QUIZ1

Name : **Date:**

This quiz will be used to check your attendance and performance. You can use your class notes and handouts. If you need, it is o.k. to discuss with your classmates.

1.

The probability that a visit to a primary care physician's (PCP) office results in neither lab work nor referral to a specialist is 35%. Of those coming to a PCP's office, 30% are referred to specialists and 40% require lab work. Determine the probability that a visit to a PCP's office results in both lab work and referral to a specialist.

(A) 0.05 (B) 0.12 (C) 0.18 (D) 0.25 (E) 0.35

Show your work in details.

Answer: A: 0.05

Hint/Solution: An easy exercise in using Venn diagrams, or the formula for P(A union B).

2.

Workplace accidents are categorized into three groups: minor, moderate, severe. The probability that a given accident is minor is 0.5, that it is moderate is 0.4, and that it is severe is 0.1. Two accidents occur independently in one month. Calculate the probability that neither accident is severe and at most one is moderate.

(A) 0.25 (B) 0.40 (C) 0.45 (D) 0.56 (E) 0.65

Show your work in details.

Answer: E: 0.65

Hint/Solution: The probability breaks down into three mutually exclusive cases: (A1 minor, A2 minor), (A1 minor, A2 moderate), and (A1 moderate, A2 moderate), where A1 is the first accident, A2 the second. The probabilities for each these cases can

be computed, using the independence assumption, by multiplying out the individual probabilities. Adding them up gives the result.

3.

You are given $P(A \cup B) = 0.7$ and $P(A \cup B') = 0.7$ Determine $P(A)$.

(A) 0.2 (B) 0.3 (C) 0.4 (D) 0.6 (E) 0.8

Answer :P(A)=0.4 (C)

0.7-(1-0.7)=0.4

4.

An insurance company estimates that 40% of policyholders who have only an auto policy will renew next year and 60% of policyholders who have only a homeowners policy will renew next year. The company estimates that 80% of policyholders who have both an auto and a homeowners policy will renew at least one of those policies next year. Company records show that 65% of policyholders have an auto policy, 50% of policyholders have a homeowners policy, and 15% of policyholders have both an auto and a homeowners policy. Using the company's estimates, calculate the percentage of policyholders that will renew at least one policy next year.

(A) 20 (B) 29 (C) 41 (D) 53 (E) 70

Show your work in details.

Answer: D: 53

Hint/Solution: The policyholders fall into 3 disjoint groups: only auto (A), only home (H), and auto and home (AH). From the given data we deduce $P(AH) = 0.15$, $P(A) = 0.65 - 0.15 = 0.5$, $P(H) = 0.5 - 0.15 = 0.35$, and (with R denoting renewal of policy) $P(R|A) = 0.4$, $P(R|H) = 0.6$, and $P(R|AH) = 0.8$. We want $P(R)$. This can be computed from the above probabilities using the total probability formula.

5.

An insurance company issues life insurance policies in three separate categories: standard, preferred, and ultra-preferred. Of the company's policyholders, 50% are standard, 40% are preferred, and 10% are ultra-preferred. Each standard policyholder has probability 0.010 of dying in the next year, each preferred policyholder has probability 0.005 of dying in the next year, and each ultra-preferred policyholder has probability 0.001 of dying in the next year. A policyholder dies in the next year. What is the probability that the deceased policyholder was ultra-preferred?

(A) 0.0001 (B) 0.0010 (C) 0.0071 (D) 0.0141 (E) 0.2817

Show your work in details.

Answer: D: 0.0141

Hint/Solution: This is a standard Bayes' Rule exercise. Let S, P, U denote the standard, preferred, and ultra-preferred policyholders, and let D denote the event "dies in the next year". We need to compute $P(U|D)$.

Applying Bayes' Rule with S, P, U as the partition of the sample space, and substituting the given data, we get

$$\begin{aligned} P(U|D) &= \frac{P(D|U)P(U)}{P(D|U)P(U) + P(D|S)P(S) + P(D|P)P(P)} \\ &= \frac{0.001 \cdot 0.1}{0.001 \cdot 0.1 + 0.01 \cdot 0.5 + 0.005 \cdot 0.4} = 0.01408. \end{aligned}$$