CS513 KDD HOMEWORK 1 : PROBABILITY SUBMISSION

CS513 : KDD

Home Work 1

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HW 1.1

Solution :- $P(J) = 20\% = 0.2$ J : Jenny

$P(S) = 30\% = 0.3$ S : Susan

$P(J \cap S) = 8\% = 0.08$

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

So, 26.7%.

(b) $P(J/\bar{S}) = \frac{P(J \cap \bar{S})}{P(\bar{S})} = \frac{P(J) - P(J \cap S)}{P(\bar{S})}$

$= \frac{0.20 - 0.08}{1 - 0.30} = \frac{0.12}{0.70} \simeq 0.17$

So, 17%.

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

$= \frac{P(J \cap S)}{P(J \cup S)} = \frac{0.08}{\cancel{0}.08}$

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

$= \frac{0.08}{0.20 + 0.30 - 0.08} = \frac{0.08}{0.42} = 0.19$ So 19%.

HW 1.2

Solution :-

$P(H) = 80\% = 0.80$ H: Harold

$P(S) = 90\% = 0.90$ S: Sharon

$P(H \cup S) = 91\% = 0.91$

So,

$$P(H \cap S) = P(H) + P(S) - P(H \cup S)$$
$$= 0.80 + 0.90 - 0.91$$
$$= 0.79 \text{ or } 79\%$$

(a) Prob. that only Harold gets a "B" is 1%

$$P(H = \text{'B' only}) = P(H) - P(H \cap S)$$
$$= 0.80 - 0.79$$
$$= 0.01 \text{ or } 1\%$$

(b) Prob that only Sharon gets a "B" is; 11%.

$$P(S = \text{'B' only}) = P(S) - P(H \cap S)$$
$$= 0.90 - 0.79$$
$$= 0.11 \text{ or } 11\%$$

(c) Prob that Harold & Sharon don't get "B" is 9%.

$$P(H, S \neq B) = P(\overline{H \cup S}) = 1 - P(H \cup S)$$
$$= 1 - 0.91$$
$$= 0.09 \text{ or } 9\%$$

HW 1.3

Solution : $P(J) = 20\% = 0.20$ J = Jerry

$P(S) = 0.30\%$ S = Susan

$P(J \cap S) = 8\% = 0.08$

Assume, The events "Jerry is at the bank and" Susan is at the bank" are Independ
So, then

$$P(J) * P(S) = P(J \cap S)$$

So $0.20 \times 0.30 \neq 0.08$.

Since the events individual parameter products are not equal to the intersection so thus prooved that these two events are ~~not~~ not Independent.

HW 1.4

Solution :

(a) For the events to be independent

$P(\text{Second die} = 5 \ \& \ \text{Sum} = 6) = P(\text{Second die} = 5) \times P(\text{Sum} = 6)$

But,

$$\frac{5}{36} \times \frac{6}{36} \neq \frac{1}{36}.$$

So the Events "the sum is 6" and "the Second die shows 5" are not independent.

(b) For the events to be independent

$P(\text{First die} = 5 \ \& \ \text{Sum} = 7) = P(\text{First die} = 5) \times P(\text{Sum} = 7)$

$$\frac{1}{36} = \frac{\cancel{6}^{1}}{\cancel{36}_{6}} \times \frac{\cancel{6}^{1}}{\cancel{36}_{6}}.$$

$$1/36 = 1/36$$

So, the two events "First die shows 5" & "Sum is 7" are independent Events.

HW 1.5

Solution : $P(Tx) = 0.60$ Tx - Texas

$P(NJ) = 0.10 = 0.10$ NJ

$P(AK) = 0.30$

$P(Tx\ oil) = 0.30$

$P(Ak\ oil) = 0.20$

$P(NJ\ oil) = 0.10$

(1.) $P(\text{Finding Oil}) = P(Tx\ Oil) \times P(Tx) + P(Ak\ oil) \times P(Ak) + P(NJ\ oil) \times P(NJ)$

$$P(\text{oil}) = (0.30 \times 0.60) + (0.20 \times 0.30) + (0.10 \times 0.10)$$
$$= 0.18 + 0.06 + 0.01$$
$$= 0.25 \text{ or } 25\%.$$

(2.) $$P(Tx/\text{oil}) = \frac{P(Tx \cap \text{oil})}{P(\text{oil})}$$

$$= \frac{0.30 \times 0.60}{0.25}$$

$$= \frac{0.18}{0.25} = 0.72 \text{ or } 72\%.$$

HW 1.6

Solution: No. of Survived = 711

No. of Not Survived = 1490

Total = 2201

(1.) $P(\text{Not Survived}) = \frac{1490}{2201} = 0.676965 \approx 0.677$

or 67.7%

(2.) $P(\text{Passenger: First Class}) = \frac{325}{2201} = 0.148$

or 14.8%

(3.) $P(\text{First class} / \text{Survived}) = \frac{P(\text{First class} \cap \text{Survived})}{P(\text{Survived})}$

$= \frac{203}{711} = 0.285513$

or 28.5%

(4.) For the events "Survived" & "first class" to be independent

LHS RHS

$P(\text{Survived}) \times P(\text{First class}) = P(\text{Survived} \cap \text{First class})$

$\Rightarrow$ LHS is

$(1 - 0.677) \times (0.148)$

0.323×0.148

0.0478 or 4.78%

$\Rightarrow \text{RHS} = \dfrac{203}{2201} = 0.0922$ or 9.22%

Since LHS $\neq$ RHS

$\Rightarrow$ So these two events are not Independent

(5.) $P\left(\begin{matrix}\text{Passenger} \\ \text{First class} \\ \text{child}\end{matrix} \middle/ \text{Survived}\right) = \dfrac{P(\text{First class} \cap \text{child} \cap \text{Survived})}{P(\text{Survived})}$

$= \dfrac{6}{711} = 0.00843$ or 0.84%

(6) $P(\text{Adult} / \text{Survived}) = \dfrac{P(\text{Adult} \cap \text{Survived})}{P(\text{Survived})}$

$= \dfrac{654}{711} = 0.91985$ or 91.98%

7). The condition is checked for
① Adult, first class } given Survived
② Child, first class

(A) P(Adult ∩ first class) given Survived $= \frac{197}{711} = 0.2770$

$P(Adult) * P(First class) = \frac{654}{711} * \frac{203}{711}$

$= 0.9198 * 0.2855$

$= 0.2626$

Since
P(Adult ∩ First Class) ≠ P(Adult) * P(First class)
So the two events are not independent.
given Survived.

(B) P(Child ∩ first class) given Survived $= \frac{6}{711} = 0.0084$

$P(Child) * P(First Class) = \frac{57}{711} * \frac{203}{711}$

$= 0.0801 * 0.2855$

$= 0.0228$.

Since, P(child ∩ first class) ≠ P(Child) * P(First class)
So the two events are not Independent
given Survived.