Statics and Probability Theory (SPT)

Formulas

1) Arithmetic mean

Ungrouped

$$\bar{X} = \frac{\Sigma x_i}{n} \qquad M = \frac{\Sigma x_i}{N}$$

Sample Data — Population Data

Grouped

$$\bar{X} = \frac{\Sigma f_i x_i}{\Sigma f}$$

2) Geometric mean

Ungrouped $\quad \text{antilog} \frac{1}{n} \Sigma \log x_i$

Grouped $\quad \text{antilog} \frac{1}{n} \Sigma f_i \log x_i$

3) Harmonic Mean

Ungrouped Reciprocal $\quad \frac{1/x_i}{n}$

Grouped Reciprocal $\quad \frac{f_i/x_i}{\Sigma f}$

4) Quartiles

$$Q_1 = l + \frac{h}{f}\left(n/4 - c\right)$$

$$Q_2 \text{ or Median} = l + h/f\left(2n/4 - c\right)$$

$$Q_3 = l + h/f\left(3n/4 - c\right)$$

5) Mode $= l + \frac{f_m - f_i}{(f_m - f_1) + (f_m - f_2)} \times h$

DARSI NOTES

Measure of Dispersion

6) Range $= R = x_m - x_0$

7) Coefficient of Dispersion $= \frac{x_m - x_0}{x_m + x_0}$

8) Quartile Deviation $= \frac{Q_3 - Q_1}{Q_3 + Q_1} = \frac{Q_3 - Q_1}{2}$

9) Mean Deviation

Grouped

$$M.D = \frac{\sum f_i |x_i - \bar{x}|}{\sum f_i}$$

Ungrouped

$$M.D = \frac{\sum |x_i - \bar{x}|}{n} \rightarrow \text{Sample data}$$

$$M.D = \frac{\sum |x_i - M|}{N} \rightarrow \text{Population data}$$

10) Coefficient of Deviation (Mean)

$= M.D / \frac{\text{Mean}}{\text{Median}}$

11) Variance $= \sigma^2 = \frac{\sum (x_i - M)^2}{N}$

12) Standard Deviation $= S^2 = \frac{\sum (x_i - M)^2}{N}$

13) Coefficient of S.D $= S.D / \text{Mean}$

14) Coefficient of Variance $= \sigma / \bar{x} \times 100$

Moments

15) r^{th} Population Moment about Mean

$$= M_r = \frac{\sum (x_i - M)^r}{N}$$

16) r^{th} Sample Moment about Mean

$$= m_r = \frac{\sum (x_i - \bar{x})^r}{n}$$

17) Grouped Data $M_r = \frac{\sum f_i (x_i - M)^r}{N \text{ or } \sum f_i}$ $\quad m_r = \frac{\sum f_i (x_i - \bar{x})^r}{\sum f_i}$

18) Moments about Origin (Arbitrary)

(P)	(S)
$M_r' = \frac{\Sigma (x_i - a)^r}{N}$	$m_r' = \frac{\Sigma (x_i - a)^r}{n}$
$M_r' = \frac{\Sigma f_i (x_i - a)^r (c)}{\Sigma f_i}$	$m_r' = \frac{\Sigma f_i (x_i - a)^r (c)}{\Sigma f_i}$

19) Moments about O(zero)

(P)	(S)
$M_r' = \frac{\Sigma (x_i)^r}{N}$	$m_r' = \frac{\Sigma (x_i)^r}{n}$
$M_r' = \frac{\Sigma f_i (x_i)^r (c)}{N}$	$m_r' = \frac{\Sigma f_i (x_i)^r}{\Sigma f_i}$

20) Conversion from moments about mean To Moments about Origin

a) $m_1 = m_1' - m_1' = 0$

b) $m_2 = m_2' - (m_1')^2$

c) $m_3 = m_3' - 3 m_2' m_1' + 2 (m_1')^3$

d) $m_4 = m_4' - 4 m_3' m_1' + 6 m_2' (m_1')^2 - 3 (m_1')^2$

Note: Replace M by m for population data

21) Moments Ratio $B_1 = \frac{m_3^2}{m_2^3}$ $B_2 = m_4 / m_2^2$

22) Kurtosis

Percentile coefficient of Kurtosis

$$= \frac{Q.D}{P_a - P_b}$$

DARSI NOTES

23) Skewness

Coefficient of skewness = $\frac{\text{Mean} - \text{Mode}}{SD}$

$SK = \frac{3(\text{Median} - \text{Mean})}{SD}$ (range blw $-3 \rightarrow +3$)

24) Quartile Skewness

$SK(\text{Quartile}) = \frac{Q_1 - 2Q_2 + Q_3}{Q_3 - Q_1}$

25) Skewness by using moment ration

$Sk = M_3 / \sigma^3$ Population data

$Sk = m_3 / s^3$ Sample data