Probability:

It is about determining the likelihood of an event

E.g Toss a Coin {H, T}

Probability = $\frac{\text{No. of Favourable outcomes}}{\text{No. of possible outcomes.}}$

$P(H) = \frac{1}{2} = 50\%$

(2 ← Sample size)

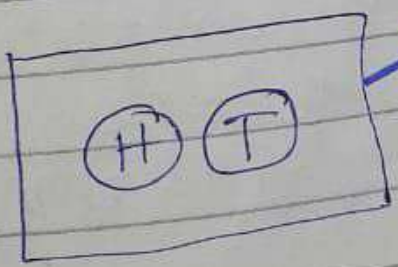
⇒ Rolling a dice {1, 2, 3, 4, 5, 6}

$P(x=1) = \frac{1}{6}$

• Mutual Exclusive Event:

Two events are mutual exclusive if they cannot occur at the same time.

e.g Tossing a Coin because head and tail cannot come at same time



→ Venn Diagram No intersection

So,

$P(H \text{ or } T) = P(H) + P(T)$

↓

Addition rule for mutual exclusive event

$P(H) = \frac{1}{2} = 0.5 \quad P(T) = \frac{1}{2} = 0.5$

$P(H \text{ or } T) = 0.5 + 0.5$

$P(H \text{ or } T) = 1$

$P(H \cup T)$ e.g Rolling a dice $\{1, 2, 3, 4, 5, 6\}$

$P(1 \text{ or } 5) = P(1) + P(5)$

$P(1) = \frac{1}{6} \quad P(5) = \frac{1}{6}$

$P(1 \text{ or } 5) = \frac{1}{6} + \frac{1}{6} = \frac{2}{6_3}$

$P(1 \text{ or } 5) = \frac{1}{3}$

- Non-mutual exclusive event

  Two events can occur at the same time

- e.g Drawing a card from deck

it can be King(K) or it can be King-heart(K♡) or can be heart(♡)

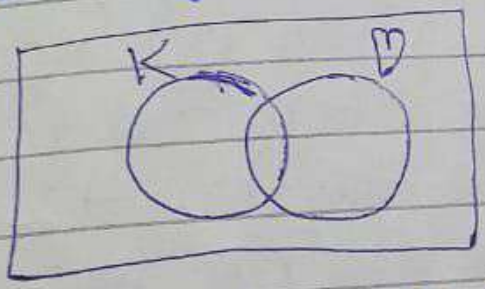
$Pr(K \text{ or } ♡) = Pr(K) + Pr(♡) - Pr(K \text{ and } ♡)$

$Pr(K \text{ or } ♡) = \frac{4}{52} + \frac{13}{52} - \frac{1}{52}$

$$\boxed{Pr(K \text{ or } ♡) = \frac{16}{52}}$$

Addition Rule for non-mutual exclusive event

- Venn Diagram



- Multiplication Rule (Dependent and independent events)
- Independent events:

Two events are independent if they do not affect one another

eg
Tossing a coin (First time head then tails)
For first time
$Pr(H) = \frac{1}{2}$
After getting head Probability of tail will be
$Pr(T) = \frac{1}{2}$ so no effect(independent events)

- **Dependent events:**

Two events are dependent if they affect each other

e.g Take a King card from the deck and then the queen card from deck.

In 1st attempt

$Pr(K) = \frac{4}{52}$ $Pr(Q) = \frac{4}{52}$

After picking up King

$Pr(Q) = \frac{4}{51}$ (So affected)

Dependent event

• Multiplication Rule

(i) Independent event

Pr(H and then tail) = Pr(H) * Pr(T)

Pr(H and T) = $\frac{1}{2} \times \frac{1}{2} = \boxed{\frac{1}{4}}$

Pr(H ∩ T)

(ii) Dependent event.

Pr(K and then Q) = P(K) × P($\frac{Q}{K}$)

↓

This is also called conditional probability / Baye's theorem

Pr(K and then Q) = $\frac{4}{52} \times \frac{4}{51}$

★ Conditional Probability will be used in Naive Baye's ML theorem.