"Prob Summary"

⇒ **Statistics:**

① Collection of Data.
② Presentation of Data.
③ Analysis of Data.
④ Desicion about Data.

→ statistic is "Umbrell", prob is "part" of it.

⇒ **Population:**

→ totality of anything.

⇒ **Sample:**

→ part of population.

⇒ **Parameters:**

→ Set of characteristics.

Collection of Data
- Primary Data
  - First hand / raw
- Secondary Data
  - Second hand / calculated

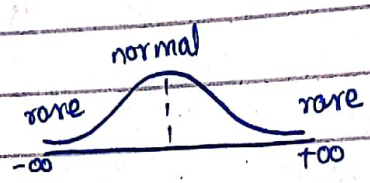
⇒ **Presentation of Data:**

Presentation
- Tabular
  - Frequency distribution
- Graphical
  - Bar chart./Quality
  - Pie chart./Quality
  - Histogram./Quantit

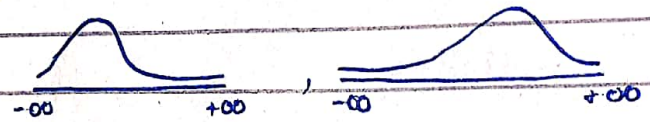
Types of Bar charts:

① Simple : 1 variable.
② Multiple : 2 variable
③ Component : Sum of variables.

⇒ **Normality:**



⇒ **Abnormality:**



⇒ **Measure the centre location:**

① **Mean/Average:** $\bar{x} = \sum_{i=1}^{n} / n$ (center)

② **Median:** middle value of arranged data set. (50%)

③ **Mode:** (Qualitative) most repeated value.

⇒ **weighted arithmetic mean:** $\bar{x}w = \frac{\Sigma Wx}{\Sigma W}$

⇒ **Quantiles:**

- Quartile : $Q_1 = (n+1)4$, $Q_2 = (n+1)/2$, $Q_3 = 3(n+1)/4$
- Decile : $i \times (n+1)/10$
- Pecentile : $n = (P/100) \times N$

⇒ Measure of dispertion :

① Range : range = max - min

② Avarage dispertion : $\frac{\Sigma (x - \bar{x})}{n}$

⇒ Deviations :

① Mean deviation : $\frac{\Sigma |x - \bar{x}|}{n}$

② Variance : $\frac{\Sigma (x - \bar{x})^2}{n}$

③ Standard deviation : $\sqrt{\text{variance}}$ OR $\sqrt{\frac{\Sigma (x - \bar{x})^2}{n}}$

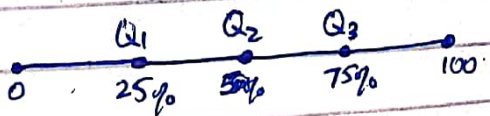
⇒ Sigma limits :

$\bar{x} \pm 1SD$ = 68.5 %

$\bar{x} \pm 2SD$ = 95.7 %

$\bar{x} \pm 3SD$ = 99.5 %

⇒ Quartile :



⇒ Interquartile range : (IQR) = $Q_3 - Q_1$

⇒ Absolute Measures :

$\bar{x} \pm S.D$

median ± IQR

mode ± range

⇒ **Box Plot / Wisker Plot:**

① Q_1 : lower quartile.
② Q_2 : median
③ Q_3 : upper quartile.
④ $Q_1 - 1.5\ IQR$.
⑤ $Q_3 + 1.5\ IQR$.

⇒ **Coefficient of variance:**

$$C.V = \frac{S.D}{\overline{X}} * 100$$

⇒ **Coefficient of IQR:**

$$C.IQR = \frac{Q_3 - Q_1}{Q_3 + Q_1}$$

⇒ **Coefficient of range:**

$$C.R = \frac{Max - Min}{Max + Min}$$

⇒ **Probability:**
→ Measuring chances of uncertainity.

⇒ **Experiment:**
→ Any planned activity.

⇒ **Random Experiment:**
→ Outcomes are known, but exact outcomes are not known.

⇒ **Sample space:**

→ A space that gathered all possible outcomes of random experiment.

⇒ **Outcomes:**

→ Each element of sample space.

⇒ **Event:**

→ Outcomes in which we are interested.

⇒ **Simple probability formula:** $P(A) = \lim_{n \to \infty} \frac{n(A)}{n(S)}$

$$0 \leq P(A) \leq 1$$

chances = probability * 100

$$P(\overline{A}) = 1 - P(A)$$

⇒ **Properties of events:**

① **Mutually exclusive event:**

→ events that can not occur together.

$P(A \cap B)$

② **Mutually inclusive event:**

→ events can occur together.

$P(A \cup B)$

③ **Independent:** coin toss.

④ **Dependent:** picking card from deck.

⇒ Join Probability :

(i) mutually exclusive : $P(A \cup B) = P(A) + P(B)$

(ii) non-mutually exclusive : $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

(iii) $P(A \cap B)$: Independent : $P(A \cap B) = P(A) \cdot P(B)$

(iv) $P(A \cap B)$: dependent : Baye's theorem.

Possibility	Probability
→ Possibilities are in numbers	→ Probability is like occurance.

⇒ Number plate possibility :

- 3 letters , 4 digits.

$26 \quad 26 \quad 26 \quad 10 \quad 10 \quad 10 \quad 10 = 175760000$ possibilities.

complete possibility	Reduced possibility
① Repetition is allowed.	① Repetion not allowed.
② Dice.	② cards.
③ No reduction.	③ One-by-one reduction

Permutation	combination
① Order do matter.	① order do not matter.
② $AB \neq BA$	② $AB = BA$
③ if obj = 3, arr = 2 then, ${}^3P_2 = 6$	③ if obj = 3, arr = 2 then, ${}^3C_2 = 3$
④ ${}^nP_r = \frac{n!}{(n-r)!}$	④ ${}^nC_r = \frac{n!}{(n-r)!\,r!}$

⇒ Conditional probability:

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

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

⇒ Distributions:

① Binomial Distribution:

$$P(x) = {}^nC_x \cdot p^x \cdot q^{n-x}$$

- n = number of trials.
- x = " " success trials.
- p = probability of success.
- q = " " failure

② Piosson Distribution: (time and space)

$$P(x) = \frac{e^{-m} \cdot m^x}{x!} \qquad \therefore e = 2.718$$

- m = average / mean
- x = number of success

(2b) Approximation :

→ when $n > 100$ and $p < 0.1$

→ $m = p * n$.

(3) Normal Distribution :

$$P(x) = z = \frac{x - M}{\delta}$$

x = required value.
M = mean / average.
δ = standard deviation.

⇒ Covariance and Correlation :

$$COV(X,Y) = \sum_{i=1}^{N} \frac{(x_i - \bar{X})(Y_i - \bar{Y})}{N}$$

$$COR = \frac{COV(X,Y)}{S.D(X) \times S.D(Y)}$$

$$\therefore S.D = \sqrt{\frac{\Sigma(X - \bar{X})^2}{N}}$$