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# Probability Assignment

1.1 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're at the bank 8% of the days.

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

→ $P(J|S) = \frac{P(J \cap S)}{P(S)} = \frac{8}{30} \times 100 = 26.66\%$

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

→ $P(J|\bar{S}) = \frac{P(J \cap \bar{S})}{P(\bar{S})} = \frac{12}{70} \times 100 = 17.14\%$

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

→ $P(J|S) = \frac{P(J \cap S)}{P(J \cup S)} = \frac{8}{42} \times 100 = 19.05\%$

1.2 Harold & Sharon are studying for a test.
Harold's chances of getting 'B' are 80%.
Sharon's chances of getting 'B' are 90%.
The probability of atleast one of them getting a 'B' is 91%.

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

$\rightarrow P(H|\bar{S}) = P(H) - P(H \cap S)$

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

$P(H|\bar{S}) = 80 - 79 = 1$
$= 1\%$

b. What is the prob. that only Sharon gets a "B"?

$\rightarrow P(S|\bar{H}) = P(S) - P(H \cap S)$
$= 90 - 79 = 11$
$= 11\%$

c. What is the prob. that both won't get a "B"?

→ $P(\text{both won't get}) = 100 - P(H \cup S)$

$= 100 - 91$

$= 9\%$

1.3

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" & "Susan is at the bank" independent?

→ Events are independent when probability of one event does not affect the probability of another event.

$P(J) = 20$
$P(S) = 30$
$P(J \cap S) = 8$

If the events are independent, both going to bank individually will be same when calculated.

$$P(J|S) = P(J) * P(S)$$
$$= (20 \times 30)\%$$
$$= 6$$

Ideally, $P(J|S) = P(J \cap S)$

whereas, $6 \neq 8$

Therefore, the two events are <u>not independent</u>.

1.4

1.4 You roll 2 dice

a. Are the events "the sum is 6" & "the second die shows 5" independent?

→ Getting sum = 6 — i) 1+5
ii) 2+4
iii) 3+3
iv) 4+4
v) 1+5

$= \frac{5}{36}$

Second die = 5 → Irrespective of 1st die
$= \frac{6}{6} \times \frac{1}{6} = \frac{1}{6}$

P( sum = 6 & second die = 5) $= \frac{1}{36}$ (1)

P( sum = 6) X P( second die = 5) $= \frac{5}{36} \times \frac{1}{6}$

$= \frac{5}{216}$ (2)

In order to be independent event, (1) & (2) must be same.

Since, they are not, the two events are <u>not independent</u>.

1.4 b: Are the events "the sum is 7" & "the first die shows 5" independent?

$P(\text{sum} = 7) = (1)$ $1+6$
$2+5$
$3+4$
$4+3$
$5+2$
$6+1$

$= \frac{6}{36}$

$P(1^{st} \text{ die} = 5)$ irrespective of $2^{nd}$ one $= \frac{6}{36}$

In order for events to be independent
& $P(\text{sum} = 7 \ \& \ 1^{st} \text{ die} = 5) =$

$P(\text{sum} = 7) \times P(1^{st} \text{ die} = 5)$

$\Rightarrow P(\text{sum} = 7 \ \& \ 1^{st} \text{ die} = 5) = \frac{1}{36}$ (1)

$P(\text{sum} = 7) \times P(1^{st} \text{ die} = 5) = \frac{6}{36} \times \frac{6}{36} = \frac{1}{36}$ (2)

Using (1) = (2), the two events are independent.

1.5 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 and 10% chance – NJ.
There is 30% chance of finding oil in TX, 20% – in AK, and 10% – in NJ.

1. What's the probability of finding oil?

→

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

$$P(\text{finding oil}) = 18 + 6 + 1 = 25\%$$

2. $$P(\text{oil found in } \cancel{\text{Texas}}) = \frac{P(\text{oil in TX})}{P(\text{Total oil})}$$

$$= \frac{18}{25}$$

$$= 0.72$$

$$= 72\%$$

1.6 (i) What is the probability that a passenger did not survive?

P( passenger not surviving) =

$$\frac{P(\text{not survived})}{P(\text{total})}$$

$$= \frac{1490}{1490 + 711} = \frac{1490}{2201}$$

$$= 0.677 \text{ ; Ans}$$

ii) What is the probability that a passenger was staying in 1st class?

$$P(\text{First class}) = \frac{325}{2201}$$

$$= 0.1477 \text{ : Ans}$$

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

$$P(\text{first class} ; \text{survived}) = \frac{203}{711}$$

$$= \underline{\underline{0.2855}} : \text{Ans}$$

iv) Are survival & staying in 1st class independent?

$$P(\text{survive}) = \frac{711}{2201} = 0.323$$

$$P(1^{st} \text{ class}) = \frac{325}{2201} = 0.1477$$

① $P(\text{survive} \cap 1^{st} \text{ class}) = \frac{203}{2201} = 0.0922$

② $P(\text{survive}) \times P(1^{st}) = 0.0477$

① $\neq$ ②

Therefore, survival & staying are <u>not independent</u>

v) Given that a passenger survived, what is the probability that the passenger was staying in 1st class & the passenger was a child?

$$P(1^{st} \text{ class, survived \& child}) = \frac{6}{711}$$

$$= \underline{\underline{0.0084}} \text{ : Ans}$$

vi) Given that a passenger survived, what is the probability that the passenger was an adult?

$$P(\text{Adult, survived}) = \frac{654}{711}$$

$$= \underline{\underline{0.9198}} \text{ : Ans}$$

vii) Given that a passenger survived, are age & staying in the 1st class independent?

$P(\text{adult} / \text{survived}) = \frac{654}{711}$

$P(\text{child} / \text{survived}) = \frac{57}{711}$

Total survived $= \frac{654}{711} + \frac{57}{711} = 1$

$P(1^{st} \text{ class} / \text{survived}) = \frac{203}{711} = 0.28$ (I)

$P(\text{age} / \text{first class}) = P(A \cap B) = \frac{203}{711}$

$= 0.28.$ (II)

(I) = (II)

$P(A \cap B) = P(A) \times P(B)$

$0.28 = 1 \times 0.28$

$0.28 = 0.28$

$\therefore$ Age & $1^{st}$ class are <u>independent</u>.