Unit - 3

frequency distribution

Q. major of central tendency

1. Arithmatic mean

$\bar{x} = \frac{1}{n} \Sigma x_i = \frac{\Sigma f_i x_i}{N}$

$\bar{x} = A + \frac{h \Sigma f d}{N}$ $\left[d = \frac{x - A}{h} \right]$

2. median

$median = l + \frac{h}{f}\left(\frac{N}{2} - C\right)$

3. mode

$mode = l + \frac{h (f_k - f_{k-1})}{2f_k - f_{k-1} - f_{k+1}}$

4. Geometric mean

$G = Antilog\left[\frac{1}{n}\sum_{i=1}^{n} \log x_i\right]$

Discrete, $Antilog\left[\frac{1}{N}\sum_{i=1}^{n} f_i \log x_i\right]$

Alt. mode = 3median − 2mean

$F(x) = \frac{3}{4}$

$F(x) = \frac{4}{4} = 1 \quad 2 \le x$

5. Harmonic means

$$H = \frac{1}{\frac{1}{n}\sum_{i=1}^{n}\frac{1}{x_i}} \quad ; \quad H = \frac{1}{\frac{1}{N}\sum_{i=1}^{n}\frac{f_i}{x_i}}$$

moments

1. About a point

$$\mu_1' = \frac{1}{N}\Sigma f_i d_i$$

$$\mu_2' = \frac{1}{N}\Sigma f_i d_i^2$$

$$\mu_3' = \frac{1}{N}\Sigma f_i d_i^3$$

$$\mu_4' = \frac{1}{N}\Sigma f_i d_i^4$$

2. About mean

$$\mu_1 = \mu_1'$$

$$\mu_2 = \mu_2' - \mu_1'^2$$

$$\mu_3 = \mu_3' - 3\mu_3'\mu_1' + 2\mu_1'^3$$

$$\mu_4 = \mu_4' - 4\mu_3'\cdot\mu_1' + 6\mu_2'\mu_1^2 - 3\mu_1'^2$$

Karl's pearson coefficient

$$\beta_1 = \frac{\mu_3^2}{\mu_2^2}$$

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

$$\gamma_1 = \pm\sqrt{B_1}$$

$$\gamma_2 = B_2 - 3$$

$p_1 + p_2 + p_3 + \dots$

or $\sum_{i=1}^{n} p_i = 1$

$0 \le p_i \le 1$

coin simultaneously

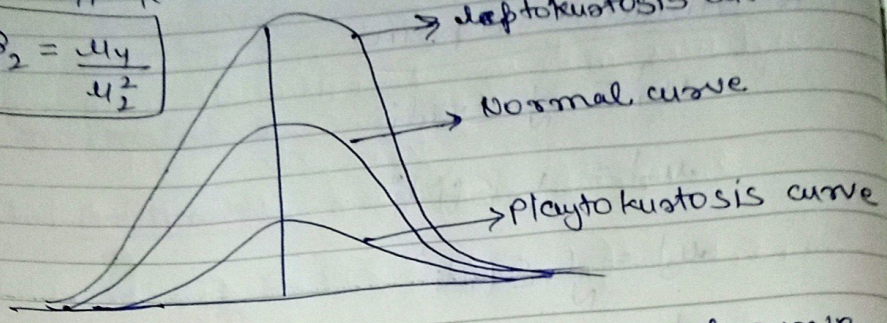
TT H

P(x)

Ballon

Kurtosis ⇒ flatness

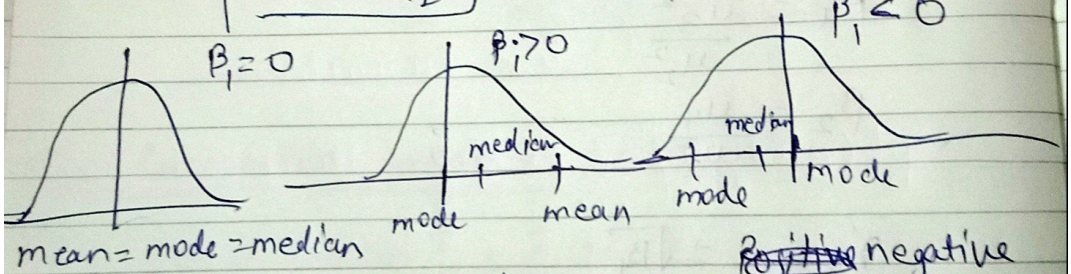
$$\beta_2 = \frac{\mu_4}{\mu_2^2}$$



1. $\beta_2 = 3$, $\gamma_2 = 0$ → Normal curve (Mesokurtic)
2. $\beta_2 < 3$, $\gamma_2 < 0$ → Playtokurtosis curve.
3. $\beta_2 > 3$, $\gamma > 0$ → leptokurtosis curve.

skewness → Symmetric

$$\beta_1 = \frac{\mu_3^2}{\mu_2^3}$$



mean = mode = median

Symmetrical skewed

Positive skewed

~~Positive~~ negative skewed

$F(x) = 0$

$F(x) = \frac{1}{4}$

$F(x) = \frac{3}{4}$ $1 \le x$

$F(x) = \frac{4}{4} = 1$ $2 \le x$

Bittoo

| 25% | 25% | medium (1) | 25% | 25% |

Q_1 Q_2 Q_3

Quartile

Quartile deviation

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

$$\text{coefficient of } QD = \frac{Q_3 - Q_1}{Q_3 + Q_1} \times 100$$

$Q_1 \rightarrow$ first Quatile
$Q_2 \rightarrow$ second Quartile
$Q_3 \rightarrow$ third Quartile

$$Q_1 = \left(\frac{n+1}{4}\right)^{th} \text{term}$$

$$Q_3 = 3\left(\frac{n+1}{4}\right)^{th} \text{term}$$

for individual and discrete

$$Q_1 = L + \left(\frac{\frac{N}{4} - Cf}{f}\right) \times h$$

$$Q_2 = L + \left(\frac{\frac{3N}{4} - Cf}{f}\right) \times h$$

for continuous

Unit-4

Revision

Correlation coefficient

$$r(x,y) = \frac{\frac{1}{n}\sum xy - \bar{x}\bar{y}}{\sqrt{\frac{1}{n}\sum x^2 - \bar{x}^2} \times \sqrt{\frac{1}{n}\sum y^2 - \bar{y}^2}}$$

Q. **Rank correlation:**

$$\rho = 1 - \frac{6\sum_{i=1}^{n} d_i^2}{n(n^2-1)} \qquad d_i = x_i - y_i$$

When rank are repeated

$$\rho = 1 - 6\left[\frac{\sum D_i^2 + \frac{1}{12}(m_1^3 - m_1) + \frac{1}{12}(m_2^3 - m_2) + \cdots}{n(n^2-1)}\right]$$

Curve fitting:

1. Straight line

$$y = a + bx$$
$$\sum y = na + b\sum x$$
$$\sum yx = a\sum x + b\sum x^2$$

2. Power curve

$$y = ax^b$$
$$U = A + bV$$
$$\sum U = nA + b\sum V$$
~~$\sum UV = A\sum V$~~
$$\sum UV = A\sum V + b\sum V^2$$

$$\begin{bmatrix} U = \log y \\ A = \log a \\ V = \log x \end{bmatrix}$$

$F(x) = \frac{1}{4}$

$F(x) = \frac{3}{4}$ $1 \le x$

$F(x) = \frac{4}{4} = 1$ $2 \le x$

3. Exponential curve

$y = ab^x$

$\left[\begin{array}{l} U = \log y \\ A = \log a \\ V = \log b \end{array}\right]$

$U = A + xV$

$\Sigma U = nA + V\Sigma x$

$\Sigma Ux = A\Sigma x + V\Sigma x^2$

4. Parabola curve

$y = a + bx + cx^2$

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

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

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

Regression :-

↳ avg. relation blw two variable

x on y

$(x - \bar{x}) = r\frac{\sigma_x}{\sigma_y}(y - \bar{y})$

y on x

$(y - \bar{y}) = r\frac{\sigma_x}{\sigma_y}(x - \bar{x})$

Unit – 2

Two dimensional random variable.

Discreate r.v

⇒ Joint probab. mass fxn / marginal

Pmf., $P(x,y) = \begin{cases} P(x=x_i, y=y_i) & i=1,2,\cdots \\ 0 & \text{otherwise.} \end{cases}$

⇒ Conditional Prob. Fxn

$$P_{x/y}(x/y) = \frac{P(x=x_i, y=y_i)}{P(y=y_i)}$$

$$P_{y/x}(y/x) = \frac{P(x=x_i, y=y_i)}{P(x=x_i)}$$

Continuous r.v

marginal $f_x(x) = \int_{-\infty}^{\infty} f_{xy}(x,y)\,dy$

$$f_y(y) = \int_{-\infty}^{\infty} f_{xy}(x,y)\,dx$$

$F(x) = \frac{4}{4} = 1 \quad 2 \le x$

$P(x) = \frac{4}{4} = 1$

Bitha

Conditional prob. fxn.

$$f_{x/y}(x/y) = \frac{f_{xy}(x,y)}{f_y(y)}$$

$$f_{y/x}(y/x) = \frac{f_{xy}(x,y)}{f_x(x)}$$

Independent random variable

~~$f_{xy}(x/y)$~~

$$f_{xx}(x,y) = f_x(x) \cdot f_x(y)$$

⇒ Exception

* discrate

$$E(x) = \Sigma x p(x)$$

* continuous

$$E(x) = \int_{-\infty}^{\infty} x f(x)\,dx$$

Property

1. $E(x+y) = E(x) + E(x)$
2. $E(xx) = E(x)\,E(y)$
3. $E(a\psi(x)) = aE(\psi(x))$
4. $E(\psi(x)+a) = E(\psi(x)+a$
5. $E[ax+b] = aE(x) + b$