CS-513

HW01 - Probability

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1.1

Jerry & Susan have a joint bank account. Jerry goes to the bank 50% of the days. Susan goes there 30% of the days. Together they are at the bank 8% of the days.

(a) Susan was at the bank last Monday. What's the probability that Jerry was there too?

→ Soln: Probability of Jerry going to the bank when Susan is also there at the bank:-

$$P(\text{Jerry} \mid \text{Susan}) = \frac{P(\text{Jerry} \cap \text{Susan})}{P(\text{Susan})}$$

$$= \frac{8}{30} = \boxed{26.66\%} \text{ Ans}$$

(b) Last Friday, Susan wasn't at the bank. What's the probability that Jerry was there?

→ Soln: Probability of Jerry going to the bank when ~~Susan~~ Susan is not there

$$P(\text{Jerry} \mid (\text{Susan})') = \frac{P(\text{Jerry} \cap (\text{Susan})')}{P(\text{Susan}')}$$

$$P((\text{Susan})') = 1 - P(\text{Susan})$$

$$1 - 0.3 = 0.7 = 70\%$$

$$\therefore \frac{P(J \cap S')}{P(S')} = \frac{12}{70}$$

$$= \boxed{17.14\%} \text{ Ans}$$

(c) Last Wednesday at least one of them was at the bank. What is the probability that both of them were there?

→ Sol^n: Probability that both Jerry & Susan either one of them was present at the bank

$$P(\text{Jerry} \mid \text{Susan}) = \frac{P(\text{Jerry} \cap \text{Susan})}{P(\text{Jerry} \cup \text{Susan})}$$

$$P(\text{Jerry} \cap \text{Susan}) = 8\%$$

$$P(\text{Jerry} \cup \text{Susan}) = P(\text{Jerry}) + P(\text{Susan}) - P(\text{Jerry} \cap \text{Susan})$$

$$= 20 + 30 - 8$$

$$= 42$$

$$\therefore P(\text{Jerry} \mid \text{Susan}) = \frac{8}{42} = \boxed{19.04\%} \text{ Ans}$$

1.2 Homework

Harold and Sharon are studying for a test. Harold's chances of getting a 'B' are 80%. Sharon's chances of getting a 'B' are 90%.

The probability of at least one of them getting a 'B' is 91%.

(a) What is the probability that only Harold gets a 'B'?

→ Solution: Probability that only Harold gets a 'B'.

$$P(\text{only Harold}) = P(\text{Harold}) - P(\text{Harold} \cap \text{Sharon})$$

$$= 80 - 79$$

$$= \boxed{1\%} \text{ Ans}$$

(b) what is the probability that only Sharon gets a 'B'?

→ Soln: P(sharon getting B) = P(Sharon) − P(Harold ∩ Sharon)

$90 - 79$

$= \boxed{11\%}$ Ans

(c) what is the probability that both won't get an 'B'?

→ Soln :- $P((Harold \cap Sharon))' = 100 - P(Harold \cap Sharon)$

$100 - 79$

$= \boxed{21\%}$ Ans.

Homework

Jerry & Susan have a joint bank account. Jerry goes to the bank 20% of the days. Susan goes there 30% of the days. Together they are at the bank 8% of the days.
Are the events "Jerry is at the bank" and "Susan is at the bank" independent?

→ Soln :-

Both Jerry & Susan are at the bank 8% of the days together.

If the events were going to be independent the individual parameters of going together to the bank if calculated then product would be similar. But, $20 \times 30 = 60\%$.

∴ Hence the events are **not** independent

1.4 Homework

You roll 2 dice.

(a) Are the events "the sum is 6" and "the second die shows 5" independent?

→ Soln: If these events are independent:

$P(2^{nd} \text{ die} = 5 \text{ and sum} = 6) = P(\text{sum} = 6) * P(\text{second die} = 5)$

$= \frac{5}{36} \times \frac{6}{36} = \frac{1}{36}$ which is not equal.

Ans → ∴ The events are **not** independent

(b) Are the events "the sum is 7" & "the first die shows 5" independent?

→ Soln:- If these events are independent

$P(\text{first die} = 5 \text{ \& sum} = 7) = P(\text{sum} = 7) \times P(\text{first die})$

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

Ans As both events are equal, the events are independent

1.5 Homework

An oil company is considering drilling in either TX, AK and NJ. The company may operate in only one state. There is 60% chance the company will choose TX & 10% chance - NJ. There is 30% chance of finding oil in TX, 20% - in AK & 10% in NJ

Q1. What is the probability of finding oil?

→ Soln :-
Find the probability of finding oil in a state & probability of choosing that state.

For TX
$P(oil|TX) * P(TX) = 30\% * 60\% = 18\%$

For AK
$P(oil|AK) * P(AK) = 20\% * 30\% = 6\%$

For NJ
$P(oil|NJ) * P(NJ) = 10\% * 10\% = 1\%$

∴ Probability of finding oil = $18\% + 6\% + 1\% = 25\%$

Ans → **Probability of finding oil = 25%**

Q2 The company decided to drill & found oil. What is the probability that they drilled in TX?

→ Soln : Probability of drilling in TX & finding oil

$$P(TX|oil) = \frac{P(TX \cap oil)}{P(oil)} = \frac{18}{25} \rightarrow \text{found in 1st soln}$$

$$= 72\% \text{ Ans}$$

1.6 Homework

Answering Questions based on Titanic survivor provided data

Q1. What is the probability that a passenger did not survive?

→ soln: P(Not survived) = $\frac{1490 - 673}{2201 - 885}$ = 62.08 % Ans.

Not survived (Total) − Crew Not survived

Total − Total (Crew)

Q2 What is the probability that the passenger was staying in the first class?

→ soln: P(First class) = $\frac{P(\text{Total 1st})}{P(\text{Total}) - P(\text{Crew})}$

$= \frac{325}{2201 - 885} = \frac{325}{1316}$

= 24.69 % Ans

Q3 Given that the passenger survived, what is the probability that the passenger was staying in the 1st class?

→ soln:

P(Passeger survived staying in First class)

$= P(S \cap F) = \frac{203}{499}$ = 40.68 % Ans

Q4 Are survival & staying in the first class independent?

→ soln: If probability of staying in First class and surviving are equally by being mutually exclusive then they are independent

P(surviving) = 100 − P(Not surviving)
= 100 − 62.08
= 37.92%

∴ 24.69 * 37.92 = 9.36%

Ans → survial and staying in First class are not independent

Q5 Given that a passenger survived, what is the probability that the passenger was staying in the First class & the passenger was a child?

→ soln :- P(survived, staying in first class and is a child)
= 6 / 499 (711−212) = 1.2%

Q6 Given that the passenger survived, what is the probability that the passenger was an adult?

P(Passenger survived and Adult) = 442 / 499 = 88.57%
(654−212)

Q7 Given that a passenger survived, are age & staying in First class independent?

P(age passenger survived) = P(A|S) * P(C|S)
442/499 + 57/499 = 1

P(Passenger survived & staying in 1st class)
= 40.68%.

∴ P(age & staying in 1st class) = 40.68%.

→ Ans | Since Probability of age & first class are equal
then Events are independent

—— x — x — x ——