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

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 occuring 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.

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

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.

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

- 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	$\overline{x}$	$(x-\overline{x})$	$(x-\overline{x})^2$
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

$\overline{x} = 13$

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

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	$\overline{x}$	$(x-\overline{x})$	$(x-\overline{x})^2$
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

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

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

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	$\overline{x}$	$(x - \overline{x})$	$(x-\overline{x})^2$
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

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

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