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PROBLEM SET - 2.

1. $P(FR \text{ AND } AR) = 0.4$ ~~$P(F.No.R) = 0.15$~~ $P(F.No.R \text{ AND } A.R) = 0.15$

$P(FR \text{ AND } No.R) = 0.2$ $P(F.No.R \text{ AND } No.R) = 0.25$

a) $P(\text{Forecast Rain}) = P(\text{Forecast Rain AND Actual Rain}) + P(\text{Forecast Rain AND No Rain})$

$= 0.4 + 0.2$

$= 0.6$

b) $P(\text{Mistake}) = P(\text{Forecast Rain AND No Rain}) + P(\text{Forecast No Rain AND Actual Rain})$

$= 0.2 + 0.15$

$= 0.35$

c) $P(\text{Actual Rain} \mid \text{Forecast Rain}) = \dfrac{P(\text{Actual Rain AND Forecast Rain})}{P(\text{Forecast Rain})}$

$= \dfrac{0.4}{0.6}$

d) $P(\text{Forecast Rain} \mid \text{Actual Rain}) = \dfrac{P(\text{Forecast Rain AND Actual Rain})}{P(\text{Actual Rain})}$

$= \dfrac{P(F.R \cap A.R)}{P(F.R \cap A.R) + P(F.No.R \cap AR)}$

$= \dfrac{0.4}{0.4 + 0.15} = \dfrac{0.4}{0.55}$

2. EP → Ectopic Pregnancy. W → Women

S → Smoker, NS → Non-Smoker. $P(S) = 32.1 = 0.32$.

a) $P(EP|S) = 2(EP|NS)$

b) $P(S) = 0.32$.

c) $P(NS) = 1 - P(S) = 1 - 0.32 = 0.68$

~~d) $P(S|EP) = \frac{P(S \text{ AND } EP)}{P(EP)}$~~

$= \frac{P(S \wedge EP)}{P(}$

d) $P(S|EP) = \frac{P(EP \wedge S)}{P(EP \wedge S) + P(EP \wedge NS)}$

$= \frac{P(EP \wedge S)}{P(EP \wedge S) + \frac{1}{2}P(EP \wedge NS)}$

$= \frac{P(EP \wedge S)}{\frac{3}{2}P(EP \wedge S)} = \frac{2}{3}$.

3. $P(\text{Females}) = 0.52$

$P(CS) = 0.05$ $P(\text{females AND } CS) = 0.02$

a) $P(\text{Female}|CS) = \frac{P(\text{Female AND } CS)}{P(CS)} = \frac{0.02}{0.05} = 0.4$.

b) $P(CS|F) = \frac{P(CS \text{ AND Female})}{P(\text{Female})} = \frac{0.02}{0.52} = 0.038$

4. $P(\text{Crash} \mid \text{Structural Failure}) = 0.25$ $P(\text{Structure Failure}) = 0.002$,

$P(\text{Crash} \mid \text{Engine}) = 0.30$ $P(\text{Engine}) = 0.002$

$P(\text{Crash} \mid \text{Control System}) = 0.90$ $P(\text{Control System}) = 0.01$

$P(\text{Crash} \mid \text{Human Error}) = 0.10$ $P(\text{Human Error}) = 0.001$

$$\Rightarrow P(\text{Control System} \mid \text{Crash}) = \frac{P(\text{Crash} \mid \text{Control System}) P(\text{Control system})}{P(\text{Crash})}$$

$$P(\text{Crash}) = P(\text{Crash} \mid \text{Structural Failure}) + P(\text{Crash} \mid \text{Engine}) + P(\text{Crash} \mid \text{Control System}) + P(\text{Crash} \mid \text{Human Error})$$

$$= P(\text{Crash} \mid \text{Structure}) P(\text{Structure}) + P(\text{Crash} \mid \text{Engine}) P(\text{Engine}) + P(\text{Crash} \mid \text{Control System}) P(\text{Control System}) + P(\text{Crash} \mid \text{Human}) P(\text{Human})$$

$$= (0.25)(0.002) + (0.30)(0.002) + (0.90)(0.01) + (0.10)(0.001)$$

$$= 0.01$$

$$\Rightarrow P(\text{Control System} \mid \text{Crash}) = \frac{(0.90)(0.01)}{0.01}$$

$$= 0.05$$

5. $P(L_1) = 0.8$

$P(L_2) = 0.2$

$P(\text{Observe Wind} \mid \text{No Wind}) = 0.2 = P(\text{Obs Wind} \mid L_1)$

$P(\text{Observe Wind} \mid \text{Window}) = 0.9 = P(\text{Obs Wind} \mid L_2)$

~~P(L1) · P(L~~

a) $P(L_1 | \text{Obs Wind}) = \dfrac{P(\text{Obs Wind} | L_1)\, P(L_1)}{P(\text{Obs Wind})}$

$= \dfrac{0.2 \times 0.8}{P(\text{Obs Wind})}$

$P(\text{Obs Wind}) = P(\text{Obs Wind} | L_1)\, P(L_1) + P(\text{Obs Wind} | L_2)\, P(L_2)$

$= (0.2)(0.8) + (0.9)(0.2)$

$P(L_1 | \text{Obs Wind}) = \dfrac{0.2 \times 0.8}{(0.2)(0.8) + (0.9)(0.2)} = \dfrac{0.16}{0.34} = 0.47.$