



**JUSTICE BASHEER AHMED SAYEED COLLEGE FOR WOMEN  
(Autonomous) Chennai 18.  
S.I.E.T.**

**DEPARTMENT OF ECONOMICS  
(F.N.SESSION)**

**BASIC STATISTICS  
UNIT -IV**

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# MEASURES OF DISPERSION

- Meaning
- Definition
- Methods of measuring Dispersion
- Range – Merits – Demerits
- Inter-Quartile Range – Merits – Demerits – Sums – Direct Method
- Standard Deviation – Meaning – Definition – Steps – Merits – Demerits – Sums – Direct method
- Skewness – meaning – test of skewness – characteristics of dispersion and skewness – objectives of skewness.

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# MEANING

## Measures of Dispersion

The measure of dispersion shows the scatterings of the data. It tells the variation of the data from one another and gives a clear idea about the distribution of the data. The measure of dispersion shows the homogeneity or the heterogeneity of the distribution of the observations.

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20 July 2020

# DEFINITION



***"Dispersion is the measure of the variation of the items."***

***—A.L. Bowley***

***"Dispersion is a measure of the extent to which the individual items vary."***

***—L.R. Connor***

***"Dispersion or spread is the degree of the scatter or variation of the variables about a central value."***

***—B.C. Brooks and W.F.L. Dicks***

***"The degree to which numerical data tend to spread about an average value is called the variation or dispersion of the data."***

***—Spiegel***

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# METHODS OF MEASURING DISPERSION

- RANGE
- INTER-QUARTILE RANGE
- MEAN-DEVIATION
- STANDARD DEVIATION

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# RANGE

- It is the simplest method of measurement of dispersion and defines the difference between the largest and the smallest item in a given distribution.

- **Formula**

**Range** = Largest value - Smallest value

**(R=L-S)**

**Co-efficient of Range** =  $L-S/L+S$

**Co-efficient of Range** =  $\frac{\text{largest value} - \text{smallest value}}$

$\frac{\text{largest value} + \text{smallest value}}$

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# **MERITS OR USES**

1. It is simple to understand.
2. It is easy to calculate.
3. In certain types of problems like quality control, weather forecasts, share price analysis, etc.,
4. Range is most widely used.

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# DEMERITS OR LIMITATIONS OR DRAWBACKS

1. It is very much affected by the extreme items.
2. It is based on only two extreme observations.
3. It cannot be calculated from open-end class intervals.
4. It is not suitable for mathematical treatment.
5. It is a very rarely used measure.

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# SUM

- **Example 1**

The yields (kg per plot) of a cotton variety from five plots are 8, 9, 8, 10 and 11. Find the range.

- **Solution**

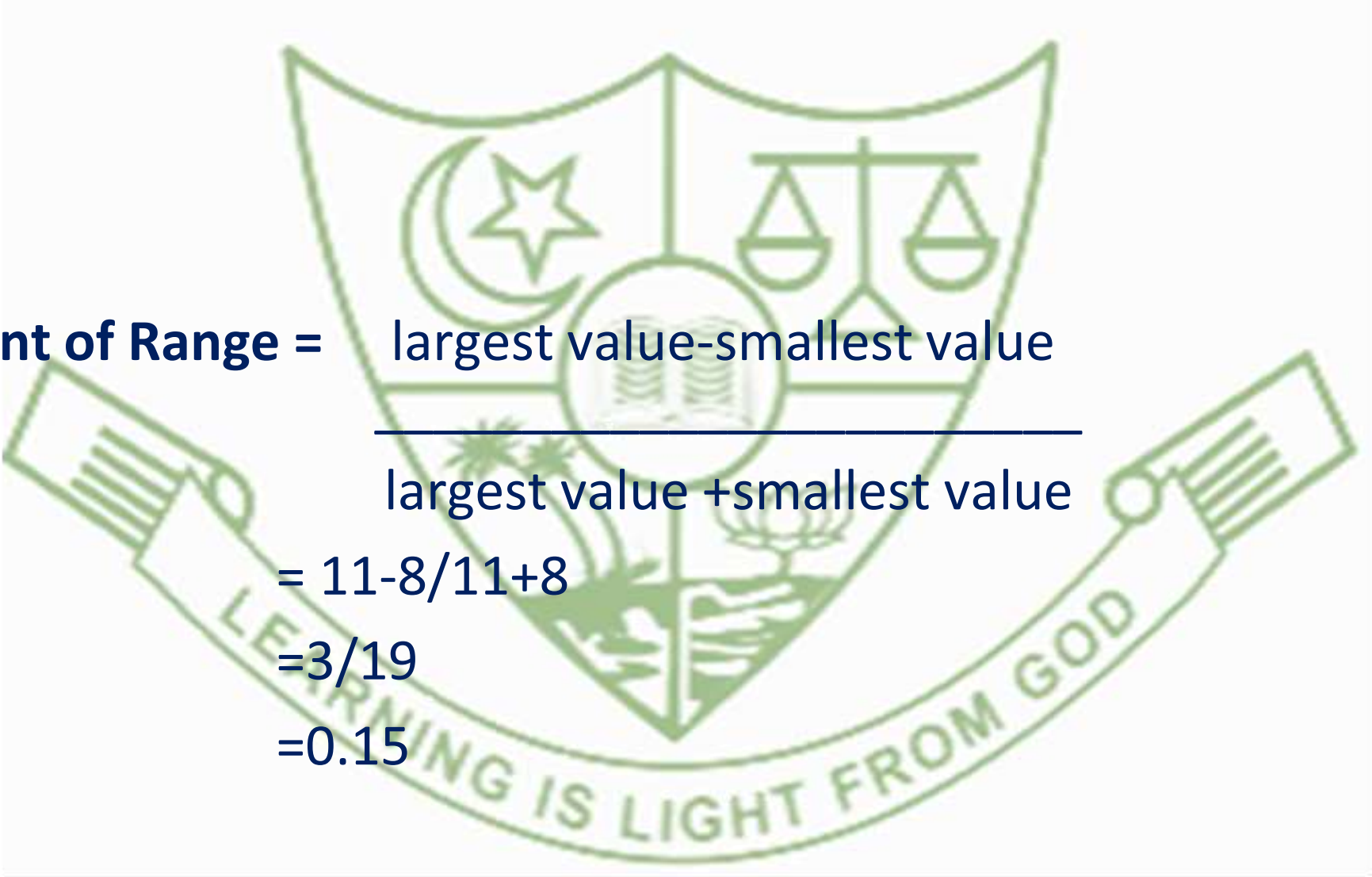
$$L=11, S = 8.$$

$$\text{Range} = L - S = 11 - 8 = 3$$

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**Co-efficient of Range =**  $\frac{\text{largest value} - \text{smallest value}}{\text{largest value} + \text{smallest value}}$

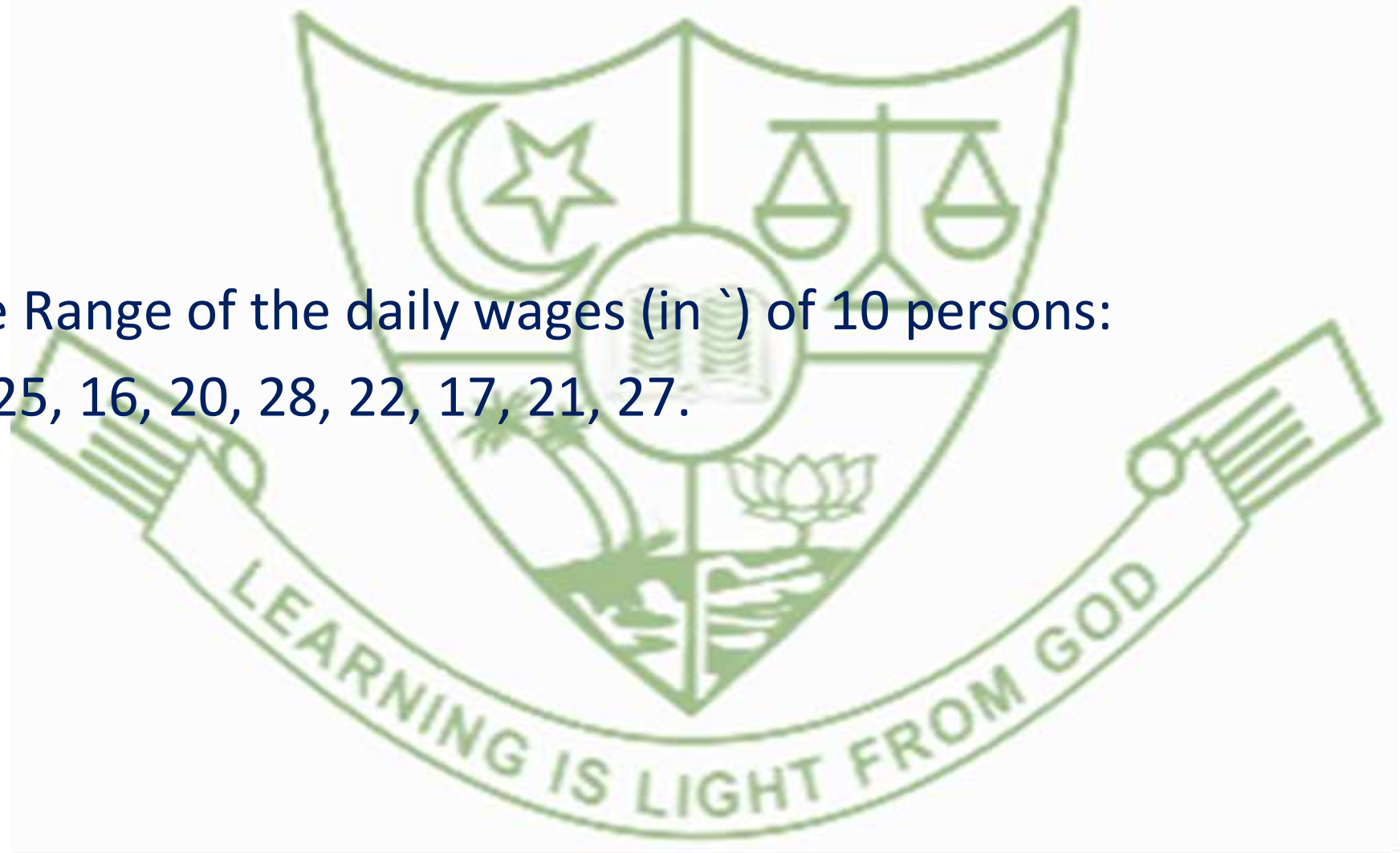
$$= \frac{11 - 8}{11 + 8}$$
$$= \frac{3}{19}$$
$$= 0.15$$

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Find the Range of the daily wages (in `) of 10 persons:  
24, 18, 25, 16, 20, 28, 22, 17, 21, 27.



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# INTER-QUARTILE RANGE OR QUARTILE DEVIATION

- The **inter-quartile range** is a measure of variability, based on dividing a data set into quartiles.
- The inter quartile range is equal to  $Q3 - Q1$ .
- Semi inter quartile range =  $Q3 - Q1/2$
- Co-efficient of inter quartile range =  $Q3-Q1/Q3+Q1$

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# MERITS OF QUARTILE DEVIATION

- It is simple to understand and easy to compute
- It is not influenced by the extreme values
- It can be found out with open end distribution
- It is not affected by presence of extreme values.

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# DEMERITS QUARTILE DEVIATION

- It ignores first 25% of the item and the last 25% of the items.
- It is a positional average; hence not amenable for mathematical treatment.
- Its value affected by sampling fluctuations
- It gives only a rough measure
- It is not the representative value of data.

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# MEAN DEVIATION

- **Mean Deviation:**
- The range and quartile deviation are not based on all observations. The mean deviation is a measure of dispersion based on all items in a distribution. The mean deviation and standard deviation are based on all items in order to measure the dispersion.
- Mean deviation is the arithmetic mean of the deviations of a series computed from any measure of central tendency; the mean, median and mode; all the deviations are taken positive + signs and –signs are ignored.

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# Calculation of mean deviation

- Calculate the median of the series
- Take the deviations of the items from median ignoring signs and done by  $[D]$
- Multiply these deviations by the respective frequencies and obtain the total  $\sum f [D]$
- Divide the total obtained in step (ii) by the number of observations.

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# STANDARD DEVIATION

- Standard deviation is a measure of dispersement in statistics. “Dispersement” tells you how much your data is spread out. Specifically, it shows you how much your data is spread out around the mean or average.
- For example, are all your scores close to the average? Or are lots of scores way above (or way below) the average score?
- Its symbol is  $\sigma$  (the greek letter sigma)
- The formula is easy: it is the **square root**

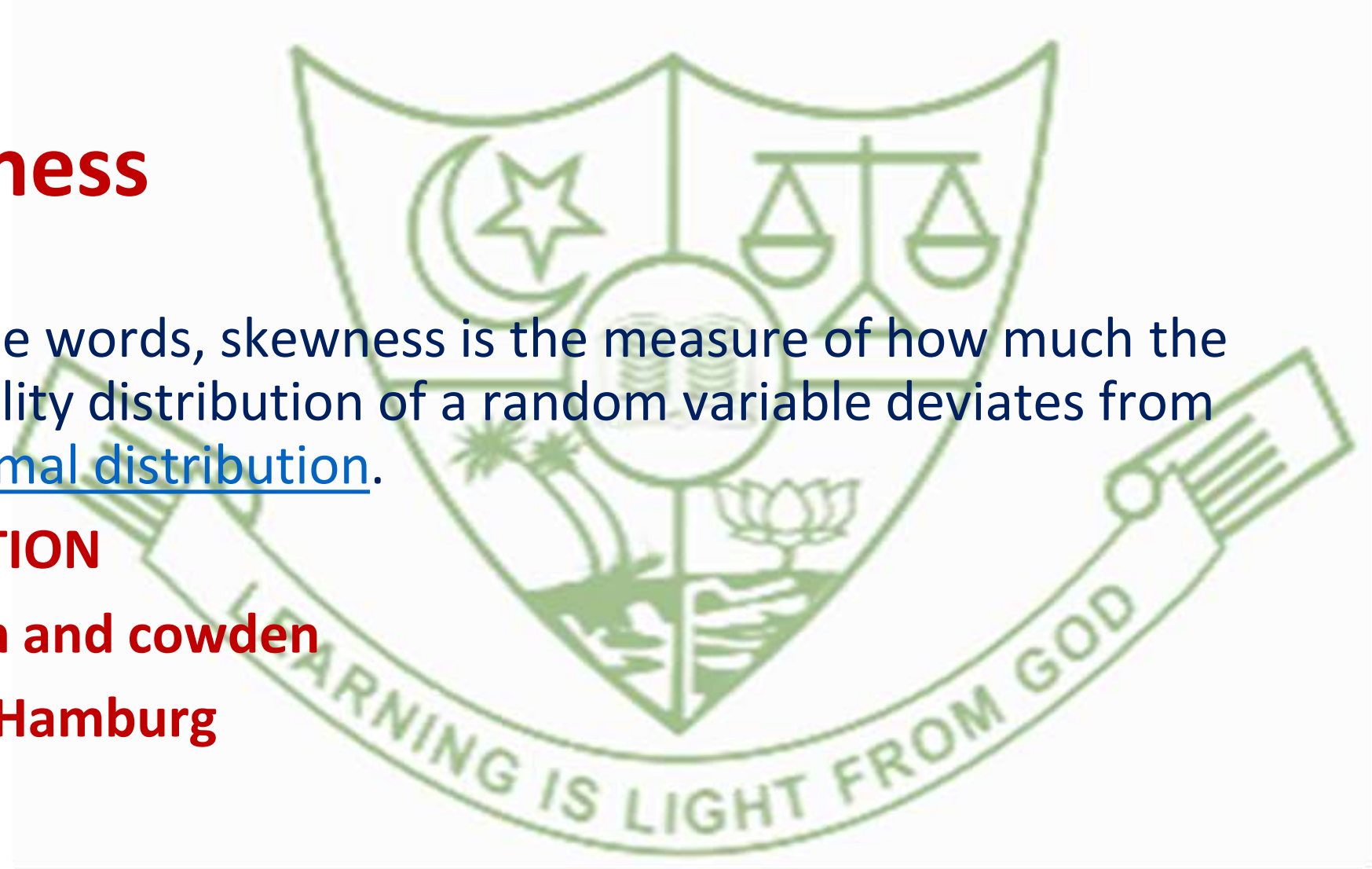
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# Skewness

- In simple words, skewness is the measure of how much the probability distribution of a random variable deviates from the normal distribution.
- **DEFINITION**
- **Croxton and cowden**
- **Morris Hamburg**

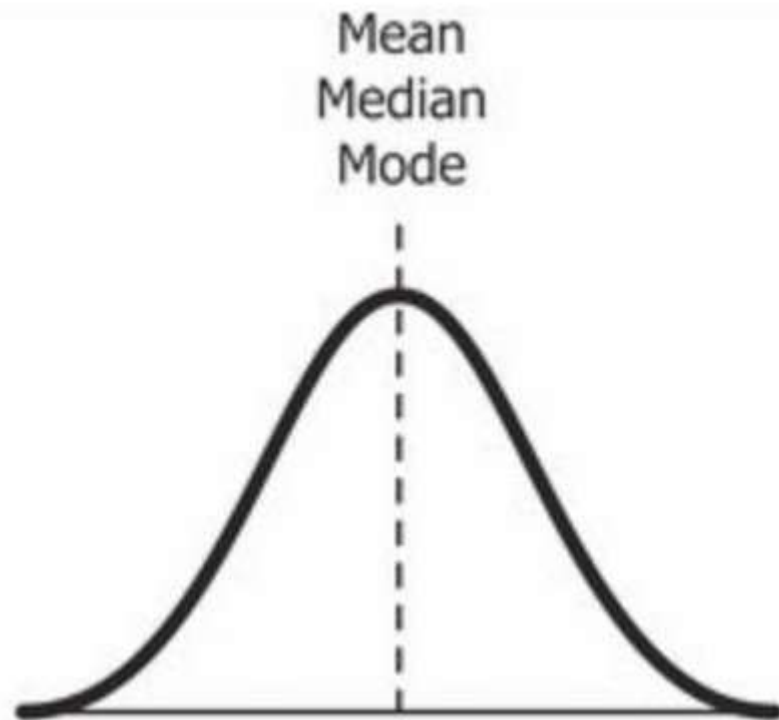


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# What is Symmetrical Distribution?



*It is the symmetrical distribution the values of mean, median, and mode coincide. The spread of frequencies is the same on both the sides of the centre point of the curve.*

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# What is Asymmetric Distribution?

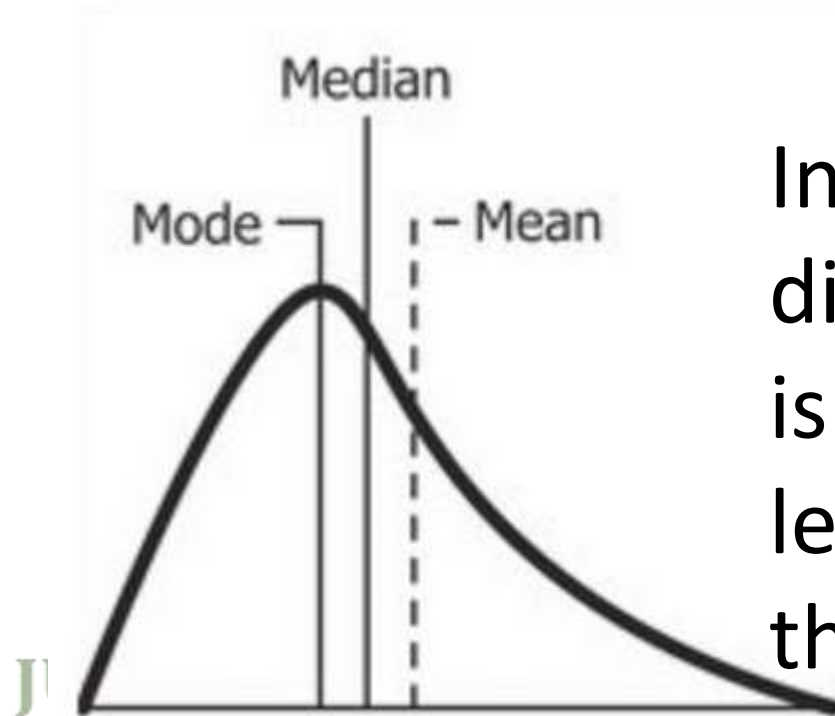
- A distribution which is not symmetrical is called a skewed distribution and such a distribution could either be positively skewed or negatively skewed

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# Positively Skewed Distribution

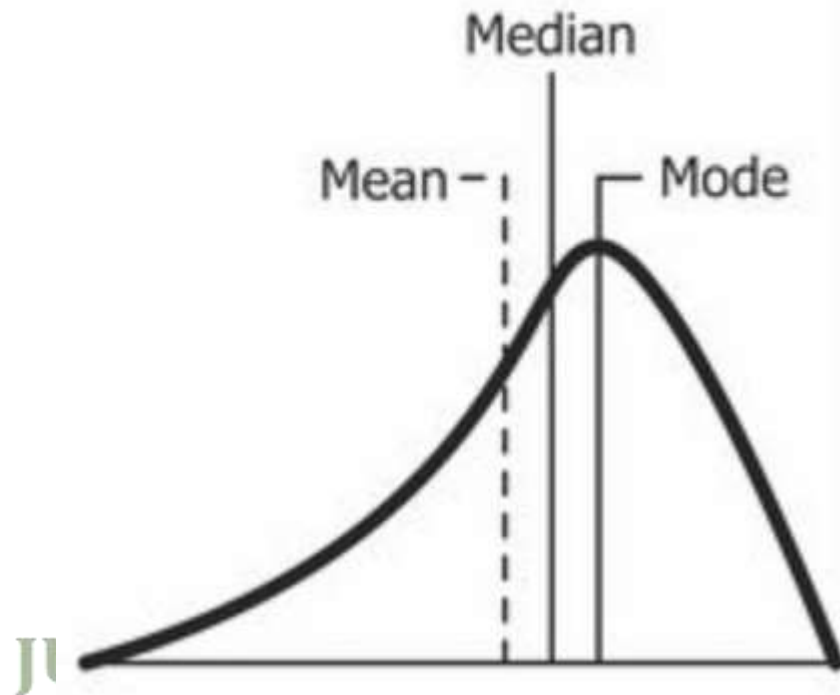


In the positively skewed distribution the value of the mean is maximum and that of mode least- the median lies in between the two.

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# Negatively Skewed Distribution



In a negatively skewed distribution the value of mode is maximum and that of mean least – the median lies in between the two.

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# Test of Skewness

- The value of mean, median and mode do not coincide
- When the data plotted on a graph they do not give the normal bell-shaped form i.e. when cut along a vertical line through the centre the two halves are not equal.
- The sum of the positive deviations from the median is not equal to the sum of the negative deviations
- Quartiles are not equidistant from the median
- Frequencies are not equally distributed at points of equal deviation from the mode.

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# Difference between Dispersion and Skewness (characteristics)

- Dispersion is a measure of range of distribution around the central location whereas skewness is a measure of asymmetry in a statistical distribution.
- Dispersion deals with the dispersal of the items of a series around its central value but skewness deals with the nature of distribution of a series i.e. to find out whether the series is symmetrically distributed, or not.
- Dispersion speaks of the amount of variation of the items from their average value but skewness speaks of the direction of the variation of the items, i.e. whether it is towards the right, or left of the distribution.



## Conti..

- Dispersion is computed both on the basis, and form of certain averages, but skewness is computed only on the basis of the averages viz. Mean, Median, Mode, Quartiles and Percentiles.
- Dispersion studies the degree of variation in the data, but skewness studies the concentration of the data either in lower or higher values.
- Dispersion speaks of the representative character of a central value, and skewness speaks of the normalcy, or otherwise of the distribution.
- Dispersion indicates the general shape of a frequency distribution but skewness indicates how the dispersion on the two sides of the Mode varies in the arrangement of frequencies.

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# Objectives of skewness

- 1. It tells us whether the distribution is normal or not
- 2. It gives us an idea about the nature and degree of concentration of observations about the mean
- 3. The empirical relation of mean, median and mode are based on a moderately skewed distribution
- 4. Measure of skewness tells us the direction and extent of asymmetry in a series, and permit us to compare two or more series with regard to these.
- 5. Measure of skewness gives an idea about the nature of variation of the items about the central value.

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