PROBABILITY

Measures of Central Tendency	
Classical Probability A = Event, S = Sample	$P(A) = \frac{n(A)}{n(S)}$
Odds in favour of Event A	$\frac{n(A)}{n(S) - n(A)} = \frac{P(A)}{1 - P(A)}$
Odds against Event A	$\frac{n(S) - (A)}{n(A)} = \frac{1 - P(A)}{P(A)}$

Some Important Results

- $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- $P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(A \cap C) + P(A \cap B \cap C)$
- $P(A^c) = 1 - P(A)$
- $P(A^c \cap B^c) = 1 - P(A \cup B)$
- $P(A \cap B) \leq P(A), P(B) \leq P(A \cup B) \leq P(A) + P(B)$

Conditional Probability

- Probability of occurrence of A given B has already occurred represented as P(A/B) or P(A given B)

$$P\left(\frac{A}{B}\right) \text{ i.e. } P(A \text{ given } B) = \frac{n(A \cap B)}{n(B)} = \frac{P(A \cap B)}{P(B)}$$

Multiplication Theorem

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

- In General,

$$P(A \cap B \cap C) = P(A) \times P\left(\frac{B}{A}\right) \times P\left(\frac{C}{A \cap B}\right)$$

Note : Two events are independent if,

$$P\left(\frac{A}{B}\right) = P(A) \Rightarrow P(A) \times P(B) = P(A \cap B)$$

- Multiplication theorem only when order comes in play
- If A and B are ind., PA & PB are also independent

Baye's Theorem	$P\left(\frac{E_1}{A}\right) = \frac{P(E_1) \times P\left({}^{A}/_{E_1}\right)}{\sum_{r=1}^{n} P(E_1) \times P\left({}^{A}/_{E_r}\right)}$
Mean Value/expectation	$E(X) = \sum_{i=1}^{n} (x_i\, p_i)$
Variance	$V(x) = E(X^2) - [E(X)]^2$