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Course :- CS 513-A
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Probability Assignment

Q 1.1

Probability of Jerry goes to bank $P(J) = 20\% = 0.2$

Probability of Susan goes to bank $P(S) = 30\% = 0.3$

Probability of both them are at the bank $P(J \cap S) = 8\% = 0.08$

$$P(J \cup S) = P(J) + P(S) - P(J \cap S) = 0.2 + 0.3 - 0.08$$

$$P(J \cup S) = 0.42$$

a) Probability of Jerry at the bank on last Monday when Susan was there too :-

$$P(J|S) = \frac{P(J \cap S)}{P(S)} = \frac{0.08}{0.3} = 0.2666 = 26.67\%$$

b) Probability of Jerry at the bank last friday when Susan was not there :-

$$P(J|S') = \frac{P(J \cap S')}{P(S')} = \frac{0.2 - 0.08}{0.7}$$

$$= 0.1714$$

$$= 17.14\%$$

c) Probability of both of them were there on Wednesday when at least one of them is at the bank :-

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

$$= \frac{0.08}{0.42} = 0.1904 = 19.04\%$$

Q 1.2

Probability of Harold getting a 'B' $P(H) = 80\% = 0.8$

Probability of Sharon getting a 'B' $P(S) = 90\% = 0.9$

Probability of at least one of them getting a 'B' $P(H \cup S) = 91\% = 0.91$

$P(H \cap S) = P(H) + P(S) - P(H \cup S) = 0.8 + 0.9 - 0.91$
$= 0.79$

(a) Probability of only Harold get's 'B' :-

$= P(H) - P(H \cap S)$
$= 0.8 - 0.79$
$= 0.01$
$= 1\%$

(b) Probability of only Sharon get's 'B' :-

$= P(S) - P(H \cap S)$
$= 0.9 - 0.79 = 0.11 = 11\%$

(c) Probability of none of them getting a 'B' :-

$= 1 - P(H \cap S)$

$= 1 - 0.79$

$= 0.21$

$= 21\%$

Q 1.3

Probability of Jerry at the bank $P(J) = 0.2$

Probability of Susan at the bank $P(S) = 0.3$

Probability of both of them at the bank $= 0.08$

$P(J \cap S) = 0.08$

If both cases are independent then:-

$$P(J \cap S) = P(J) * P(S) = 0.2 * 0.3 = 0.06 \neq 0.08$$

So, both the events are not independent

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Q 1.4

Die 2

Die 1		1	2	3	4	5	6
	1	2	3	4	5	6	7
	2	3	4	5	6	7	8
	3	4	5	6	7	8	9
	4	5	6	7	8	9	10
	5	6	7	8	9	10	11
	6	7	8	9	10	11	12

(a) Probability of sum is 6 $P(Sum=6) = 5/36 = 13.89\%$

Probability of second die show 5 $P(Second\ die=5) = 6/36 = 16.67\%$

$P(Second\ die=5\ \&\ sum=6) = 1/36 = 2.78\%$

If both events are Independent :-

$P(second\ die=5\ \&\ sum=6) = 5/36 * 6/36 = 0.0231 = 2.31\%$
$\neq 2.78$

So, both the events are not Independent

(b) $P(Sum=7) = 6/36 = 16.67\%$
$P(second\ die=5) = 6/36 = 16.67\%$
$P(Sum=7\ and\ second\ die=5) = 1/36 = 2.78\%$

If both ~~are~~ events are independent,

$P(Sum=7\ and\ second\ die=5) = 6/36 * 6/36 = 2.78\%$

So, both the events are independent

Q 1.5

$P(TX) = 0.6$, Probability of choosing TX
$P(NJ) = 0.1$, Probability of choosing NJ
$P(AK) = 0.3$, Probability of choosing AK

Probability of finding oil in TX $P(\text{oil in } TX) = 0.3 * 0.6$
$= 0.18$

Probability of finding oil in AK $P(\text{oil in } AK) = 0.2 * 0.3$
$= 0.06$

Probability of finding oil in NJ $P(\text{oil in } NJ) = 0.1 * 0.1$
$= 0.01$

a) Probability of finding oil is

$P(\text{oil}) = P(\text{oil in } Tx) + P(\text{oil in } AK) + P(\text{oil in } NJ)$
$= 0.18 + 0.06 + 0.01$
$= 0.25$

b) Probability of place where oil found is TX

$P(TX \mid \text{oil}) = \dfrac{P(\text{oil in } TX)}{P(\text{oil})} = \dfrac{0.18}{0.25} = 0.72 = 72\%$

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Q 1.6

a) Probability that a passenger did not survived :-

$$P(\text{Passenger not survived}) = \frac{1490}{2201} = 0.676 = 67.6\%$$

b) Probability of a passenger staying in 1^{st} class :-

$$P(\text{Passenger } 1^{st} \text{ class}) = \frac{325}{2201} = 0.147 = 14.7\%$$

c) Probability of passenger staying in first class survived :-

$$P(\text{Passenger } 1^{st} \text{ class} / \text{survived}) = \frac{203}{711} = 0.285 = 28.5\%$$

d) $P(\text{Passenger survived}) = 0.324 = 32.4\%$

$P(\text{Passenger } 1^{st} \text{ Class}) = 0.147 = 14.7\%$

$P(\text{Passenger } 1^{st} \text{ class} \cap \text{survived}) = 0.285 = 28.5\%$

If both events are independent then,

$$P(\text{Passenger } 1^{st} \cap \text{survived}) = 0.324 * 0.147 = 0.0478 \neq 0.285$$

So, both the events are not independent

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e) P(Passenger 1^{st} class child and survived) $= \frac{6}{711} = 0.008 = 0.8\%$

(f) P(Passenger survived and is adult) $= \frac{654}{711} = 0.91 = 91\%$

g) P(Passenger survived) $= \frac{711}{711} = 1$

P(Passenger 1^{st} class survived) $= 0.285$

P(Passenger 1^{st} Class and survived) $= 0.285$

If both ~~or~~ events are independent,

P(Passenger 1^{st} class and survived) $= 1 * 0.285 = 0.285$

So, both the events are independent.

Q 1.7

From the given Information in question,

	AI-generated	Human-generated	Sub Total
True	970	930	1900
False	30	70	100
Sub Total	1000	1000	2000 = Total

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Confusion Matrix :-

	Actual Positive	Actual Negative
Predicted Positive	TP = 970	FP = 70
Predicted Negative	FN = 30	TN = 930

- $\text{Accuracy} = \dfrac{TP+TN}{TP+FP+FN+TN} = \dfrac{1990}{2000} = 0.95 = 95\%$

- $\text{Precision} = \dfrac{TP}{TP+FP} = \dfrac{970}{1040} = 0.9326 = 93.26\%$

- $\text{Recall} = \dfrac{TP}{TP+FN} = \dfrac{970}{1000} = 0.97 = 97\%$

- $F1 = \dfrac{2 * \text{Precision} * \text{Recall}}{\text{Precision} + \text{Recall}} = \dfrac{2(0.9326)(0.97)}{0.9326+0.97}$

$$= 0.9509$$
$$= 95.09\%$$