PROBABILITY

- Probability :

  It is the ratio of desired outcomes to total outcomes: (desired outcomes)/(total outcomes).

- Probability of all outcomes always sums to 1.

Example:

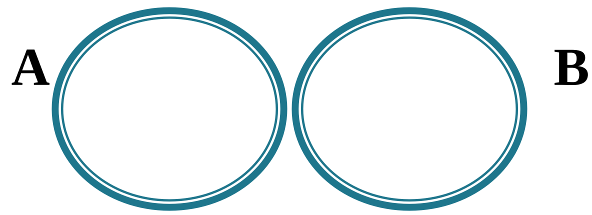
- On rolling a dice, you get 6 possible outcomes
- Each possibility only has one outcome, so each has a probability of 1/6
- For example the probability of getting a number '2' on the dice is 1/6

- **MUTUAL EXCLUSIVE AND MUTUAL INCLUSIVE EVENTS**

- Mutual Exclusive Event :

  These are the events which cannot occur both at the same time. For example, a set of outcomes of a single coin toss, which can results in either heads or tails, but not both.

- The Additive theorem of probability states if A and B are two mutual exclusive events then the probability of either A or B is given by



P(A or B) = P(A) + P(B)

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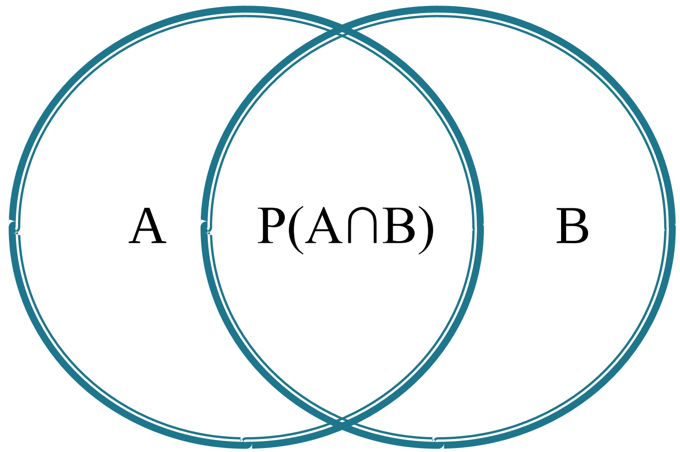

$$P(A \cap B) = P(A) + P(B) - P(A \cap B)$$

INDEPENDENT AND DEPENDENT EVENTS

- Independent Events :

  Two events are independent if the outcome of first event doesn’t affects the outcome of the second event. When two events, A and B are independent, then the probability of both occurring is :

$$P(A \text{ and } B) = P(A) \,.\, P(B)$$

- Dependent events :

  Two events are dependent if the outcome of first event affect the outcome of the second event. When two events, A and B are dependent, then the probability of both occurring is :

$$P(A \text{ and } B) = P(A) \,.\, P(B/A)$$

CONDITIONAL PROBABILITY

- Probability of an event or outcome based on the occurrence of a previous event or out come
- Conditional Probability of an event B is the probability that the event will occur given that event A has already occurred
- If A and B are dependent events then the expression for conditional probability is given by :

$$P(B/A) = P(A \text{ and } B) / P(A) \quad \text{or} \quad P(A/B) = P(A \text{ and } B)/P(B)$$

- If A and B are independent events then the expression for conditional probability is given by :

$$P(B/A) = P(B)$$

BAYE'S THEOREM :

It shows the relation between one conditional probability and its inverse. It is given as

$$P(B/A) = P(A/B).P(A)/P(B)$$

Example:

P(A) is the probability that the stock price is increases by 5%, P(B) is the probability that the CEO is replaced by 20%, P(A/B) is the probability of the stock price increases by 5% given that the CEO has been replaced. Find P(B/A) is the probability of the CEO replacement given the stock price has increased.

Sol:

$P(B/A) = P(A/B).P(A)/P(B)$

$P(B/A) = (0.05)*(0.05)/(0.2)$

- Examples:

1. What is the probablilty of spinning a prime number or an odd number on a spinner numbered 1 to 8?

Sol: S = (1, 2, 3, 4, 5, 6, 7, 8)

prime numbers = 1, 3, 5, 7 = 4/8 = 0.5

2. For numbers 1 to 9, get the probability of getting a number less than 4 or 2?

Sol: set S = (1, 2, 3, 4, 5, 6, 7, 8, 9)

we want probability of number less than 4 or 2

less than 4 means we get S = 1, 2, 3 = 3/9 = 0.5

less than 2 means we get S = 1 = 1/9 = 0.11

3. Let X and Y are two independent events such that $P(X) = 0.3$ and $P(Y) = 0.7$. Find P(X and Y) ,P(X or Y).

Sol: We know that : $P(X \text{ and } Y) = P(X)*P(Y)$

$$=(0.3)*(0.7)$$

$$=0.21$$

$$P(X \text{ or } Y) = P(X) + P(Y)$$

$$=0.3 + 0.7$$

$$= 1$$