CS-513 | HW1

TARUN DADLANI
CWID: 20010209

1.) Given: $P(\text{Jerry} \cap \text{Susan}) = 8\%$
$P(\text{Jerry}) = 20\%$
$P(\text{Susan}) = 30\%$

1) P(Jerry going to bank when Susan is also there)

$$= \frac{P(\text{Jerry} \cap \text{Susan})}{P(\text{Susan})} = \frac{8}{30} = \underline{\underline{26.67\%}}$$

2.) $P(\overline{\text{Susan}})$ = Prob. of Jerry that he was there on friday & Susan was not there

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

$$= \frac{20-8}{70} = \frac{12}{70} = 0.1714$$

$$= \underline{\underline{17.14\%}}$$

3.) Both of them were at bank on wednesday

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

$$= \frac{8}{42} = 0.1905$$

$$= \underline{\underline{19.05\%}}$$

1.2) Given: $P(\text{Harold}) = 80\%$

$P(\text{Sharon}) = 90\%$

~~P(H ∪ B~~

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

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

$= 80 + 90 - 91$

$= 79\%$

a) P(only Harold gets 'B')

$= P(H) - P(H \cap S) = 80 - 79 = \underline{\underline{1\%}}$

b) P(only Sharon gets 'B')

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

$= 90 - 79 = \underline{\underline{11\%}}$

c) P(Both won't get 'B')

$= P(\overline{H \cup S}) = 100 - P(H \cup S)$

$= 100 - 91 = \underline{\underline{9\%}}$

1.3) Given: $P(\text{Jerry}) = 20\%$

$P(\text{Susan}) = 30\%$

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

→ The events 'Jerry is at the Bank' & 'Susan is at the Bank' are independent if ⇒

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

$$= \frac{20}{100} \times \frac{30}{100}$$

$$= \frac{6}{100}$$

$$= 6\%$$

∵ Given in Question, $P(\text{Jerry} \cap \text{Susan})$ is 8% but by calculation, we get 6%.

Hence, $8\% \neq 6\%$,

"The events are not independent"

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

$P(\text{2nd dice}=5) = \frac{1}{6}$

~~P(2nd dice = 5 & Sum = 6)~~

~~$= P(\text{Sum}=6) \cdot P(\text{2nd dice}=5)$~~

~~$= \frac{5}{36} \times \frac{6}{36}$~~

$P(\text{2nd dice}=5 \ \& \ \text{Sum}=6) = P(\text{sum}=6) + P(\text{2nd dice}=5)$

$\frac{5}{36} \times \frac{6}{36} = \frac{1}{36}$

In the above case, LHS ≠ RHS

∴ Both events are not independent

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

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

$P(\text{Sum}=7) = P(\text{first dice}=5)$

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

LHS = RHS

∴ both events are independent

1.5) P(drill in TX) = 60 %
P(drill in AK) = 30 %
P(drill in NJ) = 10 %

P(found in TX) = 30%
P(found in AK) = 20 %
P(found in NJ) = 10 %

1.) P(found oil) = P(drill in TX) × P(Found in TX)
+ P(drill in AK) × P(found in AK)
+ P(drill in NJ) × P(found in NJ)
= 0.6 × 0.3 + 0.3 × 0.2 + 0.1 × 0.1
= 0.18 + 0.06 + 0.01
= 0.25 = 25 %

2.) Probability of drill & found oil in TX

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

$$= \frac{18}{25} = \frac{72}{100} = 72\ \%$$

1.6.) 1) P(Passenger did not survive)

$$= \frac{P(\text{Total not survived})}{P(\text{Total Passengers})}$$

$$= \frac{1490}{2201} = 67.70\%$$

2.) Probability of Passenger staying in 1st class $= \frac{325}{2201} = 0.1476$

$= 14.76\%$

3.) P(Passenger in 1st class - Passenger survived)

$$= \frac{203}{711} = 28.55\%$$

4.) P(Staying in 1st class) $= \frac{325}{2201} = 14.76\%$

P(Surviving) $= \frac{711}{2201} = 0.323 = 32.30\%$

P(Surviving & staying in 1st class) =

P(Surviving) X P(staying in 1st class)

$$\frac{203}{711} = \frac{32.30 \times 14.76}{100 \times 100}$$

$$0.28 \neq 0.04$$

∴ The events are not independent

5.) P (child staying in 1st class survived

$$= \frac{6}{711} = \underline{\underline{0.84\ \%}}$$

vi.) P(adult passenger survived) $= \frac{654}{711}$

$$= \underline{\underline{91.98\ \%}}$$

iii) For survived,

P(adult) × P(1st class) = P(adult and 1st class)

$$\frac{654}{711} \times \frac{203}{711} = \frac{197}{711}$$

$$0.2626 \neq 0.2770 \quad -(1)$$

P(child) × P(1st class) = P(child and 1st class)

$$\frac{57}{711} \times \frac{203}{711} = \frac{6}{711}$$

$$0.022 \neq 0.008 \quad -(2)$$

As Equation (1) & (2) given,

The events are not independent events

1.7.) Confusion matrix

	AI	Human	Total
Predicted as AI	970	30	1000
Predicted as Human	70	930	1000
	1040	960	2000

$$\text{Accuracy} = \frac{TP + TN}{TP + FP + FN + TN} = \frac{970 + 930}{2000}$$

$$= \underline{\underline{95\ \%}}$$

$$\text{Precision} = \frac{TP}{TP + FP} = \frac{970}{970 + 30} = \underline{\underline{97\ \%}}$$

$$\text{Recall} = \frac{TP}{TP + FN} = \frac{970}{970 + 70} = \underline{\underline{93\ \%}}$$

$$F1 = \frac{2 \times \text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$$

$$= \frac{2 \times 0.97 \times 0.93}{0.97 + 0.93} \simeq \underline{\underline{0.949}}$$