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EEL 3850

HW #2

PROBLEM 1

1. $P(A) = P(B) = P(C) = 1/3 \quad P(D|A) = 0.002 \quad P(D|B) = 0.02 \quad P(D|C) = 0.001$

$$P(D) = P(A)P(D|A) + P(B)P(D|B) + P(C)P(D|C)$$

$$P(D) = \frac{1}{3}[0.002 + 0.02 + 0.001] = 0.00767$$

$$\boxed{P(D) = 0.00767}$$

2.

$$P(A|D) = \frac{P(A)P(D|A)}{P(D)} = \frac{1/3 \cdot 0.002}{0.00767} = 0.0870$$

$$\boxed{P(A|D) = 0.0870}$$

$$P(B|D) = \frac{P(B)P(D|B)}{P(D)} = \frac{1/3 \cdot 0.02}{0.00767} = 0.870$$

$$\boxed{P(B|D) = 0.870}$$

$$\cancel{P(C|D) = \frac{P(C)P(D|C)}{P(D)} = \frac{2/5 \cdot 0.001}{0.0034} = 0.118}$$

$$\cancel{\boxed{P(C|D) = 0.118}}$$

$$P(C|D) = \frac{P(C)P(D|C)}{P(D)} = \frac{1/3 \cdot 0.001}{0.00767} = 0.0435$$

$$\boxed{P(C|D) = 0.0435}$$

3. $P(A) = \frac{1}{2} \quad P(B) = \frac{1}{10} \quad P(C) = \frac{2}{5}$

$$P(D) = P(A)P(D|A) + P(B)P(D|B) + P(C)P(D|C)$$

$$P(D) = \frac{1}{2} \cdot 0.002 + \frac{1}{10} \cdot 0.02 + \frac{2}{5} \cdot 0.001 = 0.0034$$

$$\boxed{P(D) = 0.0034}$$

4.

$$P(A|D) = \frac{P(A)P(D|A)}{P(D)} = \frac{1/2 \cdot 0.002}{0.0034} = 0.294$$

$$\boxed{P(A|D) = 0.294}$$

$$P(B|D) = \frac{P(B)P(D|B)}{P(D)} = \frac{1/10 \cdot 0.02}{0.0034} = 0.588$$

$$\boxed{P(B|D) = 0.588}$$

$$P(C|D) = \frac{P(C)P(D|C)}{P(D)} = \frac{2/5 \cdot 0.001}{P \cdot 0.0034} = 0.118$$

$$\boxed{P(C|D) = 0.118}$$

Problem 2

$S_i = \{i^{th} \text{ ITEM SELECTED IS NOT DEFELTIVE}\}$

$A = \{\text{ACCEPTED}\}$

$P(A) = P(S_1) \, P(S_2 | S_1) \, P(S_3 | S_1 \cap S_2) \, P(S_4 | S_1 \cap S_2 \cap S_3) = \frac{95}{100} \cdot \frac{94}{99} \cdot \frac{93}{98} \cdot \frac{92}{97} = 0.812$

$\boxed{P(A) = 0.812}$

Problem 3

$E = \{\text{ELEVATED PSA}\}$

$L = \{\text{CANCEROUS MAN}\}$

$P(E | \bar{L}) = 0.135$

$P(E | L) = 0.268$

1. $P(L) = 0.7 \quad P(\bar{L}) = 0.3$

$P(L | E) = \frac{P(L) \, P(E | L)}{P(E)} = \frac{0.7 \cdot 0.268}{0.2281} = 0.822$

$P(E) = P(L) \, P(E | L) + P(\bar{L}) \, P(E | \bar{L}) = 0.7 \cdot 0.268 + 0.3 \cdot 0.135 = 0.2281$

$\boxed{P(L | E) = 0.822}$

2.

$P(L | \bar{E}) = \frac{P(L) \, P(\bar{E} | L)}{P(\bar{E})} = \frac{0.7 \cdot 0.732}{0.7719} = 0.664$

$P(\bar{E}) = 1 - P(E) = 0.7719$

$P(\bar{E} | L) = 1 - P(E | L) = (1 - 0.268) = 0.732$

$\boxed{P(L | \bar{E}) = 0.664}$

3. $P(L) = 0.3$

$P(L | E) = \frac{P(L) \, P(E | L)}{P(E)} = \frac{0.3 \cdot 0.268}{0.1749} = 0.46$

$P(E) = P(L) \, P(E | L) + P(\bar{L}) \, P(E | \bar{L}) = 0.3 \cdot 0.268 + 0.7 \cdot 0.135 = 0.1749$

$\boxed{P(L | E) = 0.46}$

4. $P(L) = 0.3 \quad P(\bar{L}) = 0.7$

$P(L | \bar{E}) = \frac{P(L) \, P(\bar{E} | L)}{P(\bar{E})} = \frac{0.3 \cdot 0.732}{0.8251} = 0.266$

$P(\bar{E}) = 1 - P(E) = 1 - 0.1749 = 0.8251$

$P(\bar{E} | L) = 1 - P(E | L) = 1 - 0.268 = 0.732$

$\boxed{P(L | \bar{E}) = 0.266}$

Problem 4

ORDER DOESN'T MATTER ∴ COMBINATION

1. $\binom{10}{4} = \frac{10!}{4! \, (10-4)!} = \frac{10!}{4! \, 6!} = \boxed{210}$

2. $L = \{\text{CLEAN THE ROOM}\}$

$\boxed{P(L) = \frac{1}{210} = 0.00476}$

$\binom{3}{2} \times 2 \times 3 = 3 \times 2 \times 3 = 18$

P   LA   C

18 WAYS TO GET 2 PROB AND STATS, 1 LINEAR ALGEBRA AND 1 CULINARY

$\boxed{P(L) = \frac{18}{210} = 0.0857}$