

1) probability

$$P(A) = \frac{\text{No. of points in event A}}{\text{No. of points in sample space.}}$$

2) Permutation

$${}^n P_r = \frac{n!}{(n-r)!}$$

3) Combination

$${}^n C_r = \frac{n!}{(n-r)! r!}$$

4) Binomial Distribution

$$P(x) = [{}^n C_r] \times [P^r] \times [q^{n-r}]$$

p = probability of success

q = probability of failure

$$\boxed{P+q=1}$$

5) Poission Distribution

$$P(x) = \frac{e^{-m} \times m^x}{x!}$$

m = mean

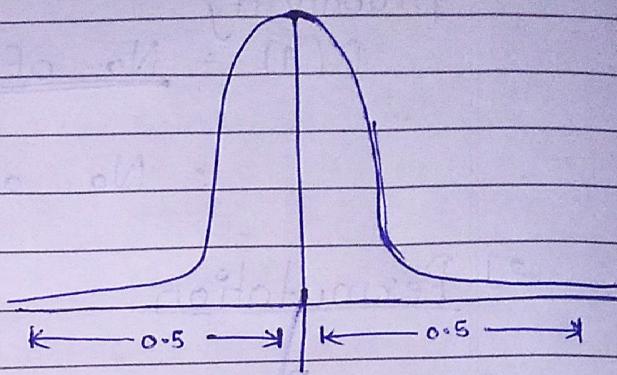
n = total no.

p = probability

$$m = n \times p$$

6] Normal Distribution

$$Z = \frac{x - \mu}{\sigma}$$



7] Conditional Probability

$$P(B/A) = \frac{P(A \cap B)}{P(A)}, \quad P(A) \neq 0$$

Also

$$P(A/B) = \frac{P(A \cap B)}{P(B)}, \quad P(B) \neq 0$$

8] Addition theorem of probability

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

or

$$P(A+B) = P(A) + P(B) - P(AB)$$

[IF A & B are mutually exclusive event]
then $P(A \cap B) = 0$
 $\therefore P(A \cup B) = P(A) + P(B)$

9] Multiplication theorem of probability

$$P(A \cap B) = P(AB) = P(A) \cdot P(B/A)$$

$$P(A \cap B) = P(AB) = P(B) \cdot P(A/B).$$

[If A & B are independent sets then]
 $P(A \cap B) = P(A) \cdot P(B)$

5. Eigen Values & Eigen Vector

1) Inverse of matrix by adjoint method :

$$A^{-1} = \frac{1}{|A|} \times \text{adjoint of } A$$

$$\Rightarrow A \cdot A^{-1} = I$$

2)

2) Eigen value & Eigen vector

$$Ax = \lambda x \quad \begin{matrix} \text{eigen value vector} \\ \downarrow \\ \text{eigen value} \end{matrix}$$

$$Ax = \lambda x$$

$$Ax - \lambda x = 0$$

$$(A - \lambda I)x = 0$$

$$(A - \lambda I)x = 0$$

3) Rank of matrix :

The total number of non-zero rows in matrix, is the rank of the matrix

i) Fitting of straight line

$$y = a + bx \quad \text{To find}$$

$$\sum y = na + b \sum x$$

$$\sum xy = a \sum x + b \sum x^2$$

ii) Fitting of straight 2nd degree polynomial / parabola

$$y = a + bx + cx^2 \quad \text{To find}$$

$$\sum y = na + b \sum x + c \sum x^2$$

$$\sum xy = a \sum x + b \sum x^2 + c \sum x^3$$

$$\sum x^2 y = a \sum x^2 + b \sum x^3 + c \sum x^4$$

iii) Coefficient of Correlation

i) Direct Method :

$$\rho = \frac{n \sum xy - (\sum x)(\sum y)}{\sqrt{[n(\sum x^2) - (\sum x)^2][n(\sum y^2) - (\sum y)^2]}}$$

ii) Karl Pearson coefficient of correlation

$\rho = \frac{\operatorname{cov}(x, y)}{\sigma x \cdot \sigma y}$	$\bar{x} = \frac{\sum x}{N}$
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$$\bar{y} = \frac{\sum y}{N}$$

where, $\operatorname{cov}(x, y) = \frac{\sum xy - \bar{x} \cdot \bar{y}}{n}$

$$\sigma x = \sqrt{\frac{\sum x^2 - (\bar{x})^2}{N}}$$

$$\sigma y = \sqrt{\frac{\sum y^2 - (\bar{y})^2}{N}}$$

iii) Spearman's Rank correlation

$$R = \pm - \frac{6 \sum d^2}{n^3 - n}$$

4] Regression of line:

i) regression of x on y

$$(x - \bar{x}) = b_{xy} (y - \bar{y})$$

$$\text{where, } b_{xy} = r \cdot \frac{\sigma_x}{\sigma_y}$$

$$r = \frac{\text{cov}(x, y)}{\sigma_x \cdot \sigma_y}$$

ii) regression of y on x

$$(y - \bar{y}) = b_{yx} (x - \bar{x})$$

where,

$$b_{yx} = r \cdot \frac{\sigma_y}{\sigma_x}$$

$$r = \frac{\text{cov}(x, y)}{\sigma_x \cdot \sigma_y}$$

5] Quartile Deviation

$$\frac{Q_3 - Q_1}{2}$$

* coefficient of quartile deviation

$$\frac{Q_3 - Q_1}{Q_3 + Q_1}$$

$$Q_1 = \left(\frac{n+1}{4} \right)^{\text{th}} \text{ observation}, \quad Q_3 = \left(\frac{3(n+1)}{4} \right)^{\text{th}} \text{ observation}$$

* Deciles :

$$D_1 = \left(\frac{N}{10}\right)^{\text{th}}, \quad D_2 = \left(\frac{2N}{10}\right)^{\text{th}}, \quad D_7 = \left(\frac{7N}{10}\right)^{\text{th}}$$

$$D_1 = l + \left(\frac{N/10 - F_c}{f_m} \right) \times h, \quad D_2 = l + \left(\frac{N/5 - F_c}{f_m} \right) \times h$$

$$D_7 = l + \left(\frac{7N/10 - F_c}{f_m} \right)$$

* Percentile :

$$P_1 = \left(\frac{N}{100}\right)^{\text{th}}, \quad P_2 = \left(\frac{2N}{100}\right)^{\text{th}}, \quad P_{35} = \left(\frac{35N}{100}\right)^{\text{th}}$$

$$P_1 = l + \left(\frac{N/100 - F_c}{f_m} \right) \times h, \quad P_2 = l + \left(\frac{2N/100 - F_c}{f_m} \right) \times h$$

$$P_{35} = l + \left(\frac{35N/100 - F_c}{f_m} \right) \times h$$

6) Measure of skewness :

i) Karl Pearson coefficient of skewness

$$Sk = \frac{\text{mean} - \text{mode}}{\text{S.D.}}$$

$$Sk = \frac{3\text{mean} - 3\text{median}}{\text{S.D.}}$$

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$$

$$\text{median} = l + \left(\frac{N/2 - F_c}{f_m} \right) \times h$$

7) Bowditch's coefficient of skewness:

$$SB = \frac{Q_3 + Q_1 - 2M}{Q_3 - Q_1} \quad Q_3 = 3\text{rd Q.D.}$$

$Q_1 = 1\text{st Q.D.}$

$M = \text{Median.}$

8) Kurtosis:

$$\beta_2 = \frac{\mu_4}{(\mu_2)^2}$$

(where, $\mu_1 = \frac{\sum Fd}{N}$ where $d = x - \bar{x}$)
 $\bar{x} = \text{mean}$

$$\mu_2 = \frac{\sum Fd^2}{N} \quad \text{mean} = \frac{\sum x}{N}$$

$\mu_3 = \frac{\sum Fd^3}{N}$ leptokurtic ($\beta_2 > 3$)

Mesokurtic ($\beta_2 = 3$)

$\mu_4 = \frac{\sum Fd^4}{N}$ platykurtic ($\beta_2 < 3$)

9) Harmonic Mean

$$HM = \frac{N}{\sum \left(\frac{1}{x_i} \right)}$$

If frequency is given:

$$HM = \frac{N}{\sum f \left(\frac{1}{x_i} \right)}$$

10) Geometric Mean

$$G.M. =$$

If x_1, x_2, \dots, x_n are the observations, then

$$G.M. = \sqrt[n]{x_1 \times x_2 \times \dots \times x_n}$$

or

$$G.M. = (x_1 \times x_2 \times \dots \times x_n)^{\frac{1}{n}}$$

11) Combined Harmonic Mean