ASSIGNMENT-02

1: What is probability?

Probability is a number that reflects the chance or likelihood that a particular event will occur.

Probability ranges between 0 to 1.

Probability of an Event is: $\frac{\text{Number of ways it can happen}}{\text{Number of possible outcomes}}$

2. Define mutual Exclusive and mutual inclusive Events?

mutually Exclusive Event: mutually Exclusive Events are the events if they cannot both occur at the same time. $\Rightarrow P(A \text{ or } B) = P(A) + P(B)$

Eg: Probability of a dice showing a number of 3 or number of 5.

$$P(3 \text{ or } 5) = P(3) + P(5) = 1/6 + 1/6 = 1/3.$$

mutually Inclusive Events:

mutually Inclusive Events allow both Events to happen at the same time or occur in a single trial.

$$P(A \text{ or } B) = P(A) + P(B) - P(A \cap B)$$

Eg: Probability of getting an Even number or number than 5 in a set of $\{1, 2, 3, 4, 5, 6, 7, 8\}$ is

$$P(\text{Even or } 5) = \frac{4}{8} + \frac{4}{8} - \frac{2}{8} = \frac{3}{4}.$$

3. Define Independent and Dependent Events.

Independent Events:-

Two Events are independent, if the outcome or occurrence of the first doesnot affects the outcome or occurrence of the second. when two

Events A and B are independent, the probability of both occuring is $P(A \text{ and } B) = P(A) \cdot P(B)$.

Eg:- If we flip a coin in the air and get the outcome as Head; then again if we flip the coin but this time outcome may be Tail. In both cases, the occurrence of both events is independent of each other.

Dependent Events:

Two events are dependent if the outcome or occurrence of the first affects the outcome or occurrence of the second so that probability is changed.

→ When two events, A and B are dependent, the probability of both occurring is $P(A \text{ and } B) = P(A) \cdot P(B|A)$.

$P(A \text{ and } B) = P(B) \cdot P(A|B)$

Eg:- Riya has to select two students from a class of 23 girls and 25 boys. What is the probability that both students chosen are boys?

Total students = 48

$P(\text{Boy } 1) = 25/48$

$P(\text{Boy } 2) = 24/47$.

$P(\text{Boy } 1 \text{ and Boy } 2) = P(\text{Boy } 1) \cdot P(\text{Boy } 2 / \text{Boy } 1)$

$= \frac{25}{48} \cdot \frac{24}{47}$

$= \frac{600}{2256}$.

4 Explain conditional probability.

conditional probability is probability of an event occuring given that another event has already occurred.

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

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

$$P(B|A) = \frac{P(B \cap A)}{P(A)} = \frac{P(A \cap B)}{P(A)}$$

Eg:- Probability that it is Friday and that a student is absent is 0.03. since there are 5 working days in a week, the probability that it is Friday is 0.2 what is probability that a student is absent? Given that today is Friday?

$P(\text{Friday} | \text{Absent}) = 0.03$

$P(\text{Friday}) (0.2)$

$$P(\text{Absent} | \text{Friday}) = \frac{P(\text{Friday} | \text{Absent})}{P(\text{Friday})}$$

$$= \frac{0.03}{0.2} = 15\%$$

5. Explain Bayes Theorem.

theorem can be used to determine the conditional probability of Event A, given that Event B has occurred, by knowing the conditional probability of Event B, Given the Event A has occurred, as well as individual probabilities of Events A and B.

$P(A|B) = [P(B|A) * P(A)] / P(B)$.

From conditional probability.

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

$$P(B|A) = \frac{P(A \cap B)}{P(A)}$$

$\therefore P(A|B) \cdot P(B) = P(B|A) \cdot P(A)$.

$$P(A|B) = \frac{P(B|A) \cdot P(A)}{P(B)}$$

$$P(B|A) = \frac{P(A|B) \cdot P(B)}{P(A)}$$

Eg:- $P(A)$ - probability that stock price increases is 5%.

$P(B)$ - probability that CEO is replaced by 20%.

$P(A|B)$ - probability of stock price increases given that the CEO has been replaced by 5%.

Find $P(B|A)$ probability of CEO replacement given the stock price has increased.

$$P(B|A) = \frac{P(A|B) \cdot P(B)}{P(A)}$$

$$= \frac{0.05 \times 0.2}{0.05}$$

$$P(B|A) = 0.2$$

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

Set = $\{1, 2, 3, 4, 5, 6, 7, 8\}$

Set (prime) = $\{2, 3, 5, 7\}$

Set (odd) = $\{1, 3, 5, 7\}$.

Set (prime or odd) = $\frac{4}{8} + \frac{4}{8} - \frac{3}{8}$

$$= \frac{5}{8}.$$

7. For numbers, one to nine, find the probability of getting a number 2 or no. less that 4?

Set = $\{1, 2, 3, 4, 5, 6, 7, 8, 9\}$.

$S_1 = \{2\}$

$S_2 = \{1, 2, 3\}$.

probability of getting 2 or less than 4 = $\frac{1}{9} + \frac{3}{9} - \frac{1}{9}$

$$= \frac{3}{9} = \frac{1}{3}$$

8. let x and y are two independent Events such that P(x) = 0.3 and P(y) = 0.7 Find P(x and y)

Independent Events

$$P(x \text{ and } y) = P(x) * P(y)$$

$$= 0.3 * 0.7$$

$$P(x \text{ and } y) = 0.21$$