

# STATISTICS

## ▶ **Measurement Of Central Tendency**

▶ **Definition :** It is used to represent or describe an entire group of data with a single number.

▶ There are three main measures of central tendency :

1. Mean
2. Median
3. Mode

### 1. **Mean:**

The mean is the measure of average all the values in a sample/dataset.

Example: 7, 11, 16, 14, 11, 13, 19, 13, 13

$$\text{Mean} = (7+11+16+14+11+13+19+13+13)/9 = 117/9 = 13$$

## 2. **Median :**

It is defined as the measure of the central value of the sample/dataset, when the values are arranged in ascending or descending order.

Example : 7, 11, 16, 14, 11, 13, 19, 13, 13


(7, 11, 11, 13, **13**, 13, 14, 16, 19) = 13 (midpoint value)

## 3. **Mode :**

The most common value in the sample set is known as Mode.

Example : 7, 11, 16, 14, 11, 13, 19, 13, 13

The most commonly occurring value is 13, therefore the mode of this sample is 13.



## ► Standard Deviation And Variance

### 1. Variance :

Variance describes how much a random variable differs from its expected value.

$$\sigma^2 = \frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2 \quad \text{or} \quad \sigma^2 = \frac{\sum (x_i - \bar{x})^2}{n - 1}$$

Example : (7, 11, 16, 14, 11, 13, 19, 13, 13)

n = 9, mean=13 variance = 11.25

### 2. Standard Deviation :

Standard deviation is a number that describes how spread out the values are.

A low SD means that most of the numbers are close to the mean value, whereas the high SD means that the values are spread out over a wider range.

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

▶ Example : (7, 11, 16, 14, 11, 13, 19, 13, 13)

n=9, Mean=13, variance = 11.25

SD = square root of the variance

SD = 3.35410

## POPULATION MEAN AND SAMPLE MEAN

### Population Mean :

A population is a entire group that you want to draw conclusions about. Whereas population doesn't always refer to people. It can mean a group containing elements of anything you want to study, such as objects, events, species, etc.

Formula :

$$\mu = \frac{\sum_{i=1}^N x_i}{N}$$

N = number of items in the population

Example:

Let's consider we have a list consisting of names of all the soldiers in an army, it is nothing but a population. Out of which each soldier will be considered as an 'Elementary Unit'.

**Sample Mean :**

A part of the population is selected according to a plan for conducting characteristics is called Sample. The number of items in a sample is called **SAMPLE SIZE**.

► Formula :

$$\overline{X} = \frac{\sum_{i=1}^n x_i}{n}$$

n = number of items in the sample

Example:

Imagine an XYZ army consisting of maximum number of snipers, but they will use top 10 snipers for their operation to complete successfully.

### **ASSIGNMENT :**

1. Find Mean, Median, Mode and Standard Deviation for each data set.
  - a) 7, 11, 16, 14, 11, 13, 19, 13, 13
  - b) 16, 15, 16, 17, 19, 12, 14, 9
  - c) 27, 66, 24, 81, 50, 40, 74, 81, 97

a) Given set = (7, 11, 16, 14, 11, 13, 19, 13, 13)  $n = 9$

Ascending order = (7, 11, 11, 13, **13**, 13, 14, 16, 19)

We get:

Mean = 13

Median = 13

Mode = 13

Variance =  $90/9-1 = 11.25$

wkt: SD is square root  
of variance

SD =  $\sqrt{11.25} = 3.3541$

x	$\bar{x}$	$(x - \bar{x})$	$(x - \bar{x})^2$
7	13	-6	36
11	13	-2	4
16	13	3	9
14	13	1	1
11	13	-2	4
13	13	0	0
19	13	6	36
13	13	0	0
13	13	0	0

$$\bar{x} = 13$$

$$\sum (x - \bar{x})^2 = 90$$

b) Given set =(16, 15, 16, 17, 19, 12, 14, 9)    n = 8  
 ascending order set = (9, 12, 14, **15, 16**, 16, 17, 19)

We get :

Mean = 14.75

Median =  $15+16/2 = 15.5$

Mode = 16

Variance =  $65/8-1 = 9.2857$

SD =  $\sqrt{9.285} = 3.04712$

x	$\bar{x}$	$(x - \bar{x})$	$(x - \bar{x})^2$
16	14.75	1.25	1.5625
15	14.75	0.25	0.0625
16	14.75	1.25	1.5625
17	14.75	2.25	5.0625
19	14.75	4.25	18.0625
12	14.75	-2.25	5.0625
14	14.75	-0.75	0.5625
9	14.75	-5.75	33.0625

$$\bar{x} = \frac{118}{8} = 14.75$$

$$\Sigma(x - \bar{x})^2 = 65$$



c) Given set = (27, 66, 24, 81, 50, 40, 74, 81, 97)  $n = 9$

Ascending order set = (24, 27, 40, 50, **66**, 74, 81, 81, 97)

We get:

Mean = 60

median = 66

Mode = 81

Variance =  $5368/9-1$   
= 671

SD =  $\sqrt{671} = 25.90366$

$x$	$\bar{x}$	$(x - \bar{x})$	$(x - \bar{x})^2$
27	60	-33	1089
66	60	6	36
24	60	-36	1289
81	60	21	441
50	60	-10	100
40	60	-20	400
74	60	14	196
81	60	21	441
97	60	37	1369

$$\bar{x} = \frac{540}{9} = 60$$

$$\sum (x - \bar{x})^2 = 5368$$