CS 513

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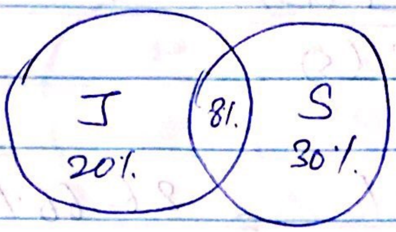
HW 01

$\boxed{1.1}$



	Susan at Bank (S)	Susan not in Bank (S')
Jerry at Bank (J)	8%	12%
Jerry not at Bank (J')	22%	58%

$P(J \cap S) = 8\%$

$P(J - S) = 20 - 8 = 12\%$

$P(S - J) = 30 - 8 = 22\%$

$$P(J' \cap S') = 100\% - (J \cup S)$$
$$= 100\% - \{P(J) + P(S) - P(J \cap S)\}$$
$$= 100\% - \{20 + 30 - 8\}$$
$$= 100 - 42$$
$$= 58\%$$

(a) $P(J/S) = \frac{P(J \cap S)}{P(S)}$

$= \frac{8\%}{30\%} = \underline{26.66\%}$

(b) $P(J/S') = \frac{P(J \cap S')}{P(S)'} = \frac{12\%}{70\%} = \underline{17.14\%}$

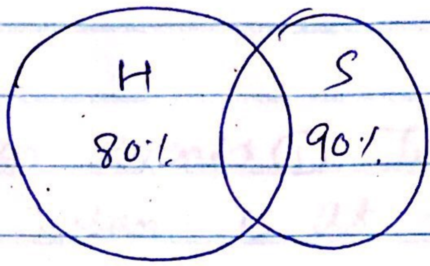
(c) $P(J \cap S \mid J \cup S) = \frac{P(J \cap S) \cap (J \cup S)}{P(J \cup S)}$

$= \frac{P(J \cap S)}{P(J \cup S)}$

$= \frac{8}{42}$

$= \underline{\underline{19.04\%}}$

1.2



H - Harold
S - Sharon

Given - $P(H \cup S) = 91\%$

$P(H \cup S) = P(H) + P(S) - P(H \cap S)$

$P(H \cap S) = P(H) + P(S) - P(H \cup S)$
$= 80\% + 90\% - 91\%$
$= 79\%$

(a) $P(H) = P(H) - P(H \cap S)$
$= 80\% - 79\% = 1\%$

(b) $P(S) = P(S) - P(S \cap S)$
$= 90\% - 79\% = 11\%$

(c) $P(H' \cup S') = 100\% - P(H \cup S)$
$= 100\% - 91\%$
$= 9\%$

Scanned with CamScanner

$\boxed{1.3}$

The given events ① Jerry is at the bank and ② Susan is at the bank are not independent.

Because the probability of occurance of the events is given 8%.

Also,

According to independent probability.

$$P(J \cap S) = P(J) * P(S)$$
$$= 20\% * 30\%$$
$$= \underline{\underline{6\%}}$$

Scanned with CamScanner

$\boxed{1.4}$

ⓐ $P(\text{Sum is } 6) = \frac{5}{36}$

$P(\text{Second die is } 5) = \frac{6}{36}$

Joint prob states that -

$P(\text{Sum is } 6 \cap \text{Second die shows } 5) = 1/36$

~~Acc. to~~

According to Independent Probability →

$P(\text{Sum is } 6 \cap \text{Second die shows } 5)$

$= P(\text{Sum is } 6) * P(\text{Second die shows } 5)$

$= 1/6 * 5/36$

The above equations are not equal, therefore, these two events are not independent.

P. 1

(b) $P(\text{Sum is } 7) = \frac{6}{36} = \frac{1}{6}$

$P(\text{first die shows } 5) = \frac{6}{36} = \frac{1}{6}$

According to joint probability =>

$P(\text{Sum is } 7 \cap \text{First die shows } 5) = \frac{1}{36}$

Acc. to Independent Probability =>

$P(\text{Sum is } 7 \cap \text{first die shows } 5)$

$= P(\text{Sum is } 7) * P(\text{First die shows } 5)$

$= \frac{1}{6} * \frac{1}{6}$

$= \frac{1}{36}$

The equations are equal, implies,

these events are Independent.

1.5

	TX	AK	NJ	
Oil	18%	6%	1%	25%
No oil	42%	24%	9%	75%
	60%	30%	10%	100%

The probability of finding oil in TX,

$P(oil / TX) = 30\%$

The probability of choosing TX,

$P(TX) = 60\%$

$$P(oil / TX) = \frac{P(oil \cap TX)}{P(TX)}$$

$$P(oil \cap TX) = P(oil/TX) \times P(TX)$$

$$= 30\% \times 60\%$$

$$= 18\%$$

For finding $P(oil \cap NJ)$ we need,

$P(oil / NJ) = 10\%$

$P(NJ) = 10\%$

So, $P(oil \cap NJ) = P(oil / NJ) * P(NJ)$

$$= 10\% * 10\%$$

$$= 1\%$$

For finding $P(\text{oil} \cap AK)$,

$P(\text{oil}/AK) = 100\% - (60\% + 10\%)$

$= 30\%$

$P(\text{oil} \cap AK) = 30\% * 20\%$

$= 6\%$

ⓐ $P(\text{oil}) = 18\% + 6\% + 1\%$

$= 25\%$

ⓑ $P(TX/\text{oil}) = \dfrac{P(TX \cap \text{oil})}{P(\text{oil})}$

$= \dfrac{18\%}{25\%} = 72\%$

11.6

1. P (Passenger did not Survive) =

$$= \frac{\text{No. of not survived}}{\text{Total}} = \frac{1490}{2201} = \underline{\underline{0.676}}$$

2. P(Passenger staying in first class) $= \frac{325}{2201} = \underline{\underline{0.147}}$

3. A: Passenger Survived
   B: passenger was staying in first class.

$$P(B|A) = \frac{P(B \cap A)}{P(A)}$$

$$= \frac{203/2201}{711/2201} = 0.285$$

4.

Let X = Survival

Y = Staying in First Class

If $P(X \cap Y) = P(X).P(Y)$ then X & Y are independent

$$P(X \cap Y) = \frac{203}{2201} = 0.092$$

$$P(X) = \frac{711}{2201} = 0.323 \quad P(Y) = \frac{325}{2201} = 0.147.$$

$$P(X).P(Y) = 0.323 \times 0.147$$
$$= 0.047.$$

Since $P(X \cap Y) \neq P(X).P(Y)$

=> X and Y are not independent

5.> Let, A = Staying in first Class

B = Passenger was a child

C = Passenger Survived.

$$P(A \cap B / C) = \frac{P(A \cap B \cap C)}{P(C)}$$

$$= \frac{6/2201}{711/2201} = 0.008$$

6 Let X = Passenger Survived

Y = Passenger was an adult

$$P(Y|X) = \frac{P(Y \cap X)}{P(X)} = \frac{654/2201}{711/2201}$$

$$= 0.919$$

7. Let A = Passenger Survived

B = Adult

C = Child

D = First class

$$P(B \cap D) = \frac{197}{711} = 0.277$$

$$P(C \cap D) = \frac{6}{711} = 0.008$$

$$P(C) = \frac{57}{711} = 0.080$$

$$P(D) = \frac{203}{711} = 0.285$$

$$P(B) = \frac{654}{711} = 0.919$$

$$P(C).\,P(D) = \frac{57 \times 203}{711 \times 711} = 0.022$$

$$P(B).\,P(D) = \frac{654 \times 203}{711 \times 711} = 0.262$$

Since $P(B \cap D) \neq P(B).\,P(D)$

Adult and first class are not independent
(Given that passenger survived)

Since $P(C \cap D) \neq P(C).\,P(D)$

Child and first class are not independent
(Given that passenger survived)