848786084 6109974647.P54	861M
867	(1,17,289) L.M	
L	(51M) 1279693.2795209.5673649.83 4225827263.3707142967 6781111221. .443452 7237563776 3996684787.P54	867L
M	(3,51L) 494191.P125	
873	(1,3,97,291L,291M) L.M	
L	(9L) 1747.19207.4 0809935673 7585867477.P110	
M	(9M) P138	
879	(1,293) L.M	
L	(3) 70321.2297707.5 6267724103.41662 9385310769. .16775194 6286921312 4882198918 8042716237 6891986493.P56	879L
M	17581.162 5466728689.99 5612609941 6515198337.P102	
885	(1,5,59,295) L.M	
L	(3,15L,177M) 1196 6355914190 3028808875 9027416908 8432923151.P69	
M	(15M,177L) 3541.153991.3239558431.6846630811.123399 3275550631.P67	



- 891 (1,3,9L,9M,11,27L,27M,33L,33M,99L,99M,297L,297M) L.M  
 L (81L) 42695729 5383741779 2609635043.P102  
 M (81M) 106921.P124
- 897 (1,13,23,299) L.M  
 L (39L,69L) 52027.129169.7161090906 4105842601.2 0538830572 5186615253.  
 .1451 9259165885 8492795837 1446332297.P43 897L  
 M (3,39M,69M) 19109689.30250418 8071570951 1811071215 4917677307 3635506699.P72
- 903 (1,7,43,301) L.M  
 L (21M,129M) 6045855901.8396466037.P101  
 M (3,21L,129L) 43\*.3613.2 6628205801.3847355158 4154787339.  
 .6 2085835001 0958430897.P65 903M
- 909 (1,3,101,303L,303M) L.M  
 L (9M) 1072218223.8758 7876001150 0587604133.P111  
 M (9L) 34543.89083.301789.881 4142206721.  
 .211524 5411381559 8662873977 3550942557 7692165007.P71 909M
- 915 (1,5,61,305) L.M  
 L (3,15L,183M) 7321.402601.  
 .116 8029083343 6277523654 5105178183 6566199312 8293160111.P54 915L  
 M (15M,183L) 1831.23821111.P104
- 921 (1,307) L.M  
 L (3) 5527.12435343.9 4037544541.415443 6629213099 3379842581.P99  
 M 183 9136588897.P135
- 927 (1,3,103,309L,309M) L.M  
 L (9M) 1 6378714333.24 8791041001.24 6060390942 2278394029.P103  
 M (9L) 3709.7417.667441.1496204418 0614665681.  
 .1514 0038547438 4804001237 6465100350 3396345909.P71 927M
- 933 (1,311) L.M  
 L 11197.6126079.5767346 1824953153.P121  
 M (3) 2375632591.1 5789599377.  
 .240 3609388542 3318631121 8753813861 7537886829.P86 933M
- 939 (1,313) L.M  
 L 58651 9385070354 0120141889.P125  
 M (3) 37561.477013.P139
- 945 (1,3,5,7,9L,9M,15L,15M,21L,21M,35,45L,45M,63L,63M,105L,105M,315L,315M) L.M  
 L (27L,135M,189M) 2 7390932201 1876278491.P83  
 M (27M,135L,189L) 1729 7447591971.62224 4499968071.P76
- 951 (1,317) L.M  
 L (3) 454579.36324397.424203 1875148351.1 1063690835 4198084399.  
 .54951 2115983126 5758559246 4987660127 7813687417.P57 951L  
 M P152
- 957 (1,11,29,319) L.M  
 L (3,33M,87L) 170347.63889321.1073843959.206256 5445871789.  
 .128948319 5503733143.P79 957L  
 M (33L,87M) 28909057.P126
- 963 (1,3,107,321L,321M) L.M  
 L (9L) 7 5319350121.272787099 2921938573.120195805 6381342795 3015581187.  
 .385307277 1514013478 0820983363.P66 963L  
 M (9M) 616321.114798284 2062882883.1301207 2099964685 9863046577.  
 .101890 3915374204 5838694879 9624431573 6990815281.P57 963M
- 969 (1,17,19,323) L.M  
 L (51M,57M) 3877.475441789.P125  
 M (3,51L,57L) P138
- 975 (1,5,13,25,65,325) L.M  
 L (15M,39L,75L,195M) 1951.P112  
 M (3,15L,39M,75M,195L) 5851.12641851.914673296 6527003248 9740651551.P75
- 981 (1,3,109,327L,327M) L.M  
 L (9L) 2063874889.9 1755041113.P135  
 M (9M) 45127.38767159.3399 2611927399.25935 1671880027.  
 .893974 8369206359.30 4318619971 5894155713.P77 981M

987	(1,7,47,329) L.M		
	L (3,21L,141M) 2675 5907602439 1843374758 4855183735 9355828727.P89		
	M (21M,141L) 34519339.55399 8931060051.6 3455377976 3610143347. .184528579 3688520284 2977571159.P60	987M	
993	(1,331) L.M		
	L (3) 1987.617647.4784 0575696854 9949554133.P125		
	M 9103 6793334049. .156904380 9285303951 9623397570 3584287931 3565982819 9624606933.P86	993M	
999	(1,3,9L,9M,37,111L,111M,333L,333M) L.M		
	L (27L) 2615383. .7926159016 6539092135 9533539904 9388177763 7194832352 2457540677.P89	999L	
	M (27M) 1999.7993.4836 6655669261.P134		
1005	(1,5,67,335) L.M		
	L (15M,201M) 2011.73 9828812361.27 0964446809 5958739571. .396067351 9891700360 7412836486 9717451081.P51	1005L	
	M (3,15L,201L) 164 8757425261.11 4930794313 9037344678 7761823650 0915404671.P74		
1011	(1,337) L.M		
	L 10111.47 5422088807. .400176665 9074997433 7826438228 2293973424 0851261265 1846790009.P87	1011L	
	M (3) 2 9676800746 6640363281.1183112 9699419364 8484589397.P114		
1017	(1,3,113,339L,339M) L.M		
	L (9M) 8342589313.91509962 1078019541 3704690512 1821980994 1501498141.P103		
	M (9L) 258319.4759561.42 3195294979.2495 0462084865 5097819331. .1621106284 2493949016 9582722443 5827868515 2181951173.P65	1017M	
1023	(1,11,31,341) L.M		
	L (3,33M,93L) 1 9174858828 3063606455 3345052672 0857649051. .1933 7980565378 1715348899 9309442186 1389450501.P60	1023L	
	M (33L,93M) 8232 5575332463.9 1622610673 7897927533. .1575 1552074299 6366169668 3189664217.P75	1023M	
1029	(1,7,49,343) L.M		
	L (3,21L,147M) 7*.4851705 2647620607.P123		
	M (21M,147L) 374557.596821.4313048 5963642981.90629 4025453882 4227819939. .335 4356969043 8172668508 5632252323 1704213187.P45	1029M	
1035	(1,3,5,15L,15M,23,69L,69M,115,345L,345M) L.M		
	L (9M,45L,207M) 205 4419284023 2981974341 5245416411 1443173905 5519477161.P74		
	M (9L,45M,207L) P126		
1041	(1,347) L.M		
	L 6 8927933233 7391235881 4239820687. .25 4139660710 3142658592 4212227784 3290934557. .202748 9666453382 5806900061 6761946140 9824120037.P49	1041L	
	M (3) 2083.5377807.6 2778629657 7630424677 3749286734 8937820421 5295\ 658825 7467848331 7963541237.P84	1041M	
1047	(1,349) L.M		
	L 627184828 7482534909.P148		
	M (3) 60727.77479.898327.2770820587.460776856 8088467088 485731928\ 9 1152036252 9656858535 0836901963 6063025441.P72	1047M	
1053	(1,3,9L,9M,13,27L,27M,39L,39M,117L,117M,351L,351M) L.M		
	L (81L) 381350269.828864739.14 7709822354 5681576046 6328504017. .2387 9893447642 4843597831 3838909315 5014728859.P63	1053L	
	M (81M) 21061.36 5426184943.P139		
1059	(1,353) L.M		
	L (3) 79615621.23677 1906376385 7822934247. .195570 0614205790 4203104108 8952820573. .50 0258793716 4117486897 9755845082 9549801989.P59	1059L	
	M P169		
1065	(1,5,71,355) L.M		
	L (3,15L,213M) 4261.2236 2247200781.P118		
	M (15M,213L) 63901.432391.153492061.P115		

1071	(1, 3, 7, 17, 21L, 21M, 51L, 51M, 119, 357L, 357M) L.M	
	L (9L, 63M, 153M) 2143.40277 7955417573.3695455 6187808421. .648 7658311004 2176390667.8084698606 6584909565 3200462979.P51	1071L
	M (9M, 63L, 153L) 73643 7756465937.P123	
1077	(1, 359) L.M	
	L 318793.409261.3668263.1276578871.6 0311487349.12 7112425273.P123	
	M (3) 803443.51 8094843517.12 0549427263 6831421987. .447794855 8119325654 3637836329 7310952926 9284647362 9922755299.P74	1077M
	$3^{3h} + 1 = (3^h + 1)L.M$ , $L = 3^h - 3^k + 1$ , $M = 3^h + 3^k + 1$ , $h = 2k - 1$ .	

Factorizations of  $5^n - 1$ ,  $n$  odd,  $n < 376$   
 L,M for  $n = 10k - 5 \leq 745$

n	Prime Factors
1	2.2
3	(1) 3 <sup>1</sup>
5	(1) L.M
L	11
M	7 <sup>1</sup>
7	(1) 1953 <sup>1</sup>
9	(1,3) 19.829
11	(1) 1220703 <sup>1</sup>
13	(1) 30517578 <sup>1</sup>
15	(1,3) L.M
L	(5M) 18 <sup>1</sup>
M	(5L) 174 <sup>1</sup>
17	(1) 409.466344409
19	(1) 191.6271.398107 <sup>1</sup>
21	(1,3,7) 379.519499
23	(1) 8971.33 220736136 <sup>1</sup>
25	(1,5L,5M) L.M
L	938425 <sup>1</sup>
M	101.251.40 <sup>1</sup>
27	(1,3,9) 109.271.4159.3105 <sup>1</sup>
29	(1) 59.35671.2212 5996444329
31	(1) 1861.62555250 847358847 <sup>1</sup>
33	(1,3,11) 199.38 6478495679
35	(1,7) L.M
L	(5M) 8528058 <sup>1</sup>
M	(5L) 211.631.420 <sup>1</sup>
37	(1) 149.1 3971969971.873 7481256739
39	(1,3,13) 79.60845 9012088799
41	(1) 2238236249.507930464 3216687969
43	(1) 1644512641.1 7282755219 881588879 <sup>1</sup>
45	(1,3,9) L.M
L	(5L,15M) 1171.16983 <sup>1</sup>
M	(5M,15L) 29731590 <sup>1</sup>
47	(1) 177 6356839400 2504646778 106689453 <sup>1</sup>
49	(1,7) 2273765858 6353111267 700203125 <sup>1</sup>
51	(1,3,17) 90271.317731.65 465216802 <sup>1</sup>
53	(1) 5960555749.1 715409448 <sup>1</sup> .2714536 5052629449
55	(1,11) L.M
L	(5L) 11*.103511.19029582 <sup>1</sup>
M	(5M) 511831.6562875 <sup>1</sup>
57	(1,3,19) 117354 1550674807 640814012 <sup>1</sup>
59	(1) 2118024 7636732981.20475 7223065733 875157505 <sup>1</sup>
61	(1) 8419.91 8585913061.1401941 7930717189 8833699259
63	(1,3,7,9,21) 280729.2161279.2379 216364371 <sup>1</sup>
65	(1,13) L.M
L	(5M) 2098620 782556558 <sup>1</sup>
M	(5L) 131.103415 093024191 <sup>1</sup>
67	(1) 269.1609.26399.245 4335007529.6040 8862365749 712565314 <sup>1</sup>
69	(1,3,23) 139.6211.59 8761682261.886 8050880709

- 71 (1) 569.1860792 9421228039 0832232535 2986911164 4362732899  
73 (1) 4853479.5729041.9519524 1517703499 1472620057 6714027279  
75 (1,3,5L,5M,15L,15M) L.M  
L (25M) 151.3301.183794551  
M (25L) 1989151.49892851  
77 (1,7,11) 527093491.809 0594434231.1 6271505242 6691233701  
79 (1) 20536 7807127911.5852312322 1688392679.3 4412045636 8919234899  
81 (1,3,9,27) 4861.11419 6978463809 5598202677 7206637491  
83 (1) 20515111.14311 8570670186 8962383741.880400 9594510383 4627376781  
85 (1,17) L.M  
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M (5L) 1531.3456315535 0221618511  
87 (1,3,29) 5569.6961.28 8701942506 6220321043 7116612769  
89 (1) 179.9807089.14597959.834019001.815 7179360521.2316 6965436368 3130095909  
91 (1,7,13) 96806 4779056858 9086355559.174997 3366315297 6533452519  
93 (1,3,31) 31\*.148429.878851.1729748124 6323931002 4750410929  
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101 (1) 593 7018283241.34344873 1139658982 1473854121.P30  
103 (1) 3709.28429.591178977 1319873837 1603984809.P35  
105 (1,3,7,21) L.M  
L (5L,15M,35M) 2122678 3250214361  
M (5M,15L,35L) 1736701.11 9461537021  
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109 (1) 1091.1007161.1528399.P61  
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M (5L) 461.691.2855911.824480311.1 7223586571  
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119 (1,7,17) 239.1429.4999.74 9718268129 1140146079.P36  
121 (1,11) 12101.486179.P68  
123 (1,3,41) 739.960139.1785961.9025583299.P31  
125 (1,5L,5M,25L,25M) L.M  
L 3597751.P29  
M 28707251.403 2808198751.76718 6663625251  
127 (1) P89  
129 (1,3,43) 18471511.439559 3496195183 3386625799.P26  
131 (1) 2621.23928199.34720241.1681 5642611861.P60  
133 (1,7,19) 9311.65171.281429.3257947519.15 2317058321.P41  
135 (1,3,9,27) L.M  
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139 (1) 2152 1602057721.67894415 4602476974 1462601111.P56  
141 (1,3,47) P65  
143 (1,11,13) 2461 5836446631.5313056676 3791958299.P51  
145 (1,29) L.M  
L (5L) 1461311.P34  
M (5M) P39  
147 (1,3,7,21,49) 24556351.5071357999.203 5895040229.P30  
149 (1) P104  
151 (1) 1175989.2237519.38 9439261961.1279 9319666401.  
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153 (1,3,9,17,51) 4591.26481241.36014367 2909416579.P39

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	M (5M) 311.5624951.P33	
157	(1) 32029.5129819.2107089779.8616 3144521004 9415390137 1725720169.P55	
159	(1,3,53) 177530 5720077559.P58	
161	(1,7,23) P93	
163	(1) 4599209.40100609.675775181.658215108 7844246659. .102 5563995838 2857444701 1133455059.P40	163
165	(1,3,11,33) L.M	
	L (5M,15L,55M) 2311.P26	
	M (5L,15M,55L) 331.98671 6511563526 7180926131	
167	(1) 18371.53441.P108	
169	(1,13) 13859.784646 8267059802 8303937208 5276899721.P70	
171	(1,3,9,19,57) 19*.P75	
173	(1) 1039.3461.170827 2343265311.P99	
175	(1,5L,5M,7,35L,35M) L.M	
	L (25M) 28001.200201.8894201.P26	
	M (25L) 12601.50051.22661801.1657309151.3810526 3380318401	
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179	(1) 359.3581.75539.17315029.1008 9407336238 7242965129.P84	
181	(1) P126	
183	(1,3,61) 38431.P80	
185	(1,37) L.M	
	L (5M) 2591.P47	
	M (5L) 30810641.2182932 1837586441.P27	
187	(1,11,17) 4200769.120 2338040280 5105241346 3254109792 4516136661.P64	
189	(1,3,7,9,21,27,63) 30592 1358183421.P62	
191	(1) 112691.60426671.P121	
193	(1) 74 9154725101.4068753 8356109192 2623241829.P96	
195	(1,3,13,39) L.M	
	L (5L,15M,65M) 14821.P29	
	M (5M,15L,65L) 933692761.P26	
197	(1) 47 0323176131.36220 4827770839.P111	
199	(1) 53731.P134	
201	(1,3,67) 1 2482287321 9506311260 9361470351.P63	
203	(1,7,29) 493291.49786550 6291017067 0969991331.P84	
205	(1,41) L.M	
	L (5L) 15991.125 6950067521.P40	
	M (5M) P56	
207	(1,3,9,23,69) 1 0047916621.P83	
209	(1,11,19) 419.56431.P119	
211	(1) 559 4292675731.3797361225 8438259769.20 4767697871 0884689089. .144115 3930663109 6194738544 5876092809.P59	211
213	(1,3,71) 15630959 2445437909.P81	
215	(1,43) L.M	
	L (5M) 1291.P56	
	M (5L) 431.144982241.127331689 6028212631.P31	
217	(1,7,31) 8681.182 8916514769.P110	
219	(1,3,73) 439.429241.2183431.2397017573 2091138981 7996792709.P57	
221	(1,13,17) 351391.23 1452141519.1832 7609419010 4631834639. .143600 3589550079 4034179851 9161288943 3318011249.P49	221
223	(1) 355909.P150	
225	(1,3,5L,5M,9,15L,15M,45L,45M) L.M	
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	M (25M,75L) 1086749551.P33	
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229	(1) 2749.53129.637 8511608135 3654247759.257033653 6160890911 0896940589.P101	
231	(1,3,7,11,21,33,77) 1 3920748381.267 8595575292 0989772240 6319386619.P42	
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	M (5L) 941.4231.9676661 0646500911.P42	
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239	(1) 479.4009 3613041379.P151	
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243	(1,3,9,27,81) 1459.14001661.P103	
245	(1,7,49) L.M	
	L (5L,35M) 491.8821.10781.P49	
	M (5M,35L) 166 5032891036 6149531471.P37	
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249	(1,3,83) 499.12451.169321.6461357766 2440706821. .4863 0776133292 0261532701.P60	249
251	(1) 8325671.31005529.P161	
253	(1,11,23) 21 5556321311.4586 6058877694 0625714888 8900423581. .7545874 1165755163 9383544061 4393216048 5170968091.P62	253
255	(1,3,17,51) L.M	
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	M (5M,15L,85L) 236641.78 2302186051.3838 5602257801.26342 0722813531	
257	(1) 10081 3924320721 2547740418 5330039079.P146	
259	(1,7,37) 148325 3451821989.123315 1243020553 5516641371.P111	
261	(1,3,9,29,87) 6717619.81131329.4206107 4305650501 8221215111.P77	
263	(1) 152 3516701711.P172	
265	(1,53) L.M	
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	M (5L) 1061.433476 5049222087 7561107611.P45	
267	(1,3,89) 1069.1133149.1652731.1848 4574880511.36971 8501929859. .92358800 6049379371 3012490850 9003639071.P42	267
269	(1) 3229.4016171.3278571965 9723694619.P158	
271	(1) 64993931.1 2987902099.P171	
273	(1,3,7,13,21,39,91) 376909 3691550663 7991958222 4252183771.P66	
275	(1,5L,5M,11,55L,55M) L.M	
	L (25L) 2378587 4550224051.2988116 3609373451.4387729 0026688801.P21	
	M (5L) 233201.123 4133939501.35465 5233566701.P38	
277	(1) 37095841.14075563 1354766690 1389501918 0975816431.P149	
279	(1,3,9,31,93) 24711 4592858611.P112	
281	(1) 63110020 2961413821.P179	
283	(1) 1699.451669.113334709.41674282 1994932569.339 2666115769 4104397239. .15035 5562464203 9390353881.871 7585253517 8949661542 8441319542 0314854559.P73	283
285	(1,3,19,57) L.M	
	L (5M,15L,95M) 30211.26 0930841421.P35	
	M (5L,15M,95L) 571.P48	
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289	(1,17) 17341.81053519.2760554 2907603789.90 2711016977 2242694759.P140	
291	(1,3,97) 8731.15247819.6548 2996292971.42579 8685220729.P95	
293	(1) 1759.520369.22410 8738217451.889575 8831668654 7560127731.P155	
295	(1,59) L.M	
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299	(1,13,23) 599.71761.1076401.7752619982 2679665425 3504153166 5354400879. .44836221 8776718091 6663396803 9316094796 7436894115 5912707479.P74	299
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305	(1,61) L.M	
	L (5L) 1884901.P78	
	M (5M) 1831.2441.178656 0207910631.1173694 4559917832 2177831741.P36	

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309	(1,3,103)	619.8934148519.4 2173111702 5213419404 1698934004 1084225191.P90		
311	(1)	263729.1649908341 0473464248 7613142998 8519619911.	C173	311
313	(1)	229651231.	C210	313
315	(1,3,7,9,21,63)	L.M		
	L	(5M,15L,35L,45M,105M) 11971.23311.34651.P38		
	M	(5L,15M,35M,45L,105L) 1732501.P45		
317	(1)	34871.290 4896745820 3698934091.	C194	317
319	(1,11,29)	95701.533942839.	C182	319
321	(1,3,107)	35311.80251.3482851. .20443868 1420686525 7330149913 5150262442 2714996979.P85		321
323	(1,17,19)	324769 1391126251.	C186	323
325	(1,5L,5M,13,65L,65M)	L.M		
	L	(25M) 1659451.14281661 1356873351.P61		
	M	(25L) 1 6413953173 6674586884 8220671801.P54		
327	(1,3,109)	3900606421.257 0834326384 9260582209 1978212393 3663342371.P99		
329	(1,7,47)	659.6581.15 9572171044 0923328597 8673415179.	C155	329
331	(1)	6744 0292875072 4677348085 5158771858 0464816759.	C187	331
333	(1,3,9,37,111)	15319.344145511. .110716652 9067144953 0331408923 8561861072 6891609202 3773607149.P81		333
335	(1,67)	L.M		
	L	(5M) 126631.114941627 2557136018 6894779691.P59		
	M	(5L) 11485 5228051494 1389076611.P69		
337	(1)	242 5505629366 3667826616 3293887551.P203		
339	(1,3,113)	7459.234303241.2262 8763748399.20486732 5883294509. .24 5285575975 7518845541 4632667311.P83		339
341	(1,11,31)	109121.10161119.19 2446105281.60 9146164309.	C175	341
343	(1,7,49)		C206	343
345	(1,3,23,69)	L.M		
	L	(5L,15M,115M) 21391.31741.1715341.2 7875688121.P36		
	M	(5M,15L,115L) 37951.5347963681.235188111 5374174051.P30		
347	(1)	34911671.90601 9831236510 6899848549.	C210	347
349	(1)		C244	349
351	(1,3,9,13,27,39,117)	7655311. .647571 1850365695 0297874830 3305641419 9292785571. .148916102 3006154219 9037902258 0535628079 2802449809.P51		351
353	(1)	235099.5451190499.20550 4553260781.3478521588 5504832719.	C198	353
355	(1,71)	L.M		
	L	(5L) 849962 6476216091.8558727566 6838047316 1735697296 0527829841.P43		
	M	(5M) 71*.17041.7484111.P85		
357	(1,3,7,17,21,51,119)	P135		
359	(1)	719.417 8569265357 8003162849.66778810 0878296799 7903339939. .8372485716 6784855556 9202584041.P168		359
361	(1,19)	1294 2286565210 4096162599.64174638 0871565828 2089494909.	C189	361
363	(1,3,11,33,121)	3631.P151		
365	(1,73)	L.M		
	L	(5M) 107 7334433621.112193384 2585386522 1726037921.P61		
	M	(5L) 6571.1328865721.65 0916499741.2235 4588958731.3373 5961890251. .56029438 0367699191.P32		365M
367	(1)	104 7157937929.6456 5841128666 6140609459. .52 8620439594 5214141164 1760543741.P189		367
369	(1,3,9,41,123)	12 7551580041 8804219885 5653459546 4339049133 99274\ 44507 5087457957 0996690409.P97		369
371	(1,7,53)	2969.11131.3592 2655704041.2 2657824153 7144915139. .1 1014814494 8004873526 0475574809 1574916119.C137		371
373	(1)	2239.4350204259.136867 1486390599.4372845 4669591948 9287780329. .13 2287615591 6191150600 7306307335 5132265371.C165		373
375	(1,3,5L,5M,15L,15M,25L,25M,75L,75M)	L.M		
	L	(125M) 751.317286001.52 7559073501.P47		
	M	(125L) 28 1057814001.3803386 3525621501.P42		

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- 385 (1,7,11,77) L.M  
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 M (5L,35M,55L) 2471701.92 7476143441.13423446 0550630441.P49
- 395 (1,79) L.M  
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 M (5M) 190391.68175421.3870 1052851841.64 4086240142 2039384631.P61
- 405 (1,3,9,27,81) L.M  
 L (5L,15M,45L,135M) 811.1621.6481.921737881.P57  
 M (5M,15L,45M,135L) 233236 8714077641.2791513 4668944479 9703543961.P34
- 415 (1,83) L.M  
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 M (5L) 1209311.P109
- 425 (1,5L,5M,17,85L,85M) L.M  
 L (25M) 5101.3609101.P102  
 M (25L) 487816143 2677729051.P94
- 435 (1,3,29,87) L.M  
 L (5M,15L,145M) 22621.646325611.8109704949 2978072251.P46  
 M (5L,15M,145L) 5931661.1953470937 3567758985 0742253611.P42
- 445 (1,89) L.M  
 L (5L) 26701.2 6698816301.10373878 9930024471.P92  
 M (5M) 8011.15131.10123272 4284574681.14 5421120497 5070840249 6286411251.P67
- 455 (1,7,13,91) L.M  
 L (5L,35M,65M) 25200919 0957922611 9271929884 2466548458 1951479831.P53  
 M (5M,35L,65L) 911.4914911.6481021.P85
- 465 (1,3,31,93) L.M  
 L (5M,15L,155M) 189183529 4247111495 8730682051.P57  
 M (5L,15M,155L) 2791.608 4353978581.385 9887646937 3268915110 4968796091.P35
- 475 (1,5L,5M,19,95L,95M) L.M  
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 M (25M) 113608561 4643708051 1603913201.  
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- 485 (1,97) L.M  
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 M (5L) 3881.12611.5829701.11401381.4588270721.P104
- 495 (1,3,9,11,33,99) L.M  
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 M (5M,15L,45M,55M,165L) 991.19801.1430 0545887541.  
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- 505 (1,101) L.M  
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 M (5M) 5051.671651.119524411.947 6228324821.  
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- 515 (1,103) L.M  
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- 525 (1,3,5L,5M,7,15L,15M,21,35L,35M,105L,105M) L.M  
 L (25L,75M,175M) 1051.P81  
 M (25M,75L,175L) 3 7815352051.P74
- 535 (1,107) L.M  
 L (5M) 6186913367 1342777821 2600657181.277 2674619008 6821645523 1985933091.P86  
 M (5L) P149
- 545 (1,109) L.M  
 L (5L) 232171.21519871.22 2583733401.P128  
 M (5M) 1102582961.23 9226840075 1445411411.1972 7999949997 8473755531.  
 .26021 1103517941 8475927861.P73 545M

555	(1, 3, 37, 111) L.M		
L	(5L, 15M, 185M) 12211.154402111.9202869 8253775713 3081645464 0823938251.P51		
M	(5M, 15L, 185L) 156511.834721.19852351.P83		
565	(1, 113) L.M		
L	(5M) 811198 1087549195 8307893501.P131		
M	(5L) 1 7317559621.578 9043346431 6399151818 5302373441.P114		
575	(1, 5L, 5M, 23, 115L, 115M) L.M		
L	(25M) 201781301.5938371825 2771389151.31766 2074700904 2321125655 1886690151. .8681684 8503864301 5142200719 7514419601.P55		575L
M	(25L) 1151.173651.1069501.40231601.2 6135496851. .31905055 1737466568 1595009461 1540838529 6347943110 1993034851.P64		575M
585	(1, 3, 9, 13, 39, 117) L.M		
L	(5M, 15L, 45M, 65L, 195M) 5648761.94 5078093181.101 6644491721.P70		
M	(5L, 15M, 45L, 65M, 195L) 249 7240172701.784 5827291641.P76		
595	(1, 7, 17, 119) L.M		
L	(5L, 35M, 85M) 23801.2597070 9103346701.9 5385010245 7780153519 3513460771.P83		
M	(5M, 35L, 85L) 359776 4176982506 7455871508 8606071761 2102325001.P90		
605	(1, 11, 121) L.M		
L	(5L, 55L) 11*. .187 5826792538 8969281703 0220745179 1653237212 0656198627 8625943751.P91		605L
M	(5M, 55M) P154		
615	(1, 3, 41, 123) L.M		
L	(5M, 15L, 205M) 1231.2908888501.17885 8260014586 2687626441.P76		
M	(5L, 15M, 205L) 62731.248461.1 8383372131.2 2607366551 6341068071.P71		
625	(1, 5L, 5M, 25L, 25M, 125L, 125M) L.M		
L	6 3704343525 6965381251.8 8791802872 7761332501.P133		
M	1122853751.P166		
635	(1, 127) L.M		
L	(5M) 39371.12917793 8459071482 9718240121.	C144	635L
M	(5L) 70 2206150831.55 9849381955 2929453451. .123185424 1504644347 7661711361.P115		635M
645	(1, 3, 43, 129) L.M		
L	(5L, 15M, 215M) P117		
M	(5M, 15L, 215L) 1269509641.41 4498797841 5039132191. .3118954 4017813860 5315002215 3343306501.P51		645M
655	(1, 131) L.M		
L	(5L) 14411.592121.601291.230 4799900471. .9 4010871653 1224942568 0125005501.P124		655L
M	(5M) 18341.51703081.79972 6387996561.	C155	655M
665	(1, 7, 19, 133) L.M		
L	(5M, 35L, 95M)	C152	665L
M	(5L, 35M, 95L) 347131.42 6361515667 7698516995 3988205647 9395496411.P104		
675	(1, 3, 5L, 5M, 9, 15L, 15M, 27, 45L, 45M, 135L, 135M) L.M		
L	(25M, 75L, 225M) 14851.71551. .2244 9125646642 8912635990 4009174249 1284229680 7654322501.P64		675L
M	(25L, 75M, 225L) 1357803001.8227149 9359292830 4413247151 2207436501.P80		
685	(1, 137) L.M		
L	(5M) 1 8025611971.535 5697449433 9971695885 5013333971.P147		
M	(5L) 4974785 3293887115 9260123601.5276 5838328433 9653209580 2023230871.C131		685M
695	(1, 139) L.M		
L	(5L) 10170631.460 5037276245 8488337380 4093554831. .6361 0524704231 3894581407 3705227461.P120		695L
M	(5M) 822881.2 8927420661.98070 8383859046 9822562651.	C152	695M
705	(1, 3, 47, 141) L.M		
L	(5L, 15M, 235M) P129		
M	(5M, 15L, 235L) 1290151.43779091.401303684 1954018004 3461725371.P87		
715	(1, 11, 13, 143) L.M		
L	(5M, 55M, 65L) 2861.15731.56 8219795001.183 5752527181.473 4577062931. .1565066 5725833711.P108		715L
M	(5L, 55L, 65M) 7151.	C164	715M

725	(1, 5L, 5M, 29, 145L, 145M) L.M		
	L (25L) 1451.21751.15266 2592191103 9333504551.	C165	725L
	M (25M) 97151.50800516 3062054101.29 8682532758 4332523851.		
		.14020 0680913670 0630208151.P128	725M
735	(1, 3, 7, 21, 49, 147) L.M		
	L (5M, 15L, 35L, 105M, 245M) 1471.1238 8179201301.		
	.698838 4988910998 5909137301.2330 8336481995 3036671654 3767343661.P42		735L
	M (5L, 15M, 35M, 105L, 245L) 72031.56117251.P105		
745	(1, 149) L.M		
	L (5L) 8941.444296 9449294014 7450117711 0211288771.	C168	745L
	M (5M) 6748 6587152634 984477781.8627 4905881454 1800048281.	C159	745M

$$5^{5h} - 1 = (5^h - 1)LM, \quad L = T^2 - T \cdot 5^k + 5^h, \quad M = T^2 + T \cdot 5^k + 5^h, \quad T = 5^h + 1, \quad h = 2k - 1.$$

5+

## Factorizations of $5^n + 1$ , $n \leq 375$

$n$	Prime Factors
1	2.3
2	2*.13
3	(1) 3*.7
4	2*.313
5	(1) 521
6	(2) 601
7	(1) 29.449
8	2*.17.11489
9	(1,3) 3*.5167
10	(2) 41.9161
11	(1) 23.67.5281
12	(4) 390001
13	(1) 5227.38923
14	(2) 234750601
15	(1,3,5) 61.7621
16	2*.2593.29423041
17	(1) 3061.41540861
18	(2,6) 37.6597973
19	(1) 761.19609.213029
20	(4) 241.632133361
21	(1,3,7) 7*.43.127.7603
22	(2) 89.103 0330938209
23	(1) 47.4227 2797713043
24	(8) 15 2587500001
25	(1,5) 1901.5 0150933101
26	(2) 13*.53.8318 1652304609
27	(1,3,9) 3*.163.487.16018507
28	(4) 5950942 9687890001
29	(1) 5096867.609 0817323763
30	(2,6,10) 2281.69566521
31	(1) 1303.21207101.2 8086211607
32	2*.641.75068993.24 1931001601
33	(1,3,11) 595123.190771747
34	(2) 1973.20129.45289.1 2447002677
35	(1,5,7) 15216601.4698932281
36	(4,12) 73.543097.1503418321
37	(1) 9103.29010221.4592 0153384867
38	(2) 4885168129.286422 6125209369
39	(1,3,13) 3121.2273 5632934561
40	(8) 25601.90945684 7814334401
41	(1) 83.43543.221401.947202 6608675509
42	(2,6,14) 2521.2458 7411156281
43	(1) 1549.9547.7866608083.162 8744948329
44	(4) 90804183 4837188735 9375390001
45	(1,3,5,9,15) 6008145 1169922001
46	(2) 5 4657133520 0077066054 7109750601
47	(1) 2069.1 5888756269.360237201 0909260861
48	(16) 97.2 4003159139 4168814433
49	(1,7) 49105547.1866013003.248 1357870461
50	(2,10) 239201.424256201.8962 0825374601
51	(1,3,17) 103.8467.528667.6 0119016343

- 52 (4) 51169.53 7181587281.12904400 8326199409  
53 (1) 107.2 8838378869.5996 5900332130 9822423087  
54 (2,6,18) 145519 1522836303 7109375001  
55 (1,5,11) 109104448 5540399624 6103496881  
56 (8) 113.337.2520917617.3700770032 7977836913  
57 (1,3,19) 229.756 4938255544 8580095589  
58 (2) 1334402673 8283131495 4763421645 5312875601  
59 (1) 827.5242462229.323 7765225301.205964 7179472887  
60 (4,12,20) 233 2031717285 1318360001  
61 (1) 367.9029.1557 1335384347.140 0836463912 8540436401  
62 (2) 812460471 7965111529.1026 5135352352 0067851969  
63 (1,3,7,9,21) 883.406729.24132781.1692416503  
64 2\*.769.366 6499598977.961329567 8264374195 1225664001  
65 (1,5,13) 18461.1518 8886343541.1519922 1608544481  
66 (2,6,22) 1453.65093 8718341740 4924784917  
67 (1) 1129377 2630057337 8542443000 0906189282 7351888021  
68 (4) 137.623017.93 8894988049.136 1753880209.495 9636586609  
69 (1,3,23) 66163549.253592389.40331 6413944121  
70 (2,10,14) 281.13 1488321957 2029950389 6018648521  
71 (1) 4261.57 4733849982 0296170481.2882 3103871383 8413442281  
72 (8,24) 1297.2 7391778556 6730984560 5995807633  
73 (1) 6 3554310563.77761276 7772190289.35 7067786689 7550288203  
74 (2) 9769.40849.51 0241095096 1837579307 3336391882 0917976121  
75 (1,3,5,15,25) 118801.20775901.24665701.149439601  
76 (4) 457.2136398150 7860375753.216544722 0254073212 6905077281  
77 (1,7,11) 2 0828886541.49 9700615160 3617961532 5895945741  
78 (2,6,26) 157.8684521.4056854881.66792 9705480493  
79 (1) 18251687.7897663181.51 1465533067.373990 9552516713 6010188229  
80 (16) 131349761.16 7597261761.246254 4412605252 4088217281  
81 (1,3,9,27) 3\*.1783.5023.2 0660672713 8013621222 4701233463  
82 (2) 193357.6355001.114 8205782281.56 3730789527 2262853059 8981268453  
83 (1) 167.40296 6610884058 5686296627.2 5607877028 4163976747 4730913969  
84 (4,12,28) 6553.90217.60190 2258503559 0658668001  
85 (1,5,17) 75752681.247515241.504156421.6879506966 4507129341  
86 (2) 173.217 1388367013.13233 1554743163 5419162843 6487846050 4933118649  
87 (1,3,29) 349.21039 0487070809.225 0035813396 5991972941  
88 (8) 13729.929281.712 2515956795 1317923809.910 2901460640 6186465761  
89 (1) 3938799 6609449861.5652226 7529181963.120947157 8667799558 6454978647  
90 (2,6,10,18,30) 20478961.679 4091374761.2553 5754811081  
91 (1,7,13) 1588747 6811320661.15994 1464853737 5128941899 7754783021  
92 (4) 15022 0315444217.21475208 8491462210 5919955818 2862886119 2144614553  
93 (1,3,31) 258065887.7 5005167927.533 4567149072 2200466369  
94 (2) 5077.12409.32957 3417220613.93 5213864500 2312086526 0331642997 3471246089  
95 (1,5,19) 4561.1797 6343678423 9734042181.3098 2836236118 8845069741  
96 (32) 193.520782 6497153857.5393447 5733615192 6206665601  
97 (1) 29683.261707.547663.9013076010 2421063383.P32  
98 (2,14) 197.16420 4573839769.7453567553 0760254357.214 4197059348 4574539001  
99 (1,3,9,11,33) P42  
100 (4,20) 4001.132001.776401.P42  
101 (1) P70  
102 (2,6,34) 6733.4613053.19724557.34288117.2683724126 0899651321  
103 (1) P72  
104 (8) 247161617.825256433.2220784177.3130 8249137777.P27  
105 (1,3,5,7,15,21,35) 421.5236141.13542 2421896856 7573270561  
106 (2) 88 7172601592 3707071209.P51  
107 (1) 643.P72  
108 (4,12,36) 73009.1853281.3314953.3 6280398313.130 1287377605 5827785521  
109 (1) 19403.40 4632289544 7485867367.P50  
110 (2,10,22) 245521.1458601.280220429 1103029121.P26  
111 (1,3,37) 223.5107.668221.13844587.107903101.2217 4623490161 1997486023  
112 (16) 271489.1149569.10922689.46531442 0407473281.P31

113	(1)	227.1387189.1 2249784663.P60	
114	(2,6,38)	22573.53590717.210 8505761893.P26	
115	(1,5,23)	73141.P57	
116	(4)	233.929.33409.39782338 6118610689.154735534 1777494553.P33	
117	(1,3,9,13,39)	40483.4 3236180703.P36	
118	(2)	P82	
119	(1,7,17)	2381.25229.4172141.P53	
120	(8,24,40)	2172116161.P36	
121	(1,11)	374499841.30 4639362281.1144931 3571047243.460071568 6162128721.P23	
122	(2)	733.61001.1 9811275733.2693335 6951273517.P50	
123	(1,3,41)	309 7042021120 7224741561.P34	
124	(4)	P84	
125	(1,5,25)	3001.512 0473802759 3108331001.P44	
126	(2,6,14,18,42)	466 1402165281.14705 3007410401.3089 4247525727 3345172721	
127	(1)	509.2287.2735581.P76	
128	2*	257.236532 0098383000 3298459393.P62	
129	(1,3,43)	327845761.558801427.1420986601.P33	
130	(2,10,26)	87881.14402441.P56	
131	(1)	263.P89	
132	(4,12,44)	331660297.11283504 7682166217.P31	
133	(1,7,19)	2129.354047.P67	
134	(2)	20369.P88	
135	(1,3,5,9,15,27,45)	164701.3147 2682400981.18251 7282870121. .22382394 4168266601	135
136	(8)	17*.999329.P83	
137	(1)	823.2741.22469.76 4253070277 0043710321.615626 3076141121 8787053569.P37	
138	(2,6,46)	277.70942489.2 2600337281.6698 8220431117.P28	
139	(1)	17269 4671812043.41778 6018853823.245971674 6919477501.P50	
140	(4,20,28)	5148456 0302566198 8644048801.P41	
141	(1,3,47)	283.1129.2 4048335089.3751 6308093487.P35	
142	(2)	853.72497533.8367932201.20 0771218157.55 4474665573. .109583 2589179957.P40	142
143	(1,11,13)	2010581.225 3938672701.56761 8483045329. .30287 0460021353 4236926361.P27	143
144	(16,48)	P68	
145	(1,5,29)	9 8047293061.353 2907090761.1714 9742984461.P42	
146	(2)	293.27133517.84128413.7725579 3815542926 0697128053.P56	
147	(1,3,7,21,49)	7*.9887502829.P48	
148	(4)	3257.3542233.1004 4059578457.P78	
149	(1)	85229.4394309.1270 3371381749.108480 2496290323. .8642038 4438148246 4122519761.P37	149
150	(2,6,10,30,50)	14401.2 9954155215 4912341601.P32	
151	(1)	43367201.P98	
152	(8)	14897.4189729.1152438057 9073027969. .101 2849224145 1382761167 2455293249.P39	152
153	(1,3,9,17,51)	307.6427.6297787.4 5618058027.P44	
154	(2,14,22)	8009.40987409.7435 3801974761.P59	
155	(1,5,31)	21701.10867 4992710961.1454759 4945812910 9023753501.P40	
156	(4,12,52)	3191435 3373873895 5692755921.P41	
157	(1)	1585387.2 2397562046 2535382927.P83	
158	(2)	317.41081.72997.1039 0269663517.P85	
159	(1,3,53)	5407.1725469.P63	
160	(32)	4 6957667265 6667584028 9495258492 0394200961.P49	
161	(1,7,23)	116243.P88	
162	(2,6,18,54)	50 3731168597.7203144 1042010060 2530036001.P37	
163	(1)	198174092 6993660561.2 8607555347 0422974507. .7214931 0409446139 7911450801.P48	163
164	(4)	2953.81 1755457273.4696487220 5858855033. .2 2118773725 7721564085 6618933593.P47	164
165	(1,3,5,11,15,33,55)	661.9651181.P47	
166	(2)	997.4649.990 0623095114 7470700089.P85	

167	(1)	497 8061451403.5090 2967640396 1730526372 7962686984 5515838501.P60	
168	(8,24,56)	12433.447639226 5682340957 4575008753.P35	
169	(1,13)	493481.P104	
170	(2,10,34)	1361.14281.14239201.87393601.19726187 6290426766 5190337601.P40	
171	(1,3,9,19,57)	6027 2250820183.62674 7642757850 2461453809.P37	
172	(4)	18233.3 0185745097.264671329 4612838233.P85	
173	(1)	347.4279 4294406607.P104	
174	(2,6,58)	382801.506670253.1 4681772034 0602448117.P44	
175	(1,5,7,25,35)	701.2801.630915424 5455368301.P59	
176	(16)	353.1827937.2704769.180075054 7615213217. .6092 0148549093 0587260897.8309 4090799735 7679202561.P31	176
177	(1,3,59)	709.1063.347629.4 9987218529.13032554 3183670643. .5 0458385688 1942565107.16 6388708446 5861537223	177
178	(2)	203652882 9484414131 3970353677.P95	
179	(1)	2 1320258969.1202130 4420747747.22713802 3883511049. .203 2434636646 8227562461.97112349 9617907087 6201114229.P31	179
180	(4,12,20,36,60)	8641.440641.35 6646293281.5073530 7557193841.P30	
181	(1)	1087.28961.101723.P114	
182	(2,14,26)	3640732369.14143795 5091157453.P74	
183	(1,3,61)	17203.11833147.2880471241.111719759 5048793563.P46	
184	(8)	14966561.73231 8765422081 5881445121. .36153 6734706660 2695808453 2869022033.P57	184
185	(1,5,37)	2221.3701.P94	
186	(2,6,62)	373.1117.1489.1 0269119521.P66	
187	(1,11,17)	1123.12343. .1787163564 6349095375 9833687091 6422433435 6049680569.P56	187
188	(4)	90617.755009.951281.1279513 4934601897. .4760 5941906274 8765416912 4325931441.P63	188
189	(1,3,7,9,21,27,63)	2932903.238040587.391 6103733109. .17 4342459381 9524631667.P27	189
190	(2,10,38)	98041.257464 5949207561.P81	
191	(1)	383.1793262 1608157901.45 3439892643 9904724500 9865403089.P83	
192	(64)	P90	
193	(1)	69481.1046447. .133 0202277214 5301912117 2455353486 0452103425 4056544901.P72	193
194	(2)	25997.52769.6647 7837920609.3 7496232185 2666418369.P91	
195	(1,3,5,13,15,39,65)	1401193 3046202781.17 5569205387 3139750161.P30	
196	(4,28)	19993.2333311009.3881 1185416697.P91	
197	(1)	20420627.15 2626814313 8331950101.P109	
198	(2,6,18,22,66)	397.76 6142400277.7502 1320776093 6191769333.P46	
199	(1)	2389.75223.446569871 4051853503 9596003383.P102	
200	(8,40)	1601.10339 0853395201.4580474363 9930233601. .6682199064 3053759006 0380972001.P46	200
201	(1,3,67)	11655571 3473655927.3082552744 6446607747.P56	
202	(2)	809.3637.5728721.337526 8261753121. .54234164 6494570198 5809078678 3366331533.P74	202
203	(1,7,29)	29*.230 3920845056 0482164167.1041934113 4729176973 8017451047.P65	
204	(4,12,68)	2857.65127 8013527708 6566492366 1368506241.P52	
205	(1,5,41)	821.2175461.3399 6220923281.2483443 3083178321. .37882 8567297103 2867364321.P49	205
206	(2)	72 0016715917 9008264342 9082665920 7222585733.P101	
207	(1,3,9,23,69)	3727.17389.314227.2401937749.6 7153740229. .2152931154 6645480718 4993896087.P30	207
208	(16)	1 4934372575 0590533761.5102 5382540781 8607167641 5499055681. .5717693 5570438290 2782551301 9667841281.P44	208
209	(1,11,19)	10123543.21 3379486321. .4 5859681134 6482983378 5910158325 9138328629.P67	209
210	(2,6,10,14,30,42,70)	P68	
211	(1)	2 2144561409.87856 1207123492 7581234843.15507607 2919682305 8417670649. .91807021 5174670579 4282754349 1998459427.P47	211
212	(4)	24452081.P138	

213	(1, 3, 71)	2893657 3797339172 6539631077 2669592883 .P62	
214	(2)	25253 . 232 5261295624 3152283169 . 18 3944488993 3630996520 0241530917 . . 997 7781848118 2008593289 1049469009 .P58	214
215	(1, 5, 43)	1721 .P115	
216	(8, 24, 72)	433 . 177553 . 39209617 . 170735041 . 2 4641426027 7520913233 .P57	
217	(1, 7, 31)	51647 . 44245867 . 102765 0404358607 . 2086488850 5062314147 .P80	
218	(2)	938804357 . 3698717 6266711133 . 4333070199 9236285089 . . 89 8182807442 1045046272 6655090961 .P74	218
219	(1, 3, 73)	1526556583 . 249603 8864033071 0632107832 1358781541 .P57	
220	(4, 20, 44)	881 . 21121 . 148721 . 2530153561 9781301761 . . 431176 7321757919 4979701441 .P55	220
221	(1, 13, 17)	443 . 4421 . 27847 . 495041 . 12 3067090303 . 5 1041013072 2343681961 .P87	
222	(2, 6, 74)	2096889231 2069830573 . 59981 5412105933 3854804908 7060890529 .P47	
223	(1)	187373521 . 158824879 2798900263 . 64020 9564362014 4342873702 9803881709 . . 2897241 5246940047 4880171778 3894063698 2760270727 .P48	223
224	(32)	3137 . 18 1398083777 . 35822 8004389750 4996426193 3857034881 . . 259 3161252309 2651022491 4283683090 4141299137 .P43	224
225	(1, 3, 5, 9, 15, 25, 45, 75)	119701 . 826201 . 2596501 . 643 1752796248 6535125801 .P44	
226	(2)	119 1328746689 4338293503 9138140670 3911065344 3245880449 .P105	
227	(1)	176905726 5869086021 . 110157576 4391464632 1123501403 . . 2989637738 9316794823 9115560463 .P83	227
228	(4, 12, 76)	7753 . 738721 . 1524 5577749507 8401684021 1158773621 2639440481 .P48	
229	(1)	P160	
230	(2, 10, 46)	118681 . 140761 . 3 3453655481 . 3852260 6861373961 .P86	
231	(1, 3, 7, 11, 21, 33, 77)	463 . 42967 . 1430975701 . 26628684 4846214347 .P50	
232	(8)	336320319 3152232653 1782695489 . . 4177156944 9671881561 3000367085 8609781761 .P89	232
233	(1)	467 . 2909687359 0481178947 .P140	
234	(2, 6, 18, 26, 78)	138485881 . 139192519 1575724209 .P75	
235	(1, 5, 47)	14975141 . 2501939 3608870061 . 746901580 8480614081 .P87	
236	(4)	1889 . 66553 . 3 8710282321 .P144	
237	(1, 3, 79)	1423 . 53089 . 787597927 . 362 0406337123 . 5197753 9194197989 .P64	
238	(2, 14, 34)	22 3730792106 9778921841 .P113	
239	(1)	17209 . 572988 9967417247 . . 10 0324083102 1866550564 9376807328 5480027069 3763847709 .P96	239
240	(16, 48, 80)	582954476 4937408380 8477814863 3415817921 .P51	
241	(1)	1447 . 271849 . 533122367 . 5254 1158906758 0318444083 . . 3665855797 0564117648 8670059469 .P98	241
242	(2, 22)	30493 . 991625 1976518642 0525633572 9707788353 2184524093 .P104	
243	(1, 3, 9, 27, 81)	3* . 8263 . 39367 . 17995609 . 985562803 . 598653 5931982369 . . 83 8817651486 0236537051 0261987969 .P41	243
244	(4)	57097 . 14 7503431140 7732073353 .P142	
245	(1, 5, 7, 35, 49)	114661 . 187181 . 5758481 . 2033402201 3834451721 . . 1940 4354650649 0017613781 . 19356 3546595289 0802398761 .P34	245
246	(2, 6, 82)	4560841 . 6546 5466516157 .P92	
247	(1, 13, 19)	4447 . 5853901 . 29599987 . 551 3798691623 . 66 5547226622 5553901469 . . 14120148 0374548733 3745277051 4154962809 .P62	247
248	(8)	128 4020836753 . 557639293 9202243775 9699097699 1388831169 .P117	
249	(1, 3, 83)	77264 1961672840 9660092049 .P90	
250	(2, 10, 50)	P140	
251	(1)	503 . 27258601 . . 5452 4195722301 5210665999 4530769257 0749936560 8184793723 .P111	251
252	(4, 12, 28, 36, 84)	1009 . 11824849 . 2759159593 . 4996993 0916222857 . . 1 3173654819 1549409370 2637365041 .P35	252
253	(1, 11, 23)	23* . 39 0782201041 .P141	
254	(2)	18797 . 23369 . 60961 . 813474135 0985769921 . 5108 5462911106 3017581573 . . 5336075653 5393674204 8782478767 1823315327 6708896801 .P71	254
255	(1, 3, 5, 15, 17, 51, 85)	20 6249584501 . 8507 7293022121 . . 186 5479660364 7183092401 .P42	255
256	2*	. 1655809 . 10119966 4791578113 . 45 6356643022 0614493697 . . 1202570 2000065183 8057515137 3261627651 6181800961 .P88	256



257	(1) 176303.468309 0869184897 2641835440 2565618496 2101756530 27076\ 81386 7715861667 7982264217 3925770149.P88	257
258	(2,6,86) 56175373. .46021 0379618541 4861907092 0471767267 6962926194 9140369401.P56	258
259	(1,7,37) 4663.1387965001 2159635243.P129	
260	(4,20,52) 2081.P131	
261	(1,3,9,29,87) 523.79867.4144681.999092863.18 5737685563.P83	
262	(2) 1049.17293.48821081.85731185 4600156055 5564908129.P139	
263	(1) 119929.47328 7944795636 7560040127.722142045 4584887493 7749773069.P125	
264	(8,24,88) 51837851 9354634577.P95	
265	(1,5,53) P146	
266	(2,14,38) 1597.170773.12628 6794969133.P129	
267	(1,3,89) 448027.59483329.325 3990826145 6858140701. .560 8650249931 3161545149.P65	267
268	(4) P185	
269	(1) 8609.9 3386204629.1553811 0699419449.P157	
270	(2,6,10,18,30,54,90) 618841.2068201. .1608 3519052368 8198716750 8102211701 7825998721.P46	270
271	(1) 1627.13009.412463.37013723.247 6120019041.P156	
272	(16) 136 5734376353.49 9763060701 9625728363 1828680511 9714865332 4\ 939120570 7849296189 6277276034 5131203329.P86	272
273	(1,3,7,13,21,39,91) 547.9829.84 2474804263.5090739 3322559047.P66	
274	(2) 68911 1405199403 2697301089.169455 0899741129 2389468001.P141	
275	(1,5,11,25,55) 4405399004 5343516701. .33091 3450293623 0727761627 9711411801.P86	275
276	(4,12,92) 1657.3368857.327869982 0981309633 3308538793.P85	
277	(1) 1109.9650681.149030599 1985489901. .126 3881597610 5534323429 2253502483.P133	277
278	(2) 557.P191	
279	(1,3,9,31,93) 59707.62935 2358596132 5272635001. .60117 7658416693 0501774730 3876010686 1025677463.P52	279
280	(8,40,56) 3361.1046757601.55471566 2634844481. .211311163 9722448196 1941732661 7601756161.P66	280
281	(1) 563.1 7568442139 3646637872 6696505807.P163	
282	(2,6,94) 35141 6125984969.25475403 2198578321.584608687 8571351849. .4 0568949061 8274673831 9224618717.P48	282
283	(1) 28867.107949 2176213679 4464572609.30179284 3472464925 515759\ 0320 5690040477 0576599505 1333302715 4449865801.P101	283
284	(4) 6587 3251351400 5296788816 0464362250 4978360233. .790 5422398994 2445013826 6946751563 9799247474 4610986129.P99	284
285	(1,3,5,15,19,57,95) 3907 2294640644 8237780581. .9979141 0699974190 4216882099 9353619521.P40	285
286	(2,22,26) 11 0809516598 3260585456 3544212479 9433394333. .25 7862489551 0885609549 6727464834 5742202673 1923767910 9854509573.P66	286
287	(1,7,41) 1723.49669943.5942 8670579923.P144	
288	(32,96) 577.597889. .384015 9952088227 4416151769 9187297345 3917150065 9227280833.P71	288
289	(1,17) 1644989.8528969.72 2534482201 6874223743. C156	289
290	(2,10,58) 13921.1 1483163641.169 7251048638 4731643441. .183 9123830360 0748207500 8706426861 7948153832 1537172841.P68	290
291	(1,3,97) 2072101 4227435723.102 2435941519 8339175066 0845889189.P86	
292	(4) 1753.38907833.P191	
293	(1) 587.645187.P196	
294	(2,6,14,42,98) 267534 4361321465 5421212169 3391142331 3001176485 3739132929.P62	
295	(1,5,59) 1181.3541.14014 5823858841.96 2560088920 7570043521.P120	
296	(8) 593.177601.8 1495473417 5776096337.P173	
297	(1,3,9,11,27,33,99) 5448169.P120	
298	(2) 244957.1898 8882573081. C189	298
299	(1,13,23) 10 3442450501 1113115503.152186 4978115066 8794223283. .24606023 4401750432 5543906769.P112	299

300	(4, 12, 20, 60, 100) 1201.747733128 3039457201. .1943721 7250562986 3135260458 6154656001.P54	300
301	(1, 7, 43) 14449.42743.176989.2604 1733579107. .71 3983562233 5105435447 9829866663 0256643886 4431099359 3530081301.P87	301
302	(2) 7853.8286881.403 3512514609.	C187 302
303	(1, 3, 101) 607.24847.1740662887.6159 7393790041. .114854 0966490621 2442587795 3365492367 7123377383.P65	303
304	(16) 40129.52289.9 1248052703 0336132161.	C172 304
305	(1, 5, 61) 15056021.22351621.28 3554791907 4635255541. .335 6831787530 6837620981.1071572 8222098661 4613635281. .668 5448602981 7110606216 8575595041.P51	305
306	(2, 6, 18, 34, 102) 613.455983453.2194449013.9556692707 2257854677.P94	
307	(1) 1229.1102507 0531745749.81461658 6610803721.229729697 7063162527.	C159 307
308	(4, 28, 44) 617.P165	
309	(1, 3, 103) 1487527.4527469.642310267.2 4193913287.33054 5029709161. .42287 9580647947.151771333 8849924001.P64	309
310	(2, 10, 62) P168	
311	(1) 1867.2 7920959867.	C203 311
312	(8, 24, 104) 1249.1873.2938768272 4764582400 1934037873.P99	
313	(1) 43 2166113522 7604368687.	C197 313
314	(2) 15980089.388 0383147486 3766512611 3925790477.	C179 314
315	(1, 3, 5, 7, 9, 15, 21, 35, 45, 63, 105) 35281.6985091214 0360790741.P77	
316	(4) 1195838801.1 0005578153.7 0432242073.8 2932824137.P178	
317	(1) 4084229.1 7299271678 3529233443.36203 8200497700 1942052983.	C170 317
318	(2, 6, 106) 19081.20947933.4362762 0682507634 9879647249. .110948 5825591216 5314161670 7828218569.P73	318
319	(1, 11, 29) 2 8476798241.76276 8789799551 8443953143 1817934729.P151	
320	(64) 17921.	C175 320
321	(1, 3, 107) 23035 7338393565 0005163767.2738606 7366794399 3469496783. .155080734 4332412684 0152709489.4 7537128212 5469801577 1925989227.P39	321
322	(2, 14, 46) 1289.424397.419588 5464702037.11984 0037670557 5705576881. .12658 2890267994 2961011028 8303852317. .37458200 1847315605 1297275787 9121310733.P65	C168 322
323	(1, 17, 19) 647.18089.7270077 7195829092 1190121741.	323
324	(4, 12, 36, 108) 20929 0024478377.177309 2774613602 1830939013 7951788241. .14448621 9582638871 0025766042 1295942561.P65	324
325	(1, 5, 13, 25, 65) 1301.2024275501.3 1306627301.P145	
326	(2) 653.2609.189895001.2328835198 5517693013. .256662 1895043793 4848265249.8366787 4422194558 0045751077.P141	326
327	(1, 3, 109) 1078 7032338307.1656 6453047149.2475304696 8859330729. .296805174 7086139877 6947048909.23 8012792129 7654769845 0531783389.P46	327
328	(8) 17713.20907377.94 8775991433 9022789821 1503024977.	C181 328
329	(1, 7, 47) 254905 7618736721.135 6372086903 5756711741. .19 1403458989 3156595618 1098154647.P125	329
330	(2, 6, 10, 22, 30, 66, 110) 1321.4411608961.P100	
331	(1) 48989.274069.404483.350 9802708543 6321411407.	C193 331
332	(4) 2058554713.654380942 0367655443 2094356953. .92204 5676511150 9608696434 9490379361.P157	332
333	(1, 3, 9, 37, 111) 826048260 4912643089.250 8567921556 6320053389. .2088 0879276654 5358864451 7957100805 3406388481.P67	333
334	(2)	C233 334
335	(1, 5, 67) 6701.62830 1435347801.33378029 8767467267 1171503141. .4813691646 9902471860 2707258539 9061245861.P99	335
336	(16, 48, 112) 673.2689.890683 5789071809.P112	
337	(1) 9934 7042703101.86819 4288081270 9284936701.P196	
338	(2, 26) 13*.677.3 4970977837 3997142089.4526 2951277113 8390982997. .40202 2611786475 5963006649.13147110 4434494594 2445899409. .684557619 9477607455 0081198997.P90	338
339	(1, 3, 113) 18307.4392763.2987233423.11 7825760147.165 0939957419 2003102207. .4 5722566413 2454497901 0285169371 3961533231 2607324601.P53	339

340	(4, 20, 68) 8161.17681.488860 5540239186 2040941201. .1 1441045552 4040914431 8774002163 3178237681.P106	340
341	(1, 11, 31) 683.21143.305 5305555941.85386 9447408847.284680 0854247901. .1926361897 0549625859 2833146488 0223029383.P121	341
342	(2, 6, 18, 38, 114) 50164561.19 7991079813.9049237818 4051683013. .170952 6991712109 6397448449. .742 9367931326 1167838317 8061013072 6189759289.P44	342
343	(1, 7, 49) 15078281.67054833 3797224163.4970308833 5119243034 4613753441. .705782 5754592153 8645010005 7697624063.P115	343
344	(8) 183399473.3070535057.	C218 344
345	(1, 3, 5, 15, 23, 69, 115) 1381.4310038422 4227086881. .1632639993 0694296396 7949719201.P71	345
346	(2) 3379037.1490847569.213307682 0179418693. .1611 3350601918 8769151498 8317272249.C174	346
347	(1) P242	
348	(4, 12, 116) 1 9316392153.2616 0681101041.70157 0688430849. .86752 1757880801.516301 1441108401.206200317 2288320153.P70	348
349	(1) 8942070323.69960 3551730901.35622 0205587036 7855123667.	C194 349
350	(2, 10, 14, 50, 70) 21001.481388939 0953505801.P145	
351	(1, 3, 9, 13, 27, 39, 117) 87049.3771847.P140	
352	(32) 1409.369059329.P212	
353	(1) 4943.149 2860183629.	C231 353
354	(2, 6, 118) 236 6295543712 6651591573. .538823 3474508376 5366364264 9134600452 7091093436 2265818081.P85	354
355	(1, 5, 71) 656729 9738106091 4413551821. .30535 0220925900 3363154112 7783262141.C136	355
356	(4) 2137.1870909 3056270693 6930665593.8405525731 4680963545 9322735649.P187	
357	(1, 3, 7, 17, 21, 51, 119) 9283.P131	
358	(2) 1222797 5198457533.	C233 358
359	(1) 1487054 4741210523.P234	
360	(8, 24, 40, 72, 120) 30241.43201.47 1354274081. .79940 1970704871 7497718120 1851988481.P79	360
361	(1, 19) 140069.5958 8684185483.	C221 361
362	(2) 154213.2533277.	C241 362
363	(1, 3, 11, 33, 121) 727.P151	
364	(4, 28, 52) 6165 3107433057 3834279470 3714473897.P168	
365	(1, 5, 73) 49799 7249288521.1 4336096900 4690255541.P167	
366	(2, 6, 122) 18524 8749250792 8532657573. .1516 0766483596 2675953349 7301564169 1225680692 3448428872 3988182009.P81	366
367	(1) 7 3219364069.7005799565 2034894429.	C226 367
368	(16) 22817.339125 5113651617.767392482 0048666337.3835593736 2039743393. .11 8198566927 4649173537.C167	368
369	(1, 3, 9, 41, 123) 1048377 3125218147. .385 1545394849 7338727133 2423670150 1484420747 1841623117 1285497783.P90	369
370	(2, 10, 74) 1481.5121318001.	C189 370
371	(1, 7, 53) 743.31907.171403.42073627.234086 5442872909. .835 2956119659 5406306863.4294105 9171630128 4802706186 7115931367. .24 1881732025 6578191451 0336201743 6952827107.P82	371
372	(4, 12, 124) 854099353.P159	
373	(1) 16827523.85594 7877694729.34022 7030774578 0791746163.	C214 373
374	(2, 22, 34) 36653.183 3280694213.2 7379916733 4154011397.	C187 374
375	(1, 3, 5, 15, 25, 75, 125) 9001.994501.8 4719274001.P119	

Factorizations of  $6^n - 1$ ,  $n$  odd,  $n < 330$ 

$n$	Prime Factors
1	5
3	(1) 43
5	(1) $5^* \cdot 311$
7	(1) 55987
9	(1,3) 19.2467
11	(1) $23 \cdot 3154757$
13	(1) $3433 \cdot 760891$
15	(1,3,5) 1171.1201
17	(1) $239 \cdot 409 \cdot 1123 \cdot 30839$
19	(1) $191 \cdot 63 \cdot 8073026189$
21	(1,3,7) 1822428931
23	(1) $47 \cdot 139 \cdot 3221 \cdot 7505944891$
25	(1,5) $5^* \cdot 18198701 \cdot 40185601$
27	(1,3,9) 163.62 3067280651
29	(1) $73 \cdot 6913065735 \cdot 7778596659$
31	(1) $5333 \cdot 4974474098 \cdot 3476472807$
33	(1,3,11) $67 \cdot 4568 \cdot 6117391553$
35	(1,5,7) 71.37863211.1469029031
37	(1) $149 \cdot 7919 \cdot 12211 \cdot 2569799 \cdot 33 \cdot 4286825813$
39	(1,3,13) 3143401.126 2014275211
41	(1) $8648131 \cdot 18548 \cdot 5088588649 \cdot 7427178961$
43	(1) $173 \cdot 431 \cdot 7383359 \cdot 10 \cdot 4895390312 \cdot 9961695599$
45	(1,3,5,9,15) 2161.112771.1 9353635731
47	(1) $930911329 \cdot 4 \cdot 5110836129 \cdot 1782171 \cdot 8159716147$
49	(1,7) $6527977 \cdot 12 \cdot 2694573317 \cdot 60082 \cdot 7908214213$
51	(1,3,17) 307.927037099.2341 2002806867
53	(1) $13781 \cdot 35729 \cdot 3834576449 \cdot 70 \cdot 9153108874 \cdot 0602980647$
55	(1,5,11) 3675127061.30 3146295935 1050977391
57	(1,3,19) 47881.820459.21981582 9325921729
59	(1) $486 \cdot 6979762781 \cdot 2905 \cdot 0941569087 \cdot 1152216300 \cdot 7228653937$
61	(1) $42461491 \cdot 80057377 \cdot 17 \cdot 2528033542 \cdot 9742134694 \cdot 3980322273$
63	(1,3,7,9,21) 379.8387947.616332907.5239858051
65	(1,5,13) 11831.1420901.49398961.2253364965 4910414281
67	(1) $9049 \cdot 4902832991 \cdot 0415467529 \cdot 30237066 \cdot 3780954222 \cdot 2940030043$
69	(1,3,23) 11731.1 2363858534 3205788966 7843739281
71	(1) $35462 \cdot 4529745721 \cdot 7493590449 \cdot 1917485464 \cdot 5800559518 \cdot 7661976371$
73	(1) $4 \cdot 4764549877 \cdot 243 \cdot 6094907761 \cdot 843914 \cdot 8071138817 \cdot 13872164 \cdot 8424756087$
75	(1,3,5,15,25) 601.82051.2710 4151160059 1342728451
77	(1,7,11) 4 8484757451 0970082567.840020 9205624801 6278479853
79	(1) $114 \cdot 7240288157 \cdot 2628382523 \cdot 7209622143 \cdot 1975312514 \cdot 4605932947 \cdot 1533015409$
81	(1,3,9,27) 2 7767002339.37 7258057173 5061942995 0429139147
83	(1) $167 \cdot 499 \cdot 17597 \cdot 41580677 \cdot 8 \cdot 0781507941 \cdot 60 \cdot 5274844997 \cdot P_{25}$
85	(1,5,17) 26807981.2 0891158391.P32
87	(1,3,29) 2694217.1833921547.470 6691035521.135761 0070580129
89	(1) 8011.2064441331.P56
91	(1,7,13) 4821591056 3832798697.P37
93	(1,3,31) 186187.290869963.659988451.84 2660004553.135 8539033057
95	(1,5,19) 571.1901.825838991.129 8704628041.2542 5408247171.299552 3312517361
97	(1) $389 \cdot 1747 \cdot 158 \cdot 6365166597 \cdot 189 \cdot 6965318129 \cdot 9397175271 \cdot P_{35}$
99	(1,3,9,11,33) 16633.18380539.18414001.22 6407819331.3816729 3140100433
101	(1) 1275678077.P69

103	(1)	2473.5563.160681.P68	
105	(1,3,5,7,15,21,35)	211.35281.58171.P26	
107	(1)	643.504414.0393054571.P65	
109	(1)	3072.6149494277.P71	
111	(1,3,37)	89728627.18.7333846633.148771683.4806007369.356169332.3285489089	
113	(1)	107351.5446695.4894479739.2.0143686286.4351419099.P46	
115	(1,5,23)	461.1151.44851.2579.1752630734.5124973861.P35	
117	(1,3,9,13,39)	6553.5958157609.3903.1258670353.P29	
119	(1,7,17)	16661.2.9032062767.10319.8889691409.1240529.1558509977.P30	
121	(1,11)	4163261521.130.4380464883.P64	
123	(1,3,41)	25512169.141304123.P47	
125	(1,5,25)	5*.9536585501.1.1781179277.2681609501.1058.7532158856.7599765751.P25	
127	(1)	P99	
129	(1,3,43)	43*.P64	
131	(1)	263.3931.6551.1284.8274425742.2193687097.4393373403.P59	
133	(1,7,19)	11971.188861.1101773.16433123.0229374083.P52	
135	(1,3,5,9,15,27,45)	175509721.P48	
137	(1)	6577.25247731.53280671.6004205648.8501962187.P68	
139	(1)	557.21407.128159.P96	
141	(1,3,47)	283.13537.753554761.12.2320721569.98.9671414201.P33	
143	(1,11,13)	859.625.4548615305.6268832471.P68	
145	(1,5,29)	132241.1.5043363139.4488258261.P62	
147	(1,3,7,21,49)	32093041.P58	
149	(1)	38538553.13.1871355471.3829548602.5129566860.4027237645.0743377909.P57	
151	(1)	262.3968964411.495650.4421137000.3384299231.7587888595.4098593563.P59	
153	(1,3,9,17,51)	9757142011.126444432.3057980188.6843521019.P37	
155	(1,5,31)	355.9267608341.2.0821028914.2572055121.P61	
157	(1)	6446107.6423436771.811272997.0287129452.3556776543. .8.6959949043.5630213477.5281276601.P46	157
159	(1,3,53)	11.8721004139.6758.7459957091.P56	
161	(1,7,23)	10949.593447.49178757.4454982121. .3358586.1377536099.6151644764.1418203949.P39	161
163	(1)	653.237852.3250342970.9475820435.5561017171.7174452063.P78	
165	(1,3,5,11,15,33,55)	331.1372486277.4476458441.P41	
167	(1)	19466857.1.0301691259.22902.7359614687.970310775.9710968661. .22004.4654021326.0920441013.P55	167
169	(1,13)	677.3719.1420277.30660424.1330002566.1761581713. .3510824135.9903125131.6269147227.P52	169
171	(1,3,9,19,57)	19*.25896916.0986217770.2532046106.7950269867.P46	
173	(1)	92466.9087985921.495043698.7173222211.8032594604.7148316337.P81	
175	(1,5,7,25,35)	3822701.114265201.141218351.7292423951.3.4840572551. .3.5107498301.237.0825139201.P28	175
177	(1,3,59)	1421059369.P82	
179	(1)	359.4297.399887.112.6853766403. .171074.0419015363.0002113251.7497157303.P80	179
181	(1)	39821.1268420.6910817829.P120	
183	(1,3,61)	223355.3320236215.7841587721.P68	
185	(1,5,37)	10630.5398863787.4955869001.P88	
187	(1,11,17)	382229.420.8612395681.6467774.4985198512.2419754293.9036067237.P70	
189	(1,3,7,9,21,27,63)	10644859.29264.5031213683.P63	
191	(1)	383.12.0477626957.14117334.3133408897.1728047.9106117173.3536391399.P91	
193	(1)	748132849.3759493321.23.0824001813.34492.9902064301. .5777.0149783790.6594854943.P82	193
195	(1,3,5,13,15,39,65)	5.2306527452.0717779891.7.9538236668.7653584971.P34	
197	(1)	2235557.1012325.2906683101.P131	
199	(1)	797.191837.3693839.48449369.0172684383. .238910685.3487241752.3156850355.7934988035.4989277451.P74	199
201	(1,3,67)	319.6645037857.P91	
203	(1,7,29)	1458188789.4325491.2688738803.9664858367.P95	
205	(1,5,41)	6.6571969781.2885280721.0022072371.P95	
207	(1,3,9,23,69)	399097.P98	

209	(1, 11, 19) 18873119.414230477.8412 5065520563. .3 9547815403 9823636104 5733383868 8241066157.P70	209
211	(1) 3 5768449921.12 7491843407.22502 4773608204 9230776871 3607212049. .9 5386426775 7776424221 0685386562 8552815453 2046177627.P57	211
213	(1, 3, 71) 2230166 0719710979.P93	
215	(1, 5, 43) 1291.1966 0072438421.P115	
217	(1, 7, 31) 38 5227416351.26 3160137658 7304280611 2463084693. .126 5855393578 6667851344 9649319475 7776649681.P55	217
219	(1, 3, 73) 1143619.282 0121693645 4879979568 9279966625 6974847683.P64	
221	(1, 13, 17) 4421.39721657.4 1183788762 1602101829 2737389271 4194450477.P98	
223	(1) 359734681.1926 1747635283.P151	
225	(1, 3, 5, 9, 15, 25, 45, 75) 320851.3388291201. .2 0565836970 4156992901 7137051051.P49	225
227	(1) 1393781.1 4127313744 5779487073. .199496 9355576066 5497107153 1139160757 1195545033.P105	227
229	(1) 1505447.P172	
231	(1, 3, 7, 11, 21, 33, 77) 17 4090854323.152632 3866435523. .835316798 1236086982 0818648177.P39	231
233	(1) 56846 5670186789.39455247 0392766848 4254051089. .630 0766008244 1750517471 7786052089.P106	233
235	(1, 5, 47) 941.8 8816955621.P130	
237	(1, 3, 79) 15643.393 0248996198 5959073953 7077043657.P85	
239	(1) 479.55 5643125049.67 4693399227.278718 7926109459.P144	
241	(1) 248231.2048 1747682829.184088904 4920084403. .77100382 7979180858 0832936799. .24631 6726378395 4494667487 5820381190 7753252397.P78	241
243	(1, 3, 9, 27, 81) 24 9844450267.47 8476554726 3670114004 5116262913. .103939 3803603296 6674629237 0686492281.P48	243
245	(1, 5, 7, 35, 49) 22541.P127	
247	(1, 13, 19) 1483.77071411.32 9143658741.825697375 2470502414 2782304189.P117	
249	(1, 3, 83) 17929.63871987.305654519 8016277916 3327091617.P87	
251	(1) 503.34204273.5 9351200969.8044070 5758435499. .3 4894780200 2515477640 5154855930 8322189026 3015363685 8925509939.P97	251
253	(1, 11, 23) 23*.1013.7516 8534000121. .25966604 6866989553 2346788399 8618813717 6834471947.P106	253
255	(1, 3, 5, 15, 17, 51, 85) 11996 9950233639 5787186091.P76	
257	(1) 9767.17477.330969345 2762216327.	C173 257
259	(1, 7, 37) 2458852243.12824101 6566344721 6094903673 6553020530 8828\ 951059 7637357011 9192542968 8386832869.P82	259
261	(1, 3, 9, 29, 87) 523.46728 1506322297.108876710 1178107721.P96	
263	(1) 131982869.	C196 263
265	(1, 5, 53) 1061.12721.59 4991492154 0956561586 2915027061. .144388 3079527663 6039434443 4005579169 6913305571.P78	265
267	(1, 3, 89) 1 8530245891.P127	
269	(1) 2908387364 5382611513.23 3477578169 4290932919. .1 4914054997 5667586643 1606264433 1821838847.P128	269
271	(1) P211	
273	(1, 3, 7, 13, 21, 39, 91) 547.243014 3818773217. .31 1093172628 2573765139 9662765563 5721132089.P53	273
275	(1, 5, 11, 25, 55) 13751.10764601.108041680 1397537451.P127	
277	(1) 1109.555 5507589053.15232 7217259127. .1401105 3856556766 5545950097 9343894696 8040153039.C139	277
279	(1, 3, 9, 31, 93) 32689268 5378628881. .4195369622 1075617287 2552858865 7828897923.P83	279
281	(1) 33721.186023.12241337 9955569789.2285667968 5336862276 5083206587.C162	281
283	(1) 36791.217516631.6650 5100371069 1316455749 9908650923.	C173 283
285	(1, 3, 5, 15, 19, 57, 95) 4 7562842881.27 0596289241. .2095471 7934481651 1252551051.P64	285
287	(1, 7, 41) 24884 8212837883.P173	
289	(1, 17) 671059.606329606 7889787612 6475951314 6230361569.P168	
291	(1, 3, 97) 111 9406007278 4160031723 6399112257.P118	

293	(1)	946391.193844113.	C214	293
295	(1,5,59)	1181.1956803 2756311331.15208 1182559338 3429335900 9545761871.P127		
297	(1,3,9,11,27,33,99)	18079 4604080179.P126		
299	(1,13,23)	599.5981.309379487.2341190333.3940980 6457264394 7287218201.C155		299
301	(1,7,43)	4941217.21 0619620359.38715300 1486618459. .1026218 9946213530 4122000135 8738943323. .500188595 7827075084 8409089664 7858368270 0724643573 5770683387.P66		301
303	(1,3,101)	2529268867.4844162809.3 6536927761.25793 4717592273. .31140 1925901507 1338214621 9858775467.P77		303
305	(1,5,61)	86011.21122425 8538246595 7468782381.	C155	305
307	(1)	1229.4762799.7 7447101407 7469888593.2058984 3616826186 7044624683.P182		
309	(1,3,103)	619.P156		
311	(1)	119 1554036683.366 6342101717.10281 2393496224 2970067317. .76401 5026410083 9651419559.C168		311
313	(1)	20032627.1280155603.	C227	313
315	(1,3,5,7,9,15,21,35,45,63,105)	423123121.107683 6800079531. .727256 8060810890 5121706081.P63		315
317	(1)	15217.494521.P237		
319	(1,11,29)	10847.642814987.10 5726751219.89 1967447801.2213828 9428735393. .140908891 3314217103.503513 9503085804 7251181629. .4 5283815760 9781645246 1578808677.P92		319
321	(1,3,107)	242123 0245588271 7029271553.3 9890176806 5835135529 7802631081.P109		
323	(1,17,19)	647.P222		
325	(1,5,13,25,65)	1301.15601.9034 7109228159 4039875101. .9458 9990462446 3468762291 1142066001. .57 0312905179 9870524214 6708227547 0442757451.P80		325
327	(1,3,109)	2617.5233.16823497.16 1662095193.P143		
329	(1,7,47)	135817534 2743772577 9783140643. .5552584 9665500291 9243649170 3687097023.C150		329

6+

Factorizations of  $6^n + 1$ ,  $n \leq 330$   
L,M for  $n = 12k - 6 \leq 654$

$n$	Prime Factors
1	7
2	37
3	(1) 31
4	1297
5	(1) 11·101
6	(2) L.M
L	13
M	97
7	(1) 7*·29·197
8	17·98801
9	(1,3) 46441
10	(2) 241·6781
11	(1) 51828151
12	(4) 1678321
13	(1) 53·937·37571
14	(2) 421·5030761
15	(1,3,5) 1950271
16	353·1697·4709377
17	(1) 190537·12690943
18	(2,6L,6M) L.M
L	73·541
M	55117
19	(1) 1787·48713705333
20	(4) 41·68754507401
21	(1,3,7) 2527867231
22	(2) 58477·70489·863017
23	(1) 113958101·990000731
24	(8) 5953·473896897
25	(1,5) 3655688315536801
26	(2) 313·2341·6291946695217
27	(1,3,9) 114967·883383463
28	(4) 281·337·617·81035189089
29	(1) 59·32713·2727192763388813
30	(2,10) L.M
L	(6L) 61·74161
M	(6M) 181·3541
31	(1) 189491931189200021056951
32	2753·145601·19854979505843329
33	(1,3,11) 463·72073·127236649
34	(2) 934117·8289713345361373993
35	(1,5,7) 631·701·2311·9241·585131
36	(4,12) 577·3313·2478750186961
37	(1) 3923·1096762734443·2054788991719
38	(2) 1030762781149·9736145643041809
39	(1,3,13) 79·9049·868999·8857759
40	(8) 17761·3696985841·121206120881
41	(1) 83·28537·4837453663777044375040181



- 42 (2,14) L.M  
 L (6M) 804146449  
 M (6L) 6055984789
- 43 (1) 412 4826886271 7807980759 8675848631  
 44 (4) 89.1500807647 9292298867 6714149209  
 45 (1,3,5,9,15) 476031781 6590150361  
 46 (2) 6073.2259889.9564781.12840749 4947883673  
 47 (1) 534577 5644608227 9143064788 3899825591  
 48 (16) 193.8641.688490113.6931400449  
 49 (1,7) 7\*.76233 2681442053.9017961 6936384011  
 50 (2,10) 343801.22243201.174801673 5462726601  
 51 (1,3,17) 103.919.980146969.9 9617785207  
 52 (4) 192193.14090441.82844 3495052624 0125727017  
 53 (1) 107.97351567.3368 5364386033.7108046 4397105403  
 54 (2,6L,6M,18L,18M) L.M  
 L 591841.171467713  
 M 109.93 2461936453
- 55 (1,5,11) 11\*.1031141.1 6336066781.8415 5540944421  
 56 (8) 113.4817.4048129.101894 4023901288 3075423169  
 57 (1,3,19) 457.137713.1 9032449293 8225748951  
 58 (2) 349.10 5134528469 7790716705 0163115932 8247729809  
 59 (1) 116365 8999540220 4164124464 8270891913 9658591671  
 60 (4,12,20) 13441.5 9257510962 7400042641  
 61 (1) 9151.457 7830180684 9453601626 1319828664 5069141001  
 62 (2) 4755276 7764994953 2328545697 7988880376 1183529901  
 63 (1,3,7,9,21) 127.15 4260982009.52892 1402377887  
 64 4926056449.44718330 9836853377.287 5378719705 6661026689  
 65 (1,5,13) 131.199930 7822984835 2304058410 8028862541  
 66 (2,22) L.M  
 L (6M) 3037.96493.4629769  
 M (6L) 622513.1 6266405013
- 67 (1) 269.418349.9057154395 2974835963.1917 5776064763 9121941197  
 68 (4) 137.5849.153605 2010629489.514205763 7481138140 3609445473  
 69 (1,3,23) 2464 8570768391.8 1621407908 4081564521  
 70 (2,10,14) 1350 9594555661.17081 1426320422 2806519161  
 71 (1) 37489.1173 5704315681.5757417 4854480594 2291474832 0317168839  
 72 (8,24) 22452257 7073545572 3534882978 5471057921  
 73 (1) 293.439.120855443.1389436303.4221 8834593780 3047082447 6438562257  
 74 (2) 37\*.4441.330004 3400835529.190892 4076180229 9384106934 6975403017  
 75 (1,3,5,15,25) 151.168151.573178201.91862 8247364601  
 76 (4) 4561.35551 8408146401.502818748 6478069273.1303831368 0704041577  
 77 (1,7,11) 5701908 7134151254 0616666217 1772866916 7279862151  
 78 (2,26) L.M  
 L (6M) 8893.19774 3936282933  
 M (6L) 13\*.157.642917 8169720749
- 79 (1) 317.5531.2832941.9968731 2908749681.8 5923191538 2798858681 5914947213  
 80 (16) 9601.281 0800069601.2347 1108401585 6381602818 6318246561  
 81 (1,3,9,27) 1783.149862151.3 9203443504 0964450709 3715799617  
 82 (2) 4046701.17 4521133001.24617 9376206361 7884664419 0195829394 9537091001  
 83 (1) 710813.6547890917.216 0853606264 4851877771.548243 6356462940 1758409941  
 84 (4,12,28) 117 6362433121.191009 0065554083 0489319601  
 85 (1,5,17) 1383638161.7208 5651321561.7407976 7201467492 7371043791  
 86 (2) 1033.6501601.29 1476498937 6043020733.P35  
 87 (1,3,29) 68209.92569.1439329.380675809.519258631.2 4378360481  
 88 (8) 9307950433.P53  
 89 (1) 179.P67  
 90 (2,6L,6M,10,30L,30M) L.M  
 L (18L) 559778011 2726834061  
 M (18M) 9001.211501.2106930961
- 91 (1,7,13) 2003.2549.36947.52769627.P38  
 92 (4) 14537.43 3176829049.P53



- 144 (16,48) 115777·31057921.P63  
 145 (1,5,29) 168491·3 5969851301·711886 1191748501 8014870131.P46  
 146 (2) 877·16658893·2 0007314401.P92  
 147 (1,3,7,21,49) 32670457·1152319183.P49  
 148 (4) 12950593·1074268182 6196124641.P86  
 149 (1) 17808481·3908095969.P99  
 150 (2,10,50) L.M  
   L (6L,30L) P32  
   M (6M,30M) 38149201·3408 0098161413 0538049401  
 151 (1) 18772 5834236707 6264555657·577198399 6441748998 8525624247.P64  
 152 (8) 417827633·50 5981859041·26 8361934357 9360102399 8323852801.P61  
 153 (1,3,9,17,51) 147799·2927 4753335383·188841 1753890127.P41  
 154 (2,14,22) 4 0590776689.P83  
 155 (1,5,31) 73925704 2137049452 3616944935 4196288841.P56  
 156 (4,12,52) 8162 1337952258 8431707233.P51  
 157 (1) 1571·53381·259993·3 2577356503.P98  
 158 (2) 10429.P118  
 159 (1,3,53) 7985096 3147627239·8866296242 2062348511 4684453959.P35  
 160 (32) 82241·159540 9728230926 2360999041·  
   .4903 6264667685 7099922473 8379365121.P36 160  
 161 (1,7,23) 231841·3091531661.P88  
 162 (2,6L,6M,18L,18M,54L,54M) L.M  
   L P43  
   M 3966 1919912737.P29  
 163 (1) 11411·1712959177·5210 8050586547·4 1731779249 2527332337·  
   .3903318 4133630292 9436994813.P52 163  
 164 (4) 9082 3862327833 0868003863 5251306724 8343828857.P81  
 165 (1,3,5,11,15,33,55) 66198 2172984001.P48  
 166 (2) 997·778873·3020869·13852369·16118 4670755001·  
   .4 3780189181 7492814657·624 9222585566 2442512009.P48 166  
 167 (1) 2339·24 3622858759 2235686865 5021961427.P95  
 168 (8,24,56) 673·3 2769747803 6428448279 9810397121.P42  
 169 (1,13) 4057·11672007 0342348721·  
   .337830 7227685242 6237135081 1698946852 4398534111.P56 169  
 170 (2,10,34) 1021·3 7281047699 4982432801·22 4480729970 0346905001·  
   .418196 7467444158 7529015061.P30 170  
 171 (1,3,9,19,57) 6217432738 7790051073.P65  
 172 (4) 1721·1904729·5993513377·344 9220534377·  
   .2400135 8499561290 3097929322 1108376113.P63 172  
 173 (1) 347.P132  
 174 (2,58) L.M  
   L (6L) 104485957·3347320129.P27  
   M (6M) P44  
 175 (1,5,7,25,35) 3851·12601·1305192701·6 6631795301.P66  
 176 (16) 26536 5570360005 5300471675 9402716113 6363132036 8111914433.P71  
 177 (1,3,59) P91  
 178 (2)  
   92874768 9137205829 0085891129 9754687243 1499418685 0175573324 6139460861.P69  
 179 (1) 16111·3490859·317649821·216420 1732799819·189021308 8140761141·  
   .6 8401559316 8267521517.P65 179  
 180 (4,12,20,36,60) P75  
 181 (1) 1087·13757·13952929·632269201·3 3644936669·103 2407342933.P95  
 182 (2,14,26) 1093·8955493.P103  
 183 (1,3,61) 367·1676281·188247743 7757002169.P67  
 184 (8) 11 8593079873·3640953 1469515520 7401455201·  
   .160 0211859918 6832384453 3898916209·2912 2545034054 9787452278 2767870577.P34 184  
 185 (1,5,37) 5311351·3371674951·3085 8852252821.P83  
 186 (2,62) L.M  
   L (6M) 373·316201·532333·1680597049·1802142841·9538 8829922809  
   M (6L) 1489.P44  
 187 (1,11,17) 480615433.P116

188	(4)	4513.4889.347984 0316388138 6778838493 8483862609.P101	
189	(1,3,7,9,21,27,63)	216217.4622286817.203823001 3432107097.P51	
190	(2,10,38)	300961.2190 5019726901.3 4710107017 9037778781.P73	
191	(1)	1258380199.1 5245395794 5936437771 7928165817. .20894 2749740386 7536398051 1918504639.P75	191
192	(64)	769.272040961.10 3352381953.P78	
193	(1)	773.1931.6563.96 4591900729.P128	
194	(2)	145501.57224 0484565153.4 0437112381 8722970575 4319631461.P99	
195	(1,3,5,13,15,39,65)	1951.50311.78296791.P59	
196	(4,28)	352409.171103297.11 0495360641.P106	
197	(1)	4729.P149	
198	(2,6L,6M,22,66L,66M)	L.M	
	L	(18M) 397.7129.118496047 1459158549.123 3598889198 5043955517	
	M	(18L) 23761.1 3705107769.69 7344975757.2 5425385979 6489462713	
199	(1)	236029523.379 9311562897.3187 8912911333.7771914 0435208369.P103	
200	(8,40)	401.88610 9293550401.81261071 3899205201. .5977338652 2355896001.214 6317076648 0994553601.P47	200
201	(1,3,67)	68 2489921447.266 5157957929.19 1992022588 8720033879.P58	
202	(2)	5390 2351586977.194721394 2756469621 6240566673.P114	
203	(1,7,29)	29*.23549.140071.4131 6543716813.40645712 7805781473.P89	
204	(4,12,68)	8715697.35540881.P86	
205	(1,5,41)	821.21 8646938147 5738293871.2 1916836929 1245226353 0405964341.P70	
206	(2)	840 8219407597. .2678 6241439528 0845751633 0191792080 3227185478 4088775249 3464690277.P83	206
207	(1,3,9,23,69)	4811469913.6 1040960263.25 2808832792 4319935241 5750302719.P51	
208	(16)	2099459291 0993979280 7681119841.P121	
209	(1,11,19)	419.87713957. .6907939 1915767473 4946282168 4466659106 7865219146 8497041123.P73	209
210	(2,10,14,70)	L.M	
	L	(6M,30M,42L) 66361.2138 7387918961.4164908589 1390429201	
	M	(6L,30L,42M) 9120301.P30	
211	(1)	91997.525720 1752845087 2868981647.P133	
212	(4)	6969 3040414889.2008934031 0546423313.11 1099811298 3390874377. .831830515 4523444733 6922778521.8250997451 2416638980 3400429081.P49	212
213	(1,3,71)	5113.74551.2673405 6474599359.P84	
214	(2)	51141721.7254122353.P148	
215	(1,5,43)	8171.1211741.21619111.945889289 4402537221.P95	
216	(8,24,72)	3457.19009.P105	
217	(1,7,31)	8981 6745465847.11001414 1145558053 3471034569.P100	
218	(2)	33579042 4559680201.28 8093384837 4725856201. .378303336 9252816683 9600001523 8257668805 2300376449.P81	218
219	(1,3,73)	10513.65600137.7426195831.46726 0890471943. .638855147 1149527279.P57	219
220	(4,20,44)	8247361.778055521.25 4055515561.2069524 8084558521. .5 1806007233 5148988041.65609700 0483987896 5676927281.P33	220
221	(1,13,17)	443.66728 5023687316 4425783418 8952657813.P113	
222	(2,74)	L.M	
	L	(6M) 82660813.1 2023017393.P38	
	M	(6L) 270841.205760 4700829917.6371742 7974558037.829687576 8265773901	
223	(1)	10259.968713.224523 3071284547.2 3251815697 2996725239. .6 6654649252 4951029181. .83579065 5259197870 5863199558 7876457413 6853697743.P59	223
224	(32)	449.1 4050095361. .4 3479315879 8482438655 6915294792 7677259578 7341859010 0902582977.P76	224
225	(1,3,5,9,15,25,45,75)	1801.4468904551.526 7460432151. .1802772 0294319663 8580206001.P42	225
226	(2)	267 8668139593.7452 0969665581. .8 2787563486 5306157105 3938306201 6180279313.P108	226
227	(1)	715 5680908793 5085523319.3983501 7614149393 5951217441. .1 0185701811 3424074134 6108055571 8755753916 0628544405 5532689903.P67	227
228	(4,12,76)	8502577.704672974 3430131549 6188595297.P77	

229	(1)	2469 2063988803.P164	
230	(2,10,46)	489901.9528100260 1500920612 8296414875 2758062946 1615901941.P82	
231	(1,3,7,11,21,33,77)	944005 0343754637 2775546407 3082424887.P58	
232	(8)	3240229719 2556687417 7785587856 0898355441 9311526178 9544399681.P115	
233	(1)	467.1399. .163877 3752376728 7078980615 7730284778 9021354516 8814576817 8589145021.P110	233
234	(2,6L,6M,26,78L,78M)	L.M	
	L (18M)	1044927469.P47	
	M (18L)	21529.580 6612933322 7697089409.P30	
235	(1,5,47)	150301041 7562301835 7289123321 6900932066 6477334603 9681810841.P86	
236	(4)	499203536 6913467897.21948439 5139691811 6457818851 2458069689.P125	
237	(1,3,79)	47093 9983769122 3036624311 0271664383.P87	
238	(2,14,34)	2857.236834 4826245732 4289601073.12233994 4157898132 9719781061. .7340 9071479761 4309006739 3104626029.P60	238
239	(1)	146715409.457 7909312531.1199673655 7726158297. .5558033798 2189268741.32530713 5115019287 8011946957.P98	239
240	(16,48,80)	P100	
241	(1)	1447.1125808 9375071587 7136155593 6049934936 9034796331 5703776847. .333 8316602238 4432312713 1130894040 8766703222 4070331130 4485275421.P65	241
242	(2,22)	1453.16998867 9132951027 7176681109. .54534460 8882915450 4711498574 4571945145 1381455375 9428356613.P84	242
243	(1,3,9,27,81)	487.939439.1254367.3816559.1 2685746961.P95	
244	(4)	5857.412849.	C178 244
245	(1,5,7,35,49)	491.5 3171499859 9056253801.577 1811756135 5946617161. .20765 3186775519 6744245501.P61	245
246	(2,82)	L.M	
	L (6M)	7873.595894155 3345630517 3269384769.P30	
	M (6L)	3 7448441257.159187 1626929745 3972620877.P27	
247	(1,13,19)	23842881 9287279709 4543947807 9946872806 3645576507.P121	
248	(8)	26 5533200728 7526596353.P166	
249	(1,3,83)	1 8879747223.P118	
250	(2,10,50)	1 8347449147 5865399686 8853565501. .761206864 7760892587 5672791716 9846945126 0170146501.P77	250
251	(1)	2796981 1991472751.	C179 251
252	(4,12,28,36,84)	2017.142539 8717511217.P94	
253	(1,11,23)	291 6281795549. .44249044 7397887376 5064495306 6380070663 7907696507.P112	253
254	(2)	14 0348646913.2597 4264373441.4951587827 8227889669. .919631 1857217178 9377372037.235 3332942426 2872757073 4732881529. .1516570873 6690191667 7911827594 8915051773.P55	254
255	(1,3,5,15,17,51,85)	47431.24131 7924973591. .850 2717192143 5050283513 2764398471.P48	255
256	18433.696159865 6913942337 5849495295 9095499568 1382885388 8948633601.P137		
257	(1)		C200 257
258	(2,86)	L.M	
	L (6L)	P66	
	M (6M)	75 2393127973.P54	
259	(1,7,37)	334868353.425555 2817165375 8816503341.P134	
260	(4,20,52)	521.380641.98735521.286293102 3015114481. .3277919502 2307860881.259841965 8213748436 1518374801.P67	260
261	(1,3,9,29,87)	828396 3567043783.309920992 4759291137. .4489424516 6647019137.15 3539797704 0517521649 3168455121.P46	261
262	(2)	25153.P198	
263	(1)	5261.30383 4678444151.	C186 263
264	(8,24,88)	3169.2508001.3537601.8245249. .65 3601194883 8551178811 5672063955 3118131649.P60	264
265	(1,5,53)	9011.3 0871938731.7388373037 4153134711.P128	
266	(2,14,38)	1597.28729.18151 4505515281.1990027 1591604097. .7479560026 5930240481.1292 0114403080 2371695392 4874633901.P77	266
267	(1,3,89)	10289 5570700431.73738 0287479449. .10597454 8536692346 1644327075 6994034202 2635766599.P62	267

268	(4)	856 9643669801.86 0862336592 1809689881. .1581 1086180835 9460225384 7328498841.C138	268
269	(1)	258241.178613311.1 6328634290 7309883903. .2 6917859611 0556567283 0216572574 0157055483.C135	269
270	(2,6L,6M,10,18L,18M,30L,30M,90L,90M)	L.M	
	L	(54L) 39326041.5 1353541541.7540 8883542901.6991 2042954864 6987756001	
	M	(54M) 4861.15 9594687181.3477549 9883178521.39403 7442337437 9301990321	
271	(1)	444329 9354431499.C195	271
272	(16)	257857.80189953.350828321.P178	
273	(1,3,7,13,21,39,91)	3216487.P106	
274	(2)	77269.1422061.1 9955176141.C191	274
275	(1,5,11,25,55)	11551.1458601.541019051.P137	
276	(4,12,92)	100 6002606571 3210639336 7429005921.P105	
277	(1)	8311.9419.113017.8065133.14 3476139909.P184	
278	(2)	1561232989.P206	
279	(1,3,9,31,93)	P141	
280	(8,40,56)	3361.275521.11672641.5576968321.P124	
281	(1)	563.8431.135 1757950997.140 6306252130 2839553357. .199 7469619962 3424031237.1156004605 7865072038 3010805853.P126	281
282	(2,94)	L.M	
	L	(6L) 333790 3223042569.P57	
	M	(6M) 949160200 0279600777.P53	
283	(1)	22299700 6311538766 5250948239.C193	283
284	(4)	569.392489.469077689.896 0414689257 3318713736 5896107353.C168	284
285	(1,3,5,15,19,57,95)	408447463 4999946443 6020322521.P84	
286	(2,22,26)	252253.29518633.C174	286
287	(1,7,41)	1121023.28531157 5637232993 0021879179.C154	287
288	(32,96)	1153.1984301569.15 6710318749 9033148929.P116	
289	(1,17)	8093.23 2788929250 3425831829 4404644503. .7679 9623612093 5079524576 6079339091.C143	289
290	(2,10,58)	1741.375841.P166	
291	(1,3,97)	135607.334 3385035897.P132	
292	(4)	C225	292
293	(1)	587.1782 8792392643.P212	
294	(2,14,98)	L.M	
	L	(6L,42M) 843405 2750068597.P50	
	M	(6M,42L) P66	
295	(1,5,59)	2044155216 6028072811.P162	
296	(8)	593.13 7045594113.675 8410568257.5519 7682698737. .837582946 3350094657.4563704623 3441330193. .28 2924772880 6215136257.147 0711926940 4607768750 4556871041.P92	296
297	(1,3,9,11,27,33,99)	2377.4159.5014719043 6375827433.P114	
298	(2)	682568 8699471381.C215	298
299	(1,13,23)	3241759.5666051.P193	
300	(4,12,20,60,100)	2056871500 6531358436 1634503328 8599993601.P86	
301	(1,7,43)	29 8183187219.393091 1502995317 4936420529 7712116979.C150	301
302	(2)	19515241.895128953 2327540357.27564 1636223153 1449082493 5535295293.C173	302
303	(1,3,101)	10303.21561481.C145	303
304	(16)	440123297.C216	304
305	(1,5,61)	1054 2843898331.P174	
306	(2,6L,6M,34,102L,102M)	L.M	
	L	(18M) 613.12241.8463700 5455859651 8376711409.P41	
	M	(18L) 6121.5737 2656104261.P58	
307	(1)	4 7325620843 3324971419 6514227673.55 3856983711 2958803062 9087875349.P176	
308	(4,28,44)	65725969.596 4965212879 3520533433.P157	
309	(1,3,103)	427039.26432479.P146	
310	(2,10,62)	27901.50221.37 2201769081.561 1229634961 0045406881.P144	
311	(1)	2 5253560139.431 0758347899.1870 7517257089. .652686 2335251037 4655683719.15375 9974221862 9171993391 5126668351. .2495174740 0323371044 5500701299 6408231601. .386497814 6331181248 2481063093 9505105828 8828336437.P57	311

312	(8, 24, 104)	1249.9457 8317595841.P133		
313	(1)	22699 5903246587 4003365857.P219		
314	(2)	55 8436298701.438 7767153479 1092362933.	C209	314
315	(1, 3, 5, 7, 9, 15, 21, 35, 45, 63, 105)	272566 7472495241. .8 8130323871 1788245469 2315491751.P66		315
316	(4)	1578867457.1 6162944961. 8836 2484215497.	C210	316
317	(1)	974459.434022 3635815993.	C225	317
318	(2, 106)	L.M		
	L (6L)	4013301142 5325338673.P62		
	M (6M)	6997.10786528 4306808709 7186164246 3992861493.P40		
319	(1, 11, 29)	1277.169709. 1034019361.125221711 6623387773.P183		
320	(64)	641.6827521.62143 2697463041.174303658 2663429761. .248043128 8764419201.P139		320
321	(1, 3, 107)	2651847769.P156		
322	(2, 14, 46)	1933.2593505209.476275 6207579441.P178		
323	(1, 17, 19)	13567.	C221	323
324	(4, 12, 36, 108)	2593.3889.405671953 0621312834 2900074449.P133		
325	(1, 5, 13, 25, 65)	43798301.8 8461995051. .51 2517661513 9717295361 7959306150 6405316951.P127		325
326	(2)	9128653.86 2123028232 4652331661 3331820319 5759014737.	C204	326
327	(1, 3, 109)	32560 2227159887 5682006278 1110511873.P134		
328	(8)	554977.1487809.P238		
329	(1, 7, 47)	659.6581.13 1589345007.2909 1932006593.641722120 4788802521. .9937963371 4344941623.5608779 0672078793 4003619587. .6880324 2681264737 9990413979.P92		329
330	(2, 10, 22, 110)	L.M		
	L (6M, 30M, 66L)	661.144541.1 4966414761.P45		
	M (6L, 30L, 66M)	1321.110221.188074921.P46		
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342	(2, 6L, 6M, 38, 114L, 114M)	L.M		
	L (18L)	60204997.4765941001.23501179 4248567117.4 7316473791 3969822009.P29		
	M (18M)	37187713.P77		
354	(2, 118)	L.M		
	L (6M)	709.2833.254923189.P76		
	M (6L)	P91		
366	(2, 122)	L.M		
	L (6M)	8053.241561.1016 1211191529.4573 4687984987 8822260409.P47		
	M (6L)	733.30694 6280522833 8593646133.1739410009 6553853775 5852657517.P38		
378	(2, 6L, 6M, 14, 18L, 18M, 42L, 42M, 126L, 126M)	L.M		
	L (54M)	1 0794083454 4630662943 4220802955 2733580361.P45		
	M (54L)	757.9829.2592 2662363359 8481802123 7855668549.P44		
390	(2, 10, 26, 130)	L.M		
	L (6M, 30M, 78L)	342421.55088 6253415684 7958466759 8703368001.P35		
	M (6L, 30L, 78M)	122210 6886101401.P60		
402	(2, 134)	L.M		
	L (6L)	1609.18493.64009167 4182677660 8939188781.P68		
	M (6M)	9826638 7530667777.P86		
414	(2, 6L, 6M, 46, 138L, 138M)	L.M		
	L (18L)	1657.102673.284833.3173 9306955000 3186820046 0576210513 2924971289.P46		
	M (18M)	829.1195928 0174921358 1571134447 7809659138 4713470257.P54		
426	(2, 142)	L.M		
	L (6L)	853.99535753.1 5006883477.1 7403644677. .1 0927761756 0493622693 0157745921.P48		426L
	M (6M)	17041.5123509669.6 1803564541.25 3055139049.P73		
438	(2, 146)	L.M		
	L (6L)	1753.26245837.5 1911357917.332963 4082406617. .432212870 1610242421.68 9811909540 2110707133.P36		438L
	M (6M)	8761.28348020 0282934561.P91		
450	(2, 6L, 6M, 10, 30L, 30M, 50, 150L, 150M)	L.M		
	L (18L, 90L)	2 6922319201.P83		
	M (18M, 90M)	5771844901.1 5198535801.272 4303865501.31224128 3985799801.P44		

462	(2, 14, 22, 154) L.M		
	L (6L, 42M, 66M) 7393 · 55441 · 449989 · 2123353 · 3834601 ·		
		.4473 0933830084 4744160129 · P43	462L
	M (6M, 42L, 66L) 93 8733964477 · 4609 4532937993 · 8115459 1004568313 · P52		
474	(2, 158) L.M		
	L (6M) 3793 · P118		
	M (6L) 5689 · 18709729 · 317233981 · 1945096921 · P94		
486	(2, 6L, 6M, 18L, 18M, 54L, 54M, 162L, 162M) L.M		
	L 763296049 · P118		
	M 17082732 1094639893 · 34094 6311768944 2128783261 ·		
		.3 1714835472 7405962498 5263562628 1791475129 · P44	486M
498	(2, 166) L.M		
	L (6M) P128		
	M (6L) 1993 · 24 5351666247 7885603124 0823485603 7538218169 · P84		
510	(2, 10, 34, 170) L.M		
	L (6M, 30M, 102L) 484 6014905718 8690349351 8015104501 · P68		
	M (6L, 30L, 102M) P100		
522	(2, 6L, 6M, 58, 174L, 174M) L.M		
	L (18L) 2089 · 29 0924056117 · 94734949 3773774517 · P99		
	M (18M) 359137 · 279795 8656485541 · P110		
534	(2, 178) L.M		
	L (6M) 1069 · 694201 · 2803 1381649109 · 19694735 5253345341 · P97		
	M (6L) 2137 · 7 2373984885 7641030189 · P114		
546	(2, 14, 26, 182) L.M		
	L (6L, 42M, 78M) 15289 · P108		
	M (6M, 42L, 78L) 16381 · 162 7627815399 7133773431 6347164963 1733474853 · P67		
558	(2, 6L, 6M, 62, 186L, 186M) L.M		
	L (18M) 11161 · 15746 2752204253 · 2112421421 7163783261 ·		
		.15201 6875624532 1923557857 · P79	558L
	M (18L) 1117 · P138		
570	(2, 10, 38, 190) L.M		
	L (6L, 30L, 114L) 2281 · 2358661 · 381 7262181721 · 619720 8621830041 ·		
		.8 8806687080 6284147801 · P53	570L
	M (6M, 30M, 114M) 1880551 6694127001 · P97		
582	(2, 194) L.M		
	L (6L) 169699 5935981617 · P135		
	M (6M) 97* ·		
		.1083115 8919491438 2664863536 6282163052 4004381873 0349946460 9499226261 · P81	582M
594	(2, 6L, 6M, 18L, 18M, 22, 66L, 66M, 198L, 198M) L.M		
	L (54M) 28964629 · 1553664 9073902661 · 2942674 9337349541 ·		
		.194 2974718358 3833735981 · P78	594L
	M (54L) 3155329 · 176 9896060168 3054308649 · 35128309 6611268378 2744191389 · P84		
606	(2, 202) L.M		
	L (6L) 1213 · 25453 · 215737 · 93098 5424669173 · P129		
	M (6M) 3637 · 181339441 · 7 3805592037 · 25730 9257577257 · 34332 0968801689 · P104		
618	(2, 206) L.M		
	L (6M) 3 3703023049 · 3171219 6448668781 · P132		
	M (6L) 1237 · 33479895 3136016503 6569511760 3613865333 · P119		
630	(2, 6L, 6M, 10, 14, 30L, 30M, 42L, 42M, 70, 210L, 210M) L.M		
	L (18M, 90M, 126L) 51 4379712421 · 922683 0539692081 ·		
		.2 5319786186 5025639316 2606524681 · P55	630L
	M (18L, 90L, 126M) 2521 · 6797701 · 346409259 5315894059 7772893101 · P74		
642	(2, 214) L.M		
	L (6M) 5972962561 · 14 2696920050 7388358761 · 17402 6910446308 6681404229 ·		
		.1 0200602444 0756182556 5400125523 7011614621 · P70	642L
	M (6L) 10273 · 533550 3285366949 0874614844 9547022477 · P126		
654	(2, 218) L.M		
	L (6M) 132109 · 878550901 · 7 0971053221 · 716396 9211901657 ·		
		.151876 9073541305 0491663016 3154066721 ·	
		.148 0112921488 5864423782 8324041284 0195548801 · P50	654L
	M (6L)	C169	654M



$$6^{6h} + 1 = (6^{2h} + 1)L.M, \quad L = T^2 - T.6^k + 6^h, \quad M = T^2 + T.6^k + 6^h, \quad T = 6^h + 1, \quad h = 2k - 1.$$

Factorizations of  $7^n - 1$ ,  $n$  odd,  $n < 300$ 

$n$	Prime Factors	
1	2.3	
3	(1) 3*.19	
5	(1) 2801	
7	(1) 29.4733	
9	(1,3) 3*.37.1063	
11	(1) 1123.293459	
13	(1) 16148168401	
15	(1,3,5) 31.159871	
17	(1) 14009.2767631689	
19	(1) 419.4534166740403	
21	(1,3,7) 11898664849	
23	(1) 47.3083.31479823396757	
25	(1,5) 2551.31280679788951	
27	(1,3,9) 3*.109.811.2377.2583253	
29	(1) 59.127540261.71316922984999	
31	(1) 311.21143.3999088279399464409	
33	(1,3,11) 3631.1532917.12323587	
35	(1,5,7) 2127431041.77192844961	
37	(1) 223.2887.4805345109492315767981401	
39	(1,3,13) 486643.7524739.44975113	
41	(1) 83.20515909.4362139336229068656094783	
43	(1) 166003607842448777.2192537062271178641	
45	(1,3,5,9,15) 1527007411.125096112091	
47	(1) 13722816749522711.63681511996418550459487	
49	(1,7) 3529.1074473.13473433.6106505825833677713	
51	(1,3,17) 103.365773.2316281689.10879733611	
53	(1) 8269.319591.38904276017035188056372051839841219	
55	(1,5,11) 5457586804596062091175455674392801	
57	(1,3,19) 19*.19609.879399649.6957533874046531	
59	(1) 459257.134927809.550413361.354639323684545612988577649	
61	(1) 367.4759.177237331.1914662449813727660680530326064591907	
63	(1,3,7,9,21) 2643999917660728787808396988849	
65	(1,5,13) 131.157951.787021.4446437759531.434502978835771	
67	(1) 228337.147300841.206244761.10052011757370829033540932021825161	
69	(1,3,23) 139.402011881627.235169662395069356312233	
71	(1) 990643452963163.169002145064468556765676975247413756542145739	
73	(1) 439.3675989.359390389.1958423494433591.7222605228105536202757606969	
75	(1,3,5,15,25) 29251.217648180992721729506406538251	
77	(1,7,11) 724487149.6809710909.88262612316754526107621113329689	
79	(1) 913242407367610843676812931.1056836588644853738704557482552056406147	
81	(1,3,9,27) 3*.1621.3727.3368791.70722308812401674174993533367023	
83	(1) 167.66733.76066181.7685542369.62911130477521.303567967057423. .18624275418445601	83
85	(1,5,17) 1531.4931.P48	
87	(1,3,29) 2576743207.196915704073465747.358475907408445923469	
89	(1) 1805633.18489605314740987765913.P46	
91	(1,7,13) 7304123737.231410451435538144122809.P28	
93	(1,3,31) 5463751.2211164386353499.P29	
95	(1,5,19) 36671.1966385431.P47	
97	(1) 389.971.P76	
99	(1,3,9,11,33) 199.173647.P44	

101	(1)	607.809.6263.P76	
103	(1)	17923.P83	
105	(1,3,5,7,15,21,35)	P41	
107	(1)	2 2710928374 5807808529.16 2022156888 1364582821.P49	
109	(1)	1455128 8401737861.635057076 9004888010 1785428103.P47	
111	(1,3,37)	6217.177379.567 1387564314 9053038693.P29	
113	(1)	227.P93	
115	(1,5,23)	1151.188831.1446701.72 3461377501.2722950783 6853201541.P29	
117	(1,3,9,13,39)	1873.322921.2280097.7687225261.P36	
119	(1,7,17)	12377.34273.30521358 8009240737.4407 7982388362 8367834893.P32	
121	(1,11)	1453.65099.1179526 1559086963.587923 1512401382 3398811997.P44	
123	(1,3,41)	267403.P63	
125	(1,5,25)	251.21 8281675375 8823696751.P61	
127	(1)	260461507.5543512265 0527538067 6162672703.P69	
129	(1,3,43)	10837.6335 0976270733.1754 4658428139 5198837259.P30	
131	(1)	P110	
133	(1,7,19)	401563177.2662276961.37374 0808373213.8 9755851340 7803666357.P38	
135	(1,3,5,9,15,27,45)	271.185221.17556187 6921802311.P36	
137	(1)	2741.213721.251533.571629223 9925400235 2124124899. .654802034 5846490296 5944539043.P44	137
139	(1)	19739.673039.P107	
141	(1,3,47)	283.5960917.P69	
143	(1,11,13)	52880 8508322667.37 6215890379 3159973114 1637278469 1746214777.P46	
145	(1,5,29)	4899841.2774636326 4566796500 8782910911.P59	
147	(1,3,7,21,49)	406 0603391041.4247 7087133990 3301567509.P35	
149	(1)	P126	
151	(1)	11 5356256117.3607 6003832567.2 0646252050 3013793561. .28 5634900131 5592319937.P61	151
153	(1,3,9,17,51)	307.613.4591.44371.440 7286280409 1655188147.P45	
155	(1,5,31)	21391.21701.1622982371.9254997611.P74	
157	(1)	4397.5653.103 9945344901.P113	
159	(1,3,53)	32119.1695259.842476820 6300585046 4952755729.P49	
161	(1,7,23)	4406588677.46151 8579693533 4098258901.P78	
163	(1)	653.9781.1260643.9622 0794501447 0392304193. .164853 6343690282 9757644893 8356267839 6141955057.P55	163
165	(1,3,5,11,15,33,55)	7591.3 6647640811.19 4695106338 6221338821.P32	
167	(1)	2158061509.6 2393237420 4290945359. .494 8168947939 4543419575 6741367539.P78	167
169	(1,13)	14 5297991540 2500135854 4173625739 2636887413 4931212567.P81	
171	(1,3,9,19,57)	18684829.967 4698906207.1753369387 7023611817 6950803989.P42	
173	(1)	949193558 6594867440 3673916464 6692592621 1879363793.P97	
175	(1,5,7,25,35)	701.123757861 2719152201.10 9447131760 6762277701.P60	
177	(1,3,59)	709.89209.22 7248655866 3495326198 6967832791.P59	
179	(1)	41887.1498 7498700092 6513705179.P123	
181	(1)	1811.1 3873726021.61880594 7190964867.3643088 0778632294 3430987769.P95	
183	(1,3,61)	5153013553.104199 6664707365 4595992013 7256413473.P57	
185	(1,5,37)	1481.6661.219041.P110	
187	(1,11,17)	10099.10 7969286569. .15766342 7378398137 4654904510 4950357055 8624435143.P73	187
189	(1,3,7,9,21,27,63)	757.59062 5534947766 0375285361.P64	
191	(1)	383.355 4639684154 8971517329.P136	
193	(1)	14669.857 2828535540 9267895679.7569371 5591039004 4916932629. .5994 9463273047 1246870557 1873826831. .4539546 9704855364 3642470747 5812653713.P38	193
195	(1,3,5,13,15,39,65)	567538141.1 4046059431.P63	
197	(1)	3547.6159369299.P153	
199	(1)	3583.214 6612951394 3188564383 2154153997. .8653911665 3269014086 9610510206 2701223228 4504261471.P82	199
201	(1,3,67)	85627.13 2955527487.77 5594571863.9852 7557194917. .42899 5274049217.P55	201

203	(1,7,29) 29*.60089.145 9166196122 8378338637 0190568409. .11 5856059599 0812530792 6193567884 6777747767 4946730941.P53	203
205	(1,5,41) 834035 4916280673 9761597177 8938263976 9271804943 4998230297 5033997201.P70	
207	(1,3,9,23,69) 7756 9456660417.227556220 1362875060 2894227677 0826968937.P60	
209	(1,11,19) 804854187 6545647951.P134	
211	(1) 141793.2590182818 1222890897 4285857741 7976686017 0863299438 6\ 954137952 5493050519 1880636307.P93	211
213	(1,3,71) 968299.58 2053568181. .127475 9667849259 7325057743 7632619381 6317726317.P56	213
215	(1,5,43) 31391.822161.1130017632 2829911971.1 4779541084 5880963171. .1 1916717598 6645391513 0830688880 3765941891.P53	215
217	(1,7,31) 604997.195680 8820481173.6 0285880182 4822604293. .6264 7594006553 9137153553.14784849 8072518370 4794749135 9227676537.P50	217
219	(1,3,73) 877.1699904022 5222266951.P100	
221	(1,13,17) 22543.76 0999500977.9761302 0419921175 2491070394 7100342853.P109	
223	(1) 17288166877.13 2218621369.P167	
225	(1,3,5,9,15,25,45,75) 8101.1708445701.1 2125741837 4086998051. .20 2977811821 6947854694 6347835701.P37	225
227	(1) 6246307 8483642684 5238059277 8468910308 8686041429. .9856289697 5488148732 2427476013 0028454242 8765101790 4086946721.P85	227
229	(1) 50839.8771 5610063134 9161821926 0558398401.P155	
231	(1,3,7,11,21,33,77) 1793870233.12584453 8662442909. .37526915 4594756066 9458268649.P48	231
233	(1) 467.7 9227874003.135149985 4688664607 8035233993. C155	233
235	(1,5,47) 28128946 1973580408 7343816418 2618515877 0508037564 7708714001.P98	
237	(1,3,79) 2371.5296373383 3472940548 3135077873.P99	
239	(1) 479.871986721.64338 4173113837.4040 6092739253 8868579985 6703093687.P142	
241	(1) 1447.28439.3348607 8253526557.58035187 2045743557. .54728 3138069536 8694129489 7537738522 2182769003. .29 3702655045 1562627666 1511502790 7833012590 9163812627.P65	241
243	(1,3,9,27,81) 3*.1459.169129.1382671.73 8707874768 4993339347 4604683663.P91	
245	(1,5,7,35,49) 4896864001.9152363081.1149 2120512321. .3532 0795799740 2826578121.P86	245
247	(1,13,19) 6917.2 2931541257.1497586 9588530371.P153	
249	(1,3,83) 11606389.4149179 4184631137. .7635435 9945860977 7345714919 6287430492 3412180177.P68	249
251	(1) 503.27611.889 5962998159.P192	
253	(1,11,23) 1106436299. C177	253
255	(1,3,5,15,17,51,85) 580381.32 6568900271.60 4822302841.P80	
257	(1) 1543.19 9878409095 8019204289. C192	257
259	(1,7,37) 3109.65269. C175	259
261	(1,3,9,29,87) 523.5743.8 3226515419.71007 4092185677. .474062 5067082427 6070177155 3376690953.P75	261
263	(1) 111473077.24 6420328513. C203	263
265	(1,5,53) 1061.3041671.19069931.1 8797842269 9271372501. .21 2135996587 8574657749 9458347207 7008056991. .10532296 1980986497 3568366478 2308569743 8251004501.P51	265
267	(1,3,89) 2871385577 3905923529 3255861296 0572694702 9936343189 321\ 7413044 6555537271.P80	267
269	(1) 2153. C224	269
271	(1) 6780421.164514887. C214	271
273	(1,3,7,13,21,39,91) 1093. .8942 6528511765 7047082911 2432548613 6663859609 0445735393.P65	273
275	(1,5,11,25,55) 242929786 4813474051. .1 3108478445 6795851879 4584656279 2720732451. .15 2254207931 5248706409 0726418125 7222395351.P70	275
277	(1) 137947.8954857.6 0770576810 5925529871. C201	277
279	(1,3,9,31,93) 8 2484547340 3230639635 0042707176 5882340704 0574201480 4291507291.P92	

281	(1)	563.8431.34 1614931501.442013573 8596254569. .372634 0960916282 2932103935 8180848549.C165	281
283	(1)	644316289.18273949 7717749501.P213	
285	(1,3,5,15,19,57,95)	523261.9358676077 6923620671. .801 8393466429 2567561851.P74	285
287	(1,7,41)	12412177.240 5532607493.2174767645 7911610417. .73 8710854664 9323732057 3758829809 0279327121.P123	287
289	(1,17)	1828793.801172 4366552960 2959164650 0403317187. .2 6773640876 5413358758 2109244448 4138995809.P148	289
291	(1,3,97)	4657.134002009.951340693.2 3363930803. .5888849368 3908838977 3662393029.11 0897675318 8497781663 8380462821.P71	291
293	(1)	587.15823.P240	
295	(1,5,59)	123311.	C191 295
297	(1,3,9,11,27,33,99)	5347.27170749.P141	
299	(1,13,23)	1045903.5240570609.6443 2450872271. .124 0178151825 5741477249 4313985201. .121219 2499408334 0477007991 5022116301.P127	299

7+

Factorizations of  $7^n + 1$ ,  $n \leq 301$   
L,M for  $n = 14k - 7 \leq 595$

$n$	Prime Factors
1	2.2.2
2	2*.5.5
3	(1) 43
4	2*.1201
5	(1) 11.191
6	(2) 13.181
7	(1) L.M
L	113
M	911
8	2*.17.169553
9	(1,3) 117307
10	(2) 5*.281.4021
11	(1) 23.10746341
12	(4) 73.193.409
13	(1) 53.228511817
14	(2) 13564461457
15	(1,3,5) 6568801
16	2*.353.47072139617
17	(1) 29078814248401
18	(2,6) 13841169553
19	(1) 351121.4058036683
20	(4) 41.810221830361
21	(1,3) L.M
L	(7L) 309079
M	(7M) 51031
22	(2) 661.1409.83960385389
23	(1) 3421093417510114543
24	(8) 33232924804801
25	(1,5) 79787519018560501
26	(2) 157.1195857367853217109
27	(1,3,9) 1628413557556843
28	(4) 337.2129.517553.515717329
29	(1) 402488219476647465854701
30	(2,6,10) 61.555915824341
31	(1) 373.9754399.5420506947192709
32	2*.7699649.134818753.531968664833
33	(1,3,11) 67.1357105535093947
34	(2) 137.59361349.133088039373662309
35	(1,5) L.M
L	(7M) 421.12128131
M	(7L) 71.603926681
36	(4,12) 42409.137089.32952799801
37	(1) 149.15572244900182528777225808449
38	(2) 2598696228942460402343442913969
39	(1,3,13) 79.23850061.115868130379
40	(8) 881.542081.2312581841562813841
41	(1) 4849399.8999993.1636258751.78009515593
42	(2,6,14) 195489390796456327201
43	(1) 947.19867.20899.163573.235211.3799051.4749781

- 44 (4) 89.8713.82069736 0915053644 6402438593  
45 (1,3,5,9,15) 541.154351.295831.7777981  
46 (2) 26681.649981.15513961.5568194236 1860463813  
47 (1) 655417289 5945379543 0768233985 7743931943  
48 (16) 97.104837857.10860439 7663266369  
49 (1,7L,7M) L.M  
L 197.883.161309.19847549  
M 3823.1445599.101361401  
50 (2,10) 5\*.101.13001.25301.383 2796630023 1909291101  
51 (1,3,17) 1135261.12192877.9092 0746649833  
52 (4) 313.85094881.1 3774546353 4253746093 5008154217  
53 (1) 107.345449549.3541 6476134069.5890231697 0027001503  
54 (2,6,18) 26893.16 7039577217.59029 7313273013  
55 (1,5,11) 11\*.331.2311.38501.2864401.784081 5905526451  
56 (8) 449.673.39648001.2153 5258550401.14225 6806230113  
57 (1,3,19) 457.2 4006520939.27543025 1632699963  
58 (2) 233.136853089.5571 6067510309.1167 1464002897 3541741413  
59 (1) 122131.4261190159.118 7164242679.146 8340366288 8806475673  
60 (4,12,20) 12913561.8556026185 9655897641  
61 (1) 4 4451912814 7170444656 9146729456 8943905088 0209231501  
62 (2) 3 3947629297.7450264876 8583254173.1 9684632540 9292090901  
63 (1,3,9) L.M  
L (7L,21L) 127.9829.1506625093  
M (7M,21M) 20801593.67979647  
64 2\*.35969.111 0623386241.15266848 1967935560 9808500033 2888634369  
65 (1,5,13) 1175071.35695 0438690490 4922217454 3845808031  
66 (2,6,22) 29569.2784937.678240817.11632 0403133001  
67 (1) 20771.655775085 3567755279.383 9426654656 3506831258 1125821527  
68 (4) 20129.94793.63899 1748543082 1130374560 0942029347 7766438233  
69 (1,3,23) 277.739 6787205469.85 0194891513 6155490673  
70 (2,10,14) 10 2314938321.1869 0488255321.1958484 5505919961  
71 (1) 135140 5472411521.9291 4860840816 8881173724 3372441958 4467881183  
72 (8,24) 129169.25726609.51385969.635311009.33 8325042961  
73 (1) 3067.279883.71 6764748064 3504302058 1747544866 9879053881 8746798241  
74 (2) 6 8910429493 0588221439 4659726647 3448649585 1596715859 6120016737  
75 (1,3,5,15,25) 151.600 5492312551.702137028 9199888801  
76 (4) 44118001.700197881.129 5161807633.129925 4811081649.13521443 4686939513  
77 (1,11) L.M  
L (7M) 258576319.3281726 2777539703  
M (7L) 463.333103.44363232 3630099913  
78 (2,6,26) 13\*.36530261 6611175569.78 8642210755 6319674933  
79 (1) 317.2874811.757376306 5938754357.P39  
80 (16) 38470561.10211877 7045028801.P30  
81 (1,3,9,27) 163.487.15877.P37  
82 (2) 33842057.544962817 6194898649.P42  
83 (1) 6963362191.P60  
84 (4,12,28) 3361.489 4546210513.22320 5976032903 7670187857  
85 (1,5,17) 159098 8506392861.P39  
86 (2) 173.1033.P66  
87 (1,3,29) 5406066031.128456494 1030772067.3472005899 2462423813  
88 (8) 208 5729338353.P56  
89 (1) 179.3917.18691.11 7953690705 7197599849.P44  
90 (2,6,10,18,30) 9901.179516843 4777002101.206502516 4427492401  
91 (1,13) L.M  
L (7M) 73 2700162559.136262139 6812563889  
M (7L) 467280997.172 2545445672 4489912483  
92 (4) 1657.19 7202518881.181248 7089636161.P45  
93 (1,3,31) 149731.P46  
94 (2) 95881.4574857237.P64  
95 (1,5,19) 571.176515 1799417091.24 4059016047 3742205021.P22  
96 (32) 2113.9917569.596878081.1 6356157057.59621 5044213923 0211450049

- 97 (1) 599599487.14653 3138940077.P59  
 98 (2,14) 16073.193366 5951863017.1014805164 7066664017.P33  
 99 (1,3,9,11,33) 8095532743.24 4188888967.P30  
 100 (4,20) 401.P66  
 101 (1) 230281.3843253.P73  
 102 (2,6,34) 2857.85647973.P43  
 103 (1) 1031.490201721.105 8638292629.46178 5968654529.  
 .418 7577353589 1952971477.P26 103  
 104 (8) 177129884 6189942308 1645348353.P53  
 105 (1,3,5,15) L.M  
 L (7M,21M,35L) 4 5079889454 2150330401  
 M (7L,21L,35M) 211.33864086 5331157691  
 106 (2) 15053.7627549.P77  
 107 (1) 1499.8 2413922847.P76  
 108 (4,12,36) 40177.609 2288058456 7163834041.P34  
 109 (1) 5233.1005941476 1347582747.P69  
 110 (2,10,22) 2861.32561.543841.4704503 7529563701.P38  
 111 (1,3,37) 1 5015834247.2544 3079695091.1255809 0335903767.P22  
 112 (16) P82  
 113 (1) 1583.8654522423.1202497 4285713817 5784797627.  
 .48427230 7488632012 1848080733.P28 113  
 114 (2,6,38) 229.P59  
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247	(1, 13, 19) 666901.1037401.P171		
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	.40991 5991384227 9603345990 1850750268 6594228493 6776208113 3062231001.P67		413L
	M (7M) 4957.8 3426014043.6444292 2154738163.2 6290991348 2545708331.		
	.175282 7730191617 3559051083.P70		413M
427	(1,61) L.M		
	L (7M) 334 4317139297.14559964 1870136959.36463471 2836108861 9014438417.P95		
	M (7L) 1709.835213.805 2785365241.309 4396495614 3466601798 0378843611.P99		
441	(1,3,7L,7M,9,21L,21M,63L,63M) L.M		
	L (49L,147L) 7057.2658349.394387183.1 8506674369.		
	.210 8144903950 5868111974 4912719151.P46		441L
	M (49M,147M) 28473607.1415 4038259733.11575951 4862686269.		
	.100191451 4798811391.111 5085462610 1679939871.P29		441M
455	(1,5,13,65) L.M		
	L (7L,35M,91M) 39368 2027461815 7565147799 6103158141.P87		
	M (7M,35L,91L) 21841.2041681136 4869616971.P99		
469	(1,67) L.M		
	L (7M) 3 7452491379 3607757589 4219292545 7071108912 8544808522 9305573219.P107		
	M (7L) 1877.581 1328935669 9002427121.		
	.40809029 4146032352 7696322770 8687836291.P105		469M
483	(1,3,23,69) L.M		
	L (7M,21M,161L) 1933.51199.215 2701447163.3312789 2504734987.		
	.828167 9985079535 1486361063.P50		483L
	M (7L,21L,161M) 967.612139711.3 1612243058 9196488923.		
	.377 2836794848 5501911947.1293 4388310803 7584587651.P34		483M
497	(1,71) L.M		
	L (7M) 7273 5455323542 8733469289.161406142 2810249914 3832286457.P125		
	M (7L) 295219.9182573.2425569 6294888183 4246849409.P140		
511	(1,73) L.M		
	L (7M) 6133.9199.61678723.	C167	511L
	M (7L) P184		
525	(1,3,5,15,25,75) L.M		
	L (7L,21L,35M,105M,175L) 17851.298 2139333951.128 6651076438 2766303751.		
	.32586242 2411567256 0243320051.P36		525L
	M (7M,21M,35L,105L,175M) 1051.519071701.8 2189065001.11164 9516421101.		
	.2653200 5724410644 3142346301.P39		525M
539	(1,7L,7M,11,77L,77M) L.M		
	L (49M) 52109 6004795829.7 9383591513 9705265367.	C142	539L
	M (49L) 440903.P172		
553	(1,79) L.M		
	L (7M) 3319.19336199.379794871.7202155 7595389137.	C162	553L
	M (7L) 56027650 8936447227.662 4037351796 2417335857.P158		
567	(1,3,9,27,81) L.M		
	L (7L,21L,63L,189L) 1150005277.7657984783.188 9398413773 2812609271.P96		
	M (7M,21M,63M,189M) 7455355 3407147697.550 3653553178 6018683083 4043508553.P88		

581 (1,83) L.M  
   L (7L) 1163.P206  
   M (7M) 10459.156909509.199728047.1859414971.P178  
 595 (1,5,17,85) L.M  
   L (7L,35M,119M) 210631.31 7922574058 6661416281.P135  
   M (7M,35L,119L) 929148 4250876801.7 7534190178 7730204901.  
       .124485 9444058198 1295316991.315554 1349401272 9293961731.P76 595M

$$7^{7h} + 1 = (7^h + 1)L.M, \quad L = T^3 - B, \quad M = T^3 + B, \quad T = 7^h + 1, \quad B = 7^k(T^2 - 7^h), \quad h = 2k - 1.$$

Factorizations of  $10^n - 1$ ,  $n$  odd,  $n < 330$ 

$n$	Prime Factors
1	3·3
3	(1) 3*·37
5	(1) 41·271
7	(1) 239·4649
9	(1,3) 3*·333667
11	(1) 21649·513239
13	(1) 53·79·265371653
15	(1,3,5) 31·2906161
17	(1) 2071723·5363222357
19	(1) 111111111 1111111111
21	(1,3,7) 43·1933·10838689
23	(1) 111 1111111111 1111111111
25	(1,5) 21401·25601·18 2521213001
27	(1,3,9) 3*·757·44033 4654777631
29	(1) 3191·16763·43037·62003·7 7843839397
31	(1) 2791·6943319·5733641506 3790604359
33	(1,3,11) 67·134462821 0313298373
35	(1,5,7) 71·123551·10259880 0232111471
37	(1) 2028119·247629013·22 1239429677 0203368013
39	(1,3,13) 9009 0090090099 0990990991
41	(1) 83·1231·538987·2017637099 0032280374 8657942361
43	(1) 173·1527791·196350 6722254397·214099201 5395526641
45	(1,3,5,9,15) 238681·418550283 0133110721
47	(1) 35121409·316362908 7634585250 0140615403 8726382279
49	(1,7) 505885997·1976 7301445981 9096356802 3014679333
51	(1,3,17) 613·210631·52986961·1316816 4561429877
53	(1) 107·1659431·132581526 7337711173·471988 5879949142 5660200071
55	(1,5,11) 1321·62921·83251631·13006 3569267805 8358830121
57	(1,3,19) 21319·10749631·39311 2302230512 9377976519
59	(1) 255 9647034361·434087 6285657460 2121445342 8992855982 6755746751
61	(1) 733·4637·329401·974293·1360682471·10600 7173861643·706170999 0156159479
63	(1,3,7,9,21) 10837·23311·45613·45121231·192143 6048294281
65	(1,5,13) 16 2503518711·5538396 9973640240 5628651064 0780600481
67	(1) 493121·7986359577 8924342083·2 8213380943 1766670012 6315366099 9177245677
69	(1,3,23) 277·20386 4078068831·15953520 8632922464 4348978893
71	(1) 2415731423 9362767357 6957439049·P41
73	(1) 1 2171337159·185519384 2151350117·P44
75	(1,3,5,15,25) 151·4201·P35
77	(1,7,11) 5237·42043·29920507·P45
79	(1) 317·6163·10271·307627·4917219553 6083790769·P43
81	(1,3,9,27) 3*·163·9397·2462401·67642 1558270641·P27
83	(1) 336 7147378267·95125385 0862415437 3682136329·P42
85	(1,5,17) 262533041·811 9594779271·P43
87	(1,3,29) 4003·72559·P48
89	(1) 497867·103733951·10 4984505733·50785 5496602631 5671444089·P39
91	(1,7,13) 547·14197·17837·4262077·4 3442141653·31687736 5766624209·P27
93	(1,3,31) P60
95	(1,5,19) 191·59281·63841·12899812 3195084954 3985493631·P33
97	(1) 12004721·846035 7313969192 3376721153 7899097169·P54
99	(1,3,9,11,33) 199·397·34849·P51
101	(1) 45315301 8181661323 4555190841·129 0632822328 4896195198 5354966759·P41

103	(1)	1031.7034077.P93	
105	(1,3,5,7,15,21,35)	3 0703738801.62 5437743071.P26	
107	(1)	643.999809.9885089.215257037.2386760191.51139953 8427507881. .64682695 0155548399.P38	107
109	(1)	1192679.7 1276748097 1213008079.52 9527534876 7234696493.P60	
111	(1,3,37)	37*.3055705 1518647307.88459 8117086562 9119271997.P29	
113	(1)	227.90 8191467191.P98	
115	(1,5,23)	31511.1 9707665921.2041413 7203567631. .57999515 1394138214 4830754391.P30	115
117	(1,3,9,13,39)	24039 6841140769.53794 7698126879.335282 5314499987.P28	
119	(1,7,17)	923441.392 4966376871.7687365594 2140124904 2753476963.P48	
121	(1,11)	15973.38237.274187.P96	
123	(1,3,41)	1811791.62 6920594693.942585697 6319889649.P43	
125	(1,5,25)	751.1797655751.17614 4543406001.P74	
127	(1)	18797.90679.P117	
129	(1,3,43)	21 0769832431.4074 2973276750 5248479163.P50	
131	(1)	80173.109517.141811693.446790173.737 0364319027.1559484553 8029429933. .73 1772397003 1057677693.1317 5835106511 6151205213.P27	131
133	(1,7,19)	1597.202101 5460335957.P90	
135	(1,3,5,9,15,27,45)	1577071.16357951.310362841.25 8360989311.P39	
137	(1)	2467.2535528323.10298 7975692876 2117455431. .1401758 9416299060 9843314797.P74	137
139	(1)	11912 4859925363.P124	
141	(1,3,47)	283.72103049 8171501831.P72	
143	(1,11,13)	2823679.180523201.47 4286764445 9170572792 9369346443.P74	
145	(1,5,29)	9605671.1558928097 4996818911. .80684370 0012696988 5399615167 0133742711.P48	145
147	(1,3,7,21,49)	63799.4715467.26765 2966241599.260394188 3787374089.P40	
149	(1)	12517.53559 6779200919.P130	
151	(1)	907.429360649.298779 8148080601 7715604631. .286565 5283757454 6515657117 3601919711 4021191078 8651135283.P58	151
153	(1,3,9,17,51)	307.18973.11910133.2533 2185271529.4133154 1464123787.P53	
155	(1,5,31)	311.929 4566806081.P105	
157	(1)	301670477.518028 2664612031.11 4279998928 2187639700 4936937893.P101	
159	(1,3,53)	351391.385 2774594841.1 8532824738 4490197483.P66	
161	(1,7,23)	6763.472341157.1127317077 1131750391. .16267774 0316165679 7092007877.P74	161
163	(1)	57640 6666853727 0911379761. .403 9257228337 7837810730 4989280994 1028503148 5506861595 9021587563.P75	163
165	(1,3,5,11,15,33,55)	471241.138 2677701279 1645762903 4873443951.P43	
167	(1)	18843947.10681108 3848465643. .3 7576897811 1191674634 3696241048 3708090653.P102	167
169	(1,13)	11831.270924655 0432452192 3074381401 5389873000 2165574677.P104	
171	(1,3,9,19,57)	2291 6207114001 5324614111. .1104 2493493629 9518114466 8003642191.P52	171
173	(1)	347.2152816 9344472027. .4619461 8816084982 1006792343 1297423634 5786346173.P107	173
175	(1,5,7,25,35)	185 2584391849 0695886751.9914742 7166298695 7800680951.P71	
177	(1,3,59)	3187.23219 9557797964 9051433901 2184273961 9033812919.P69	
179	(1)	359.36558961.420 1521652717.35254 3640588653.P141	
181	(1)	12671.28865519.995130761.1 6814655289.41 4479952329.P138	
183	(1,3,61)	2520277. .263 8485692280 9741239246 2812408889 8099456790 2544116187.P62	183
185	(1,5,37)	65112 3004118656 0022095681.19365701 1482706992 3550119591. .6 3441573295 9066072537 8321124654 4893041361.P52	185
187	(1,11,17)	143899867.19886 4241823708 7587023918 4131623563.P118	
189	(1,3,7,9,21,27,63)	8780 7512690869 8927928483. .330306360 3799214720 5820927521.P56	189
191	(1)	4473297929.1121 0302194081 2743353521.P158	



193	(1) 773.39373.561470969.63970 1219449517.42 7441755607 6113498947. .26 4095401119 5271748790 8689681403. .4477 9828713128 4928051408 3049652657 8289217495 3181087929.P55	193
195	(1,3,5,13,15,39,65) 1951.3 5081393881.36092 4572424391.P68	
197	(1) 52009.790 4047980561 5687465683. .3599 4749614830 5331087860 5135585111 3744691380 7822602323 3589649293.P105	197
199	(1) 797.29453.2253079.P185	
201	(1,3,67) 1609.204616673 9518832881. .18 4976479633 0929311033 1303783550 4355363361.P70	201
203	(1,7,29) 1 8620680471.6861680517 3400502243.2 2307232764 8229020879.P118	
205	(1,5,41) 41*.275521.2 1158848681.P143	
207	(1,3,9,23,69) 10990 8191603107. .82379 9348530495 5072690350 1325448928 7846904557.P74	207
209	(1,11,19) 257489.1246477.9269802917. .42545 6626730958 3174378969 2955596677.P124	209
211	(1) 692 6245573243 8962066278 2322677336 7111381084 8258828173 9734\ 375570 5064923919 3184952463 6731866879.P118	211
213	(1,3,71) 853.1594093.1182534679.1 7469229933.P112	
215	(1,5,43) 431. .413982 7593967086 7448911914 3391566803 8134377700 6826487831.P110	215
217	(1,7,31) 3662093. .515086 5211600887 2412773338 3362897086 6903776508 1397085489.P118	217
219	(1,3,73) 439.2212293763. .39316 3107836591 0489225215 7287077969 2396197343 2504433459 2964583271.P68	219
221	(1,13,17) 443.16614226 1077623560 5151630089.P163	
223	(1) 2677.130975483.	C211 223
225	(1,3,5,9,15,25,45,75) 2002877551.263689 9200194401. .9767198748 5517534751.125899 6598666277 6431326748 2289910001.P41	225
227	(1) 11313 6621886721.	C212 227
229	(1) 9161.43544351.90 0699601775 7809392117.P195	
231	(1,3,7,11,21,33,77) 2311.22187551.53521 2994471849. .2349040 6637714896 0506871003.1568131207 9725357923 1191970121.P40	231
233	(1) 467.47533.11 5081654907.8941 2401116867.4298375 7528467293. .108 5798020044 4401822643.C162	233
235	(1,5,47) 51 8203357921.19089319 5970004711.15 8990864733 9072250321. .6054 3170602802 9946531059 1995125722 8241478625 0085768871.P80	235
237	(1,3,79) 90758677.1603873 5364864961 6241477827 7997333003.P112	
239	(1) 479.142847911.	C228 239
241	(1) 12 5997820213.	C229 241
243	(1,3,9,27,81) 3*.4113 6178689073 7698932559.P138	
245	(1,5,7,35,49) 336737801.2 3609565631.82749 2325162282 5388807721. .7468914019 9104459031 9931102100 5401674322 3513365511.P75	245
247	(1,13,19) 1483.10 2451616447 9902988921.12 9982352002 6173021751.	C171 247
249	(1,3,83) 4483.141314 1919363039. .7963 1228080621 9385734997 1025394018 0960724841. .352444538 9714777887 6597964214 6628632135 0017806951.P53	249
251	(1) 52371653.P243	
253	(1,11,23) 1013.3037.72932311.26153136 9118211492 7177553117.P179	
255	(1,3,5,15,17,51,85) 7796 7508765681.174529554 8142349266 1946457391. .341944731 1615954697 9818689031.P58	255
257	(1) 1017721.4271961427.	C241 257
259	(1,7,37) 2591.64638631.36 6380244998 3927390483. .689411842 5361025316 9908132923.P155	259
261	(1,3,9,29,87) 523.670249.44974999.9113995243.729 9238406959. .9 1367341498 9429593806 4503769037. .13110 8694538423 6014967315 2805139228 8744803439.P54	261
263	(1)	C263 263
265	(1,5,53) 116 7211531939 4673616019 4298023751.P176	
267	(1,3,89) 9613.54091 3940517169.P158	
269	(1) 541830 7589425009.4405281315 4697065841.	C233 269
271	(1) 1627.56369.	C263 271

273	(1, 3, 7, 13, 21, 39, 91)	1093.32786209.13970 8570703521. .53319 2408848566 3758835996 8229091231 4165685986 9805374791.P65	273
275	(1, 5, 11, 25, 55)	7151.15401.59951.2495 2832648957 7902025320 3931608951.P154	
277	(1)	101615 7022810759.102092644 2897395250 8591933833 5107091799.C224	277
279	(1, 3, 9, 31, 93)	1898 9357081041. .19 8655457793 9642346080 4455910659 8738302929 9397551517.P116	279
281	(1)	563.259 7610354323.38043198 8961690791. .133355295 5243807326 0867484630 5692470329.C210	281
283	(1)	1680936 0945688609.C266	283
285	(1, 3, 5, 15, 19, 57, 95)	184492885 5004465413 9241919401. .844267 4470943213 2343560179 2968017601. .219414044 2084408033 4520401913 7889332111.P42	285
287	(1, 7, 41)	1723.1 3365428707.194185 1180301719.C212	287
289	(1, 17)	42773.931957 5345523802 7770502373.P242	
291	(1, 3, 97)	1747.18043.162 5625533641.195 3725183587.101204 7221926483.P145	
293	(1)	587.94 7612426323 1731100867.C268	293
295	(1, 5, 59)	36 6111286951.21516 8431547401.689864925 2938113791.P188	
297	(1, 3, 9, 11, 27, 33, 99)	55243.198397.1981560241.3160 0574312077. .1654 2667044318 6506567467. .7 9070093075 9469400105 3552000588 6583911009 7409345760 3716419437.P64	297
299	(1, 13, 23)	599.64677721 5499244129.P244	
301	(1, 7, 43)	82 1856609631.1340 3893556831.C227	301
303	(1, 3, 101)	2096761.27229 5362253883.P180	
305	(1, 5, 61)	1831.2441.38981441.2 3886931441.25895751 0559998182 1056130911. .119724826 1297968602 4963821774 7306760831.C150	305
307	(1)	526199.10006668 4713521521.11357792 0094721461 9088200338 3320587841.P247	
309	(1, 3, 103)	16779806 6344417387.34 6294823049 1376473027.C166	309
311	(1)	C311	311
313	(1)	1879.209981 8661161079.P294	
315	(1, 3, 5, 7, 9, 15, 21, 35, 45, 63, 105)	631.14 2809770881.P131	
317	(1)	P317	
319	(1, 11, 29)	723493.798763879.2 5815444138 3622125012 1578260242 7193330961.P225	
321	(1, 3, 107)	167805961.P204	
323	(1, 17, 19)	85190812 7328669427.C271	323
325	(1, 5, 13, 25, 65)	77351.200201.434719 5468174001.2 8067287414 9406424401.C194	325
327	(1, 3, 109)	1147117.1 3675561831.465 5363047742 0371690681.P178	
329	(1, 7, 47)	19 6408988166 9809395643.C255	329

Factorizations of  $10^n + 1$ ,  $n \leq 330$ L,M for  $n = 20k - 10 \leq 650$ 

$n$	Prime Factors
1	11
2	101
3	(1) 7.13
4	73.137
5	(1) 9091
6	(2) 9901
7	(1) 909091
8	17.5882353
9	(1,3) 19.52579
10	(2) L.M
L	3541
M	27961
11	(1) 11*.23.4093.8779
12	(4) 99990001
13	(1) 859.1058313049
14	(2) 29.281.121499449
15	(1,3,5) 211.241.2161
16	353.449.641.1409.69857
17	(1) 103.4013.21993833369
18	(2,6) 999999000001
19	(1) 909090909090909091
20	(4) 1676321.5964848081
21	(1,3,7) 7*.127.2689.459691
22	(2) 89.1052788969.1056689261
23	(1) 47.139.2531.549797184491917
24	(8) 9999999900000001
25	(1,5) 251.5051.78875943472201
26	(2) 521.1900381976777332243781
27	(1,3,9) 70541929.14175966169
28	(4) 7841.127522001020150503761
29	(1) 59.154083204930662557781201849
30	(2,6) L.M
L	(10L) 61.4188901
M	(10M) 39526741
31	(1) 90909090909090909090909090909091
32	19841.976193.6187457.834427406578561
33	(1,3,11) 599144041.183411838171
34	(2) 28559389.1491383821.2324557465671829
35	(1,5,7) 4147571.265212793249617641
36	(4,12) 3169.98641.3199044596370769
37	(1) 7253.422650073734453.296557347313446299
38	(2) 722817036322379041.1369778187490592461
39	(1,3,13) 13*.157.6397.216451.388847808493
40	(8) 5070721.19721061166646717498359681
41	(1) 2670502781396266997.3404193829806058997303
42	(2,6,14) 226549.4458192223320340849
43	(1) 57009401.2182600451.7306116556571817748755241
44	(4) 617.16205834846012967584927082656402106953
45	(1,3,5,9,15) 29611.3762091.8985695684401

- 46 (2) 1289.1837 1524594609.41810033 0007166986 7932658901  
47 (1) 6299.485506 7598095567.2972627 0500913900 6771611927  
48 (16) 97.206209.6 6554101249.7511 8313082913  
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271	(1) 3253.136315309 3838035397 5492092299.	C239	271
272	(16) 58627969.	C249	272
273	(1,3,7,13,21,39,91) 102103.P139		
274	(2) 718606649.4 0160350429.	C253	274
275	(1,5,11,25,55) 150 1539197401.	C188	275
276	(4,12,92) 1657.1469409649.381152150 7439105678 4287931569.P136		
277	(1) 9419.9973.2583222779.	C259	277
278	(2) 1669.15422003 5640400941.	C256	278
279	(1,3,9,31,93) 1117.183 3722828645 4791674901 8225828651.P145		
280	(8,40,56) 1378721.575 8943337281.67176 5845875804 1138199521. .1081862 9916055943 3206947759 4870669601. .7048825036 8897247920 7098857667 9306254761 6862669921.P63		280
281	(1) 656 0496291091.585139 4012953537 9432477007.	C242	281
282	(2,6,94) 1129.379212 8943527581.2 2462858604 3098654850 6215527001. .4416 5945462580 9720192647 0552762575 2863783262 1638030289.P82		282
283	(1) 1699.241117.61945 5733052226 9027936366 3578823967.	C239	283
284	(4) 4672937.1 1473030297.27391964 7900781361.	C246	284
285	(1,3,5,15,19,57,95) 571.113 8227382803 1938028891. .431355 1376399169 2454656851.P94		285
286	(2,22,26) 1757 6772101461.754 3093230295 7898149445 0523147961. .4832 2271589397 1661446834 5433242909.C161		286
287	(1,7,41) 1921 4818177409.P227		
288	(32,96) 577.31 7752351489.P178		
289	(1,17) 511438099.58706379 3048979091.423239926 3941934904 9079264521.	C217	289
290	(2,58) L.M		
	L (10M) 17 6795536638 8381478541.P91		
	M (10L) 14 0879426798 5761094061 3213182901.P82		
291	(1,3,97) 12 0993298365 1298761631 7321030232 8063293143.P151		
292	(4) 73*.1753.468953.1 6239376901 7609303761.	C258	292
293	(1) P292		
294	(2,6,14,42,98) 2 3742102289 4723514231 0460558271 8329399560 972065\ 4579 6856193478 5062599221.P98		294
295	(1,5,59) 23 5386702680 3341982771.256 0260141810 2182972721. .1934282 7257909653 4429098931.8034542 0509530382 1868753731.P136		295
296	(8) 593.P286		
297	(1,3,9,11,27,33,99) 7129.89272 4462394118 1398233253. .1 8667635465 6768099610 3417376059. .1129703 0838243985 9401726947 3417407045 5495173740 8511354573.P65		297
298	(2) 10729.607921.1 3691641668 6052955621.	C267	298
299	(1,13,23) 3 2494323733.	C254	299
300	(4,12,20,60,100) 32401.4711 8061000105 6108246629 1127577601. .448263772 9513780747 0008729356 7362502512 7940754401.P74		300
301	(1,7,43) 3613.21205705 4080446499.1 2052578933 6558438197.	C212	301
302	(2) 15101.20481641.	C289	302
303	(1,3,101) 133321.329059.389659.	C184	303
304	(16) 3031489.	C282	304
305	(1,5,61) 2 4473851019 1757857651 8614756091.	C210	305
306	(2,6,18,34,102) 54469.158963941.270 9009355501.362 6707988341. .1 5753898031 9816607121.8461604 9414936579 8478410729. .1125442817 5578273267 3671367061.P78		306
307	(1) 331 1436805543.1 4904732862 0287349257 5327109823.	C264	307
308	(4,28,44) 532410896 9015554508 4545617441.	C212	308
309	(1,3,103) 619.P202		

310	(2,62) L.M		
	L (10L) P121		
	M (10M) P120		
311	(1) 82727.212 2689869717.796659 5011106561.34163 1789794741 5066069561. .8353753650 5691723689 1484436143.	C223	311
312	(8,24,104) 148068337.1 0662171313.32580 7801400017.	C160	312
313	(1) 5009.10748446 6513984544 2819616837.	C282	313
314	(2) 28 4157831951 5136458681 6438858689.	C281	314
315	(1,3,5,7,9,15,21,35,45,63,105) 2521.131041.52 5326613841. .1275 7847310481 2365963470 2312820051.P91		315
316	(4) 259121.73921249.P299		
317	(1) 3536453.12361733.	C303	317
318	(2,6,106) 3181.125929.1650244 2606471049 7680243709 0486126821.P164		
319	(1,11,29) 1277.357281.4 9561573447.	C261	319
320	(64)	C256	320
321	(1,3,107) 7569823.236 6998879807.8997883 7817010427 0110161037.P166		
322	(2,14,46) 21661343 0183025989.	C247	322
323	(1,17,19) 647.108529.738379.164 4353478367.10 7889327982 1424911891.	C242	323
324	(4,12,36,108) 68562937.	C209	324
325	(1,5,13,25,65) 107251.4271801.8 2009322851.3 1894247461 4140390001.	C197	325
326	(2) 49 8698470009.76 2329140552 0700300531 8654163381.P281		
327	(1,3,109) P217		
328	(8) 6051298241.4865 6086054529.669 9954155705 8292185946 3287135169.	C264	328
329	(1,7,47) 659.P274		
330	(2,6,22,66) L.M		
	L (10M,30M,110L) 50786 8012934701.61432 0380051993 1376420641.P41		
	M (10L,30L,110M) 17247781.1082745841.1851 6980928601.900093 1379651641.P35		
<hr/>			
350	(2,10L,10M,14,70L,70M) L.M		
	L (50M) 701.422100001.112 5310645201.P97		
	M (50L) 2135677566 1751120950 6778605497 4896458380 2558793328 8349770601.P61		
370	(2,74) L.M		
	L (10L) 1481.6336499381. .271880 6758501803 6787265302 3164942909 8807993635 2421609967 1322919521.P67		370L
	M (10M) 15541.68821.7 4615611921.409 8464044501.10777134 5624719321. .162061 7083740894 5509907221.P69		370M
390	(2,6,26,78) L.M		
	L (10L,30L,130L) 20172169 5849323521.26856471 8633070608 1032050321.P51		
	M (10M,30M,130M) 19501.916002050 9281917601.P74		
410	(2,82) L.M		
	L (10L) 59090021.12669255 9326467759 7290950641.P126		
	M (10M) 821.639601.1103 6695406441.107338021 8518144441. .13500593 5191582899 0550200161. .13907 4671904011 7784739843 6675852752 4121792121.P49		410M
430	(2,86) L.M		
	L (10L) 7741.219847 8623863901. .754 9370642855 1060643184 2888398285 6249713821.P107		430L
	M (10M) 104 4817620601.P156		
450	(2,6,10L,10M,18,30L,30M,90L,90M) L.M		
	L (50L,150L) 1801.33301.139501.560701.5030101. .152372720 0184738629 2776156498 4708391701.P57		450L
	M (50M,150M) P120		
470	(2,94) L.M		
	L (10M) 941.2 9096340761.47418105 9033108701.P153		
	M (10L) 184651106 7752333216 8571918701.	C157	470M
490	(2,14,98) L.M		
	L (10L,70M) 268330861.32 4220347206 9460287355 4553373241.P129		
	M (10M,70L) 36639 5073564101.35443421 0886621881. .28706 1645027113 9087568064 1913825481.P102		490M

510	(2, 6, 34, 102) L.M		
	L (10M, 30M, 170L)	8161.2586721.507 1197096181. .67 7827125083 3427230755 5146921335 7648491441.P64	510L
	M (10L, 30L, 170M)	1021.855781. .11479763 5898427958 7940335423 1518066374 7542680841.P72	510M
530	(2, 106) L.M		
	L (10L)	10601.	C205 530L
	M (10M)	4241.1103461.	C198 530M
550	(2, 10L, 10M, 22, 110L, 110M) L.M		
	L (50M)	2471701.486904001.1331 5737160266 4723858501. .2128904 6266270605 2906860201.490948959 1528281762 8267672401. .366899611 3223183559 8332503967 1117925190 2642533701.P59	C201 550L 550M
570	(2, 6, 38, 114) L.M		
	L (10M, 30M, 190L)	21 1592942161.48161 2717573381. .1170087 3774960920 1563737321.P93	570L
	M (10L, 30L, 190M)	20521.7594681.70532941.368590 2392604541. .90 2583652559 1423620461.146344282 9482475533 1225520581.P59	570M
590	(2, 118) L.M		
	L (10M)	193274561.34 7811486461.1201323 3555242641. .85058969 7825627865 6680007081.P168	590L 590M
	M (10L)	1181.35764621.3064985101.	C213
610	(2, 122) L.M		
	L (10M)	21961.51241.9818561.2847464 4365651641.177 1688627723 0798340041.C185	610L
	M (10L)	6101.21 7345835281.55 5818110301.895022129 4967070861. .1775103358 5336286181.C176	610M
630	(2, 6, 14, 18, 42, 126) L.M		
	L (10M, 30M, 70L, 90M, 210L)	15 8201922061.565415 8684212146 4411050521. .2 2920994754 1611916250 4685490734 9197734609 7487987121.P57	630L
	M (10L, 30L, 70M, 90L, 210M)	135185 5459456741.338 2273232883 1925621101. .198257447 8133971245 7003608841.938366482 7039416910 7274656883 2156530761.P40	630M
650	(2, 10L, 10M, 26, 130L, 130M) L.M		
	L (50L)	1301.P237	
	M (50M)	431684501.230987 1416796611 4959599501.P206	

$$10^{10h} + 1 = (10^{2h} + 1)L.M, \quad L = A - B, \quad M = A + B, \quad h = 2k - 1,$$

$$A = 10^{4h} + 5.10^{3h} + 7.10^{2h} + 5.10^h + 1, \quad B = 10^k(10^{3h} + 2.10^{2h} + 2.10^h + 1).$$

Factorizations of  $11^n - 1$ ,  $n$  odd,  $n < 240$ 

$n$	Prime Factors
1	2.5
3	(1) 7.19
5	(1) 5*.3221
7	(1) 43.45319
9	(1,3) 1772893
11	(1) 15797.1806113
13	(1) 1093.3158528101
15	(1,3,5) 195019441
17	(1) 5054470 2849929377
19	(1) 611590904 4841454629
21	(1,3,7) 7*.1723.8527.27763
23	(1) 829.28878847.374 0221981231
25	(1,5) 5*.3001.24151.185 6458657451
27	(1,3,9) 555991731 5850179173
29	(1) 523.3033096 1704999838 8989376043
31	(1) 50159.2428541.1 5757195758 4602258799
33	(1,3,11) 661.1453.63726 5428480297
35	(1,5,7) 211.424 3771796953 0394595211
37	(1) 2591.36855109.136151713.261541811 8891695851
39	(1,3,13) 79.157.547.84631.480091.32508061
41	(1) 83.1231.27061.509221.14092193.29866451.84 0139875599
43	(1) 141625 8521793067.425346560 9158326804 5915654719
45	(1,3,5,9,15) 98423 3243003746 5033595921
47	(1) 2069.2266687 9066355177.188063270 4182469059 5747113889
49	(1,7) 510810301.1065264019.1006412 2028395139 5639601683
51	(1,3,17) 10711.457315063.1 5085812853.2 5994736109
53	(1) 107.351497.6005113.6918082374 9013138551 2539766532 5977135579
55	(1,5,11) 25301.39161.64317 0158708221.64565433 5737185721
57	(1,3,19) 19*.104 7623475541.14129 0047910865 4932024439
59	(1) 1181.7 0845409351.3308314 6850190391 0253015651 4273500033 1370209599
61	(1) 440177.52051 8327319589.146 1808298382 1110341940 2764550601 9619578037
63	(1,3,7,9,21) 127.8317.867259.106431697.31682542 5410373433
65	(1,5,13) 131.67326742 6712748387 6129948043 9218364514 7042355211
67	(1) 15277.2160349.7639414 8218203559.P42
69	(1,3,23) 139.8209475377.P34
71	(1) 1847.64327.15 9248456569.127 3880539247.P42
73	(1) P76
75	(1,3,5,15,25) 151.59302051.1826934301.276 6528309169 5977275201
77	(1,7,11) 59 3554036769.P51
79	(1) 317.1852775 5110052366 2054683911.P53
81	(1,3,9,27) 139026457.1401069261 7072784593.P29
83	(1) 167.12119.178057577.5 2447614013.P61
85	(1,5,17) 584916791.55339 3500180551.P44
87	(1,3,29) 398113.54415717.P45
89	(1) 73111721.210311 4787086589.41802 3501741837 6525776333.P44
91	(1,7,13) P75
93	(1,3,31) 2791.3163.P56
95	(1,5,19) 67989221.1801244 4102950924 0214675551.P41
97	(1) 389.4247091263.P88
99	(1,3,9,11,33) 397.2377.1240500097.P48
101	(1) 3 4145908547 7993311443.86408339 2962089148 0763267277 6254957729.P46

103	(1)	24103.3 7723802531.9 9530120616 2659155091.P71	
105	(1,3,5,7,15,21,35)	421.540751.599551.2598121.126713791.P22	
107	(1)	127603 3068038437.30497129 7664201988 8986886837 0056474874 7693245597.P48	
109	(1)	359707 2845910244 6279558069.P87	
111	(1,3,37)	651950 4168641483 9263528059 6760630561.P40	
113	(1)	227.45902861.2088415259 1287817709. .22455 9071068403 6457741638 2241618449.P53	113
115	(1,5,23)	95911.333041.9964291.1718401003 1686356151.P55	
117	(1,3,9,13,39)	9127.1810693.P65	
119	(1,7,17)	239.2 0580793913.57876475 0213804083 6760695667.P60	
121	(1,11)	30977.1595696213.1240 7691244609.P88	
123	(1,3,41)	174907.28385941.142971 8209920068 7164658867 9396397417.P36	
125	(1,5,25)	5*.163 2185486501.2767843 7808551251.P75	
127	(1)	298 5212831443.607373 2108394141.1 0834561842 6999904901.P83	
129	(1,3,43)	1549.1389891409.2338110553.4401 2945778511. .344012631 4390780951.P34	129
131	(1)	263.7791763956 7490161542 1560769789 2626144401.P94	
133	(1,7,19)	292601.1889399.408 5166784889.P89	
135	(1,3,5,9,15,27,45)	271.P73	
137	(1)	8221.339761.3677081.136238281.3947114 7624391215 4244261783.P91	
139	(1)	P144	
141	(1,3,47)	283.64192789.446829 4896841241 4039336007.P60	
143	(1,11,13)	3433.311166 3528084541.19114486 9353686249. .390 8721442195 9708068637.P67	143
145	(1,5,29)	38861.144801 1303581169 8255969232 8954495371.P77	
147	(1,3,7,21,49)	7*.6469.71231 9250521341.19653207 6552133922 1407672989.P41	
149	(1)	95648167.123 8690333706 7381971073.P125	
151	(1)	16944919.1 3665285883.18 4620231357 3737811624 9335576687.P108	
153	(1,3,9,17,51)	307.1531.35236819.2 5167354031.292 6326645433. .2902049825 9950925156 5261308001.P35	153
155	(1,5,31)	11 2582632731.2100801 2759943211.1298104267 8412809421.P79	
157	(1)	8838 8104773677.407 1575367817 7846062481. .201865362 2133278261 5476135581.5898 9380148447 6124763174 8773851299.P64	157
159	(1,3,53)	1399201.2622229.2339 3486084531 9216502879 7638975783 0429777373.P53	
161	(1,7,23)	967.48359249.P127	
163	(1)	39131335891 5050362321.15684 0534918588 8385874441.P124	
165	(1,3,5,11,15,33,55)	1321.121679581.145459 8708730201.P57	
167	(1)	2339.1353068069.31 2708742481.23 7175956843 6871497727. .3 5231157129 9428929611 6782558201 0785048370 0618192085 0717652507.P67	167
169	(1,13)	2029.362685493. .5276574 1001951017 9360993557 4565521674 2310260962 2966194269 7690104397.P84	169
171	(1,3,9,19,57)	32491.406981.368030647.2736100 0362650239.P78	
173	(1)	347.593979931.1931369 7101202731.P152	
175	(1,5,7,25,35)	1849051.P119	
177	(1,3,59)	31153.128857.77162089. .700559615 0545816426 0291086780 2687096779 0150254367.P55	177
179	(1)	359.26069036 5910973937.1334246 2814769799 5732126527. .302620619 6994629483 3518392497.6807288359 9007671380 8763658029. .459 0095791171 3653098790 7464707351.P49	179
181	(1)	4 2811641487.84398779 2713926364 5774810523.P149	
183	(1,3,61)	1640962831.47001 1312403953.2 5279295275 6496725399. .1202139 3165842290 6698644629.P55	183
185	(1,5,37)	3701.2341771441.8942042341.58 6894211641. .94692664 5625286804 1356465741.111979611 6510601192 9767653050 3786924451.P50	185
187	(1,11,17)	62 5293470077.118 7896992833. .759 9155566567 2346878989 7776052021 7383136040 8098377707 8304038497.P80	187
189	(1,3,7,9,21,27,63)	757.2150969311.45255 5562844477. .557814171 1502710729.369592308 7028073007 4750882077.P39	189
191	(1)	195967.2327 6788754002 4567510779 7931468104 1524958846 6971308867.P140	
193	(1)	1931.P197	
195	(1,3,5,13,15,39,65)	50311.3762447001.P86	

197	(1)	301 2710549939.106071719 1208815311.54 0714636882 7614877351. .616346818 4654504009 3840185886 3608277357.P114	197
199	(1)	797.140893.1 8242336369.464537 3755026923.	C173 199
201	(1,3,67)	1609.66 0462844126 2591487762 3090150129. .1 4160915264 3403055250 7059051163 4038738687.P63	201
203	(1,7,29)	5279.60901.490738600 3219664047 0911957318 7611258997 827\ 8096614 3958313896 9212062707.P98	203
205	(1,5,41)	P167	
207	(1,3,9,23,69)	263198 0958036751.P123	
209	(1,11,19)	6689.310 7455009693.321 5499310277.105639 4526657537. .34 2732573655 3646051554 8316358408 3618987113.P103	209
211	(1)	8867230780 9797915061.P199	
213	(1,3,71)	48132 5262407218 2882141229.440430959 0986721979 2359537381.P93	
215	(1,5,43)	431.133680121.63 7111281906 5042612731.P143	
217	(1,7,31)	2960513 9295060799.	C171 217
219	(1,3,73)	439.4072194187. .5149 4992496785 1751873479 0839369527 6094187500 1182553509.P84	219
221	(1,13,17)	27847.312937.3473237.112616889 4058957269. .13 7200577591 4078036518 7158337101.C135	221
223	(1)	453137.47060137.767 2126756781.32649562 9795175719. .136863534 6986648651 0984412427 8446141052 9545236877.P140	223
225	(1,3,5,9,15,25,45,75)	5851.243 8939252251.P109	
227	(1)	1410605611 1465766059.17 9279839971 9936463007.	C195 227
229	(1)	84743741.1558 7642569099.	C217 229
231	(1,3,7,11,21,33,77)	312313.6103043101.35 5797740761.66 2072596417. .1096 5056258773.P74	231
233	(1)	1399.2797.57401881.30818499 3449104253. .1751385016 0477834623 6805296173.C181	233
235	(1,5,47)	2351.14749541.	C182 235
237	(1,3,79)	342734619 7984637335 0261832761.P134	
239	(1)	479.	C246 239

Factorizations of  $11^n + 1$ ,  $n \leq 240$ L,M for  $n = 22k - 11 \leq 473$ 

$n$	Prime Factors
1	2.2.3
2	2*.61
3	(1) 3*.37
4	2*.73 <sup>21</sup>
5	(1) 13421
6	(2) 13.1117
7	(1) 1623931
8	2*.17.6304673
9	(1,3) 3*.590077
10	(2) 212601841
11	(1) L.M
	L 58367
	M 23.89.199
12	(4) 10657.20113
13	(1) 53.911.59583967
14	(2) 29.1933.55527473
15	(1,3,5) 31.7537711
16	2*.51329.447600088289
17	(1) 71707.264793.2218331
18	(2,6) 3138426605161
19	(1) 191.229.83791.1390636259
20	(4) 41.1120648576818041
21	(1,3,7) 3421169496361
22	(2) 251857.2649263870814793
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223	(1) 443686153.114 0498656251.41475476 3228479352 7095981801.P183		
224	(32) 2758337.		C194 224
225	(1,3,5,9,15,25,45,75) 9 0605408587 6149781651.P105		
226	(2) 3617.228821837.		C222 226
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232	(8)	929.718243697.P222	
233	(1)	467.47574407.1681082419.1 5300218543.280 0063085689.	C200 233
234	(2, 6, 18, 26, 78)	754417.P145	
235	(1, 5, 47)	17 1956300431.	C181 235
236	(4)	1245137.1820977.19661284 6857339161. .3 4640632020 6169533644 1987275803 5731606321.C172	236
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238	(2, 14, 34)	18089.2912529718 6513714033.P177	
239	(1)	63097.102293.57577969.1309 6317022627.176057 3169194453.P202	
240	(16, 48, 80)	3361.497281. .40296890 2472395360 8891781494 3486178413 7338065281.P77	240
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297	(1, 3, 9, 27) L.M		
	L (11M, 33L, 99M)	602 1292750979 2800235219.5 3437276111 0742741994 6338417467.P41	
	M (11L, 33M, 99L)	115564483.P86	
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	M (11L)	96937721.2239 5964041133.167439 9383651611.2444070 2406360967. .425082207 6554186563.1 3624285652 6745299726 7408860021.P45	319M
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363	(1, 3, 11L, 11M, 33L, 33M) L.M		
	L (121M)	2179.1213873.17156544 1649148574 2466959717 1794606247.P68	
	M (121L)	4357.29698483.3 2054828257.2213 2988093371.P80	
385	(1, 5, 7, 35) L.M		
	L (11L, 55L, 77L)	8939701.371071471.51 8583951271. .10489473 7524665700 3170213161.P71	385L
	M (11M, 55M, 77M)	5487540521.347403189 9426599281.P98	
407	(1, 37) L.M		
	L (11L)	822622389 0809541662 5629847487.P159	
	M (11M)	24421.368743.10173001 5473692321.1 5831712730 1527316568 7503920221. .21 7876901020 5335781927 5404496594 0504784199 7885060302 6773289483.P69	407M
429	(1, 3, 13, 39) L.M		
	L (11L, 33M, 143M)	349207.361219.P114	
	M (11M, 33L, 143L)	10 5121516501.800269 6406224006 8874678393. .13678 1281056972 9297963410 2018107788 8593676549.P45	429M
451	(1, 41) L.M		
	L (11M)	2707.336017551.8911290961.1 0728819238 1863514444 9927674819. .1815484843 6685062679 8833017163 3365999003. .54715272 4762445363 2297556163 4166450586 9098913767.P69	451L
	M (11L)	77607537 0379457963.8 2872909573 2910996167 8200239527.P160	

473 (1,43) L.M  
 L (11L) 947·354751·744503·69716417· C197 473L  
 M (11M) 8000323·368900269·3804284 2158630893·12852 7484061854 8862537291·  
 .573359659 8987694359 9721563601·C134 473M

$$11^{11h} + 1 = (11^h + 1)L.M, \quad L = A - B, \quad M = A + B, \quad h = 2k - 1,$$

$$A = 11^{5h} + 5 \cdot 11^{4h} - 11^{3h} - 11^{2h} + 5 \cdot 11^h + 1,$$

$$B = 11^k(11^{4h} + 11^{3h} - 11^{2h} + 11^h + 1).$$

Factorizations of  $12^n - 1$ ,  $n$  odd,  $n < 240$ 

$n$	Prime Factors	
1	11	
3	(1) 157	
5	(1) 22621	
7	(1) 659.4943	
9	(1,3) 37.80749	
11	(1) 11*.23.266981089	
13	(1) 477517.20369233	
15	(1,3,5) 61.661.9781	
17	(1) 2693651.7 4876782031	
19	(1) 2904363630 6420266077	
21	(1,3,7) 817 7824843189	
23	(1) 47.3 9891250417.32 1218438243	
25	(1,5) 303551.1262975 7106815551	
27	(1,3,9) 306829.8676 9286104133	
29	(1) 59.24767.368939.333567298 8472972523	
31	(1) 373.126883621.2 3364027983.23 4187563803	
33	(1,3,11) 886381.5999137.661269577	
35	(1,5,7) 71.491.806821.6089651.425455031	
37	(1) 3933841.196 5606665532 8612658898 0353347341	
39	(1,3,13) 36973.17654521.11170 4871987697	
41	(1) 83.1977898057.97 6689247604 1998649137 0101198871	
43	(1) 431.12313309.1 3444466603.323597 5835856252 4963364461	
45	(1,3,5,9,15) 30781.5234401.21456901.22981681	
47	(1) 1061724 9990997021.4509 3488659736 4803770200 8076799297	
49	(1,7) 77617.2 7268138641 5644646496 2776276203 3543154129	
51	(1,3,17) 20757613.15103767 8725821423 0993801577	
53	(1) 107.743.1694941.29504677.308 9222210773.116398 1734827994 4053139101	
55	(1,5,11) 5281.44243 4513819541.57663 0832479011 4380136001	
57	(1,3,19) 114001.129733.2052 6705689989.214145 6811167917	
59	(1) 22067.3356560884 5417661253.576319092 6562662319 3795527748 5160608227	
61	(1) 1706293.1000831393.3599554846 1449237368 6499374650 9712060853 1155491049	
63	(1,3,7,9,21) 708391688 8521368983 0288719309 4373767489	
65	(1,5,13) 131.1932288541.59682759 0710414051.383 4606717849 5390031121	
67	(1) 45464593.1 6180787699.1757783 4702049211.P38	
69	(1,3,23) 627990324 1741823809.P29	
71	(1) 5113.19597.P68	
73	(1) 5065460 8967364071.P62	
75	(1,3,5,15,25) 601.80342401.P33	
77	(1,7,11) 4621.379101493.19 1199728567.5056597 4802015289.P25	
79	(1) 162109.130479719.P71	
81	(1,3,9,27) 5937949.66019 8074631409.P37	
83	(1) 167.997.1993.22079.557889481.3 5238620437.273 1547200091. .1005246 8384786123.P28	83
85	(1,5,17) 1021.22271.4832761.20 4560684821.53 8301506584 9288291601.P22	
87	(1,3,29) 349.1741.7 4233562929.93672760 4123432773.P26	
89	(1) 179.2137.120863.3163346581.1664978 9224075621. .3503531 7869663569.2 5505377572 7906405559.46 5686828388 9935515079	89
91	(1,7,13) 15270 5150363039.10913178 8077874335 5464526983.P37	
93	(1,3,31) 8929.1261081.1 6185865453.P45	
95	(1,5,19) 191.P76	
97	(1) P104	

99	(1,3,9,11,33)	397.3169.91439022 7157471966 6671109149.P31	
101	(1)	2035913 3179252403.P92	
103	(1)	3709.7417.1309643353.139 5177018863 9477959439. .226 3196928031 4634401435 7964333823.P40	103
105	(1,3,5,7,15,21,35)	2521.126001.9562853581.P34	
107	(1)	126047.8368183883.P100	
109	(1)	P117	
111	(1,3,37)	P78	
113	(1)	227.745 0459827983.31609 3109705519.7 5369277908 5581623227.P71	
115	(1,5,23)	2531.P92	
117	(1,3,9,13,39)	6553.77410 1091754693.53639 3935075258 1033772013.P35	
119	(1,7,17)	239.1429.137089.23082431.P86	
121	(1,11)	11*.7019.9971358563.1 3448069471. .3680 1041190212 6239084087 0391730649 4049155113.P51	121
123	(1,3,41)	P87	
125	(1,5,25)	251.13751.118751.P97	
127	(1)	88750555799.2597 9953113431 7521011133 4225450311.P92	
129	(1,3,43)	3784861.P85	
131	(1)	263.P138	
133	(1,7,19)	67033.365876351.1533732 3828784922 2871747653.P77	
135	(1,3,5,9,15,27,45)	117 1991449748 6992163161.457 2676196190 7655567941.P33	
137	(1)	7894763.9948564 9955791433. .427 0306101158 8986621404 8548837697 4936909627.P81	137
139	(1)	3 2830711631.1 4972327115 4501574581. .1397644620 2665769757 0776614036 9838311206 1728500003.P70	139
141	(1,3,47)	3504133.513689 0928835357.P77	
143	(1,11,13)	1068975337.281512 9908476662 9509889009.P95	
145	(1,5,29)	8458141.15 2107892171.283301 6858862791.P88	
147	(1,3,7,21,49)	7622826121.305314004 7080689861. .290140 6152472657 4502110353.P37	147
149	(1)	11027.1919442572 8973628368 0302513422 8929025089.P117	
151	(1)	1653 7237851564 6889242614 0704164885 3990657743.P119	
153	(1,3,9,17,51)	613.3673.6128894197.164498 2406845777. .2 1648685372 7393579797.532947 4021844947 8902707453.P27	153
155	(1,5,31)	311.1737 9312247321.321 7953543922 3966162981. .50 4159451473 0025603620 1338681258 4959284471.P50	155
157	(1)	3769.8965871 3513382803 6528709133.P138	
159	(1,3,53)	30529.526468081.564397849.P91	
161	(1,7,23)	1933.36709.8820 6564187383 7825950898 0670038453.P101	
163	(1)	31239 5532897766 4272236491.3 0850889152 1238560185 7770168909. .5527624 4920832349 2136826173 0604489844 2152509401.P74	163
165	(1,3,5,11,15,33,55)	47535 0812105401.P72	
167	(1)	55319467 2940916339.P162	
169	(1,13)	27 3854127119.4208 5870270393.1 7107455786 7837392887. .22367193 0292763526 8499980471.P96	169
171	(1,3,9,19,57)	2053.25309.P109	
173	(1)	347.6229.178537.165 2061872424 7316579377. .133 6316109590 3002055925 1207363442 8952014029 5055841316 5227170111.P90	173
175	(1,5,7,25,35)	24539 8400081313 5412614651.P106	
177	(1,3,59)	6373.472683457.2 9664964237.4 8253224577.21 5006774581. .224565 7505577169.2476 7942192797 0902164473.P42	177
179	(1)	359.	C190
181	(1)	56473.188 9545780485 7319554722 6930925499.P158	
183	(1,3,61)	7321.775696 8162619561.P110	
185	(1,5,37)	6 4410858561 2036804059 3352248224 8442216963 5054890142 5367127551.P95	
187	(1,11,17)	7824829.6367170107.527229208 7965614119.P138	
189	(1,3,7,9,21,27,63)	P117	
191	(1)	383.2293.5576463887.492394 7772621528 3014077912 0613620261.P154	
193	(1)	6563.143593.	C199
195	(1,3,5,13,15,39,65)	2426332 5716698381.4576442 7225623601 8195571421.P61	193

197	(1)		C212	197
199	(1)	11941 · 5 0445745393 · 53498 9935052173 · 45263370 3528239603 · .24 0810703924 3923308111 · C146		199
201	(1, 3, 67)	492853 · 33736255 7588033581 · .23400 3313601236 2062475950 7467298566 3802865546 3932144793 · P65		201
203	(1, 7, 29)	2437 · 2032540343 · 16801 0120865329 · .40386445 0614811943 9397242761 · P127		203
205	(1, 5, 41)	50860501 · 6 1708179551 · 10 9423722071 · 59 4458960231 · 127 2168094511 · .591147 5574545541 3432518951 · 80 2612658538 7010997886 3060407012 5125897621 · P52		205
207	(1, 3, 9, 23, 69)	123373 · 4635 9329929201 · 8096515 1313250177 · P107		
209	(1, 11, 19)	419 · 167246399 · 1904350 6626213169 · 28 7797226956 7413524001 · .1312 5835907657 8876173923 · 47140737 2703645320 2094931887 · P95		209
211	(1)	98327 · 599663 · 896 0574127139 · 137468 6882866127 · .11 4421570997 8218503678 0447859311 · C157		211
213	(1, 3, 71)	853 · 668821 · 5938441 · 1 4726274721 · 59359 7578469053 · P111		
215	(1, 5, 43)		C182	215
217	(1, 7, 31)	5077606871 · 3084 7829203283 · 3 6216847714 0597834640 6298479029 · P141		
219	(1, 3, 73)	877 · 384229369 · 1303682492 1402558973 · P125		
221	(1, 13, 17)	443 · 9640021 · 5201 6377765223 · 14152329 6304179193 · .272674 3304689361 9404631197 · 2767487366 1288132434 7818956838 7004020073 · P102		221
223	(1)	1423187 · 23385119 · 1 4130288853 · 4395 4882455277 · .10062499 9189286834 6686216789 · P176		223
225	(1, 3, 5, 9, 15, 25, 45, 75)	236 3726892633 4837563211 2430268177 8344117301 · P88		
227	(1)	147551 · 256057 · 152574419 · 1267583437 · 1 1056574405 6955405733 ·	C197	227
229	(1)	76487 ·	C242	229
231	(1, 3, 7, 11, 21, 33, 77)	793717 · 105 3467722693 · 23780810 5253287801 · .12852 4926041954 9776349461 · P71		231
233	(1)	467 · 31223 · 788636820 7234258712 9533815443 ·	C215	233
235	(1, 5, 47)	4982941 · 116640 3715702151 6682204241 ·	C167	235
237	(1, 3, 79)	6637 · 11 4598432057 · 12 8693099821 7149714369 · .27 5678624767 2170574149 9814127507 1294287352 4790413798 0751231873 · P71		237
239	(1)	479 ·	C255	239



Factorizations of  $12^n + 1$ ,  $n \leq 240$   
 L,M for  $n = 6k - 3 \leq 477$

$n$	Prime Factors
1	13
2	5·29
3	(1) L.M
L	7
M	19
4	89·233
5	(1) 19141
6	(2) 20593
7	(1) 211·13063
8	17·97·260753
9	(1,3L,3M) L.M
L	1657
M	1801
10	(2) 5*·85403261
11	(1) 5 7154490053
12	(4) 193·2227777
13	(1) 13*·79·36037·222379
14	(2) 673·1 3156924369
15	(1,5) L.M
L	(3M) 31·421
M	(3L) 35671
16	153953·120 0913648289
17	(1) 2551·6690 0193189411
18	(2,6) 73·12 2138321401
19	(1) 3307·8209·90 5265296671
20	(4) 41·521·127921·67657441
21	(1,7) L.M
L	(3M) 1885339
M	(3L) 7*·43·17011
22	(2) 2377·3697·6337·6 8368660537
23	(1) 829·12421·4948963 0860836437
24	(8) 7681·40609·592734049
25	(1,5) 1951·60601·73951·438472201
26	(2) 53·677·22 0028965426 6792155913
27	(1,3L,3M,9L,9M) L.M
L	109·47336293
M	271·487·39097
28	(4) 794930 1362827373 9882868481
29	(1) 1402596253·10 8487601754 4880450377
30	(2,6,10) 18616811 5009253521
31	(1) 1263499·1734204 7548405947 8781201647
32	769·44 4501809976 1619260256 0262634753
33	(1,11) L.M
L	(3L) 67·199·1453·5479
M	(3M) 3 9105782299
34	(2) 7 9471453801·4271 5274891531 0957418697
35	(1,5,7) 861212 3596491269 6227980301
36	(4,12) 2231857·3684845809·9666387937
37	(1) 5250079·415 0805645839·3002372089 9326796981

- 38 (2) 1977673·17647 7034940417·201686423 5215616489  
39 (1,13) L.M  
L (3L) 859·1 7793645013  
M (3M) 313·1 7991125491  
40 (8) 34182 1891076700 0509286225 6297738241  
41 (1) 12301·1684652527·1365 7436942593·4793666 0465075191  
42 (2,6,14) 800488 8183409465 6438235281  
43 (1) 71209·372060253·1 0273420681·71 7772791489 5266742809  
44 (4) 67651673·217245 2839709731 9727803967 8825711337  
45 (1,3L,3M,5,15L,15M) L.M  
L (9M) 181·4 7263556341  
M (9L) 929 8142299081  
46 (2) 30266995 7628317561 1073723284 9558875867 8132736113  
47 (1) 18049·12349627·2 1622395121·84055169 2743771174 1762092271  
48 (16) 7489·3122881·14615 7332293824 2802306049  
49 (1,7) 83 5673419881 7312279063·2532 6532452213 1745115559  
50 (2,10) 5\*·101·1201·700936801·233 4798291701·1480768 7049800501  
51 (1,17) L.M  
L (3M) 307·38035 5066717049  
M (3L) 103·307713 0526103089  
52 (4) 288913·25265657·865727447 6576456652 9085743983 6665912121  
53 (1) 3181·33073·77366539·1 4861828970 6177141662 5763355655 9606415803  
54 (2,6,18) 433·3889·42729553·16 5042892009·5968 6188135337  
55 (1,5,11) 331·6271·16401823 4982236911·4676848202 9635739671  
56 (8) 113·2129·244721·527633·2223295 0788588289·915051229 7530943809  
57 (1,19) L.M  
L (3M) 19\*·88498614 7755302617  
M (3L) 229·62701·317 8598581687  
58 (2) 29\*·1277·378509·953 3379150437·50712741 5651053993·3982127928 4774257217  
59 (1) 709·1063·2 5232402089·2127130 4642628211·8929310820 4809790558 8129990661  
60 (4,12,20) 241·141 8416499327 2459617853 5977341201  
61 (1) 111997·7361466337·518 8602220069·P38  
62 (2) 617521·2682 5115448057·8787327298 4241400393·P26  
63 (1,3L,3M,7,21L,21M) L.M  
L (9M) 127·79277059·2537121133  
M (9L) 2776410374 7580691401  
64 36097·81281·69619841·7338973 0593973249·P35  
65 (1,5,13) 37831·52960051·P40  
66 (2,6,22) 109297·219649·1717321·P27  
67 (1) 44623·2291803·P61  
68 (4) 137·1 7019338113·P57  
69 (1,23) L.M  
L (3L) 139·277·8419·22542577·129512587  
M (3M) 3486 7038247124 7108491803  
70 (2,10,14) 71874601·1 0365509281·161209 2376073761·529845566 4688950121  
71 (1) 4805 8613330617·P62  
72 (8,24) 577·2752993·1567094 7324691873·P27  
73 (1) 439·346059859·632572 2879776491·P51  
74 (2) 149·48989·417509·21617621·137 2147657634 3266613693·P36  
75 (1,5,25) L.M  
L (3L,15M) 151·2251·1696501·6625387201  
M (3M,15L) 395251·973331 5100252251  
76 (4) 7889080897·1435291 5554230364 7618953713·P42  
77 (1,7,11) 463·P63  
78 (2,6,26) 3247609·2 3709901801·P35  
79 (1) 54 3459970866 4429598203·2703 5498236210 0782692527·P39  
80 (16) 2081·247880 6527025281·2145 3859351380 0809975201·P28  
81 (1,3L,3M,9L,9M,27L,27M) L.M  
L 163·811·1621·6 4106515250 2677063709  
M P30  
82 (2) P87

- 83 (1) 499.830 5623819547.52778269 6145344145 7872455753.P46  
84 (4,12,28) 337.10753.28 4065793761.P34  
85 (1,5,17) 235111.32182021.1825 9343560948 0192119451.P33  
86 (2) 173.195049.1260760517.24781968 8992536197.8815 7285201788 0141483757.P33  
87 (1,29) L.M  
L (3M) P31  
M (3L) 2032959451.13 9004666139 6154093141  
88 (8) 2481601.6188868577.4 9514757601.82005 3940544879 4297995729.P35  
89 (1) 7477.5725 1134712639 4968679427.P68  
90 (2,6,10,18,30) 165348 9395093881.3327614 7172349761.1 1485912552 5232035721  
91 (1,7,13) 1093.44773.232 2926580703.262022271 0234691381.P40  
92 (4) 23369.36433.44 8059410846 8600841183 3430562841.P55  
93 (1,31) L.M  
L (3M) 5209.2 4221034391.118827779 8029874021  
M (3L) P33  
94 (2) 941.1129.6581.5607 8144420933.164515643 3564398201.  
.191410 1766445389 5628642529.P33 94  
95 (1,5,19) 25183108 8886489381.P61  
96 (32) 1153.2689.4993.22273.3124609.3531754753.P39  
97 (1) 322429.P99  
98 (2,14) 197.816 6746006659 0930293917.P66  
99 (1,3L,3M,11,33L,33M) L.M  
L (9L) 569016 2377645219.4350447 6926662819  
M (9M) 2971.P29  
100 (4,20) 15601.55201.988062 7023929801.P62  
101 (1) 1213.21211.P101  
102 (2,6,34) 409.615782161.P58  
103 (1) 1237.289765369.100 3041977479.1356 1251678157.98745 2638049443.  
.2 3772032128 4227801429.P38 103  
104 (8) 3946177.235590161.239 4253229201 4126447165 3948845582 3024969393.P47  
105 (1,5,7,35) L.M  
L (3L,15M,21M) P26  
M (3M,15L,21L) 1471.641761.13383533 0443229101  
106 (2) 8693.35617.317789.13865708 4845163757 7834086609.P72  
107 (1) 643.192601.4407 5082436603.699 1207721815 5300056899.P70  
108 (4,12,36) 2593.182696 3160610099 3253589928 8044215009.P40  
109 (1) P117  
110 (2,10,22) 19096 6927558661.P73  
111 (1,37) L.M  
L (3L) 223.2221.17276929.P27  
M (3M) 16651.P35  
112 (16) 140897.P99  
113 (1) 13528813.800189839.P105  
114 (2,6,38) 457.19 7391950050 8479511279 7936193449.P44  
115 (1,5,23) 1381.21391.1364472 9896474641.23329049 8320197431.P55  
116 (4) 18097.10161601.11212138 8095793449.P93  
117 (1,3L,3M,13,39L,39M) L.M  
L (9L) P39  
M (9M) 937.3846087181.P27  
118 (2) 248961 6072661321.  
.8794017656 0868762457 9740393445 2715068427 2220289857.P60 118  
119 (1,7,17) 12853.79953 6900947360 8488042320 0503117280 3108911069.P55  
120 (8,24,40) 148589761.29749 9056050881.P47  
121 (1,11) 727.9888121.35318213 9722763737.23945 8088105599 6074990901.P67  
122 (2) 149780377.3502 5797988529.P108  
123 (1,41) L.M  
L (3M) 676826 2271978677.P28  
M (3L) 2631304807.3138 3200376667.3 0511577297 2736748643  
124 (4) 1489.2729.2934711854 8682214281.158 3895089836 4499433201.P82  
125 (1,5,25) 21751.73233751.  
.4915545 5682299488 6070912021 6552326260 9092033251.P50 125

126	(2,6,14,18,42)	225 4746358873.12644900 5068750937 1770918441.P39	
127	(1)	7621.1373887.2567179.25 8048596775 2214559759. .329 7733393711 8557955263 1594946923 7174164031.P56	127
128	257.P136		
129	(1,43) L.M		
	L (3M)	53923.3227839.5 2929369769.1450 9663662381 8195367871	
	M (3L)	4903.10321.25801.272191.8211109.12 4336818780 3728694619	
130	(2,10,26)	1301.25 9936635790 5564046732 1336114621. .2153 5630543488 0151896121 5117565061.P36	130
131	(1)	99823.795 8872151807 1314082023 9663156533.P103	
132	(4,12,44)	1 5114872333 0113943743 8722025169.P57	
133	(1,7,19)	1597.23143.37507.15 8416924412 8345096741.P84	
134	(2)	269.12465217.238437457.61609 1446145933.284294231 5491768701. .534 1267658677 6404881794 0327317797 4007341341.P49	134
135	(1,3L,3M,5,9L,9M,15L,15M,45L,45M) L.M		
	L (27M)	541.45103501.P29	
	M (27L)	69661.92442871.2 9315905831.375464 5011808021	
136	(8)	17*.6529.277169.31457 6354050781 1991784369. .309271493 7280024436 7934236497.P75	136
137	(1)	823.2467.55897.660067.13105969.446465191.47 2651947606 7642779241. .804 8556602815 1221812203 9707720967 3375295667.P50	137
138	(2,6,46) P95		
139	(1)	2503.19104318 9673024621.1436503459 9419562813 9073964067. .20 2960904636 6446190421 3429756960 6535376821.P58	139
140	(4,20,28)	281.12041.P98	
141	(1,47) L.M		
	L (3L)	P50	
	M (3M)	283.4231.161869.37144759.148353433.259 5234901712 2640990797	
142	(2)	70550429.8 2381421565 7140097997.P123	
143	(1,11,13)	69499.215359.5 7142118749.35 6498118299 8902659851.P88	
144	(16,48)	4154606 9447448707 5907598913.P77	
145	(1,5,29)	433261.98564911.1237976071.3622798321.4007980381. .126 5121937021.P67	145
146	(2)	293.4248 1639962581.235908114 3446232996 5465365037. .42288 1728571921 7161469259 1029181454 0303336456 3608626869.P57	146
147	(1,7,49) L.M		
	L (3L,21M)	7*.883.3410989.5753751 0254151061.174420106 9246727869	
	M (3M,21L)	8527.85809 9307135729.P27	
148	(4)	4681523916 8113548974 4407308902 0189848257. .51 8542971881 1577513802 7935432781 2674150753.P75	148
149	(1)	2683.133 3516292923.P145	
150	(2,6,10,30,50)	3001.4201.4833366 6543999864 0435872281 5138642601.P43	
151	(1)	907.58639039.9 4517673559.632 7253297117. .1007917 9381693519 4025534640 8463552287 0375894173 5222841563.P72	151
152	(8)	16417.3090161.15421921.371147521.3027 0047083201.P116	
153	(1,3L,3M,17,51L,51M) L.M		
	L (9M)	919.5 3684863381.P39	
	M (9L)	336 7724482106 7007790053.P30	
154	(2,14,22)	12593813.P123	
155	(1,5,31)	757856953 3699283401. .1035968 5755533349 4614145563 6430778056 4945816191.P65	155
156	(4,12,52)	1873.P101	
157	(1)	2271678841 3945698967.5598600389 0075009071.3544 5187272680 4327183679. .590 7648479166 6826924938 7579080942 0049637197.P63	157
158	(2)	317.1 5723744461.7 7554200461.182933 8999401677.311006514 1987323841.P112	
159	(1,53) L.M		
	L (3M)	3499.11131.8326360951.P39	
	M (3L)	202222243.P49	
160	(32)	1601.1997 1561955854 0486533761.P112	
161	(1,7,23)	10627.334783723.308 9670921499.32901879 6407371519. .313793 3033544386 9092452469 5384517221 9765089293.P55	161

162	(2,6,18,54) 1297.P114		
163	(1) 6 0124519193 6553406609.109 2272788992 1079239009. .32630 9317829840 5277609527 9953978499.P98		163
164	(4) 31489.24621977.148356023 0291988529.335 7216221636 0702145217.P121		
165	(1,5,11,55) L.M L (3M,15L,33M) 89101.1094369431.P30 M (3L,15M,33L) 1321.207023 4581811001.31241 9431467873 2463656071		
166	(2) 211153.631820237.398303103 3485223917. .53 2349770788 3092330731 8421787453.P113		166
167	(1) 78853 9152479959 9235834738 7072972515 8796647538 8837188632 62\ 18141334 7391236469.P105		167
168	(8,24,56) 91980673.P96		
169	(1,13) 13*.4057.8145943651.158 8611030273 0924472087. .203880 5405124317 2305329566 5203346211.P97		169
170	(2,10,34) 6121.40 4985898377 6261992381.P113		
171	(1,3L,3M,19,57L,57M) L.M L (9M) 22573.143852 9448862747.901045989 4204410841.6188171130 7123989727 M (9L) P59		
172	(4) 41281.130527361.36228874 4135700314 0759870619 0793946704 0578292513.P122		
173	(1) 1039.43597.21397333. .47102 5209035097 5700970149 6503301214 2552925338 9244481318 6448143449.P106		173
174	(2,6,58) 171488833.2 5273969801.30389902 8430312934 3488010161.P75		
175	(1,5,7,25,35) 11172001.106 2452504191 4118138301. .22 9381028641 2917197317 3255879901.145 5593369883 7820004801 4430110801.P37		175
176	(16) 353.1661288449 4783675297.4 1530336687 9530983041. .2169534223 4555517456 7315727393.P101		176
177	(1,59) L.M L (3L) 9375882931.1 2198432901.812505 9831313561.P27 M (3M) 16993.56136259.P51		
178	(2) 2159497.238672013.120 2622621437.294658397 7087010969.	C145	178
179	(1) 27718632 7542739291.526 0391133949 5416989189.P152		
180	(4,12,20,36,60) 15121.P100		
181	(1) 79279.1685473.49673641.11964317 3667024481.P159		
182	(2,14,26) P156		
183	(1,61) L.M L (3L) 1278439.5110459.29285491.1 3154655247.97 8408452143.P23 M (3M) 367.733.56 3215815517.66 2381962579.2216 3333263957.P23		
184	(8) 4049.421361.972098497.2 0107997297.39118 1626599457. .103587 5770413409.P132		184
185	(1,5,37) 67646 8811302299 4226918648 8623687282 8946109472 8017674281.P101		
186	(2,6,62) 12115297.2 1280495849.2193621 1819491841. .35383 9047037925 2215622487 5504890761 7266765713.P52		186
187	(1,11,17) 22441.4595713.47794 5682530691.183407 7939520927. .692 1535027383 4375318159.425621286 7785911936 5602748711. .884885 3902620655 8019195154 7220308511.P45		187
188	(4) 2633.4513.1015825 5937250323 6356107925 8932013657. .162 8231809897 9754077193 2361033195 1581138873.P114		188
189	(1,3L,3M,7,9L,9M,21L,21M,63L,63M) L.M L (27M) 2647.462137131.1768 0996718533.42307 0985265769.206220589 5072564361 M (27L) 379.757.P53		
190	(2,10,38) 649612661.5 1845827441.2084 1615971638 9936472095 2131893201.P103		
191	(1) 613020613.6303137521.25 1052583513.41 9680716841. .127102802 7345083521.16560 4221492853 1046132232 1030847318 1892238691.P102		191
192	(64) 7668481.3394327 9743151873. .6213153276 8503991152 0369011272 8951403521.P75		192
193	(1) P208		
194	(2) 389.1655597.1202992061.336458 7978172444 7427004153.P164		
195	(1,5,13,65) L.M L (3M,15L,39M) 2341.14534 1745837081.P35 M (3L,15M,39L) 14821.P48		

196	(4, 28)	25873.148728721.9396 0767325881.131150 1490634441. .295009677 1565431769.11921 0768567723 6267045569.P98	196
197	(1)	15 5014378153.704 2930613634 2208921686 5009818481.P168	
198	(2, 6, 18, 22, 66)	79201.587999017.13781 5904137033. .6 1453387030 5718926553.958 6047818453 3233388713.P58	198
199	(1)	46710 2924796427.3191125 0188907711.34457438 5512279122 6122392817. .249790338 2324614773 3928472653. .1202118 8124438819 0204228861 9554078500 2102272629.P81	199
200	(8, 40)	401.29424001.108271601.1633440001.8064526 1636342801. .4428188 3469853357 6719427601. .2165077805 4241738719 7017955719 1716030538 6342344401.P53	200
201	(1, 67) L.M		
	L (3M)	3056324685 3529870844 8383841573.P42	
	M (3L)	8067337.872 5118568091.P52	
202	(2)		C216 202
203	(1, 7, 29)	18326 1006686578 3384160272 7607931220 7309847974 2701585\ 250 0076585944 8404747943.P108	203
204	(4, 12, 68)	184417.P133	
205	(1, 5, 41)	1231.486 2333034241.3351 1381037498 5359527684 7542732791.P124	
206	(2)	62213.14161 4078542763 7803934557.	C192 206
207	(1, 3L, 3M, 23, 69L, 69M) L.M		
	L (9L)	20287.66 8400059773.17721118 9194754565 8642828177.P28	
	M (9M)	7867.104743.322093.37384201.827427439.37 6160757697.P29	
208	(16)	369409.	C202 208
209	(1, 11, 19)	2585746747.	C185 209
210	(2, 6, 10, 14, 30, 42, 70)	76441.P99	
211	(1)	54161 1050206377 1552032127.P202	
212	(4)	1 0492629345 9735752969.P205	
213	(1, 71) L.M		
	L (3L)	1279.7243.52935252 3153057469.P52	
	M (3M)	2557.9 5262284863.P61	
214	(2)	2141.157408776 7398010009.431733728 9784510701.	C189 214
215	(1, 5, 43)	338053531.1 8734395231.6 8595346231.143173795 4334448711. .2798 4214140616 8204328831.P111	215
216	(8, 24, 72)	2 3958142787 8728374721 5883470689. .240491989 8173408553 0680050407 6167603617. .1391 0487547034 8730354562 1037416480 3760731489.P44	216
217	(1, 7, 31)	4140361.	C188 217
218	(2)	15711697.82588 5443389890 4905897542 0300525041.	C191 218
219	(1, 73) L.M		
	L (3L)	259697 9075258143.394152 2320230861 5565360103.P37	
	M (3M)	3067.5 7027138015 5140435027.33 7027294885 6354464883.P32	
220	(4, 20, 44)	91961.1851672241.275780 2256166761. .5611 4349979147 4213957386 8257895969 5611260961.P100	220
221	(1, 13, 17)	1074061.51 0790887053 6771352457.P180	
222	(2, 6, 74)	40849.640249.9022993753.42 9577900014 7166429168 6050194961. .61 1341062970 7491402246 6808150294 2105470241.P62	222
223	(1)	267 2516856853.P228	
224	(32)	449.3137.3870580673.716 8793748481.73822 2248933649 2114312129. .1908881 8749299344 2754216164 4841657921. .114 8488175358 3546231345 8761868831 2414140434 2407238273.P66	224
225	(1, 3L, 3M, 5, 15L, 15M, 25, 75L, 75M) L.M		
	L (9L, 45M)	21601.76113001.29914 0388019086 7231178651.P29	
	M (9M, 45L)	511201.2946346 0591278233 7115596451.P33	
226	(2)	3 2931747749.P232	
227	(1)	1 9998034891.10 8036835805 2272077617.	C213 227
228	(4, 12, 76)	P156	
229	(1)	50839.5 2973555989.3183 5342204569.28574126 4675509431.	C200 229
230	(2, 10, 46)	461.584022 1773191621.P172	

231	(1,7,11,77) L.M		
	L (3M,21L,33M) 2311.4159.8622307.16140 9762520777.P37		
	M (3L,21M,33L) 3346 8683678431.6244 2345339067.P38		
232	(8) 25057.252881.2848033.	C226	232
233	(1) 1399.2797.P244		
234	(2,6,18,26,78) 28081.2061437763 0228200209. .323 4543687001 6857281315 0420103889.P100		234
235	(1,5,47) 307381.248288311.4 3018304761.1988259255 0980069311.P155		
236	(4) 629177.440 7098760913.12836 0515998721.1031757111 2655635326 0402742257. .71683062 2926295710 6040931588 3508200529.C151		236
237	(1,79) L.M		
	L (3M) 3480424159.85041 9722408989.67173739 1081542963.P42		
	M (3L) 10903.12799.1283119.4032 0873507469.P57		
238	(2,14,34) 6 5974186959 1722485123 9065051873.	C177	238
239	(1) 32983.99826669 8294786101 5602992869.P225		
240	(16,48,80) 20161.1 3536885121.P124		
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243	(1,3L,3M,9L,9M,27L,27M,81L,81M) L.M		
	L 1 8111923839.66104 4417041377.P63		
	M 74557286 1233573041.1 6976389459 1993350021.P50		
249	(1,83) L.M		
	L (3L) 17431.128983.1734037.675 1461025693.P61		
	M (3M) 39343.399009 8666304739.381147 8302155203 8563632809.P43		
255	(1,5,17,85) L.M		
	L (3L,15M,51M) 17 7317320711.1983879 9892671391.P42		
	M (3M,15L,51L) 5101.204437467 3788302375 9876091151.P38		
261	(1,3L,3M,29,87L,87M) L.M		
	L (9M) 523.1567.7503751.116786539.3145595491.2 7322991191. .685627819 6767955867.P32		261L
	M (9L) 607933535 6606159341.23 1740125419 6914992971 3611504191.P41		
267	(1,89) L.M		
	L (3M) 36313.1 1295986832 7042355869.P71		
	M (3L) 14512 1089875222 4777318285 3974673744 5413985529.P52		
273	(1,7,13,91) L.M		
	L (3M,21L,39M) 3823.9829.434406883.P62		
	M (3L,21M,39L) 547.11393929.913439937 2201485414 3544819053.P39		
279	(1,3L,3M,31,93L,93M) L.M		
	L (9M) 3907.282349.2059414118 5056607117.P69		
	M (9L) 1117.2151005 3036946485 3834511962 3059499317.P58		
285	(1,5,19,95) L.M		
	L (3L,15M,57M) 7172881.P71		
	M (3M,15L,57L) 571.19381.103171.P66		
291	(1,97) L.M		
	L (3L) 3526932999 4328845375 7336323267 8175415119.P65		
	M (3M) 1 1266918213.1283650 8951473917.P78		
297	(1,3L,3M,9L,9M,11,33L,33M,99L,99M) L.M		
	L (27L) P98		
	M (27M) 11287.19603.13261051.28701487.8 0724945709.288597455 2146329029.P45		
303	(1,101) L.M		
	L (3M) 607.231493.298759.526860 4729186220 2798021464 4731465727.P59		
	M (3L) 1487513659.69438508 2117239221 6786450490 8608149557.P62		
309	(1,103) L.M		
	L (3M) 619.99 9571839499.P96		
	M (3L) 2473.13597.6 3774677479.P92		
315	(1,3L,3M,5,7,15L,15M,21L,21M,35,105L,105M) L.M		
	L (9L,45M,63M) 52291.2979271.1438494751.679 7462485591.P45		
	M (9M,45L,63L) 631.P75		
321	(1,107) L.M		
	L (3L) 57139.875689.2404291.9335323.38 7551764771.P79		
	M (3M) 278 3005579153.157089 6163637228 2803822883.P77		

- 327 (1,109) L.M  
 L (3L) 505613287.P109  
 M (3M) 11129886984 9168513847.6 3451209239 5927602546 1446112941 1419614827.P56
- 333 (1,3L,3M,37,111L,111M) L.M  
 L (9L) 124543.11 9810607463.6153 6615482446 5215271421.P77  
 M (9M) 47287.71263.261665 1769743883.P92
- 339 (1,113) L.M  
 L (3M) 76411 0694773033.7328293436 1847577401.11470 3270819551 4473009031.P62  
 M (3L) 27937 4056939245 9675945343.P97
- 345 (1,5,23,115) L.M  
 L (3M,15L,69M) 691.245819 6553490741 7117282311.P67  
 M (3L,15M,69L) 9 6801166741.4912523136 5237839445 6519067392 0491013101.P45
- 351 (1,3L,3M,9L,9M,13,39L,39M,117L,117M) L.M  
 L (27L) 17551.129169.31 4132679901.177 1947806954 1690622753.  
 .5010739417 7911156652 8388153767.P44 351L  
 M (27M) 18253.1018 2380153167.555730 7465977957.12 8707803373 4511273919.P63
- 357 (1,7,17,119) L.M  
 L (3L,21M,51M) 595588813.531791 2141153328 2455104389.  
 .7444 9673863251 1126766372 3410113529.P35 357L  
 M (3M,21L,51L) 3571.8895013.2610 8923931329.14 8547888332 4335621849.P59
- 363 (1,11,121) L.M  
 L (3L,33L) 11617.1902847.4240567.23 3011560739.  
 .1759 0776403036 5209990000 8352881378 9198205653.P48 363L  
 M (3M,33M) 2179.116574547.P108
- 369 (1,3L,3M,41,123L,123M) L.M  
 L (9M) 739.136531.3642031.5752711.142335 5095922941.  
 .3740721533 7032784045 7698722983.P64 369L  
 M (9L) 14627161.1 0584363776 6088877609.  
 .327 0052699297 6007974004 2123012956 4000055047.P60 369M
- 375 (1,5,25,125) L.M  
 L (3M,15L,75M) 86276885 7355002751.26061 8022060908 2752959152 6287333751.P56  
 M (3L,15M,75L) 751.1861999501.P96
- 381 (1,127) L.M  
 L (3M) 1524763.1 2721529803.2063 7598101813 6378198643.  
 .22179455 0096463138 9046193720 8319215171.P59 381L  
 M (3L) 2287.970789.40979520 7580354851.1 4804448593 4399309164 4952608883.  
 .1140 9327382231 4825886454 4522278327.P47 381M
- 387 (1,3L,3M,43,129L,129M) L.M  
 L (9M) 6967.4388268096 7160339139 7367213040 8161496791.  
 .20 2923202077 6862032775 1323185900 3158873473.P52 387L  
 M (9L) 5419.34057.51859.607848517.1 1281513627.1693 1581149574 5796632187.P81
- 393 (1,131) L.M  
 L (3L) 787.288931243.785335 2071229031.  
 .3540 0375486794 0865260651 6870379751.P80 393L  
 M (3M) 47161.540200509.17 3461409377.P116
- 399 (1,7,19,133) L.M  
 L (3L,21M,57M) 7928131.126255554 6640315313.P92  
 M (3M,21L,57L) 332767.1770692960 2633139191.10621 7777712706 8280484149.P68
- 405 (1,3L,3M,5,9L,9M,15L,15M,27L,27M,45L,45M,135L,135M) L.M  
 L (81M) 1719 4742180381 9953791091.5001310745 4891671631 4179353131.P64  
 M (81L) 9230674951.P107
- 411 (1,137) L.M  
 L (3M) 32059.886 3006874344 8247758082 0104024319 3579497800 4066530299.P90  
 M (3L) 139729711 6580222898 1841740991 5604887567.P109
- 417 (1,139) L.M  
 L (3M) 1669.15013.110923.208501.  
 .56 3888889676 3019486450 2252373142 5128503053 8064074261.P80 417L  
 M (3L) 3964837.P143



- 423 (1, 3L, 3M, 47, 141L, 141M) L.M  
 L (9L) 1031 6915586827 7226048549. 10455 2770413919 6439238126 5548669243.  
 .38184 6165419473 5739147870 4197749129 3397073551.P48 423L  
 M (9M) 554977.  
 .494283682 6699857577 1508427851 3825016244 3488468500 8412777493.P85 423M
- 429 (1, 11, 13, 143) L.M  
 L (3L, 33L, 39L) 372923 0661964237.P114  
 M (3M, 33M, 39M) 274233961. 59396752 4131726603. 1 5950407746 3298584589.  
 .434 5021097508 4947437977.P61 429M
- 435 (1, 5, 29, 145) L.M  
 L (3L, 15M, 87M) 6 9872836351. 8 8725741854 3475083551.P89  
 M (3M, 15L, 87L) 36 2856234466 2781538711 3327222416 3575251121 7245360661.P70
- 441 (1, 3L, 3M, 7, 21L, 21M, 49, 147L, 147M) L.M  
 L (9L, 63M) 3529. 11467. 6 9710998267. 16 2145535833. 120886 2422525899.P92  
 M (9M, 63L) 47629. 312229. 3819943. 147915811. 40026 8955783439.  
 .8056 3595863991 5460106611 1588180688 4967004027.P53 441M
- 447 (1, 149) L.M  
 L (3M) 2 4268594204 5674495792 2688692935 1661652137 9017039547 818607\  
 0314 6532721181.P90 447L  
 M (3L) 13411. 3740497. 27760489.  
 .20854360 5083010186 8627222971 4480783477 7153244255 9785477511.P85 447M
- 453 (1, 151) L.M  
 L (3M) 7345 0547381293 5197268143 2555641148 0614133648 0876911654 5344488307.P98  
 M (3L) 1348129. 2092861. 1123412660 8810983588 4435114483.  
 .3206 0463552694 0436098017 3532840459. 7154 4097269524 8942832685 0247389343.P54 453M
- 459 (1, 3L, 3M, 9L, 9M, 17, 51L, 51M, 153L, 153M) L.M  
 L (27M) 6427. 8263. 3290873941.  
 .4772 9490432969 3832754055 5652344566 6279016230 7244728527 5681332599.P75 459L  
 M (27L) 2583416323. 18 4857725904 5898983521.P125
- 465 (1, 5, 31, 155) L.M  
 L (3L, 15M, 93M) 3 3661195621. 7608436 2970120316 1688978900 8167761321.P82  
 M (3M, 15L, 93L) 31\*. 4853358451.P119
- 471 (1, 157) L.M  
 L (3L) 447044 5296516799 2989021059.  
 .3373910 9435523185 6056631225 5270898933 1809783342 1423281729 7798982057.P77 471L  
 M (3M) 7537. 15073. 12453241. 35010373. 7447946139 9093993433.  
 .3 1289406059 5978559505 1345741742 4955206259.P86 471M
- 477 (1, 3L, 3M, 53, 159L, 159M) L.M  
 L (9M) P169  
 M (9L) 6679. 1 2656324253 5798869117. 1 2127245100 3595655053 743013354\  
 3 6857963786 4179043848 8016907141 2408713919.P75 477M

$$12^{3h} + 1 = (12^h + 1)L.M, \quad L = 12^h - 2^h.3^k + 1, \quad M = 12^h + 2^h.3^k + 1, \quad h = 2k - 1.$$

### VIII. Introduction to the Appendices.

Certain information relating to the entries in the main tables has been collected in these appendices to make the main tables less cluttered.

*Appendix A.* This appendix contains the actual decimal digits of some prime factors shown in abbreviated form in the main tables. Generally, these are those primes with more than 25 decimal digits, but some as short as 21 digits are abbreviated. Their listing here greatly shortens the main tables, where only a short label references the actual factor. Each entry of this appendix gives the number of decimal digits, the label, and the decimal digits of the factor, separated into groups of ten. The numbers here and in Appendix C are listed by increasing number of digits.

Appendix A of the first and second editions showed the digits of all primes referenced by a short label in the main tables. We have greatly abbreviated this appendix in the third edition, giving only the Mersenne primes, the divisors of  $b^{2^n} + 1$ , the factors of  $10^n \pm 1$ , and the primes needed for the Short tables because this saves much space, few readers require the actual digits of these primes, many programs (such as Maple and Mathematica) for computing these large numbers are readily available, and we give the full Appendix A at the web site

<http://www.cerias.purdue.edu/homes/ssw/cun/index.html>.

*Appendix B.* The information in this appendix is listed in three columns: the length of the prime, its label, and a summary of the primality proof. The notation used in the third column is explained in **III B 3(c)**. All of the prime proofs were done anew for the third edition, resulting in many proof simplifications. Most proofs were done by SSW, but a few come from others such as Hugh Williams, Richard Brent and Hiromi Suyama (their names appear in the proofs they supplied). François Morain gave ECPP (see **IV A 3(b)**) proofs of primality of the ones which could not be done easily with the methods of **III B 3(a)**. We are grateful to these people for their permission to include these results in our appendix. Two asterisks denote exponentiation in a few proof summaries. The suffix “**t**” on a label indicates that the prime appears in full in the main tables and not in Appendix A.

The power of modern factoring algorithms allows one to factor  $p \pm 1$  very quickly for  $p < 10^{60}$  and thus give a proof “PPL,” “CMB” or “BLS7” with ease. Therefore, we have omitted the proofs of primality of primes smaller than 60 digits. This decision also saves space. The full Appendix B and counts of the primes of each length in the tables and in the full Appendix A are given at the web site mentioned above.

*Appendix C.* The entries in this appendix are the composite cofactors with no more than 142 digits for the incomplete factorizations in the main tables. Those with more than 142 digits can easily be produced by a program like Maple or Mathematica that can handle large numbers. The full Appendix C is available at the web site mentioned above. Each line in this appendix gives the number of decimal digits, the label and the digits of the cofactor itself. It will be noted that the numbers in this appendix have more than 129 digits. We are confident that these numbers will be factored in the near future.

## Appendix A Primes

22	10,77+	49 2463016031 5726207887
23	10,114+	339 5073642066 1075851541
26	10,105-	578020 5030878619 1965409441
27	10,81-	1306548 9780800777 8425046117
27	10,91-	1107421 8647053005 4291318013
27	10,131-	1802220 6228783402 5451247081
27	10,132+	2838308 2652223227 9893972777
27	10,210L	1397909 4101362822 7711346421
28	10,117-	23040173 8448408513 1816292573
28	10,110M	13959003 7091632724 5555441901
29	6,128+	182477700 9702132192 4017185281
29	10,111-	900778143 9605501793 8257237117
29	10,74+	405481405 1406277475 8071840361
29	10,102+	443980004 7900799756 9751764249
29	10,120+	313885064 3843375292 7908678241
30	10,115-	1224035694 9178366272 0773144041
30	10,230M	3549693054 7717848061 4478251861
31	10,78+	6 0605178603 1039803398 5611921721
31	10,87+	1 2741947328 9814847176 6404179653
31	10,130L	2 7378200366 2467203108 9487008281
31	10,159+	8 5585213775 5888517056 0719135529
31	10,170L	1 9887311849 3576144299 6825520561
32	10,110L	36 3805450299 5320595637 7406702261
33	10,95-	965 1946171216 4079145607 0347951751
35	10,75-	15763 9855537391 9170916417 0940063151
35	10,111+	48911 6891108913 0370617419 3415115219
35	10,150L	38654 6587957181 5645672995 8859629701
35	10,330M	12573 2729075598 1811703114 9894949981
35	12,64+	77941 9521377131 3979451893 7770197249
36	10,174+	925473 2401504955 0277148343 2977308389
36	10,177+	219734 9680100406 8086591232 0713950289
37	10,103+	1471865 4539938553 0266088761 4137521979
38	10,107-	10288079 4672225387 9130231155 6310051849
39	10,89-	403513310 2228090532 8493281847 5878953159
39	10,135-	483418418 5972206772 3851735391 5231961831
39	10,80+	349954396 0401225779 2804159621 4187605761
39	10,108+	579276943 4981542821 2368699988 1829009033
39	10,210M	282448028 6120668942 5698442486 9264385801
40	10,147-	4769337181 4649591479 9770475387 6850429427
40	10,231-	1098029578 6495566021 2558978530 4822700373
40	10,161+	3309383964 7758184893 1700265464 6529291847
40	10,630M	1063795972 0973087403 4346415117 3592140661

41 10, 71-	4 5994811347 8868463102 2172889522 3034301839
41 10, 101-	1 8998088572 8193752528 4207842137 4368604969
41 10, 225-	1 5397758037 2010723469 9016518007 6989140801
41 10, 75+	1 0000099999 9999899998 9999900000 0000100001
41 10, 96+	5 3763491189 9672213585 7554610727 9034709697
41 10, 97+	2 7422699366 0546216832 9562307947 1066588881
41 10, 133+	7 2021403933 7461264264 9166575446 5510017877
41 10, 138+	1 9108466176 7914006812 9270917199 2566565029
41 10, 330L	8 1090046817 6729028997 3876544869 9224348721
42 10, 83-	34 6895716385 8578045447 4113739450 5425384477
42 10, 285-	32 4783939894 0161924227 0837543956 6497511001
42 10, 73+	28 6578888976 1949979999 2259233090 8602103011
42 10, 83+	94 3176903141 3300684826 0290096029 4299878841
42 10, 190L	45 8192181720 7406357730 1863031395 2996833801
43 10, 79-	366 0574762725 5214615271 4056487508 0461079917
43 10, 85-	422 2100119405 5301701793 3119029148 8789678081
43 10, 123-	841 4640003465 1612031199 7890655805 4839526493
43 10, 165-	170 3548913892 4940750976 6456202384 4278044121
43 10, 129+	360 5696680890 7913827254 3216791103 8465896663
43 10, 135+	861 0583349234 3400555479 0876409101 7276717091
43 10, 156+	732 3941687838 1056248477 4270146768 3590147273
44 10, 73-	4920 7341634646 3269340017 3948250213 1487446637
44 10, 93+	1838 1907262281 2446331581 9067778696 6663091011
45 10, 77-	13661 4668576002 3293714964 4755591574 0910181043
45 10, 72+	11199 4624258035 6142905139 4333072012 5433979169
45 10, 76+	29747 8330786365 6284148053 0529030248 3555043017
45 10, 112+	15594 4009296214 0541006269 1600379440 7157304353
46 10, 95+	499673 1930447843 6761858439 5974662149 1531100801
46 10, 165+	111231 4101311286 0033797526 1780787040 9611285281
47 10, 219+	6114490 5745257441 1833915232 0279030460 9284611733
48 10, 87-	31017025 1658029759 0451577932 3733949834 2763245483
48 10, 119-	32301294 2148562751 6508145444 3735045464 0448842187
48 10, 145-	74490973 1145732233 9936139310 8905952897 7143716201
48 10, 270M	14184922 9571534821 2561834378 1990285779 8933927761
49 10, 94+	102303764 3093214557 6513331204 2298021317 2396059301
49 10, 131+	136360808 3180796048 4111687831 9649707168 8492468691
49 10, 189+	484119313 9246416682 9129920559 4472635856 3520908223
49 10, 207+	188070980 2856952955 3734133053 3715803218 7793270681
49 10, 410M	306197372 2987905774 7296674964 1141787595 8731844861
50 10, 129-	1049097499 4611747848 1971728399 5603987072 3832569747
50 10, 142+	8251988265 9061966708 7624834867 1944663928 8430446081
50 10, 183+	3327799391 6065498965 2348122124 3658725565 6671587921
50 10, 190M	2054722677 8782170120 5394300836 8973039472 7567536361
50 10, 258+	4622972482 0742226005 0751256175 2822578524 6749164469
51 10, 99-	6285372434 2990469324 7662354742 6886978631 1886053883
51 10, 85+	6022079482 1014452066 7419183035 8091766438 6555934641

51	10,99+	4112252487 7886182282 2335393177 9614493830 5111168717	1
51	10,153+	5739347725 7579000092 9935727527 8968341612 0273639369	1
51	10,270L	0295730593 5680526667 8618488399 9307607189 6366838581	9
51	10,390L	2238535604 6094043901 1640209943 0274808585 1637026401	7
52	7,128+	8341570405 6554985941 2690275665 4743600836 2462334209	27
52	10,171-	4780413798 6731797627 4859059506 4287883219 7147481801	39
52	10,185-	2506248407 6327146358 1292795461 6300401788 8759508161	11
53	10,153-	5372184425 0167674053 9325615854 2325130542 9858083649	137
53	10,249-	6969658252 1096493425 6970659188 0598627101 1284126373	506
53	10,127+	9953127360 3138218699 3015655675 8170515121 6702113889	360
53	10,180+	4092998504 0037939860 5505115660 1020217343 5808159761	393
54	10,97-	9984685537 0537540339 2668420701 1910766229 6580348039	1093
54	10,261-	4738460751 2419909180 9101150298 5360368514 8570876907	7951
54	10,255+	3772556233 7579790651 7491961205 8780723366 8420015131	1751
55	10,193-	3479723774 1296291807 4804784644 5181353879 0168907747	20107
55	10,171+	8426753385 6834852965 5809501455 6598306379 3936631379	65086
55	11,128+	6799183736 2316715332 5740774111 3074461858 0176804609	25138
56	10,189-	4011171367 6828358390 2331781975 9168988912 7137198507	344787
56	10,106+	4835280872 9626679875 8529014480 3454017356 9840168229	752770
56	10,109+	8332114871 9295180578 8533257418 5585898784 8620134943	193643

56	10,134+	160710 3056527759 4576986582 5525217991 7706555918 8277159741
56	10,172+	349084 9329077385 9017057784 0257921538 1715091613 1843303273
57	10,104+	3336327 6643840901 1274705987 0264076396 7004230553 6743429073
57	10,216+	1110266 5846479977 2810971884 8212718399 4552917337 8999198369
57	10,450L	2781227 2655492760 8421392646 6827751101 1668192208 8002932901
57	10,630L	5389978 9353263579 1994279014 6424528038 2126646256 8112860601
58	10,151-	33323665 3226072465 2058380106 5336050346 6693921386 9789759449
58	10,255-	23855036 2491609404 6163570223 7939785755 0641214745 4036200711
58	10,137+	32445695 8063495610 1009646791 0132968264 5985939971 7968478099
59	10,117+	360968001 5682889556 8286578224 8182587198 1791499540 1933354161
59	10,126+	229062468 9643723122 7899575633 6201397660 4469004003 9603689929
59	10,141+	300735662 7055904894 8142559741 5127087965 9052470389 2560552659
59	10,550L	161106383 6099257090 0426742492 9963980528 8146069969 6765138501
59	10,570M	731245090 2727148431 5312555621 4415165371 2981041770 1929303321
60	10,93-	9009009009 0090090090 0900900900 9909909909 9099099099 0990990991
60	10,109-	2468297439 8435543596 2408390910 3782185372 8210515008 6881669547
60	10,116+	3203269941 6316994338 4295066992 4393166558 4097965489 0345228609
60	10,202+	2747096710 5593553576 3734628625 6169476037 1468153723 1287179261
61	10,170M	1 0513610915 2980307449 7312148085 1341948347 2609063231 3891925201
61	10,350M	4 7294133571 4809064038 0520548670 4208196618 9708960077 5548490401

62	2,256+	93 4616397153 5797776916 3558199606 8965840512 3754163818 8580280321
62	5,128+	24 1717177253 3087357279 8545219226 6422159669 9425447245 8802413313
62	10,183-	13 5479629925 1829306571 6754762428 6100385494 6481570736 4291983209
62	10,122+	75 7433887682 6097411632 7848920184 3375280594 6178818153 9337429709
62	10,167+	14 9501280442 5531262945 7887411604 3006929667 2869055156 8705030373
62	10,222+	35 2671159163 8803594270 5181992852 8546148025 8878063790 8577449241
63	10,280+	245 8520835510 5121754146 5412461202 9223953952 3264041367 7301754561
64	10,297-	1113 9549033123 2946080070 1782039373 1828016357 4478409864 5224633477
64	10,168+	1433 3198271594 6678980696 6856379479 1799161365 2942479283 2495021393
64	10,510L	3486 4753194406 7400860795 7277969304 4635105233 7689374443 8151274361
65	10,273-	41581 9223545014 9498964324 8990038120 0731927463 0933416788 0538170373
65	10,71+	31321 0694641810 6835541520 9323405389 5417069794 9315618971 6729115659
65	10,79+	66443 1745414905 7909799751 0158021076 9583929389 7601150694 9065646573
65	10,91+	50678 3874117038 8910175912 5785290439 8943899203 8562709650 1794498837
65	10,123+	61051 7960355229 6927117127 4876554178 5045446837 6324892385 3725596423
65	10,145+	97862 7276654802 3124601100 8935563207 7411444912 2441851742 2691228321
65	10,297+	74507 5571220969 6453100606 6514788984 4234389319 5091193242 1947947339
66	10,159-	359063 4232366608 1943259080 8852669867 3242586232 9833964146 7853849067
66	10,119+	103746 6478304215 5124248643 0622636901 0022369715 4999072471 7454338463
67	10,370L	1106856 3911951256 0506765968 7372491496 6038512787 6035635090 4482039681

68	10,195-	44933275 1390252377 4144216419 5375614371 4972193893 6854816025 7661491391
68	10,219-	23593748 5510504099 3668801520 0253053030 0295324339 5891653371 9315706853
68	10,124+	97645954 6680188464 6728718086 6355758374 2631208648 0304253688 3990817097
68	10,252+	40455276 3607485287 4244256082 9688448751 2151857781 4567117153 4342753113
69	10,177-	121740076 2439061404 4012832877 1750387895 6386512245 1493532951 1899287347
69	10,151+	999882306 1783773451 6188984665 5198592766 3470868967 7098963613 8585751423
69	10,158+	530084044 8377912032 6741895873 4478905892 8622601111 9365862928 9735929681
69	10,182+	431916413 8206177545 4605347680 4635449461 4105339628 4382898196 6782964481
69	10,370M	626055461 6927865210 8869752759 9460905632 3424612369 4056217146 1942282321
70	10,201-	1479324487 4689328121 5477212549 9257696540 6439463285 5368023427 7466780839
70	10,89+	4180967272 6732520322 9119091718 8955510245 8741800011 6483993107 7197586653
71	10,175-	5 4442267778 7487348530 7896142036 1450411594 6692147099 4458984972 7424959801
72	10,141-	44 1506346488 3600484821 1413514191 9313523563 7149481071 6121566453 3500695867
72	10,100+	12 9694419029 0577505513 8577118456 4274499075 7009476567 5782153729 1527196801
72	10,121+	54 4471001372 5792963322 9165267564 6774644208 2652464055 9883408623 7345292487
72	10,510M	39 0165385837 4518059866 3304066749 5640526336 3390138305 9329722636 0344237401
73	10,88+	990 0879227786 8584242572 2365680473 0798555422 1027131082 5918482298 2673560177
74	2,269-	6862 5988504811 7742593646 7066155294 8915363901 8450354163 7191246347 7873783063
74	10,125-	4205 1775804956 3045598108 5900830581 9975199677 0410992305 7427345170 4628125001
74	10,137-	1230 4388013741 7667485877 8040967022 6810319992 7220551731 2732880563 3899245853



74	$10,143^-$	3722 6581283489 9537014721 8426760657 6037130878 8737973660 1328347331 1751294203
74	$10,161^-$	1536 2898429170 3967577178 8885632897 4146292496 9014338911 9356405567 1816191643
74	$10,207^-$	1103 3517351146 8416769534 7781852417 2302174982 8131320581 9580061348 8154982399
74	$10,143^+$	3460 7524609209 5125622136 5127056152 8862879196 3909363204 7194232525 4862879783
74	$10,192^+$	1660 3249990114 6946130094 0104511992 3580957837 9374621779 5036847791 1534904193
74	$10,204^+$	4443 2384794221 3437558974 4174203253 1086615578 6920975025 0941299543 9256236377
74	$10,300^+$	1461 2365731240 5703820057 9394128634 9536257260 7833703263 4712497463 1092755601
74	$10,390^M$	1416 2999157973 8093463308 5871561011 6834650947 0717169271 6672581564 3512203761
75	$2,301^+$	25049 6677636134 1944556244 8211341989 1241717626 6494613758 0332667176 8162580233
75	$2,335^+$	46296 8972850605 4877262164 2291461166 6280373111 8505256673 2709386534 6827818121
75	$2,389^+$	10417 2271624747 7465483845 0306086437 7451510556 3582447946 3135826079 3846207851
75	$2,284^+$	56108 9862628529 4697018803 0761768217 5171538701 7744854163 5858410626 5670728689
75	$10,163^-$	47722 9173213473 3886327958 5490840249 0998658711 9708544449 8238439937 3804471077
75	$10,245^-$	20351 6044706214 6094777029 9325417222 5288278166 5881150032 0160238645 4909778841
75	$10,201^+$	22058 9842618680 1989910867 3135467848 8275926380 9577425654 9633499754 8411735059
75	$10,230^L$	87064 7723077443 4247302401 2249039496 0350773424 1473301536 7164126666 9332491181
75	$10,240^+$	31509 1637261160 8799973465 9440816842 2516385623 2863492406 9053835668 1453806401
76	$10,82^+$	144774 5997018511 8937400766 0603168623 7538345362 4135315606 4557310400 6506749609
76	$10,149^+$	273786 9430252705 4329174398 1448183964 0694075521 3363135216 9193801492 9169431049
76	$10,212^+$	472103 9325728010 8205946795 4135354666 9967335225 3788937225 6631136679 1400472881

78	10,246+	55499777 3096088237 5135249589 6244992867 6083464040 6480510021 2712716453 9795044109
78	10,306+	78354710 1206294913 3711019848 3861014543 4601594940 3203590517 5534605409 4539252541
79	10,86+	292350055 6298303355 2226539485 4270659844 8925085853 7099616732 0005698487 2843366529
79	10,186+	138777081 2537486172 4245677654 1303271846 6560432631 7532191174 4514728290 9788805041
80	2,281-	4800921529 3052652841 8604432730 7933884373 7271906291 6759443910 6895522999 8769420319
80	10,235-	9451894122 7657738924 2753882032 8907528165 8118450062 1859299728 5424372969 0463660471
80	10,191+	3435500786 8290105260 1510144238 4645669200 8580727031 7751351736 2539796128 5416300659
81	2,377-	2 4901881591 8315199700 0318511617 7288015622 1637084521 9862343428 3602416002 5575777017
81	10,125+	2 6940979287 1731627664 5861946622 8123385370 1011108906 7260557532 7268108228 2441709251
82	2,296+	61 5289613528 8560374679 9453719746 8968883516 8151742564 4081045653 7360058156 4260451457
82	10,107+	91 4068923182 8972552925 5245220378 2314704593 7571379494 3226862262 8235228867 0801988451
82	10,146+	95 3703757610 3752545861 0714099673 2176172899 9089417907 9867527663 4881719101 6093460769
82	10,282+	23 7788773120 4762925852 7439511471 1906649165 8516292086 9352217582 6514632225 6742372441
82	10,290M	20 0459432856 3924403139 2298749616 9111622548 0361118012 9676814249 1965778252 6297077161
83	2,347-	202 7034530254 5987116040 0694428144 9672934166 6112096057 8859926431 2046333759 6490211193
83	2,316+	156 5260532521 9818652993 0831721074 6142978364 3502979960 8393894875 5245178119 8261880337
83	2,392+	337 2593317085 4542422930 8541356366 6376112333 1227599520 8525733513 7105749539 1835351809
83	10,101+	115 0049039411 7824585468 7960035751 6307683662 4586334794 8182717560 7295602775 8946488969
84	10,98+	9999 9999999999 0000000000 0000999999 9999999900 0000000000 0099999999 9999990000 0000000001
84	10,147+	1428 5715714285 7142856999 9999857142 8571428585 7142857142 8557142855 7142857142 8572857143

84	10,181+	7789 1842493315 5393480511 0885787624 9540954771 6376329687 1662711200 2173902204 2090054703
85	2,395+	15499 4712474231 3956602636 3526577360 2524522966 0818980496 3537116694 6639628993 3045071001
85	10,92+	41784 3715001671 5837818641 8717091934 7680777262 8503969494 4003301299 6234852068 4914375257
85	10,198+	82184 7679565933 8409712353 8419054116 0782623065 9151143998 5225455868 6670423909 9075512109
86	10,115+	159187 9884384947 7568899983 9379319665 5587713298 1347465830 6962516481 9261937626 6439940521
86	10,144+	707161 4705525771 1374123575 7984286085 9021987761 7672752248 1120859128 2416013707 5376116481
86	10,195+	630541 2991157180 1941639263 4057684614 2599915202 6392552531 5829266554 8127197402 3945336611
86	10,199+	341566 7199916755 8280316457 5480213974 3988851511 7317065783 4221830703 4210228710 9965498971
87	10,234+	7228985 1278620380 1042951920 0208428060 8145936427 7150501545 0967376583 2901166663 1945714409
88	5,256+	46955555 9639387952 9570509800 1562320756 5817330395 5183176829 7953008340 9613441280 9302652417
88	10,155+	48579006 8836513046 9291831549 8908425474 4391737693 5406225054 6461438565 7989297023 6911030721
89	2,311+	217056606 3409153700 9057064062 4263478016 9409769058 3490415257 0259274289 5667512298 8820368249
90	3,256+	7072752647 4930988140 5141965802 6715480791 7971182035 1316861777 6446062072 1694497258 9404100097
90	10,133-	2788482998 6204314375 4907679390 5857765163 9300623520 9786029420 9584165086 6748801861 1321233079
90	10,169+	9396181793 0016711069 1422839525 2953637292 3039994594 5616908880 7647796477 1217059054 7747265739
90	10,228+	1947203319 1376054607 4906161375 9302679230 7169586329 9678749187 3777545437 5796284178 5054377649
91	10,140+	1 1741556610 3637053115 8387153086 3587320857 6115835428 0249987966 1077461752 7569341634 5665039841
91	10,290L	2 0229074034 5345543504 5739409943 1846586251 1369360036 3497128797 6573977944 6827163203 4457525101
91	10,315+	4 5121037299 3041324396 4733865733 3160418209 3690191580 9527857742 8897515955 4191070897 1709035851
92	10,250L	32 8860825016 5718724790 4557195788 7490206894 5994248031 9578774270 6564908226 2417514264 6095920001

93	10,103 <sup>-</sup>	153 2116208870 1542399127 8431667808 3614392172 9429590138 7715486473 4579255348 5904479698 0526236853
93	10,163 <sup>+</sup>	106 2881061565 4418960111 2452124463 2741184416 0316876726 3777500290 2854646774 8157093448 0831778653
93	10,231 <sup>+</sup>	803 9566261499 2503111275 7148192164 9700572084 8358970463 1288984124 6471696345 3686123685 4805849361
93	10,570L	212 1737118648 7703332367 8263211660 9823173937 2213846419 9806442253 3097902685 4386527713 7628690401
94	2,313 <sup>+</sup>	5562 4662393773 7000623703 5693149875 2984445430 2697044992 1737087520 3703638692 2041809901 8130434731
94	10,196 <sup>+</sup>	3781 1770835603 8058344115 4025352663 1210701509 6830704863 3209358859 0272731625 3388129950 2797579969
94	10,250M	6209 2479296877 1829387253 0970176361 2701885934 8736865112 1607499902 2043451075 4727876604 8583639501
94	10,285 <sup>+</sup>	3245 9783776555 6721276090 4825925262 8462951980 2190230933 0517162600 2054148822 5748028726 3152055681
95	2,377 <sup>+</sup>	15604 6200037489 8713756368 4369946433 7494295489 5247911148 9128424163 5660779734 1412470533 5003435083
96	10,121 <sup>-</sup>	597149 1762095304 1236079539 1497657340 1599434219 9250253823 0831481682 2329696491 6727763782 5641074323
97	2,349 <sup>+</sup>	2911655 2631274434 0882064841 9025953647 1420468199 1750465544 2619029163 4929809394 3216397609 6966699987
97	2,397 <sup>+</sup>	2987700 9236300975 6298058699 2334019407 4741074964 5791151987 4033978814 6969912818 7856828193 2889979331
97	10,221 <sup>+</sup>	3223223 9545014793 2742316594 1405274903 1330269145 7079417263 0632038291 4993613593 7529079199 0253041841
97	10,350L	2973385 6583878416 6009019188 6374395419 3765406914 0398897438 3959767974 4394714079 7847188058 4291823101
98	2,344 <sup>+</sup>	33770734 1682536518 0037098937 5796994825 3892963180 1860104848 2005531172 8562600139 4250036897 5908606689
98	10,113 <sup>-</sup>	53895712 3122177190 6526710342 6685397298 4987051734 4922655500 3346881878 5237057810 7901574972 1646701723
98	10,294 <sup>+</sup>	42119269 2966969005 7191123321 0284860119 1818414172 2432791454 8495484369 6309464813 3063972903 8447921181
99	2,512 <sup>+</sup>	741640062 6275308015 2478714190 1937474059 9407810975 1902390582 1316144415 7595047050 0809281871 1693940737
99	10,175 <sup>+</sup>	924113758 5308473837 6478753040 0912659976 4635496937 4382095286 9672176334 4450906491 8263871248 6115217201
100	2,389 <sup>-</sup>	4684435266 6361612325 7893284760 4331726884 2694153062 1962127964 2876954933 2365376775 3584904075 5779223719

177

## Primes and Probable Primes

105 digits

100	10,249+	8088945454 2342602442 0508918747 8561681297 5777356642 8246064660 5211488071 3083291412 3592570000 4673611573
101	10,157-	2215843720 3052205549 2739023062 1406393020 4567205688 6582805666 6081536686 9888028819 4453143646 0921074521
102	10,167-	6908989237 2488283644 6864112463 2904685419 5812725222 8517997817 1763650878 6959054910 2633498828 6452327947
102	10,113+	2943108813 9783859996 4161798224 2667485519 1197099407 1194269355 3709517240 1142816292 5568501055 3886849303
102	10,162+	1796090604 6748818496 3638022901 0216626944 2643368933 6713924533 4739710314 1413689138 5063715918 2300704681
102	10,261+	1961712618 0238738338 8932979732 2976594377 3091793589 1719545686 9103863096 6648948155 5595688418 3686442687
102	10,267+	7647953094 2631295577 9180075843 7062357091 7175702932 1957798614 5801595477 7398022122 5207898823 1259971169
102	10,490M	8518285251 9969161222 9111199320 6592643219 2621175579 0365181721 2241734106 2674840042 0900378064 1949203741
103	2,379-	9649408891 0016857689 3759023330 8625949604 1760338557 9693897817 7320539702 6986339467 2042838951 7879894953
104	2,347+	2442332919 6463171175 3730425362 2533190207 8820117134 8906620164 1121786503 6868670029 1743971292 1903606443
104	10,169-	8234389876 1280029527 8221291669 4331889770 4028317003 4629012431 8006436464 9723577352 7884264451 1160852523
104	10,187+	7395872359 8207696584 3552888948 2277826574 9980140185 1492878219 7341726428 8543872366 7065871450 3098749571
105	2,373-	0346497356 9831423274 4954645732 7748644897 9341142918 9941142898 2990336039 6624967663 0335495957 7078458241
105	10,155-	6050778390 8535151949 8215779845 7569542012 9697416832 3078094365 5658473371 6973661384 1714122562 3774416801
105	10,197-	4105302558 4367520009 3023922253 1800507092 2160322154 2633658660 9291356367 5219966111 2521941701 2181327241

106	2,356+	863434 7730786151 5731230904 2937256260 0645891723 9276465834 8268739533 9003768803 7075127341 8749406164 9643499761
106	10,213+	237212 1273417053 8180946467 9644767368 2891780435 9164858872 9315105478 2924005644 3942418060 4271658946 2595192339
107	10,173-	3219804 6775720891 5934204542 4494659776 4673353202 6942657268 4347937695 3223792923 9107648291 2913495778 6957553803
107	10,264+	1121164 1228630565 6791650734 1571734921 1301068854 2093408424 1738655936 3002502053 2000175057 3708633623 9008966529
107	10,430L	2198082 6109373183 9430870132 3982817432 4083831078 2252475868 5063394139 0323492044 9458421109 8591496416 9190119801
108	10,118+	23017585 6669373992 2539762779 7461203118 2496625023 8868073860 7258133387 1027940087 1545795552 9385108982 2885094561
108	10,200+	11699030 1476747139 0631838991 0782999550 3054414640 4375697396 9673953263 7081068627 2416157567 8078966336 4521811201
109	2,388+	145387796 3178138896 0464266420 5833947976 6721357185 9522188452 5016152048 0654019427 3125039411 0837232392 5802584001
109	10,203+	665628051 0176649041 1770066665 3323389815 9823895551 6121768797 8349317275 5702305410 4072690347 1601671592 7564139783
110	10,215-	5044142268 8391875381 0075415155 9098387323 4580366435 6723961941 4758909088 8973689536 1370510689 2575199754 7638790031
110	10,154+	2556194893 1738399180 9598604930 3563300534 6674997219 8552274123 1411268552 3898853595 3606106831 4916714737 9131162769
110	10,206+	1318910733 2310223355 0299633402 1907185470 0685799054 0914701616 0310267845 9019911637 7917264725 0516205032 7675229109
111	10,184+	8 2951028565 8710111215 1219663083 5144518774 1335558528 7756750398 0614227065 9943202818 3227530678 8523802076 8017585089
112	10,213-	32 0720476515 8124268625 3706858552 9539154614 4230356835 1054801721 8483821054 9074340260 6178785555 4711938444 1220344797
112	10,237-	61 8897520849 2505209268 8866087255 9892516678 3728988042 0847917558 7492695250 0431775685 4661353971 5897975926 7737179161

115	10,225+	37036 8998633338 7654119799 5562979396 3726060273 4804685908 5707052936 8409746630 1976659345 7061270143 4439131707 2899730001
116	10,279-	264822 4055884964 9428997839 2942004000 7327940007 6391385974 0406394247 1165265327 5956393124 6435794890 5318476878 7972981533
116	10,128+	558711 8763375362 1225794775 0090161313 4643084225 3464047463 1571587847 3254421623 0781165223 7021552236 7830956282 2667655169
117	10,127-	6518718 4978524382 0958119684 2331429821 7053693814 7349501049 9558754235 4437188851 9632103159 7538365198 5414922495 1224466197
117	10,136+	4404410 8755747877 6852171834 6256386184 1294905937 4084837579 5314256336 6126920380 3741415744 5665251084 3093397538 3194546209
118	10,187-	31450345 3072357914 5937004239 0749861598 2934055841 3162283196 9789205077 5221250554 4488447195 0534721692 1181799384 5484117471
118	10,203-	31576996 0612141276 2302752567 4338183621 9467305954 9755317723 9346750263 0676412213 7710141583 5772970364 5639962433 9368321893
118	10,211-	16042040 3718189849 2842452177 6342331208 2549489560 4445254059 3692275700 6807435499 2595031636 3656515671 6924187384 2145514809
118	10,217-	47712590 6799435782 7295015706 5182365624 0259040536 0078794788 4258756410 8592005099 0987953665 4871591342 0175323413 7455073283
119	10,188+	278515389 3179118281 3585932285 4905968206 2390074716 4894668499 1670467120 9020187942 3948069199 4428165374 7511534826 8729799177
119	10,194+	324595776 0067555786 0942537579 5470202079 6079987641 3377335594 5866054169 5934726819 4103170247 2966250682 0052694632 0832808609
120	10,148+	9879587347 7650366073 0847298429 9267446449 2842748785 0380038560 4286380709 0965021048 0224210297 1813600329 0835490752 5523774393
120	10,310M	3576409999 6423625764 4576374235 7211830764 2788176388 5411823611 4838525088 5161475626 7658524373 2359357676 7640642359 0000357641
120	10,450M	9999999000 0000499999 9899999998 0000001999 9999500000 0000000002 9999999999 9999500000 0199999997 9999999000 0000499999 9900000001
121	10,166+	4 3002970288 3847415601 5268798064 6195198442 8616527256 8941158694 9534183336 3438851522 2398381949 3743465436 7240751665 9353137441

121	10,197+	8 9558599868 2298175138 3809840603 9748619992 9796400452 7560289254 2651788927 8144703454 0032897420 5489793150 1863508835 9476294463
121	10,310L	2 8240609997 1759107596 7240892404 6879412595 3120530923 4679469076 7297373623 2702620728 6077379271 4063823778 5936175939 0002824061
124	10,139-	9327 2815750404 3594282003 0416618073 8539061812 0638384597 3140973454 3103257105 2315101287 3614569275 9603807144 9541301873 4336834397
124	10,209-	7110 0681963468 2083773990 4403311442 6440296243 8809611487 2110630392 1324681395 0219942397 5998515225 2566447723 5142509594 8672135483
126	10,152+	234504 6820394523 8547222860 1837391217 1012633085 0830571913 8749905156 5408665344 2723871176 9806579683 3209976366 0072585298 7602204289
126	10,410L	377232 2547793638 3256665784 8595478700 3249306198 3039590628 1633432610 2423999954 2518211863 0038629742 6478154908 3357518747 7845254601
127	10,224+	3389990 6659953332 6536683687 2252020333 4823365489 8639773545 6228533820 5973067991 7379334653 0834741952 6450582936 5637578634 1106265537
128	10,160+	99999999 9999999999 9999999999 9999000000 0000000000 0000000000 0000009999 9999999999 9999999999 9999999900 0000000000 0000000000 0000000001
128	10,185+	22369355 0443928295 7619836393 5261212146 0519955788 4513152661 1800779453 4305198976 9289245384 2577603840 4154454146 9734289267 9968594131
128	10,217+	22059227 9044207708 3606417524 3763866620 7964779303 4918069906 7305041042 7735853460 0848355275 9881065631 1066636703 6270180767 4552261329
129	10,490L	114829854 5657619053 9897508411 9988233562 1376419863 4286427880 5348541353 6280214410 7613366835 0909404160 5785801064 9460241145 8108349501
130	10,149-	1657369267 9413365195 8901299355 7140069891 3649920823 6553470054 8884452551 7571861376 5588780820 9563554371 2730089383 3450727711 8593589757
130	10,164+	2245236606 2483971625 5462035353 0247131809 5554391743 3245626204 8578539955 4026316658 3148992537 0072038825 0374892239 7253629192 9859656473
131	10,315-	1 1108290524 7747188576 1026413498 1628814531 1886139270 6283999987 9470748868 7530576489 2449675458 9305365294 7205051233 2265330987 0820532191
131	10,215+	3 3781299214 3440966226 7801407399 0188169665 7097150700 9424177054 9427870082 2462525745 2066153176 8110670247 3737182099 7946296384 9500442241



132	10,139+	65 2065570931 3341698465 1876211089 5357104035 9533306237 8353092332 9412897765 7038418594 9278036260 1926814638 1678365918 4627215091 1969126521
132	10,245+	17 1885313809 0239733162 9729961700 1972028698 0820560079 6969972413 7675797535 4027634349 9757752890 8814962221 2093013507 1556631354 9141490281
134	10,205+	2522 7559933282 9730499297 5667536987 3687524422 1191098736 1296351626 3168625757 3671934071 3289139354 2516779351 5435649973 2672329945 7284056291
136	10,276+	107765 4773020602 1548358735 9543801699 4801570811 5427100064 2967911276 0889048401 7725600283 7849579935 9646781326 3685300203 9998615867 9489264953
136	10,295+	117446 8140649914 5840972641 3815340863 7853221082 9572393992 7504669052 3556598768 0343742844 3621873715 9495708861 4989257266 5998328808 6179744161
136	12,128+	531210 1574902471 5512110098 5879261370 1359967851 6931763489 1322426295 4673066874 1794415847 7234314422 4572301982 5218571075 8987021004 6272536321
137	6,256+	1254339 4833966440 7547227690 4163778497 3526212981 7852195271 0771873008 3926093441 7987012978 9975503760 3721680403 2570874395 2534366368 0530659329
138	10,181-	43802165 3462960104 9924089879 3751822677 6204485035 6935005524 3661800032 5770192107 9072364982 0986353752 8380608485 7648102271 5415067896 5468226079
138	10,243-	81031671 8654935254 3701142421 7349534597 4018609204 6230643676 2931070984 6283851718 9987318568 5694906126 4781563433 2028322079 2698796040 6521712613
138	10,176+	36105775 9540097288 0729372479 7972535297 2055181853 4082656998 0047852155 9326591153 0944573761 8175591254 0092512773 6996895322 3479898722 4827675649
139	10,273+	891256957 1903773640 4237877428 5770162482 0835919699 6259570335 0360116833 8923351027 0822786882 7645523726 1214743926 1334053847 5772602177 1250608797
141	10,179-	5 7154404783 7540227171 1072630310 1785360711 9654486278 1183816374 0553960294 9994236278 7801115577 1371157464 0626700398 3849159894 1656850350 5447054089
143	10,205-	376 5444553459 8090531061 6374045705 1669522592 2222356909 9168893956 6187177983 8862063550 8270861953 4148191941 8156260385 3010454845 7663293714 6377914151
143	10,179+	173 6027094838 0236765442 1235804481 8093424674 2941840774 9298270693 8109744610 1825710313 9536333050 3924753822 1205037054 2458702926 5473764580 6593390849
143	10,208+	338 5712628753 2892390194 5446827501 8070505672 7269149496 5947553204 5527287074 0814407021 4357217318 8016639364 3173336787 7452215208 8887895161 6858121601

144	10,243+	8997 1875734957 7828631761 3417300932 2071382277 0643140264 6004362291 9594180784 9819816835 9257715596 4327651839 0048146301 6883891766 4271994708 7961896703
145	10,291-	88918 1878729305 7739983401 3556429342 7660222748 7744860095 6658770383 2440497729 3608767835 4589586304 0797852524 8669851058 9705827760 1429093577 2599808911
145	10,279+	48870 5483712949 0444185770 6422917121 0645144570 8466643483 2708876218 5716351207 6927093556 9028327926 9679651852 9880218993 4847981345 0734768665 1311824503
146	10,157+	567724 9457541767 9209143612 6139363717 0284208419 0817259161 7111597775 7756348333 8093894447 3350289057 2421410683 9545113870 5476430146 6386236014 6330362411
148	10,237+	12519902 9132925779 6002278912 7418872259 2336250830 9806834359 3414449482 9127598132 7174223618 3274021507 9208573831 8266379138 6444937759 4710511510 1637978649
151	10,291+	9 0823302922 5196230468 8193151167 6834501101 3617954336 8546373275 1578239819 1708756049 2592244850 4760971472 9365430665 4509712541 9459879207 7847237093 6173919077
153	10,470L	275 4705020265 9591809562 2662444529 8384080358 5915255958 9588391774 9483701577 0211394670 5140409286 9857423464 6678926889 4813963795 7740923512 6247542556 1619290841
154	10,275-	6069 6503338896 4442389681 6835276507 7788048987 0565016113 8729963603 7572111419 8413108544 9988328049 5142492131 6978500401 4797295919 5838146864 1118930068 7347453551
155	10,259-	21275 1289964917 2285900209 3022312985 3271426386 4217253687 0145797362 0986848789 1103455074 4112751590 8894596135 6832896051 2333236460 7727296379 5552751058 5680280719
155	10,251+	21689 1967345827 0805366079 4891232689 9095388443 2599092467 7397646308 0828290074 0319659736 3377256966 0745844474 7758168816 1456723290 0298775344 3966814553 7718911503
156	10,430M	342299 9315024124 8914904798 8893055568 4687946999 5993217781 9733894222 7764976299 1938141040 5213349176 7971233788 0150453116 0389523331 3694119707 7628439855 1350113041
157	2,521-	6864797 6601306097 1498190079 9081393217 2694353001 4330540939 4463459185 5431833976 5605212255 9640661454 5549772963 1139148085 8037121987 9997166438 1257402829 1115057151
158	10,191-	22157070 8672257968 8559276358 5328262489 5699729682 4658187129 0190759966 1388004004 1515650182 7001797032 7452947404 0483237335 1030284459 3965242711 5262026523 7784647679

158	10,267-	17325664 6711846922 6559355609 3236354753 8890919169 8483978684 3373136949 3464087679 0851738628 4403996865 9262108510 8216975583 3546074754 1104137668 2673852867 9977268603
158	10,220+	11351872 8717366628 8297388195 2326901248 5822928490 2383654937 5698070374 6878547105 5629965947 7866174801 3609534619 7502724177 0726447219 0692394994 3234960272 4177071521
161	10,173+	5 5635102055 5438368354 6545704914 8501469803 4880523990 9545973825 0346232835 8625452618 1430284898 2434784577 3903751383 5913969138 8144380289 6194267502 4261456156 9128075543
163	10,221-	122 2809112881 0549574823 3378477850 0947505125 6055563397 0534437382 6182388226 0510583853 7380750105 6554769983 2521931918 8001018145 3051182310 7678001760 5799413804 7394190733
164	10,318+	1527 8590279454 4445631369 7979780522 4163439540 8747698787 9709607775 0173420678 2833003354 1374771381 7503792216 5880989097 1694481902 2901345851 9179740738 2076610594 6285784669
165	10,218+	18654 2533208908 6502965356 2871534686 0095610970 5704408985 6872575427 1736032193 9339001715 2106297563 8672064604 6197232241 9451284801 9552268302 6871896337 4072218412 6124790381
166	10,265+	252677 7489848353 5562604634 7394840888 4731636893 1266148924 9164766860 7221061047 8888237036 1457116007 4916162049 7477400598 0913556006 6761697620 0484792211 8990453002 6582759451
166	10,321+	681607 6420889383 5300619280 5293213577 1677823056 5334058537 1138742575 8295002889 8896519522 9201450565 8492373383 2063296238 4270596338 3073925056 1966583868 6770965197 5318465023
167	10,178+	1854709 2770394661 9550468938 6640395344 4141877738 8548196060 2884383134 4546174591 1253465484 7301545231 2338456023 7055546861 3066960424 3301021812 6827162623 6526315595 6618360389
168	10,209+	11840630 8604014738 0329868803 9398355348 3698736486 5237370912 1433689111 1037216663 5698584595 7804705502 6965068496 7340077530 4772469978 4687389349 0310131726 6410840138 3134457213
168	10,590L	52065332 4397227528 5545183925 4301390087 8891270344 0208429340 8576445979 0725432849 5184629937 9498824036 1058638792 4439564854 7089241334 9971308715 3799930675 2081360943 9342049701
169	10,235+	428636488 7150220673 5832250591 7710772180 6065475972 2155521252 5808606895 9357115762 7957018401 7568300401 9170941959 1697080829 2948683094 3679876008 3617168806 6396018831 4299305481

171 10,193+ 1 9713035920 8641543369  
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 6121551867 5198704069 6800248062 3640734837 4092599681

176 10,265- 771076 1721095437 0104069968  
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178 10,327- 12335892 4065308485 7410322404  
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 9887744412 9900539081 0501634032 0125612780 1156692293

178 10,288+ 54542546 8894736328 7683007582  
 9599579556 8774285018 0556063819 7790719877 6432075872  
 2919012384 7575287114 2202298332 7967821005 6333055131  
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179 10,253- 153371445 0905492268 3782139071  
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 9956676555 4172008953 2945434188 5545324780 4416787595  
 8385613786 3709875957 0418143753 8561976809 2793133653

180 10,303- 1577930412 3162343727 9937408119  
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183 2,607- 531 1379928167 6709868958 8206552468  
 6273295931 1772703192 3199444138 2004035598 6085224273  
 9162502265 2292856688 8932948624 6501015346 5793376527  
 0723940951 9978766587 3519438312 7083539321 9031728127

183 10,211+ 328 8306793104 5375491515 5768227495  
 2353292614 9751780658 4073599983 0975851010 7771719398  
 7768606878 9959604687 6239479768 4114544714 2199844840  
 0106556762 6526501680 4404656932 8803579281 2855582407

185 10,199- 21008 4113321762 9059018260 9174580040  
 6621218109 0978796200 4744874106 4318217344 4734041199  
 1127851251 0068815678 6535528858 4910608794 7050983651  
 5286612763 5471781892 7118772787 7990977769 4559002649

188 10,295- 16561173 8232111360 2236348280 2391645275  
 5152854935 4030833692 1228754968 7420763119 1966850965  
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189 10,253+ 518161682 1054419379 3980890431 4725384155  
 7133418838 1106616809 8350771698 0378235832 0213844208  
 7113080605 7993485126 7876045690 4991628242 0132402437  
 2235829645 2409076794 5912848459 5190890413 9995059681

192 7,256+ 30 5022291182 2421800271 4556680542 6714095306  
 3907041707 3699138301 9700419044 0066110479 1959927721  
 3513373229 2879877440 7512478227 0820009500 6623095475  
 4781277553 2830718829 2772134724 1323046819 0487050753

195	10,229-	30924 5091230501 8392902460 3231941981 7254710018 9889994840 1001546225 9773448082 9083633817 1917213064 5425224615 6123123939 4698315184 7424897643 5860190773 1981560210 9638853350 0135304837 1814237047 8419550253
199	10,214+	242182549 8886875706 5680858048 9744203052 5256100180 2943053838 4041357493 0314582991 5591551973 3583733897 3747281007 8846587767 1542310065 6032123324 9421606205 0916862856 0523446063 0445572480 0119249126 8292405581
202	10,309+	17 7528448933 9416641516 8030676915 9757851195 6541035700 9710806156 6866090290 9691278027 3038754460 4022794652 8253652647 8368158497 3992082231 1775462017 7883505831 8095474799 8366738269 8077366898 0454117772 3730227769
203	10,227+	647 6572499338 0330939488 2800523589 0692491308 2846309202 3638984352 5757759486 5039368121 7187893131 8797487469 2597631582 1436100074 0020826413 5473922667 0814436621 2228608292 9429446224 3944661871 2907026347 0391476727
204	10,321-	5368 7061861938 3193962281 7695379134 3616267654 5740172425 0432920561 7487027227 8885790535 7133891691 1354591324 7330891844 7241036389 1060455826 7098693776 3849222912 3488045213 7162105886 0417419318 6731305088 1374774231
206	10,650M	992893 7563778634 4255515599 1815958846 9340722576 7666370300 3305410078 7134432800 3077535470 0802050175 0422293455 0737563286 3294280776 0947614737 2842208023 4605148708 6597552309 4278015000 9337483776 2344831023 9241465001
214	10,254+	2844 3973515894 5888382277 0405294198 2772360749 8504475078 2596009027 7602903560 7577313411 9922762402 3372031187 2127427516 5807541905 8347701271 7724084678 5572296739 9703576944 8069244124 5982905586 2893155419 5464018759 6643783089
217	10,327+	1098901 0989010989 0109890109 8901098901 0989010989 0109890109 8901098901 0989010989 0109890109 8901098901 0989010989 0098901098 9010989010 9890109890 1098901098 9010989010 9890109890 1098901098 9010989010 9890109890 1098901098 9010989011
224	10,262+	1345 7444990872 2122839593 4442835474 5054930165 8632708848 3273474563 7477346962 0228354630 9625222606 8733348068 9199897527 2477513570 1676521951 4246449097 0632539638 1676888338 3694052354 0774153490 8202884921 3900172638 5914197101 8294418909
225	10,319-	60326 7817050415 8262554902 7278735990 2921650638 9436519389 1234200546 6305491337 1790002141 4304871862 7451545911 4513835900 5158005279 7679389932 0776556420 5834732364 1407004286 7358747518 6640264768 9915296031 3141002361 3372856694 2060469773

225	10,256+	16165 9663356434 9449489422 0116416300 9493717089 1023707713 7312136215 0985544514 7613791334 8799702399 6012149425 0486544867 3738037033 3511296921 2205588136 4861279113 7845552210 6972662561 2093067697 2710885926 1279464169 0958289489 7995807233
227	10,287+	5724747 8474362499 3658916441 5226463719 7753997950 1575803404 1716342496 3508056165 1949742063 0863175669 9071964963 4127046014 6510304488 8462326282 3924825916 6087109990 0426746054 2842721302 6850249797 8130281338 4849607693 7713929247 5218618379
237	10,650L	7763644 8947195236 7471330131 4381167559 5541273627 9545808987 6879015758 6603230986 9709150664 9078634518 0714756718 6455337803 1843347028 4073096463 4981401624 1699850127 6319295548 0530514601 0622058025 3411988464 2428515756 3420523060 7286933899 3143889701
242	10,289-	25 0861586467 9868574902 9022942725 8792935299 9635393793 0044688310 2252097924 0526716138 7550045665 5030807673 6713965250 1504645587 6403242557 3952576694 2448322852 9947565555 6326921951 6158897234 1506320162 5411513859 6672215506 5484243567 5104457076 0748443769
243	10,251-	212 1588774582 1410508297 5156638861 6970159622 6323257566 6670500377 5823365955 4551602774 7130897531 7451047632 7930896340 2608489579 4889481741 4128805732 1985065300 7097391237 7963535180 2073368031 9601733997 4186247493 6796650491 6526333646 7747373013 2427004187
244	10,299-	2323 0629305070 3591742440 3244732097 7953196643 9005554744 1744959945 9684857852 3351350962 2563842489 8893140379 5560701330 5206494845 2157832961 6389606708 9119572344 5374575629 2134430175 0151538959 7306411537 0943701552 4942788927 7074867405 1082457156 7173720321
247	10,307-	1857907 3347956369 0828059032 6335907757 0271419288 3762480486 2629507882 0869320720 7360008575 9762994081 0857896191 4719303320 2366524735 2527715205 5349430638 9440856059 4389672251 7278338550 4331772797 7870926082 2687071599 8456103870 5461333558 7643803175 8348830849
247	10,263+	9713799 3128986778 6667389994 6038790872 6433865303 8944049814 5954376874 3699776402 0398945629 0595336375 7162740219 3948355317 6097745274 4822052425 4964896443 6803432655 4673387318 4919607385 6366366281 6826941756 5251755897 1398523841 0111955355 2455038666 5764163451
252	2,1024+	13 0439874405 4881897274 8476879650 9903946608 5308416118 9218689529 5776832416 2514718635 74140222797 7573104895 8987839288 4292384483 1149032913 7987290886 0161794609 4119449010 5959067101 3053190617 1018354491 6096191939 1248853811 6080712299 6723228062 1782075312 7014424577



## Appendix B

## Primality Proof Summaries

60 2,473- 4492441M 54693952799M CMB  
 60 2,601-t 216645203P 1005885863P CMB  
 60 2,629-t +52924147P 218332573P CMB  
 60 2,663- 5269003P CMB  
 60 2,199+t PPL  
 60 2,373+ -100017887M 289362433M PPL  
 60 2,497+ 2786417M 158804688381833109683M PPL  
 60 2,685+ +2922331M 152374920233P CMB  
 60 2,849+t 1005915059M CMB  
 60 2,975+t 68804281160721808357M PPL  
 60 2,494L 428483201M CMB  
 60 2,662M 10891667M 54878158287193M PPL  
 60 2,846L 2578419443M -139610503P CMB  
 60 2,1026M +4631233889P +49782198559M PPL  
 60 2,1174Lt -1809917M 8121518879M CMB  
 60 2,1290L 64804837P CMB  
 60 2,1370M CMB  
 60 2,1374L 2820691805276149043P CMB  
 60 2,436+ 9739129P +271513237M CMB  
 60 2,1092+ 16630739M 81111619P CMB  
 60 3,131-t 1709590933147M CMB  
 60 3,169- 46945309M 453320333M CMB  
 60 3,227- 185764870396817M 12986798203576321M PPL  
 60 3,285- 140619975157P CMB  
 60 3,365- 1431967M 66674351P CMB  
 60 3,208+ 15685747316909M 32819908990247M PPL  
 60 3,228+ 8028109M CMB  
 60 3,241+ 2029147M CMB  
 60 3,307+t 2629230226907M BLS7  
 60 3,325+ +577297139P +18049859M 29590571P CMB  
 60 3,330+ 2735611M CMB  
 60 3,361+t +CMB  
 60 3,395+ -28774069M CMB  
 60 3,407+t -BLS7  
 60 3,433+ 24662544514889M PPL  
 60 3,459L CMB  
 60 3,486+t -CMB  
 60 3,543L 73103209P 4132610619413P CMB  
 60 3,603M 293482157M -3987138243536233P CMB  
 60 3,765L -+314883137P CMB  
 60 3,777L -CMB  
 60 3,987M -3183647M 2910570931M CMB  
 60 3,999Lt 15315705577M PPL  
 60 3,1023L 322093724417P CMB  
 60 5,97- 22782412649M CMB  
 60 5,131- 94292743292263M PPL  
 60 5,249- 1620538260889P CMB  
 60 5,113+ 1618217P 2345641P CMB Williams  
 60 5,167+ 1459990403M 7208519926669P CMB  
 60 6,232+t +12282559M 12679644503P CMB  
 60 6,238+ CMB  
 60 6,264+ 5385408683M 623182354900394968751M PPL  
 60 6,390M 38396873M 243332821M CMB  
 60 7,175- 36859231P CMB  
 60 7,207- 631129043M -CMB  
 60 7,227-t 1692283M CMB  
 60 7,83+ 303362672573196631M PPL  
 60 7,123+ 56665007587M CMB  
 60 7,157+ 32130367M 2953571P CMB



60 7,192+ -48192647M 415534988339M PPL  
 60 7,279+ 10285651P 15245704889P 122761259359503843587P CMB  
 60 10,93- PPL  
 60 10,109- 8609983175687M CMB  
 60 10,116+ +4228993M 8445707M CMB  
 60 10,202+ 2364975869M 6462083291M CMB  
 60 10,350Mt 3227596327M BLS7  
 60 11,119- 13568037283P +85445387M CMB  
 60 11,141- 2361917M CMB  
 60 11,104+ +CMB  
 60 11,215+ 929280445663408043M PPL  
 60 12,118+ 205203041M 350570089M CMB  
 60 12,369M 18523777P 2697996024052523879P CMB  
 61 2,323- 26443799M CMB  
 61 2,275+ CMB  
 61 2,343+ +CMB  
 61 2,361+ 2960101P CMB  
 61 2,1125+ 3381361M 292019593M CMB  
 61 2,478M -50961585953M 79997393617M PPL  
 61 2,514M 7783459M 24583709M CMB  
 61 2,518M 16496998997M 2277152295738815959M PPL  
 61 2,750L PPL  
 61 2,834M CMB  
 61 2,998Lt 8223737M 101145449M CMB  
 61 2,1098L CMB  
 61 2,1518M 886799383M 110634916441657P CMB  
 61 2,268+ 3476083693M CMB  
 61 2,396+ +-CMB  
 61 2,484+ 82627403527M CMB  
 61 2,556+t 363710497M 6842743891P CMB  
 61 3,277+ +CMB  
 61 3,293+t +159320426743M CMB  
 61 3,374+t 3387887407M CMB  
 61 3,386+t 3194499571M CMB  
 61 3,567M 23970695299M CMB  
 61 3,849Lt 1375597M 37746061M CMB  
 61 5,109- 6344399M 68755627M CMB  
 61 5,325L 191869988003M 104378773P CMB  
 61 5,365L 692021830455733069P CMB  
 61 5,395M 66095541857M 1073425912319M PPL  
 61 6,155- 333044337013M CMB  
 61 6,251-t 50992779657923M BLS7  
 61 6,152+ 737974969P CMB  
 61 6,224+t +-CMB  
 61 6,227+t -12146287M PPL  
 61 6,245+ 5152463M CMB  
 61 7,125- 432975449P CMB  
 61 7,151- 4425989M BLS7  
 61 7,279-t 268872523M CMB  
 61 7,74+t PPL  
 61 7,115+ 240976321P 2659053517P CMB  
 61 7,160+ 1732323401P 3116853067P CMB  
 61 7,174+ 29528563P +CMB  
 61 7,343L 889528517P 709303798406941P CMB  
 61 7,469Lt -1721535047M CMB  
 61 10,297-t 5791913M 3243331613M PPL  
 61 10,170M 32387450113380191P CMB  
 61 10,350M ++CMB  
 61 11,83- +13484226577M CMB  
 61 11,167-t 341991541M CMB  
 61 12,185-t 68292139P CMB

61 12,195- 65933707187M CMB  
61 12,67+ 2614427P 373002366929P CMB  
61 12,95+ 8370617P 179553432036197P CMB  
61 12,213M -3309307M CMB  
61 12,249L 76169237M -123467363687M CMB  
61 12,429M 970663313P 30252041928341P CMB  
62 2,287- CMB  
62 2,343- -1650829244749724346779M PPL  
62 2,349- 17461729203227M CMB  
62 2,413- 1692293P 289883484268277P CMB  
62 2,463- 501578941M -13551113M CMB  
62 2,229+ 1835027P 7396509959P CMB  
62 2,299+ 186459037057427P +-PPL  
62 2,725+ 144137467M 11805197029M CMB  
62 2,783+t +2484289M 3674323P CMB  
62 2,554L 9763689673P 3015054400363P CMB  
62 2,842L 13632947M CMB  
62 2,874M -7979687M CMB  
62 2,942L BLS7  
62 2,990M 14324105975867249M CMB  
62 2,1014L 1480916366170949P CMB  
62 2,1138Lt +895875763M 321510821P CMB  
62 2,256+ 31618624099079M BLS7  
62 2,560+ +654339967M BLS7  
62 2,608+t 491031698860613M CMB  
62 2,620+ 2145389M CMB  
62 3,173- 145071239M 8979014050203870763M PPL  
62 3,255- 44273051M BLS7  
62 3,389-t 52253903186227M PPL  
62 3,293+ 343009566287359M CMB  
62 3,342+ 225012803M BLS7  
62 3,425+t -468193937P 791753324159407P CMB  
62 5,189- 1171389711209743M CMB  
62 5,253- 2290403M 14112388049M PPL  
62 5,128+ 226722589M CMB  
62 5,213+ 6093911P CMB  
62 5,247+ +394122221P 78103374221P CMB  
62 5,286+t 3222505815965469210533M PPL  
62 5,294+ CMB  
62 5,301+t BLS7  
62 6,145- 981689201M CMB  
62 6,267+ -11246951685997M CMB  
62 6,318L 23091293619349M BLS7  
62 7,216+ +18728447M CMB  
62 7,265+t 83051446637617P +CMB  
62 10,183- 20055162679M CMB  
62 10,122+ 2348491M 10061209P CMB  
62 10,167+ -126465949P CMB  
62 10,222+ 4195203063738751M PPL  
62 11,116+ 1890316693M 1145172299P 5288402514853P CMB  
62 11,127+ 12635784911M -1186693M CMB  
62 11,148+t 1228302277427M 11858729P CMB  
62 11,150+ BLS7  
62 11,407Mt +8053079M 28548607P 53781359475839P CMB  
62 12,73- +241717011827M CMB  
62 12,237-t -+CMB  
62 12,71+ 2946336031M --+CMB  
62 12,100+ 12977589792931M CMB  
62 12,222+ -155747671M 11581589P 137236643641P CMB  
62 12,273L +6242581859P CMB  
62 12,303M ++1523161P CMB

62	12,339L	62139377P 517943460113P CMB
63	2,293-	-631568963M 17628825439M PPL
63	2,381-	2311417P 68462203P 96106506022433P CMB
63	2,433-	10757988251M BLS7
63	2,233+	-7210901M -4486421P CMB
63	2,359+	2508962376866371M CMB
63	2,423+	285563683M -CMB
63	2,507+	136692791P CMB
63	2,511+	+183713821M 390604106027M PPL
63	2,681+	+47765537P CMB
63	2,466M	1019550839852549M CMB
63	2,762L	2982848783M CMB
63	2,782M	707340721364768886589P CMB
63	2,998L	11699531M CMB
63	2,1074L	15097492309P CMB
63	2,1134L	10403989M 97504496273M PPL
63	2,680+	2268859496143P CMB
63	2,780+	+BLS7
63	3,161-	CMB
63	3,247-	1059009643200635677M CMB
63	3,315-	--9894106964029073M CMB
63	3,347-	53439079M -595976729P CMB
63	3,216+	CMB
63	3,284+	3131963447M 105627691899619208833M PPL
63	3,432+	2867021M BLS7
63	3,591L	+30313937P 466063001P CMB
63	3,597L	89392698680471P +111412525313M PPL
63	3,759L	--10077409247P CMB
63	3,1053L	179096130935778163M PPL
63	5,201-	8865421M 42845629915335131P CMB
63	5,605Lt	1454939M 9891461M CMB
63	5,159+	1561697M CMB
63	5,188+	113320847P +-CMB
63	5,369+t	+8939671915961M CMB
63	6,189-	127520694964252313M PPL
63	6,315-	89634947M 49188656399P CMB
63	6,144+	4061358857299M BLS7
63	6,172+	301633459M CMB
63	6,241+t	--21371197M CMB
63	7,123-	6189563P 17018033P CMB
63	7,195-	10395928093M 9290257P CMB
63	7,236+	225590968461721M PPL
63	10,163-t	++1767705739P CMB
63	10,280+	CMB
63	11,187-t	2161234525889P CMB
63	11,201-	CMB
63	11,85+	23897513P CMB
63	11,94+	50353081M CMB
63	12,173-t	14610499003M CMB
63	12,77+	127216317323M CMB
63	12,157+	108135887M 7115912227P CMB
63	12,243L	142610438456095339M CMB
63	12,351M	12095426857P CMB
64	2,319-	1029037P CMB
64	2,543-	1097494087P +1191746749P CMB
64	2,695-	2276383M 396732449P CMB
64	2,519+	4577329P +78723074317P CMB
64	2,711+	508445813M 35825553896903M PPL
64	2,730M	3015693108988637653P CMB
64	2,862L	137706893M 209636149P CMB
64	2,958M	5096411M 5150251M CMB

64 2,994L +211611679P +2362559M CMB  
64 2,1170M 12039889M 38058020303M PPL  
64 2,1410M -2088511M CMB  
64 2,1446M CMB  
64 2,1890M 112959439M 155330731M BLS7  
64 3,219- 5653201P +333034901M 96929889870431P CMB  
64 3,164+ 71067794790269M CMB  
64 3,193+ 423683548411121P CMB  
64 3,220+ 104635381M 83062595034272996658827M PPL  
64 3,236+ 392025173M CMB  
64 3,311+ 5766603239M CMB  
64 3,347+t 9357940013M CMB  
64 3,350+ 1032946141M 40625281937M CMB  
64 3,358+ 32610439P ++CMB  
64 3,382+ 85651327M CMB  
64 3,382+t 14596912609P CMB  
64 3,490+ 838055917M BLS7  
64 3,789L +283990193M 461664707681874491M PPL  
64 3,807M 43691545338061M CMB  
64 3,825M 10281487P 18017011P CMB  
64 3,831L CMB  
64 5,187- 11519063P +CMB  
64 5,575M CMB  
64 5,675L +75765373601M BLS7  
64 5,237+ 924523429M CMB  
64 5,309+ CMB  
64 5,366+t 4995414767312176309M PPL  
64 6,121- 9402307693213M PPL  
64 6,129- 6104404022071M BLS7  
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64 6,101+ 20478465463M CMB  
64 6,112+ 141148561P 216715777357271P CMB  
64 6,151+ -3023181011M CMB  
64 6,206+t 5907657642113P CMB  
64 7,189- 4718507M 483637868869M PPL  
64 7,94+ 5430613M 1439832343M CMB Williams  
64 7,170+ 46409917M -2323793P 1981398119P CMB  
64 7,178+t 7064957P 2033820311P 111387140929P CMB  
64 7,201+ -7500005867M CMB  
64 7,357L 1230539M 306965822923P CMB  
64 7,371L 323585081M 1675392349M CMB  
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64 10,196+t 22653739M 147864041840319443M PPL  
64 10,510L 29239267M -+426551233673P CMB  
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64 12,369L 26040131671P 114913289223809599P CMB  
64 12,405L 21709531P +466187664805252399P CMB  
64 12,453Lt 7265003M BLS7  
64 12,459Lt -+3397133M CMB  
65 2,335- 96204299M CMB  
65 2,465- 6999051097M CMB  
65 2,545- 7389013M CMB  
65 2,609- 4132153M 3723493177M PPL  
65 2,833- 15976889932429M 6312301P CMB  
65 2,981- 599598695153P CMB  
65 2,1035- 63675679M 11912284649683567M PPL

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 65 2,1102L 2658152017M -35194477P CMB  
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 65 2,744+ 1829870824963P CMB  
 65 2,816+ 14736092339P +11741029P CMB  
 65 3,249- 97635847M 207461039M PPL  
 65 3,585M 315497692348613M BLS7  
 65 3,771L 26968217P +46756361P CMB  
 65 3,903M 3095713M CMB  
 65 3,1017M 511216191511M CMB  
 65 5,141- 332207361361M BLS7  
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 65 5,303+ 4950433P +19096747M CMB  
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 65 5,324+ 4661807M 334030535312406487909M PPL  
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 65 10,123+ 340485133M 19506728849M CMB  
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 65 11,112+ 9627517M 72409907M PPL  
 65 11,177+ 16889137M 61438757M CMB  
 65 11,180+ -+2944536281P CMB  
 65 11,186+ 1533713P CMB  
 65 12,201- 72703487M 28836443M CMB  
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 66 2,383+ 2038373M 3041953P 5364031P 5482097P CMB  
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66 2,1095+ -+41689391M PPL  
66 2,830M 1753027951635670673M PPL  
66 2,898L 38572957M 949528141M PPL  
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66 2,1114M +1952591P 98791005902021P CMB  
66 2,1302L 8666712399743M 13540742946407P CMB  
66 2,1530M -60746391761893M 476660226121P CMB  
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66 3,371- 67113401M PPL  
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66 3,963L 14194139P 1207314871579P CMB  
66 5,273- 2275723P 219048413P CMB  
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66 5,273+ 3365743M 14074211M -12521341114081M CMB  
66 5,280+ 6537199M 19839465100099M PPL  
66 5,286+ 953499690070409M PPL  
66 6,301- 18012882319P +-CMB  
66 6,175+ 136874161P +BLS7  
66 6,233+t +2291102640964463P CMB  
66 6,258L 1822428931M PPL  
66 6,294M 2527867231M BLS7  
66 6,315+ 11936269M 1960556473M --CMB  
66 7,205-t 29762141113M -CMB  
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66 10,119+ +76348999M CMB  
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67 2,785- 32772096481171M CMB  
67 2,537+ 4624393M +-CMB  
67 2,718L 515942873P 11939192399P CMB  
67 2,726M 48912491M CMB  
67 2,946M 9963959M 3019291355131133M PPL  
67 2,1130Lt -CMB  
67 2,1450M -1158611P +2181912013P CMB  
67 2,1542Mt 4469111M 219063797M BLS7  
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67 3,313- -421296563M CMB  
67 3,385- 4305136483M 1699910755539949P CMB  
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 67 3,447L 1815977M 1065134353M CMB  
 67 3,469+ CMB  
 67 3,681L 3280217443P +7557971M CMB  
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71 7,198+ 11135651M 542507995567M CMB  
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71 12,231- 798886679M CMB  
71 12,237- +15418436910575587659227P CMB  
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71 12,447Lt 9355345415517461093429P CMB  
71 12,477Mt 171908017452169M CMB  
72 2,271- 3597067P CMB  
72 2,331- 26304689M 5682172949911M BLS7  
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72 2,337+ 274923533P +143925269P +84180075635101P CMB  
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72 2,795+ +44625569M -CMB  
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72 2,850M 291681872623459P CMB  
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72 2,1206L 137305867M 11466217661P CMB  
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 72 3,263+ 55441549M 2357916559P CMB  
 72 3,501L 3153445507M --+CMB  
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 72 7,163+ -1407491M 3095759P CMB  
 72 7,203L PPL  
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74 7,155- 107218499P CMB  
74 7,285- 11397767P +102500617837M CMB  
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74 11,101+ 356436007P CMB  
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75	2,301+	5730394239397M 118019799691P	CMB
75	2,335+	1466733552386143M -98406323M	CMB
75	2,389+	1607293P 5560932823P	CMB
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75	2,765+	163327063P 334733351P 816860701P	CMB
75	2,831+t	9351549420978448883M	CMB
75	2,698M	2798899P 157321573P +8015849M	CMB
75	2,790L	3840788843747P	CMB
75	2,838L	92855149098501731M	CMB
75	2,1058Lt	66870380119M	CMB
75	2,1118Lt	-+8381497M	CMB
75	2,1270M	2401561M 219420899M	BLS7
75	2,1310M	74367157M 1117202563029101M	PPL
75	2,284+	+1240483M	BLS7
75	3,429-	-5190721M -3859448136913M	CMB
75	3,245+	4037996109781M	CMB
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75	3,975M	+9459629P 451996541P 5231091163P	CMB
75	3,1023M	39856969M -32674781P 1680069917P	CMB
75	5,171-	703053473P 1789633445134905310332083P	CMB
75	5,303-	+46065414981119869P	CMB
75	5,505M	26889299M	CMB
75	5,234+	469717350689M 50541607313P	CMB
75	6,180+		PPL
75	6,191+	53581469P 14248546451062421P	CMB
75	7,261-	74894681P +31279613M	CMB
75	7,146+	1325761M 22327294181M	BLS7
75	7,285+	15441248843M 1309942918024550780603M	PPL
75	10,163-	8226271M -104466589391M -2249113M	CMB
75	10,245-	26207383M 204106622205481M	PPL
75	10,201+	14566351M 200353252182314178699827M	PPL
75	10,230L	431047871M 21183324343M	BLS7
75	10,240+	44309109107M 3225099995817383M	CMB
75	11,91-	110255462011P	CMB
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75	11,117+		CMB
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75	11,200+	-30871667M 12666940111883P	CMB
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75	11,253L	6909299M 59708107M 22796143457M	PPL
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75	12,148+	2790041P 3343663P 162356657P	CMB
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75	12,203+t	-803046677M 28917456990803M	BLS7
75	12,315M	983711454721P	+CMB
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76	2,467-	2212633M 42585726795824059M	CMB
76	2,481-	1666081M 25935720737M	BLS7
76	2,975-	4840580066925199M	CMB
76	2,425+	29089856897M 554818505942915161M	PPL
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 80 3,425- 39189552009780499673M BLS7  
 80 3,453- 113505961P +4356487M CMB  
 80 3,497- 347115407P 2183807287P 15263440223335067P CMB  
 80 3,426+ -1890030729533927M BLS7  
 80 3,639M 9254149M 18447797P CMB  
 80 3,645L -9074851M 2165929537M CMB  
 80 3,711M 209417531M 257345843M 6243975753209M PPL  
 80 5,183- +411406907M 208753343P 1838245860305527P CMB  
 80 5,675M 1542216077P +318730121813P +CMB  
 80 5,217+ 137357651P 44048696939218708437271662899P CMB  
 80 6,179- 46773821M --23408683M 9726029P CMB  
 80 6,325- 13525999081079M 199357592167P 941112404759P CMB  
 80 7,211-t 12490356077M CMB



80 7,255- 483129886439M 1522803332612297M CMB  
 80 7,267- 29770123009391M 645479711803M CMB  
 80 7,142+ 8788909M 894335431747M BLS7  
 80 10,235- 612012712229M 4706839P 3265247P 35625701268164389P CMB  
 80 10,191+ 677679389M 435880440001M 6455491967P CMB  
 80 11,187- 1447661M 351536722609M CMB  
 80 11,171+ 28835980109M 623288893P 1873808809P CMB  
 80 11,187L 336193996470100328669M BLS7  
 80 11,363M 1691873641M 6497123M BLS7  
 80 12,393L -107310769P +1350101M 2460551M CMB  
 80 12,417L 145306351765221503M -CMB  
 81 2,377- 6272017M 28990062557387M -26619031913M 1240859P 38191801P CMB  
 81 2,614L 27046681M 2453587368365873M CMB Suyama  
 81 2,954M 445601123063M BLS7  
 81 2,962M 8188439252339610097M CMB  
 81 2,524+ 61074538849567M BLS7  
 81 2,636+ 5685613M 15082707919M BLS7  
 81 3,223- 10842744124133198829477721M CMB  
 81 3,261- PPL  
 81 3,215+ BLS7  
 81 3,324+ --5054148015332291M 790701688649224501M PPL  
 81 5,213- 567453960865063M BLS7  
 81 5,333- +528611614141135673M BLS7  
 81 5,525L 16404355031M 80232444456128038397M CMB  
 81 5,190+ 35327523527M 23364193P 2488045258159117P CMB  
 81 5,366+ 18074323M 1051849P 195413593P CMB  
 81 6,173- 5023732489M 966510806897M BLS7  
 81 6,164+ -142470871083496451P CMB  
 81 6,218+ 64274491465224611M 1010411P 325932402898162631P CMB  
 81 6,582M 15401091786863M 253032598408067M CMB  
 81 7,169- +1495670131M CMB  
 81 7,136+ +186025481M 72764759172109P 15455298122464855163P CMB  
 81 7,222+ 52846840587999427859M CMB  
 81 7,230+ 466250324952739M 2046727P 3450511165244354969P CMB  
 81 7,385M -26326603211533M -105972739759869599833M PPL  
 81 10,125+ 75309341M --208177303M 67822564405919M PPL  
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 81 12,137- +33822449M 105469769M BLS7  
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 82 2,455- 27369989P +117230299P 241915547P CMB  
 82 2,825+ 45732019M 28264805939M -6533743M CMB  
 82 2,906L 56869540815296708543813M BLS7  
 82 2,1030M 31221889944461M -20542431109349M CMB  
 82 2,1690L 33126381491647M PPL  
 82 2,2310M 591238246234814751239M CMB  
 82 2,296+ 1256531P +37611508602158021M CMB  
 82 3,257- 12772531702168591489M CMB  
 82 3,321- 59873113M CMB  
 82 3,537- 2472607M -304130086963M CMB  
 82 3,239+ 101508102594671841023621M CMB  
 82 3,318+ 296065001M 1665524417601448619P 17828960393885758768250783P CMB  
 82 3,579M 56733707743P 207157436803P CMB  
 82 5,118+ (5\*\*58+1)/26 M PPL  
 82 5,272+t 719865989M -10004348258484911M CMB  
 82 5,371+ 60244764889P 1171860402102467669P CMB  
 82 6,177- -44553483845375111M BLS7  
 82 6,193- ++762281851P 3805535291P CMB  
 82 6,259- 641451223228661M 365144459423174787759233861P CMB  
 82 6,230+ CMB

82 7,199- 4968242484661M BLS7  
82 7,112+ PPL  
82 7,140+ CMB  
82 7,144+ PPL  
82 7,178+ 143502731M 286671992843P 3664867541549P CMB  
82 7,194+ -553229771P 3066954409P CMB  
82 7,206+ ++1661827P 6229106137P CMB  
82 10,107+ +405592513M 7366713451M BLS7  
82 10,146+ +24500237776073M 2033907589695648056925551M PPL  
82 10,282+ --965052176058420641701M CMB  
82 10,290M 901618301P +4771480177P +244247183M BLS7  
82 12,124+ 9411977M 25096847398421M CMB  
82 12,465L 12992017M 2395193197M BLS7  
83 2,347- 847368419M 26204717472347M CMB  
83 2,555- +129306629P 937747133P CMB  
83 2,481+ 91288801M 3325319295053213407M CMB  
83 2,491+ 75961070477P 3945602362029689P CMB  
83 2,603+ 942772781M 10485166890923M CMB  
83 2,679+ 9659513M 4268875746823P 3457630537P CMB  
83 2,745+ 9895337P 14413081P +1215437M 43590191M 75770649043721M PPL  
83 2,747+ -9254332915788617P 80001603741776623P CMB  
83 2,1078L 5180953M -1289443434073610909P CMB  
83 2,1194M 254359129M 44809552661M 2782201P 1696972674367P CMB  
83 2,1326L 895518282437M -86397401M 194405951P CMB  
83 2,1430M 207588929M 5399452716006737M PPL  
83 2,1674L +45355101021389839P +6500621P 12066547P 689809333061P CMB  
83 2,1806L 17432840407M 36453268853018161M CMB  
83 2,316+ 432120791096026381M BLS7  
83 2,392+ 5726371369M 17101169719678259M PPL  
83 2,504+ 6578051M 10254767P 1060825327P 68538466335346199P CMB  
83 2,572+ 247168499M 19938345647837209P CMB  
83 3,269- 2543971P 281637061411P 3810134087926367P CMB  
83 3,351- 1987384236834633939623P +2101439P +57681675910349M PPL  
83 3,306+ 509444247469M 20691823P 7074393523P 11015398157P CMB  
83 3,621L 1940604511P ++CMB  
83 3,945L 157416541M 344730511508676803P CMB  
83 5,207- 4050540733161199M 37144309P 17195298481P CMB  
83 5,339- -261892349716108022976803M PPL  
83 5,555M 674257777P 270821923715895404051P +-CMB  
83 5,595L 1421121785515247M 2224330309P 31765604263P CMB  
83 5,136+ 1372171M 495192227P 32697018001P CMB  
83 5,157+ 38586573791M 748549730629M CMB  
83 5,191+ 66494503343029P CMB  
83 5,227+ 22180399617059M CMB  
83 5,261+ 171174019M 21914554239401M BLS7  
83 6,279- 13647871070224549M -1708203590477P CMB  
83 6,107+ Cofactor of  $6^{**}53^{-1}$  M CMB  
83 6,154+ 8062216147P 3134639868615435163P CMB  
83 6,185+ 93246047357658270866079577M CMB  
83 6,206+ 1857553M 72153143M 9257385278963M CMB  
83 6,450L 146243957439678457P 9425801505966771019P CMB  
83 7,103- 2536811P 19107628399P +34751218211M CMB  
83 7,183+ 3358217M 4781411M 5719597901M BLS7  
83 10,101+ 60929080601M CMB  
83 11,127- 568226227073P 52217161852451P CMB  
83 11,138+ 2106157813736782582903682233M CMB  
84 2,469- 39750178477M 154158431526840111413846081M PPL  
84 2,1071+ 6644681M 1373603971M BLS7  
84 2,638L 934588968997P 1628177623157663299P CMB  
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84 2,684+ 1043316252883M BLS7

84 3,308+ 949639973M 52302776414561P 111553513433564467P CMB  
 84 3,316+ --35042885337599P CMB  
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 84 5,515M 17256936958747P 79171930477924667P CMB  
 84 5,124+ PPL  
 84 6,143+ 1066913M 46431639894821M BLS7  
 84 6,213+ 1025917M 14334328711M 7077526382341M PPL  
 84 6,242+ 17440846898039M 269701127P 3707040403985985107P CMB  
 84 6,285+ 2122553372449M -227731199M 1575476051M 1956853579849676077589P CMB  
 84 6,498M 6380682431M 59243527796263519567M PPL  
 84 6,594M +586568767P 2951958025215408452303P CMB  
 84 7,191+ 80457496279P 5119996144793P CMB  
 84 10,98+ PPL  
 84 10,147+ -620634541P +CMB  
 84 10,181+ 6828167M -BLS7  
 84 11,169- 50116715977M 31314613905343519M BLS7  
 84 11,219- 1032497P 2210878550921P CMB  
 84 11,123+ 212601841M BLS7  
 84 11,146+ 11472163M -2556939970145870801P CMB  
 84 12,133+ 106619671M 347877653M CMB  
 85 2,581- 12082407023M -666187662525058111M CMB  
 85 2,693- 259647447394918499871641P 662664295140189321731396899P CMB  
 85 2,395+ 57933475874647227555630907M BLS7  
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 85 2,633+ 5268163M -15329648857M -6285481M 41031677910779M PPL  
 85 2,639+ 65626921P +10445489P +4184211433M 156678216949M PPL  
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 85 2,998M 2321357M 4366477M 33100637M BLS7  
 85 2,1458L 4179319P 221592431383500561246138691P CMB  
 85 2,2034M 1336429P 148993263553P CMB  
 85 2,500+ 3411721M 18632456228623M BLS7  
 85 3,465- +49309679M -+214847471M 123150301P CMB  
 85 3,199+ 25559033P +1275371983M CMB  
 85 3,253+ 1282867529M 473302204357M BLS7  
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 85 5,455M -15892237P 241800649P +576102457795187M CMB  
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 85 7,227- 327480103P 5261726647P 162947586367P CMB  
 85 7,173+ 50217653P 12940913863P 466688705983P CMB  
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 85 12,129- 95945776249M 421873352262286325788968836873M PPL  
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86 2,415+ +369465074587951883M 4517336485520627104999109M PPL  
86 2,566M PPL  
86 2,622L -100549982500524937P CMB Suyama  
86 2,878M 3700843M CMB  
86 2,986M 1687699358099149P CMB  
86 2,1066L 2550652567M 4080427451530306603P CMB  
86 2,1066M 81597463M 59807507M 43741489999246195685465152747P CMB  
86 2,1094M 1682119M 29120356922161M BLS7  
86 2,1154M 4634363M 1704849364809289291M CMB  
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86 2,1330M -2716591M 49587389M -40631916102657449M BLS7  
86 2,1370L 435182733133P 75428890281119P 6325095560249126223928481P CMB  
86 2,1386L 13356229M 302275601M 6075533P 24419609P CMB  
86 2,1494L 449811091M 205989346253M BLS7  
86 2,1938L 175073621249M 833079137816113313P CMB  
86 3,271- 87336866273M 131732290423M BLS7  
86 3,279- PPL  
86 3,417- 1963103P 21931519P +++4268993M CMB  
86 3,525- 20756601466287000005790767P CMB  
86 3,310+ 7893782584898607837545207625953P CMB  
86 3,371+ 83921699209M 188073398134828235977M PPL  
86 3,475+ 466886789M 143246831744945015496709P CMB  
86 3,777M 1756483M 2265194489040433P 571840101438086187060407357P CMB  
86 3,933M 439674881M -583880491M 42327013464881405527M PPL  
86 3,993M 23235763M 1491822472303799M BLS7  
86 5,535L 129695617M 312075935309M CMB  
86 5,230+ 1714057M -21681269M 9849210320165274389M PPL  
86 5,257+t 7054781M 9447509372993356583M BLS7  
86 5,272+ 19022168949777631P +263378928900457902879016173313P CMB  
86 5,275+ -86061077M -22804471M 38937013M CMB  
86 5,291+ 364263552341460287M 41280171554186261P CMB  
86 6,148+ 97562767M -++379118447M 10794066709M CMB  
86 6,204+ 30237257498820289637M -2035303M -BLS7  
86 6,235+ -115667138861M 23264420671M CMB  
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86 7,245- 42109445477847569P 41711369123396867821322293P CMB  
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86 11,195- -3009541P 2090681350977547P CMB  
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86 11,148+ 6032429076797M 3556454749P CMB  
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86 11,297M 456216960707043104803145671M CMB  
86 12,119- -+539555938627M 3484392723797P CMB  
86 12,471M 1824107281958281561907M BLS7  
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87 2,767- 85642883866868403085249P CMB  
87 2,513+ 129027007M 351274879M 1142237P 55705276789P CMB  
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87 2,778L 466905013P 2685860867P ++69101741M 28196339711M CMB  
87 2,898M 16217586821M CMB  
87 2,978M 397120063933759288476989P +1225999M -CMB  
87 2,1042M 1108235031878237369M CMB  
87 2,1202Lt -54609471974581M 836684008099P CMB  
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87 2,1358M 2052191M 24552991M 39436543P 52359719P CMB

87	2,1506M	-1426753P +391833133M 206663460359M PPL
87	2,608+	-44307354531284362673M CMB
87	2,688+	5690355657635819P +8160041M 73599415907M CMB
87	3,349-	12193691M -4619893M 17780671M BLS7
87	3,421-	20004041M -7290120391M 5950449061P CMB
87	3,516+	855157545188203M 10330247689P 77143483013P CMB
87	3,765M	-13482475393M 264868668430063M PPL
87	3,1011L	6974468130029M 33338909361632100117611011P CMB
87	5,705M	5569763M 15955834131191393M BLS7
87	5,221+	13227289M 9640470311P 384067045657877P CMB
87	5,235+	-73924854023M -5250533P 19644245050572223P CMB
87	5,301+	-622576929487M 4655999710485157P CMB
87	6,249-	295997874200296661M BLS7
87	6,237+	35241487M -+48819893P 3250046101P CMB
87	7,145+	+819841412017M 46256680919869051M CMB
87	7,294+	---65771468687M 1353316210541M CMB
87	7,455L	-441709559M 1371584219P 566588840608789P CMB
87	10,234+	5183977M 2558719P 13972082052994993P CMB
87	11,109-	55201543M 838114078877M CMB
87	11,192+	246787571M 82111537P 79622319838580840704651P CMB
87	12,123-	BLS7
87	12,82+	CMB
88	2,705-	61821273249503P ++13511021M 920275667M BLS7
88	2,742L	7123717319M 15179766465893M CMB
88	2,1234M	34700639M 883052142182167M CMB
88	2,1362L	102137243293P 34111283P +11007391M 7406981P 2713496627P CMB
88	2,600+	4369699M 4463682931M CMB
88	3,283-	15512091817M 1114626634859M BLS7
88	3,483-	29614621M 111572837M 2812958249M BLS7
88	3,349+	243310952901193M 88202045615550719523681013M PPL
88	3,813M	1732901P 2299783P 854622331007P CMB
88	5,134+	71517767279107M 5686441P 78176712287P 5012875697951203337P CMB
88	5,161+	67580561M 451555156681M BLS7
88	5,256+	-1005486019M BLS7
88	5,257+	10662479P 6409043281903P 5618215490543P CMB
88	6,185-	1247756149M 571019254699M CMB
88	6,161+	27307999M 659802223M BLS7
88	7,567M	5523113381M -2760937M 1212636226248671221M PPL
88	10,155+	16908557678112479023P +3943799M 3381641509M CMB
88	11,97-	+136232269763M 1065956574209P 1713593884859P CMB
88	11,121-	59355481M 72948543474871957P CMB(2582000)
88	12,145-	+1212967013M 79790012486588606887M CMB
88	12,225-	2857319M 680133187M 617046149P 133028304181P CMB
88	12,143+	66433430508671M BLS7
89	2,447-	25781083M 184481113M BLS7
89	2,549-	+1832933M 32187713083837M BLS7
89	2,635-	+173973791M 23830135936231M CMB
89	2,819-	-2599907M 4571579M 35182393M BLS7
89	2,311+	516319099M 42007034230754173811M PPL Suyama
89	2,457+	2114132273579958312441041978447P CMB
89	2,674L	++733177925621P +1920599503M -62771591M PPL
89	2,758L	12258461P 100889093P 110843107P CMB
89	2,1018M	-12255811949P +147584131M 154805641M CMB
89	2,492+	1945232393633M -394101937M 8566461461M CMB
89	3,221-	1230829M 8404993M 6750364119044549M CMB
89	3,387-	397597429219P 4594796691001263212731P CMB
89	3,226+	-16911412260889M BLS7
89	3,407+	46886551P 385825441P 624044932169P CMB
89	3,717M	754672879M -243462809819P 2195377485209P CMB
89	3,987L	+1967137M 35395372397419M -BLS7
89	3,999L	13706986981M 356305421P 24254504999894863P CMB

89 5,127- PPL  
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 89 6,203+ 2265869P +-318519159683M 372844946129M CMB  
 89 7,137+ 284732190434849M -5293535551P ++CMB  
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 89 7,343M 3284647M 7088687M 9750607M 22611481M CMB  
 89 11,133- 1049089M 4247962573M 246759265663M CMB  
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 89 11,207+ 2312987M ---2156540066227M CMB  
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 90 2,523- 5695956229133M 233201267074403M BLS7  
 90 2,595- 1164822323713M 40360643P 5211893041P CMB  
 90 2,729- 6999714851M 5403160197326503M CMB  
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 90 2,890L 15675313P 4157329056343020278712879507769P CMB  
 90 2,902L 45557371P 1801949674471P +-4127797P 936721435399P CMB  
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 90 3,471- 5001523P +17098853M 439315418878231724902147P CMB  
 90 3,256+ 9006086414351023193611M BLS7  
 90 3,259+ 241873344430807M BLS7  
 90 3,855M 65111419P 9101100152148726740917995661P CMB  
 90 5,309- 259298243M 1828698458969563M BLS7  
 90 5,395L 4527911M 3118245497M 246275242123M BLS7  
 90 5,595M 603362785261091M BLS7  
 90 5,192+ PPL  
 90 5,249+ 15563328353P +BLS7  
 90 5,338+ -9146633P 1098095587415297P CMB  
 90 5,369+ 1495741193M 194907892877679239M CMB  
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 91 2,969- 1122997P 13852217P 8262066671P 217671634157P CMB  
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 91 2,619+t 390194442361M -1011606064769M CMB  
 91 2,665+ +-4541951627M 10050393911M CMB  
 91 2,897+ -19331419319P 24241364282987860876427636470621P CMB  
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 91 2,120L 90457307M 26275221376839803M BLS7  
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 92 3,394+ 9566789M +-1312001M CMB  
 92 3,425+ 657671953M 4280345591P 59192836834723P CMB  
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 94 2,537- 65996878447M -8034140843M 24032489479M CMB  
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 94 2,909+ 3975173M 50084319631M 34813178258645073490634522107P CMB  
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 CMB Haworth, Davis and Holdridge  
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99	2,416+	-2423219P 1267232041P +-8717620861M PPL Suyama
99	2,512+	+857077391M 1726801875893M 1351841P 781015379P CMB
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99	12,97+	12891158154261335153P +-6458297815148477P CMB
99	12,112+	4749296988979P +19665741265201P +9061453M 1221469P CMB
99	12,210+	655938924647M 16233977P 11400983465869P 2707823891P CMB
100	2,389-	-4126109747P +207731353M 2612580203M PPL Brent
100	2,449+	-1017377M -58607582861M BLS7
100	2,539+	7160389M 4632765124226184691M BLS7
100	2,592+	223346876813519M 8343013810968732829M CMB
100	3,369-	479111863M 36698368853M 142428309597594985147M PPL
100	3,379-	4483863540454681241543M CMB
100	3,531-	6628057P 482455229P 5133558449P +7910471P CMB
100	3,344+	-6962904544750117P +45022354148773307469649M PPL
100	3,385+	12612139P 5382462719813407432199P +2091530467135267P +977394840407M CMB
100	3,807L	250173593M 10914525315386198283003097M CMB
100	5,330+	416000257M 2070467848308169M 60224423114407939194911M PPL
100	6,134+	211293030929M 954310574924026633M BLS7
100	6,217+	-1302957346507255483879357M 12342332423535119718919432184429P CMB
100	6,240+	PPL
100	6,510M	8959800013M 2915441137057869001M BLS7
100	7,219-	12979395151725773M -305370943P CMB
100	10,249+	15121086601M 18516547873M BLS7
100	11,124+	28977864648440969M CMB
100	12,107-	-9307741P 10818857840605657P +42038797M 4268423311683721M PPL
100	12,180+	-158689539263M 221196256039841M -290191613557615413341P CMB
100	12,220+	5174887M 66402851M -165643109M 44141610407651M BLS7
100	12,234+	-145639578841P 239003655029P 536292593773494022103P CMB
101	2,427-	5678293M 861736561111962549644136452599P CMB
101	2,519-	32428769M 14067702403M 513152273620559M CMB
101	2,557-	124192901965332435451P 3078272940446286291096047749P CMB
101	2,597-	15384530509147829M 5671932289P 27352993477P 2954950724924094901947816473420903P CMB
101	2,843+	2071463M 58555028131M 8474651P 7252947623P 124866694985899P CMB
101	2,1146M	1543589M 14672767629M 11034246043025021221P CMB
101	2,1938M	44003977P 6251758176647P CMB

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 101 10,157- 31501899155723M 2088451P 28433865471241P 18949383827266379P CMB  
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 102 2,505- 8599823P 73629821P +1825736483M 8013058997P 57551382901P CMB  
 102 2,605+ -30903833M 172452604930802081M 342918854102723P CMB  
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 102 2,1082M 160327214633M 720251837126719M CMB  
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 102 10,167- 1879511M 22182877P 38290151P 72855157P 77527267P 7846569381851P CMB  
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 102 12,221- 13727821P 2197869953855038286618229307P CMB  
 102 12,191+ 13062152244091723P +7212263M 3244166011M 2906080257222943531M PPL  
 103 2,379- 253707067869887M 19484948733429892067M BLS7  
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 103 6,199+ 35781828514312649M -90097327M 611524324643M 5935294343098763M PPL  
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 103 11,209- 79269649P +BLS7  
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 104 2,509- 1428979M 1239696167M 35528809699M BLS7

104 2,347+ 1505447M 35374479827M 47635010587M CMB  
 104 2,431+ 46772359349M +-68607370927957P +13682480373108109M ---CMB  
 104 2,545+ -362957401M 67897897P 171603795329P CMB  
 104 2,886L 1665133925047M 830727872004937387491916355547719M PPL  
 104 2,1422M 840838985317M 7801009610179M -3530623M 19817693656051M CMB  
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 105 2,794M 6499991P 296611605216293620549P 9758097142855842526436021P CMB  
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 114 11,197- 146139746303497M 6060233204954689176844364369M CMB  
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 116 12,393M 716259779M 163128089591M -67279757M  
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 117 2,575- 19012813P 1757621633P 9158591527072147P 12290863468372118881P CMB  
 117 2,643- 4547507M 237373349M 1180980609983M 367435080554803M CMB  
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 126 2,876+ +177268338067M 638713609542572491P 1434545429149211187539P CMB  
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 126 3,414+ BLS7  
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 127 6,267- 1012679M 47297123M 108967831775821M 73984890121911117389M CMB  
 127 6,275- 602520071M 284913970622243M 8927011670110209771428959M CMB  
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 127 12,203- 1144007P 17999474332274722810667P  
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 132 5,287- 1425427M 7495429M 49266247M -+65715020351M  
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136 10,276+ 10617775560841119257M -142043669M 607837697M 1674266644679M BLS7

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137 2,921- 179947802977793M 1264349197P 26758239229P  
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146	2,807-	7518069079M 725029689493M 1923493353884161187M 5607778934600882371304519271091M PPL
146	2,1113-	9048174221441P +1192561M --1855453285409M 453567129021607M 79188087920786737M PPL
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146	5,257-	784702511M 8858580590860008511177M 35400494989114003163341M BLS7
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147	3,407-	6790237M 218813670735901M 1341219677960876004151371187M BLS7
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148	2,728+	6338665490192712656333M 38734667P 1352214876514318630338887413P CMB
148	3,451+	218059754033492152757M -+10313786419M 34662551290967389M BLS7
148	3,1047L	249267214591M -37949953529M 72374473189M 8964180910700445100787M BLS7
148	7,289-	2107849M 803096435952953M 1118501067311M -2601652073M 1071103219183M 1799114340407M BLS7
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150	2,604+	353324933009M 244848228024120010140271M 110403121934249582512258723549M PPL
150	2,960+	1990029735437M 10227161771788299929856227M BLS7
150	3,353-	2192966047M 40245029687M 5656482409100960039M BLS7
150	5,223-	10575793P 43495871P 26948982887P +19778489M 1038255372443M -18672450619P +5479982887982029171M BLS7

150	11,214+	419580062143643P 11910112800455257P +1446251P 190121328993473P +726967581078524205587P +31011490303891152409M CMB
151	2,1774L	5191301M 53567940097993M -6610043697782065816359319M -92520431M 17346927536186853490229M CMB
151	2,1818M	1325279603M 2169463930147793M -139942169M 300383647M 237505979057M 937121196320036578400059167023383M PPL
151	5,363-	2964191P 8239921P +829042727M 7039211P 407483408911P 69108683121482819P 97687611096395006513719P CMB
151	5,319+	12064967M 87229784090147191M 154626198619302869M BLS7
151	5,363+	1952963M -48096211M 35213049024667841M -+121600307P 2235291251P +4837769M 4592467757M CMB
151	6,223-	15588457883P 659033791549798589P 4441987949720526594481P +689874085567P 1869589859787969523P 3545793358018657793P CMB
151	10,291+	5836421M 619362637986104008901M -436687513M 736872198497033M 800553481903603M CMB
152	2,835-	1492830881P 315872225987P 320903283717091813P +18996671M -1864634089M 61864151767469M BLS7
152	2,1005+	54495859642794009499M -+8965810552665077761392000043P CMB
152	2,1282M	193763599M 190672458846143M 250048321782923286567491M BLS7
152	2,2058M	34806263M 6717408849689711M 12667789P 885970781P 1537786823P 1873583351P 14005740767P CMB
152	2,676+	321023673708665244371P 54848041615177P +1184893M 15319459P 7083130910930461P 531880646724603907166622631405153P CMB
152	3,951M	PPL
152	12,179+	1937724064033663247M 91795907029118994089M BLS7
153	2,755-	3841199M 92562538078630637345389M 260887247165049887M BLS7
153	2,775-	9963449M 7545262177604571562267M 2415629P 2227944368899P 24554360696477P CMB
153	3,492+	8194721M 21523361M 700984481M 1343172829M BLS7
153	7,247-	1966037449P 3092100598430680259P +15480527M 30149101104499219P 2000222766005762980428151P 423346934631695642167076497182879209P CMB
154	2,803-	1187050639M 2260915207M 4257875672786377M 299909087963999M BLS7
154	2,1674M	29025530551M 2820746580999627193M -3212248069P 2812565215843P +2137925378985041M BLS7
154	2,1866M	10820093M 4579882832418287M 26577735588372337M 9269520888342397P 597301930706112844103P CMB
154	5,605M	12207031M 190295821M 56914394122513M BLS7
154	10,275-	+7578503M 14970779737M 120492575358474439M BLS7
155	3,513-	1190701M BLS7
155	5,293-	109191883M 105221686121M 186477980443M 1210733725021757M BLS7
155	7,229-	3063315727M -46746421M -239554313M 342867389M 86524187051M 667311516269977M CMB
155	10,259-	437007689M -+121154628149M -6439933M 763566553P 1368387083027P 61317200705243089P CMB
155	10,251+	226692448295810897M -350692718699M 981023298947M 44683313P 11733095351P 865505423533P 66242587714309439669P CMB
156	2,2022L	32441147P 52872293P 208168144402591P +128697343783P 3165552603127P 6066389345327174120897P CMB
156	12,182+	+250782877P +1987123M 7319057M 6791814671M 3916808576002898068531M BLS7
156	12,228+	2231857M 3083929M 3684845809M BLS7
157	2,521-	CMB or Mersenne
157	2,577-	355528005163P 3607321343911P +20857830903971M 1429730725021579M 1074161863466623M BLS7 Brent
157	2,995-	8462371M 6624091150299559M --26242175234135844239M 628549913P 2135464943218343311P CMB
157	2,1746L	-42266720140331P 53144989217508193681519P +18050972508612383M 535514939556495427M BLS7
157	6,308+	-16583081M 494734283M -245351213P 3417673673P +3598013M 41278927P 59710872592597P 274488599131683229P CMB
157	11,157+	63495149P 1067767170042556127P ++10998017985347M

		289191840781184977977821M PPL
158	2,1045+	929201455612327P 782655828707507P +1229889376270587569203P 1552744617773135219P +21747679M 38442067M 41772494715713M BLS7
158	7,202+	113156089M 156367801M 21660813071M -2822933M 137517044107M 45171000405851M 1145080112989M CMB
158	7,248+	72925649448846558403386521P +212618016568619P 1067587682728356434413P +6126420647M 17759591P 376883708031223P CMB
158	10,191-	42800281M 42782005403M 17149620049453M -427177785669955514219M 3425291010035055101981M CMB
158	12,181-	27050677M 1381157625144732107M -+22684079418957401P +2346515482373076228491507M BLS7
159	2,1570M	1066049M -6950668186678753M -16360831M 2052732597547M 19959978171451M BLS7
159	3,389+	223744692109723843687P +168673223M 87728827M 638938664652885798769M 3605741P 42344537P 998276558240142145513P CMB
159	11,169+	15216143M 1064699837M 17978420809M 989966146666953532189M BLS7
160	2,875-	6713219M 494546695229891M -129143619277873P 2384656265034931P +54539163199P 9001634530731807900851109763563658949P CMB
160	2,897-	-23666213M 2351101P 647713139P 5402653319969137P 129808731798716605031P CMB
160	5,229+	3981071M 53590717M 4885168129M BLS7
161	2,1402M	15316237M 8923698559M 2595870457226838976682227M -496678493M -19363299451M 219808189P 23772258864719P 217010840632745491P CMB
161	3,535-	111878322966559M ---+729616859P 275048731097700199P +20581868320062827M 6481187P 3743984098320619P CMB
161	5,251-	2132325981110538153749P 559069959689507527P +-77976147287M 1718721956174547557M BLS7
161	10,173+	1902990637109M 1049470232483M -+161904191M 6688722647M 134990692489410841M BLS7
162	2,763+	34929707159P +2707811993P 377508771198920404891P +523210907M 1915471348537M 2194679P 175868705239P 18765138410267P CMB
162	6,295+	218723347M -+79702393P 1571376707675797973P 338805822879611P CMB
162	11,211+	1569783312983689M -135115181M 1120454184299M 42947357205546881M BLS7
162	12,167-	4190677P 58264573P 16140751915363P 294945938580739363P +7944779M 4770322049M 53024358659704530848159269M CMB
163	2,1902L	54212339361731203M -+201404725297P 4439819081871948280557629P +10086101M 5123211727M 8842958665756891811123M PPL
163	5,281+	134361280330370837M 6085223963756475787M 79103166551449549163M BLS7
163	10,221-	36776288711P +129599881M 1095114713999M 4286779322509M 619900747166472092533M BLS7
164	6,229+	141941252639P +51398706719M 611017986048193M 1733564886945330809M BLS7
164	12,194+	2823971P 2621819737P 246340772092168651P +9682223M 960521506516823701P 9243190460257762513918211P CMB
165	2,1101-	2049957374513P 668029450688079985488121P +107618341M 1753673P 7964379685349P 22682422577669669953991P CMB
165	2,2118M	2679739592656633228207M 66052996992195188399447P 37958533331815355257741P CMB
165	10,218+	47708499851M 9641383222951M 61489729013701M 24125348516715275573M BLS7
166	2,1053+	92214249729997M 5632378891228534075693M 120147288849970203221M BLS7
166	6,248+	1567117P 16832549P 33039163P 105898853P +1996777M 124883689849P 13354876167032882257P 2427422576102854848033941P CMB
166	10,265+	71135951M 45817344458377M -76140803038249M -26067403P +60972036337P 386983327637P 7173921495013287491P CMB
167	2,1114L	1121297M 1408349M 15736774913M 492717674609M 12763660054721M 1251163891299967635860272509229764287909M PPL
167	11,205-	212601841M 2591284561M 1310797679201M 1120648576818041M BLS7
168	2,929+	2909558823990109567P +2843039M 9745757065475564587M 1065960410065976029233749M CMB

168	2,1930L	44338919M 1100296987M 331532639939M -40550399M 1736958335603777669M -399356755479212295301M BLS7
168	5,310+	69566521M 83003693M BLS7
168	10,209+	276681761M 8109631377554349532607M 8202963018623814461M BLS7
169	2,1126L	7416361M 15790321M 47392381M BLS7
169	3,391+	2470891M 295081355203M 12286974851M 180050009478751841279M CMB
169	3,1059M	PPL
169	12,477L	3247609M 23709901801M 143548826711M 2200289654266792155913M BLS7
170	2,1202M	97306179804366697M -8023852511149M -931174471M 3731806250295610271297M BLS7
170	2,1666M	3657981673P 47386877948153347P +16251679M -9218226001P 6034640989856081P 109984047908588819701P CMB
170	2,1140+	1931341P 877990889P 21221190721P +64164837227M 1648486967383M 937834711734528791627M PPL
171	2,943-	1044775133M 1111097496428004539M -17386153M 66594634919M -71959828296241321M 3434589777713640233M BLS7
171	2,785+	7764049M 20815801M -569335847M 6118593119M 458640784519M 9104536579M 11550433411511M BLS7
171	3,359+	3755779M 19510643M 47029186391731M 291066066130451M BLS7
172	2,1107-	1716065423M 272062660012189M -51120636305214103068487M -2485907P 1312081348178981P 80898264274776511007P CMB
172	2,599+	20066314141M 669366523739M 43899689982193M 1341262711204188050603371M BLS7
172	2,1198M	+12309097M -364055505466229M 18594342070729P 10481853763608397P 7479102818914787P CMB
172	2,2346M	1010042532856276142239P +9503987M 13611463303819M -115080531519881M 5170982741P 5508116097866593P 14832381521131595351239095949P CMB
172	6,229-	510433921M 87497477548633561421M 225450222896024551921M BLS7
174	2,703+	6177929P 30863137P +72764983M 1128707501M 151695660277358581M 5871698564914985191M BLS7
174	2,963+	51521902427P 21501809301359P 287712707657377P +8509984334910637P +1763921591M 495679542611417891963M 317571269P 31343325353P CMB
175	2,1498L	5737847543M -53142241P 57466238491P +24042311929M 7967142541M 7814696438642864467M BLS7
176	10,265-	6283219P +1531051P +1099799M 3261871M 30308203M 72558713M 601879171M 151416210930407539M BLS7
177	2,2210L	4311977342213P +2444100759371301095730851M -276034187321M 879261249216520902352662259M BLS7
178	2,745-	Factors of $2^{**}148 - 1$ ---1317031M 89165962987803776023M BLS7
178	2,948+	359839761497P 35177483702614937P 28971418052587P +332221657M 124193501P 1703371543P 10700487829P 126272288523892811437P CMB
178	10,327-	691130846689M 223176641890453M --1421159521M 10484701064413M 1270964682227249965583M -72099652043M 5977380977521M BLS7
179	2,596+	25781083M 184481113M 231769777M 616318177M 20988936657440586486151264256610222593863921M PPL
179	7,244+	14378340380659P +500952149M 1449471940699799917197761M BLS7
179	10,253-	79491959P 186428995667P 677392223771P ++490479951164867M 26371789707064327607M BLS7
180	3,416+	1092989M 1105558698277214353M 1855970731M -8575367399M 723571952499717071M -1255269545269759M 11375400061P 18666470044841P 15208145682947245909P CMB
181	2,909-	BLS7
181	2,955-	12988301M 9508832573P 448191455251P 13637080289543653P 137990577426533424844562737P CMB
181	2,673+	6928760857M 22411205383479176777M 16376926494209P 82903706673543953P 90546853153288733P CMB
183	2,607-	CMB or Mersenne
183	2,815+	143720392729M 168746259763M 1981481142664362727M 1398127942935585109502437M BLS7
184	2,1226L	2582029M 4260133M 1326700741M BLS7
185	5,268+	12207031M 331660297M 386478495679M BLS7

186 11,179+ 73111721M 188606309M 5089163291M 75893828851M  
 23510589261592841M 2103114787086589M BLS7

187 5,356+ +879932453M -+15816037631P +4555241M 41589234923M  
 1249914937813381086523908871M -565690309M 5019122286648056231M CMB

190 2,2274M 3519553M 156567957627863791520419M 39648004114566294493M  
 --27008203M 1305647443P 2795868347P 5686157471P 1978949445608209P CMB

192 2,1926L Factors of 2\*\*159 + 1 5393592090791M BLS7

192 7,251- 905727671153M 228068651309M 410018698100041M -9782621P 232890527P  
 4659712087944853P 21665732278963151P +180662381M -1034249M 616001897339189M CMB

193 2,800+ CMB

196 2,1682M 255164059P +2729261M 58430590013M 2518021200574417M  
 -43084661M 132264016876661786525177M BLS7

197 2,1786M 1348549P 22787986064617481P +3074905513547941P +4435961M 19465387M  
 203954411M 177297937M -5020583M 200702309M 4504553426692236807437173M CMB

198 2,996+ 12112549M 43249589M 164511353M 8562191377M 8831418697M BLS7

200 11,194+ 6304673M 7746049M BLS7

201 2,835+ Factors of 2\*\*166 - 1 339550411733989M BLS7

208 2,1382L 2099863M 2796203M 3855260977M 1884103651M 168749965921M BLS7

208 2,692+ 2099863M 3855260977M 1759217765581M 2932031007403M BLS7

208 12,193+ 2227777M BLS7

211 2,701+ 7416361M BLS7

211 6,271- 1950271M 175509721M 623067280651M BLS7

212 3,446+ 13097927M 18702169M 25709599M 56737873M 78539161M 119779213M BLS7

217 10,327+ 1523663M 70541929M 14175966169M 99999000001M BLS7

231 2,1149+ 39940132241M 7068569257M 332584516519201M 87274497124602996457M  
 1046183622564446793972631570534611069350392574077339085483M PPL

232 2,952+ 6700417M 67280421310721M 895002877754504119M BLS7

232 3,487+ 1190701M 2051893M BLS7

237 2,1970M Factors of 2\*\*197 - 2\*\*99 + 1 129861491M 19707683773M BLS7

252 2,1024+ 760347109M 211898520832851652018708913943317M  
 9409853205696664168149671432955079744397M BLS7 Brent

255 2,2366M 5352022343M 36741217038179M 119446609287095591M  
 2672552563248362250067M -741997818493M 12073791467M  
 6235202863718393M 3879807640432085069M BLS7

301 2,1994M PPL

302 2,1004+ 1074001M 2020001M 2787601M 3775501M 22624001M 229668251M BLS7

317 10,317- 9615060929M 49172195536083790769M  
 3660574762725521461527140564875080461079917M  
 66443174541490579097997510158021076958392938976011506949065646573M PPL

138 digits

Appendix C Composite Cofactors

130	2,1462M	0754843020	2300207971	4318571205	8754629407	4573612685	5929387206	8039224983
		8533200272	4041984141	0184752564	6750700915	1945355117	6555615173	
131	5,685M	7263588848	2432231272	1803114829	5220672071	1671977775	8413353851	1 1409360836
		1716409270	2751455855	3911144998	9833708451	5118717951	2864787971	
133	2,145L	3641638996	7902333423	6366874686	1561295301	3743475588	4135482674	172 8303361103
		3871561969	7516145631	3246943191	6522074158	2979807958	0678390101	
133	2,1534M	4969795010	8042909282	4151162876	4674840495	0381936088	6731832078	790 2853577615
		9129530396	3940273576	8114706611	1363666143	3615277396	8837936573	
134	2,1318M	3917787101	1195417790	6312495781	9480594934	2860849810	8305715591	8922 3135057800
		5728378105	0089808780	0093079439	3769932481	0579230131	6255120909	
134	3,442+	9110880164	5551477392	6068624902	0098996749	9026297208	1896397726	5286 9888196113
		2398548533	3125120565	9508992214	0055289644	3602961204	7131951649	
134	11,473M	6610569250	0363598121	8050441690	0763390935	3111610667	5824584555	2353 6604044123
		8089004499	7190750647	7895938558	0695313338	1670226745	7590513971	
135	6,269+	2193858986	8638302478	0300710830	9562768031	1192096642	7515919222	14813 5419312095
		2329816116	6968459204	4445169443	0318572021	9892918193	6007114229	
135	11,221-	9336737698	8431106370	5442328833	0657169101	8191733252	1732734210	17221 6060152576
		9513062521	9860401045	3696163461	1924002295	3260626924	2012024883	
136	2,1610L	4322753549	0568635987	8325508048	0090391347	4721173420	2297870296	196786 2047383099
		7518549984	4813838863	6409618765	7790641486	1899403054	8782415821	
136	5,355+	1943153511	2604529420	8425881658	3606210403	3579196481	0438240251	307934 5585720349
		4761896438	8232416022	4755867408	2745707109	8809130195	8318548921	
137	2,1025-	9231922171	2141384025	3555986701	0996564438	7649428783	3804013531	1985892 4506932274
		0099152522	9115611614	4835199447	7174190222	6230558436	4955410801	
137	5,371-	8725761979	8181681887	0975011623	6867265538	5349407332	4104161410	3236150 3704698536
		7473480191	5194926873	2207301135	3307437798	8765026357	3315466119	
138	2,1131+	1961076465	3299591561	4967933698	7905082667	1592667182	1702663083	27804038 6510786511
		8878216552	9294006783	4010565628	8847460214	0472872838	4435480027	
138	2,1342M	1041608967	5881742994	6938275790	3753375775	1755593994	2801337663	56303130 1233294381
		3696501888	1291566355	8519121073	3397595924	8363513701	3934188357	

138	2,1782L	6594740116 6364480638	7800465223 6398888072	1001039583 3308668996	3632039698 1320994201	14051294 5312762741 2326420594	2414769159 8577941319 8596409977
138	2,984+	0742850434 6981025586	2011853541 5944522185	1033165568 5200636261	6196185504 5475896448	69107381 0224983113 9328170799	6018044787 7625241536 3740219297
138	6,268+	0268830488 1239174510	7863069769 6579273627	8164237169 3557721061	7501014825 7118763195	23159914 1498652455 1741333628	3658610332 4153424773 0325916441
139	2,797-	1579686768 1752163160	1901424366 8759201414	0722447876 5712136161	5077473700 9827677562	462208900 3539249066 3797958343	8688552339 2967316695 6381147657
139	3,478+	8575882703 2722793482	4748140958 3093988607	0640334749 1181787405	9255211129 5579257951	127088980 4396104199 5721497828	0354528317 3918259534 6637027313
139	6,277-	1244327957 2951864788	6882128603 0807481971	9835865140 4164353223	1453438499 3307158780	537059928 3707641922 9932380724	5803780535 5052613964 0221854347
140	2,933-	0652338068 3230585079	9480131334 6106079142	3651947986 8355662832	5376244848 2116022969	2684658662 0015303089 9041878547	3257598204 4868205164 1782122391
140	11,230+	1166906430 0738200991	7850412425 0359542065	0050008866 7879251143	5769322244 7301615987	9136466682 7604194902 8313227254	8187462064 3798238823 1976979821
141	2,1806M	4608844690 6334692015	1976480860 4468458342	7835835382 5661842806	9328849442 7394704962	3 3274631392 0914139242 0246199299	1140036367 1091402039 9618326401
141	3,404+	1913266896 9067226914	8021995546 0800533692	0489230504 6570566885	6925645655 3301244612	2 2669258045 3418626569 5259204540	3221741252 6422818421 7040259657
142	2,845+	8469357017 3129631154	2070252309 5561020055	6578141954 2852513504	3898474571 8932185641	25 1596408985 6877483097 1368335444	3856096161 3244475130 9340109721
142	2,1666L	9020973443 7757995047	0956218954 3946425051	4002153693 6777181978	9613671275 8563640060	29 3260195484 9973158779 5927992038	9110021889 9961038765 5427237521
142	7,539L	9562308535 6151994349	1983512717 7953012842	4748699993 9485438017	7871886702 1576848829	71 2318156602 5713447424 4171342811	0056335004 6089496471 7015234451