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Exercise for August 25, 2007

Study Note P-09-07, Problem No. 9

An insurance company examines its pool of auto insurance customers and gathers the following information:

- (i) All customers insure at least one car.
 - (ii) 70% of the customers insure more than one car.
 - (iii) 20% of the customers insure a sports car.
 - (iv) Of those customers who insure more than one car, 15% insure a sports car.
- Calculate the probability that a randomly selected customer insures exactly one car and that car is not a sports car.

A. 0.13 B. 0.21 C. 0.24 D. 0.25 E. 0.30

Solution.

Always start by labeling the events. Let C (stands for Corvette) be the event of insuring a sports car (not S , because we reserve this for the entire probability space), and M be the event of insuring multiple cars. Note that M^c is the event of insuring exactly one car, as all customers insure at least one car. We are given that $\Pr(M) = 0.70$, $\Pr(C) = 0.20$, and $\Pr(C|M) = 0.15$. We need to find $\Pr(M^c \cap C^c)$. You need to recall De Morgan's Laws and then we see that:

$$\begin{aligned}\Pr(M^c \cap C^c) &= \Pr((M \cup C)^c) = 1 - \Pr(M \cup C) = 1 - \Pr(M) - \Pr(C) + \Pr(M \cap C) = \\ &= 1 - \Pr(M) - \Pr(C) + \Pr(C|M)\Pr(M) = 1 - 0.70 - 0.20 + 0.15 \cdot 0.70 = 0.205.\end{aligned}$$

Answer B.

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