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Q No. 4. Write a short note on the following:

- 1- Range
- 2- Quartile Range.
- 3- Semi Inter Quartile Range
- 4- Variance
- 5- Standard deviation
- 6- Co-efficient of Variation

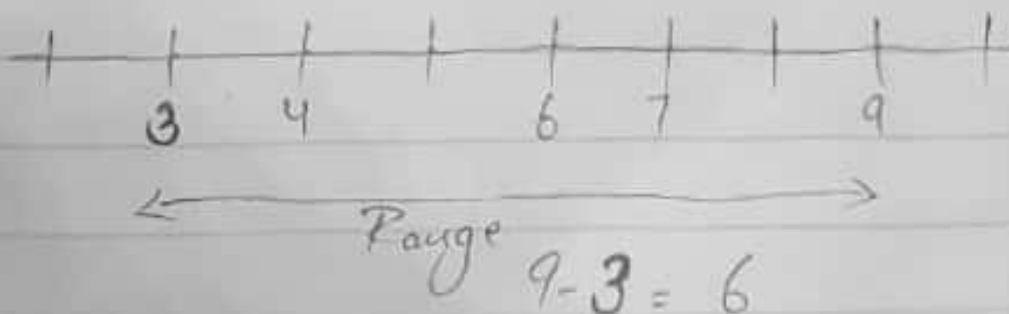
1- Range:-

The Range is the difference between the lowest and highest values.

Example:-

In $\{4, 6, 9, 3, 7\}$ the lowest value is 3, and the highest value is 9.

So the range is $9 - 3 = 6$



2- Quartile Range

It is a statistical term which describes a division of observations into four defined intervals based upon the values of the data and how they compare to the entire set of observations.

3- Semi Inter Quartile Range:-

The semi interquartile range (also called the quartile deviation) is a measure of spread. It tells you something about how data is dispersed around a central point usually the mean.

As the semi interquartile range is half of the Interquartile Range, find the interquartile range and then divide the answer with 2.

4- Variance:-

Variance (σ^2) in statistics is a measure of the spread between numbers in a data set. That is, it measures how far each number in the set is from the mean and therefore from every other number in the set.

5- Standard deviation:-

The standard deviation is a statistic that measures the dispersion of a dataset relative to its mean and is calculated as the square root of the variance. It is calculated as the square root of variance by determining the variation between each data point relative to the mean. If the data points are further from the mean, there is a higher deviation within the data set; thus, the

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more spread out the data, the higher the standard deviation.

G- Coefficient of variation:-

The coefficient of variation is a statistical measure of the dispersion of data points in a data series around the mean. The coefficient of variation represents the ratio of the standard deviation to the mean, and it is a useful statistic for comparing the degree of variation from one data series to another, even if the means are drastically different from one another.

Q No 1:

Find averages: (A.M, G.M, H.M) of the following table.

| a. Number of Children per family. | Number of families. |
|-----------------------------------|---------------------|
| 1 | 4 |
| 2 | 13 |
| 3 | 9 |
| 4 | 4 |
| 5 | 1 |

Solution:-

$$\bar{x} = \frac{\sum x}{n}$$

$$= \frac{4 + 13 + 9 + 4 + 1}{5}$$

$$= 6.2$$

| o. Marks | Frequency |
|----------|-----------|
| 0-9 | 2 |
| 10-19 | 31 |
| 20-29 | 73 |
| 30-39 | 85 |
| 40-49 | 28 |

Solution:

| Marks | Mid Point (x) | Frequency (f) | $\Sigma(fx)$ |
|-------|--------------------------|----------------|-------------------|
| 0-9 | $\frac{0+9}{2} = 4.5$ | 2 | 9 |
| 10-19 | $\frac{10+19}{2} = 14.5$ | 31 | 449.5 |
| 20-29 | $\frac{20+29}{2} = 24.5$ | 73 | 1788.5 |
| 30-39 | $\frac{30+39}{2} = 34.5$ | 85 | 2932.5 |
| 40-49 | $\frac{40+49}{2} = 44.5$ | 28 | 1246 |
| | | $\Sigma = 219$ | $\Sigma = 6425.5$ |

$$\bar{x} = \frac{\Sigma fx}{\Sigma f}$$

$$\Rightarrow \frac{6425.5}{219} = \underline{\underline{29.340}} \quad (\text{A.M.T.})$$

G.M.P.

a-

$$= \sqrt[5]{4 \times 13 \times 9 \times 4 \times 1}$$

$$= 4.5129 \text{ round of } 4.513.$$

b- G.M.P. Antilog $\left[\frac{\sum f \log x}{\sum f} \right]$

| Classes | Midpoint (x) | Frequency (f) | $\log x$ | $f \log x$ |
|---------|--------------|---------------|----------|-----------------|
| 0-9 | 4.5 | 2 | 0.65321 | 1.30642 |
| 10-19 | 14.5 | 31 | 1.16136 | 36 |
| 20-29 | 24.5 | 73 | 1.38916 | 101.408 |
| 30-39 | 34.5 | 85 | 1.53781 | 130.7138 |
| 40-49 | 44.5 | 28 | 1.64836 | 46.15408 |
| | | <u>219</u> | | <u>315.5823</u> |

$$= \frac{315.5823}{219} = 1.44101$$

$$\text{G.M.P.} = \sqrt[219]{27.60641} \text{ Antilog } \times 1.44101$$

Harmonic Mean

$$a = 10$$

$$x$$

$$\Rightarrow 5$$

$$\frac{1}{4} + \frac{1}{3} + \frac{1}{6} + \frac{1}{4} + \frac{1}{5}$$

$$5$$

$$1.6880341$$

$$= 25.3034$$

$$= 2.9620$$

0-

| Marks | Midpoint | frequency | $\frac{f}{x}$ |
|-------|----------|-----------|---------------|
| 0-9 | 4.5 | 2 | 0.44444 |
| 10-19 | 14.5 | 31 | 2.13793 |
| 20-29 | 24.5 | 73 | 2.97959 |
| 30-39 | 34.5 | 85 | 2.46377 |
| 40-49 | 44.5 | 28 | 0.62921 |
| | | 219 | 8.65494 |

$$H.M = \frac{\Sigma f}{\Sigma \frac{f}{x}}$$

$$\frac{\Sigma f}{\Sigma \frac{f}{x}}$$

$$= \frac{219}{8.65494}$$

$$= \boxed{25.3034}$$

$$8.65494$$

Q No 2:

Find Median & Mode
of the following table.

a. Number of children
Per family. Number of
families.

| | |
|---|----|
| 1 | 4 |
| 2 | 13 |
| 3 | 9 |
| 4 | 4 |
| 5 | 1 |

b.

| Marks | Frequency |
|-------|-----------|
| 0-9 | 2 |
| 10-19 | 31 |
| 20-29 | 73 |
| 30-39 | 85 |
| 40-49 | 28 |

a- Median.

Arrange into array.

1, 4, 4, 9, 13

$$\text{Position of median} = \frac{n+1}{2}$$

$$= \frac{5+1}{2}$$

$$= \frac{6}{2} = 3$$

3rd item is 4.

b-

| Marks | frequency | Cumulative frequency. |
|-------|------------|-----------------------|
| 0-9 | 2 | 2 |
| 10-19 | 31 | 33 |
| 20-29 | 73 | 106 |
| 30-39 | 85 | 191 |
| 40-49 | 28 | 219 |
| | <u>219</u> | |

$$\text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times h$$

$$\frac{n}{2} = \frac{219}{2} = 109.5^{\text{th}} \text{ value} \Rightarrow 106 = \text{Class } 20-29$$

$$l = 20$$

$$CF = 33$$

$$f = 73$$

$$h = l_2 - l_1 (29 - 20) \Rightarrow 9$$

$$20 + \left(\frac{109.5 - 33}{73} \right) 9$$

$$20 + 9.43150$$

$$\text{Median} = 29.4315$$

Mode

a- Mode is the highest repeating value so in given data $\text{Mode} = 4$

$$b- \text{Mode} = l_1 \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$$

| Marks | frequency | |
|-------|-----------|-----------------------|
| 0-9 | 2 | $l_1 = 30$ |
| 10-19 | 31 | $f_1 = 85$ |
| 20-29 | 73 | $f_0 = 73$ |
| 30-39 | 85 | $f_2 = 28$ |
| 40-49 | 28 | $n = \frac{1}{2} - 1$ |
| | | $= 39 - 30 = 9$ |

$$30 + \left(\frac{85 - 73}{2(85) - 73 - 28} \right) \times 9$$

$$30 + \left(\frac{12}{69} \right) \times 9$$

$$30 + 1.56522$$

$$\text{Mode} = \boxed{31.56522}$$

Q No 3 a-

Semi Quartile Range :-
arrange in array.

1, 4, 4, 9, 13

Lower Quartile :- $\frac{n+1}{2}$ left to the median.

$$\frac{2+1}{2} = 1.5^{th} \text{ value}$$

$$Q_1 = \frac{1+4}{2} = 2.5$$

For Median: $\frac{n+1}{2}$
 $= \frac{5+1}{2}$

$$Q_2 = \frac{6}{2} = 3^{rd} \text{ value} = 4$$

For Upper Quartile: $\frac{n+1}{2}$ right to the median.

$$= \frac{2+1}{2} = 1.5^{th} \text{ value.}$$

$$Q_3 = \frac{9 + 13}{2} = 11$$

Semi Quartile Range.

$$\begin{aligned} & \frac{Q_1 + Q_2 + Q_3}{2} \\ &= \frac{2.5 + 4 + 11}{2} \\ &= \frac{17.5}{2} = \underline{8.75} \end{aligned}$$

For Semi Inter Quartile Range:-

$$\begin{aligned} & \frac{Q_1 + Q_3}{2} \\ &= \frac{2.5 + 11}{2} \\ &= \frac{13.5}{2} \end{aligned}$$

Semi Inter Quartile Range = 6.75

Q.5(b) Variance.

| No of Children per family. | No of families. |
|-------------------------------|--------------------|
|-------------------------------|--------------------|

| | |
|---|----|
| 1 | 4 |
| 2 | 13 |
| 3 | 9 |
| 4 | 4 |
| 5 | 1 |

$$S^2 = \frac{\sum (x - \bar{x})^2}{n-1}$$

$$\text{For } \bar{x}, \quad \frac{4+13+9+4+1}{5} = \frac{31}{5} = 6.2$$

$$\bar{x} = 6.2$$

| x | \bar{x} | $(x - \bar{x})$ | $\sum (x - \bar{x})^2$ |
|-----|-----------|-----------------|------------------------|
| 4 | 6.2 | -2.2 | 4.84 |
| 13 | 6.2 | 6.8 | 46.24 |
| 9 | 6.2 | 2.8 | 7.84 |
| 4 | 6.2 | -2.2 | 27.04 4.84 |
| 1 | 6.2 | -5.2 | <u>27.04</u> |
| | | | <u>90.8</u> |

$$\Rightarrow \frac{90.8}{5-1} = \frac{90.8}{4}$$

$$S^2 = \boxed{22.7}$$

Co-efficient of variance:-

$$C.V = \frac{\text{Standard Deviation} \times 100}{\text{mean}}$$

For standard deviation:-

$$\text{Mean} = \frac{4 + 13 + 9 + 4 + 1}{5}$$

$$= \frac{31}{5}$$

$$\bar{x} = 6.2$$

| x | \bar{x} | $(x - \bar{x})$ | $\sum (x - \bar{x})^2$ |
|-----|-----------|-----------------|------------------------|
| 4 | 6.2 | -2.2 | 4.84 |
| 13 | 6.2 | 6.8 | 46.24 |
| 9 | 6.2 | 2.8 | 7.84 |
| 4 | 6.2 | -2.2 | 4.84 |
| 1 | 6.2 | -5.2 | 27.04 |
| | | | <u>90.8</u> |

$$S.D = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

$$= \sqrt{\frac{90.8}{5-1}}$$

$$= \sqrt{\frac{90.8}{4}}$$

$$S.D = \sqrt{22.7} = 4.764$$

$$C.V = \frac{4.764}{6.2} \times 100$$

$$C.V = 76.838.$$