# Lecture on Measures of Dispersion

By:
Dr. Gunjan Patil
Assistant Professor
Department of Forestry,
Wildlife and Environmental Sciences
Guru Ghasidas Vishwavidyalaya
Bilaspur-495009, INDIA

# MEASURES OF DISPERSION

The scatterness or variation of observations from their average is called the dispersion

There are different measures of dispersion like

- Range
- Quartile Deviation
- Mean Deviation
- Standard Deviation

# Range

- The simplest measure of dispersion is the range

- The range is the difference between the minimum and maximum values in a group of observations

Example- Yield of eucalyptus from different plot is as follows (tonne/plot) =

10 12 6 19 20 25 22 29 5 11

**Range for the above series is**

$$= X_{max} - X_{min}$$

$$X_{max} = 29$$

$$X_{min} = 5$$

$$\text{Range} = 29-5$$

Range= 24 Tonne/plot

# Range coefficient

$$\text{Range coefficient} = \frac{X_{max} - X_{min}}{X_{max} + X_{min}}$$

Range coefficient = 29-5/29+5

=24/34

=0. 70

# Merits, Demerits and Use of Range

**MERITS**

- Simple
- Easy to understand
- Quickly calculated

**DEMERITS**

- Its value fluctuate with size of observation
- It is unstable in repeated sampling
- It is very rough measures of dispersion and not suitable for precise and accurate studies

**USE:** Its often used in certain industrial work

# Quartile Deviation

- The quartiles are the values which divide the whole distribution into four equal parts

- We can delete the values below the first quartile and the values above the third quartile

$$Q.D.= (Q_3-Q_1)/2$$

This quantity known as quartile deviation

# Merits and Demerits of QD

## MERITS

- The quartile deviation is more stable than range
- This is not affected by two extreme value

## DEMERITS

- It fails to take the values of all deviations

# Mean Deviation

It is the deviation of each observation from the mean value of the same series is known as mean deviation

- To avoid zero value from the sum, here considering absolute value for calculating dispersion

- $X = \Sigma \bar{X}/N$

- Mean Deviation = $1/N \left| \Sigma X - \bar{X} \right|$

# Formula for frequency distribution

- Mean Deviation = $1/N \left| \Sigma f (X-\bar{X}) \right|$

| Classes | Frequency | Mid Values | fx | $X-\bar{X}$ | $f ( X-\bar{X})$ | $\left\| f ( X-\bar{X}) \right\|$ |
|---|---|---|---|---|---|---|
| 0-10 | 1 | 5 | 5 | -22 | -22 | 22 |
| 10-20 | 3 | 15 | 45 | -12 | -36 | 36 |
| 20-30 | 5 | 25 | 125 | -2 | -10 | 10 |
| 30-40 | 4 | 35 | 140 | 8 | 32 | 32 |
| 40-50 | 2 | 45 | 90 | 18 | 36 | 36 |
| **Total** | **15** | | **405** | | | **136** |

# Calculation

$\overline{X}$= 405/15=25

Mean deviation= $1/N \left|\Sigma f (X-\overline{X})\right|$

=1/15*136

=9.07

**Merits:**

- The mean deviation takes all the values into consideration
- It is fairly stable compared to range or quartile deviation

**Demerits:**

- It is not stable like standard deviation
- Mean deviation ignores signs of deviation
- It is not possible to use it for further statistical analysis

# Standard Deviation

- ✓ The standard deviation is defined as the square root of the mean of the squared deviations of individual values around their mean.

- ✓ SD= $\sqrt{\frac{\Sigma(X-\bar{X})^2}{N}}$

- ✓ SD for grouped data= $\sqrt{\frac{\Sigma f(X-\bar{X})^2}{N}}$

# Calculation

| Observation | $X-\bar{X}$ | $(X-\bar{X})^2$ |
|---|---|---|
| 5 | -2 | 4 |
| 6 | -1 | 1 |
| 7 | 0 | 0 |
| 7 | 0 | 0 |
| 8 | 1 | 1 |
| 9 | 2 | 4 |
| **Total= 42** | | **10** |

N=6

$\bar{X} = 42/6 = 7$

**SD=** $\sqrt{\frac{\Sigma(X-X)^2}{N}}$

Continue

$$SD=\sqrt{\frac{10}{6}}$$

SD=1.29

**Coefficient of SD= SD/Mean**

Coefficient of SD= 0.184

**Variance= $(SD)^2$**

Variance=1.66

**Coefficient of Variance (CV) = SD/Mean*100**

CV= 1.29/7*100

CV= 18.4

## CHARACTERISTICS

- It is rigidly defined
- Its computation is based on all the observation
- If the all variate values are the same SD=0
- SD least affected by fluctuations of sampling

## USES

- It is used in computing different statistical quantities like regression coefficients, correlation coefficient
- It is also used in testing the reliability of certain statistical measures