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CS513 (HW-1)

Q1.1 $P(J) = 20\% = 0.2$
$P(S) = 30\% = 0.3$
$P(J \cap S) = 8\% = 0.08$

a- $P(J/S) = \frac{P(J \cap S)}{P(S)} = \frac{0.08}{0.3} = \frac{8}{30} \approx 0.267$

$\boxed{= 26.7\%}$

b- $P(J/\bar{S}) = \frac{P(J \cap S')}{P(S')} = \frac{P(J) - P(J \cap S)}{P(S')} = \frac{0.2 - 0.08}{1 - 0.3}$

$= 12/70$ $\boxed{= 0.171 \approx 17\%}$

c $P(J \cap S / J \cup S) = \frac{P((J \cap S) \cap (J \cup S))}{P(J \cup S)} = \frac{P(J \cap S)}{P(J \cup S)} = \frac{0.08}{P(J) + P(S) - P(J \cap S)}$

$= 0.08 / 0.2 + 0.3 - 0.08 = 0.08 / 0.42 = 0.19$

$\boxed{= 19\%}$

Q1.2 $P(H) = 80\% = 0.8$
$P(S) = 90\% = 0.9$
$P(H \cup S) = 91\% = 0.91$
$\therefore P(H \cap S) = P(H) + P(S) - P(H \cup S) = 0.79$

a- $P(\text{Only } H) = P(H) - P(H \cap S) = 0.8 - 0.79$

$\boxed{= 0.01 \approx 1\%}$

b- $P(\text{Only } S) = P(S) - P(S \cap H)$
$= 0.9 - 0.79 = \boxed{0.11 = 11\%}$

c $P(\text{Neither getting a B}) = P(\overline{H \cup S}) = 1 - 0.91$
$\boxed{= 0.09 = 9\%}$

Q1.3 a Jerry and Susan go together 8% of the days.

If the events were independent then individual parameter products are equal to the intersection.

In this case,

$20\% \times 30\% = 6\%$ implying

$\boxed{\text{they are not independent}}$

Q1.4 a- If these events are independent,

$P(\text{Second} = 5 \text{ and Sum} = 6) = P(\text{Sum} = 6) * P(\text{Second} = 5)$

$\frac{5}{36} \times \frac{6}{36} \neq \frac{1}{36} \Rightarrow \boxed{\text{Not independent}}$

b- If the events are independent

$P(\text{first} = 5 \text{ and Sum} = 7) = P(\text{Sum} = 7) ~~and~~ * P(\text{first} = 5)$

$\frac{1}{36}$ and $\frac{6}{36} \times \frac{6}{36}$

$\frac{1}{36} = \frac{1}{36}$

$\boxed{\text{They are independent}}$

Q1.5a. P(chose TX) : 60%
P(chose NJ) : 10%
∴ P(chose AK) : 30%

P(oil in TX) : 30%
P(oil in NJ) : 10%
P(oil in AK) : 20%

$P(\text{Oil}) = P(\text{oil}/TX) \times P(TX) + P(\text{oil}/AK) \times P(AK) + P(\text{oil}/NJ) \times P(NJ)$

$= 0.30 \times 0.60 + 0.2 \times 0.3 + 0.1 \times 0.1$
$= 0.18 + 0.06 + 0.01$
$= 0.25$
$\boxed{= 25\%}$

P(Finding oil) = 25%

b- $P(TX/\text{oil}) = \dfrac{P(TX \cap \text{oil})}{P(\text{oil})}$
$= \dfrac{0.3 \times 0.6}{0.25} = 18/25$
$\boxed{= 72\%}$

Q1.6a- P(Not survive) = $\dfrac{NS}{T} = \dfrac{1490}{2201} = 0.677$
$\boxed{\approx 67.7\%}$

b- P(First class) = $\dfrac{325}{2201}$ $\boxed{\approx 0.148 = 14.8\%}$

c- $P(FC/\text{survive}) = \dfrac{P(FC \cap \text{survive})}{P(\text{survive})} = 203/711$
$\boxed{= 0.285 \approx 28.5\%}$

d- P(survival) = $1 - 0.677 = \underline{\underline{32.3\%}}$ — ①

P(first class) = $\underline{\underline{14.8\%}}$ — ②

$\therefore$ ① $*$ ② gives us $\underline{\underline{4.78\%}}$

$P(FC \cap S) = \frac{203}{2201} = 9.22\%$

$\boxed{\text{Hence they are not independent}}$

e- $P(\text{First class child} / \text{survived}) = \frac{P(\text{First} \cap \text{child} \cap \text{survive})}{P(\text{survive})}$

$= 6/711 \approx 0.0084$

$\boxed{= \underline{0.84\%}}$

f- $P(\text{Adult} / \text{survived}) = P(\text{Adult} \cap \text{Survive}) / P(\text{survived})$

$= 654/711 = \boxed{0.9198 = \underline{\underline{91.98\%}}}$

~~g- P(age / survived) = P(C / ...) + P(A / ...) = 654/711 + 57/711 =~~

~~P(First class / survived) = 203/711 = 28.55%~~

~~REASON~~

The events ~~are not independent~~

g : $P(\text{adult} \cap \text{First}~~\text{survived}~~) = \frac{197}{2201} = 0.089$

$P(\text{child} \cap \text{first}) = \frac{6}{2201} = 0.0027$

$P(\text{child}) = 57/2201$, $P(\text{First}) = 203/2201$

$P(\text{adult}) = 654/2201$

$P(\text{child}) \times P(\text{First}) = 57 \times 203/(2201)^2 = \underline{0.0023}$

$P(\text{adult}) \times P(\text{First}) = 197 \times 203/(2201)^2 = \underline{0.008}$

→ Since $P(\text{adult} \cap \text{first}) \neq P(\text{adult}).P(\text{first})$

$\Rightarrow$ Adult and first class are not independent given that passenger survived

→ Since $P(\text{child} \cap \text{First}) \neq P(\text{child}).P(\text{First})$

$\Rightarrow$ Child and first class are not independent given that passenger survived.