Chapter 6: Shape of the Distribution

Learning Outcomes

After Completing the chapter ,you will able to :

- Measures the Shape of the distribution
- Compute Skewness and Kurtosis with interpretation

Contents

From this lecture, you are going to learn…

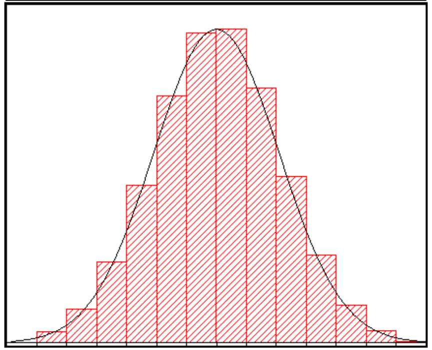
- Skewness with it's types?
- How to calculate skewness and interpretation.
- Kurtosis with it's types.
- Calculation of kurtosis.

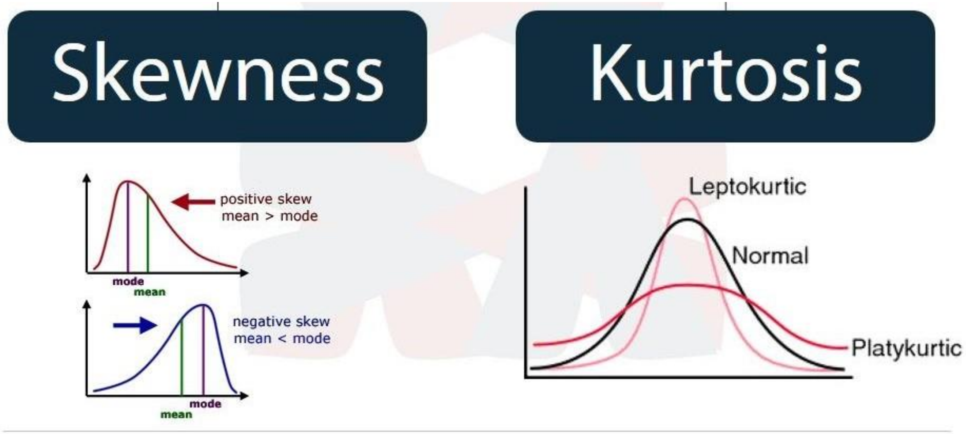
Shape of the Distribution

The **shape** of a **distribution** is described by its number of peaks, where the peak is occurred and by its tendency to skew, or its uniformity.

Two numerical measures of shape give a more precise evaluation:

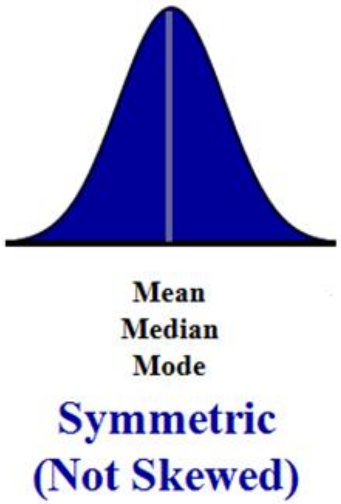
Normal distribution





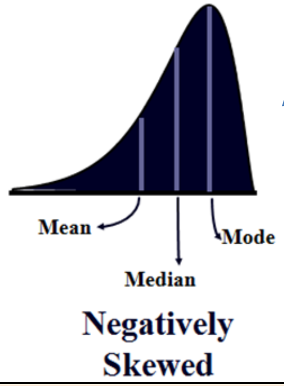
Skewness

Skewness: Skewness is the measurement of the lack of symmetry *(amount and direction of skew)* of the distribution. That is when a distribution is not symmetrical it is called a skewed distribution.



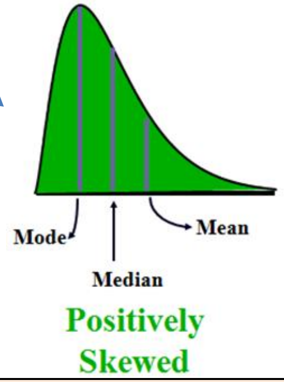
Mean = Median =Mode

Skewness is of 2 types



Long tail in left direction

Mean ≤ Median≤Mode



Long tail in right direction

Mean≥Median ≥Mode

Skewness

❓ How to measure Skewness in the data set?

Coefficient of Skewness, Sk = $\dfrac{3 \times (Mean - Median)}{Standard\ Deviation}$

Range = (-3 to +3)

Interpretation:

(-3 to -2)	(-2 to -1)	(-1to 0)	(0-1)	(1-2)	(2-3)
Strongly Negatively Skewed Distribution	*Moderately Negatively Skewed Distribution*	*Weakly Negatively Skewed Distribution*	*Weakly positively Skewed Distribution*	*Moderately positively Skewed Distribution*	*Strongly positively Skewed Distribution*

-3 -2 -1 0 1 2 3

****Suppose If SK_p = -1.75; the distribution is moderately skewed which is negative.**

Sk = 0
symmetric Distribution

****Suppose If SK_p = .75; the distribution is weakly skewed which is positive.**

Example

Problem: From the following data calculate Coefficient of skewness:
15, 18,2,6,4

Solution: We know that,

$$\text{Coefficient of Skewness, Sk} = \frac{3 \times (Mean - Median)}{Standard\ Deviation}$$

$$Mean = \frac{15+18+2+6+4}{5} = 9$$

$Median = 6$ (2, 4, 6, 15,18. So the middle value is 6)

$$s = \sqrt{\frac{(15-9)^2+(18-9)^2+(2-9)^2+(6-9)^2+(4-9)^2}{4}}$$
$$= 7.07$$

$$\text{Now, } Sk = \frac{3(Mean - Median)}{s}$$
$$= \frac{3(9-6)}{7.07}$$
$$= 1.27$$

So there is a ***moderate positive skewness*** in the data set.

Kurtosis

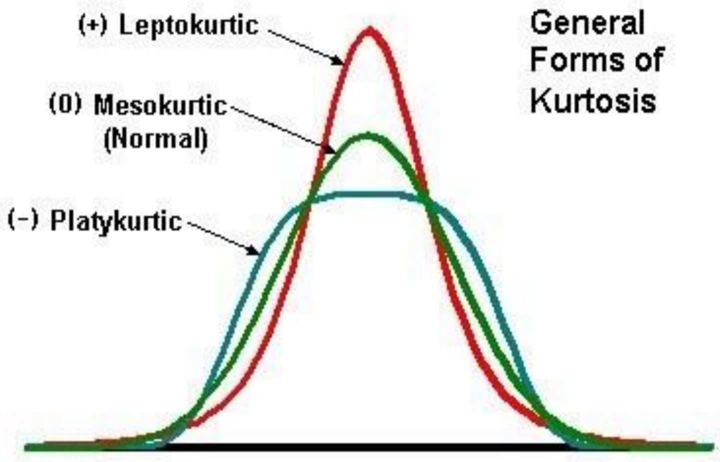
Kurtosis: Kurtosis measures the degree of flatness or peakness of a distribution relative to a standard bell curve.

Three types of distributions with respect to kurtosis:

1. **Leptokurtic distribution:** Peaked distribution or more peaked then symmetric curve. **(β_2>3)**

2. **Platykurtic distribution:** Flat distribution or less peaked then symmetric curve. **(β_2<3)**

3. **Mesokurtic distribution:** Normal distribution or symmetrical distribution. **(β_2=3)**



Kurtosis

Measures of Kurtosis: Kurtosis is measures by

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

Where, β_2=coefficient of kurtosis; μ_4=is the 4th moment; μ_2=is the 2nd moment

Moments:

The rth moment of a variable X about the arithmetic mean $\bar{x}$ is given by:

$$\mu_r = \frac{\sum_{i=1}^{N}(X_i - \bar{X})^r}{N};$$

For different values of r, we shall get different moments.

Exercise..

- Marks of 10 students in a class.

15, 25, 48, 50,65,95,18,85,75,55. Calculate coefficient of skewness and interpret the result.

- Time of reading newspaper of 6 people(in hour)

3,4,2,4,6,2,5.

Calculate coefficient of kurtosis.


Thank you