# *Measures of Central Tendency.*

## *Meaning = Average or Central Value*

## *Methods of Central Tendency*

```
              ┌──────────────┐
              │  Arithmatic  │
              │     mean     │
              └──────────────┘
   ┌──────────────┐      ┌──────────────┐
   │  Geometric   │      │     Mode     │
   │     mean     │      │              │
   └──────────────┘      └──────────────┘
   ┌──────────────┐      ┌──────────────┐
   │   Harmonic   │      │    Median    │
   │     mean     │      │              │
   └──────────────┘      └──────────────┘
```
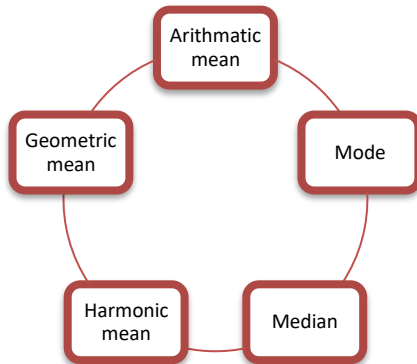
## *Measures of Central Tendency*

| Mean | Median | Mode |
|------|--------|------|
| • Mathematical average data | • Position average | • Most frequency /most common observation of data |

# *Mean*

| Arithmetic mean | Geometric Mean | Harmonic Mean |
|---|---|---|
| • Simple Average | • Ratio<br>• Rate & %<br>• Average | • Average<br>• Rate<br>• Speed |

## *Relation Between AM,GM,HM*

| Observation are Different | • AM>GM>HM |
|---|---|

| Observation are same | • AM≥GM≥HM |
|---|---|

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*Mode= 3median – 2mean*

*MO = 3MD – 2M*

```
                    ┌──────────────────┐
                    │ Arithmetic Mean  │
                    └──────────────────┘
              ┌──────────────┴──────────────┐
   ┌──────────────────┐         ┌──────────────────┐
   │    Individual    │         │     Grouped      │
   │   Observation    │         │   1.Discrete     │
   │   (ungrouped)    │         │   2.Continous    │
   └──────────────────┘         └──────────────────┘
```
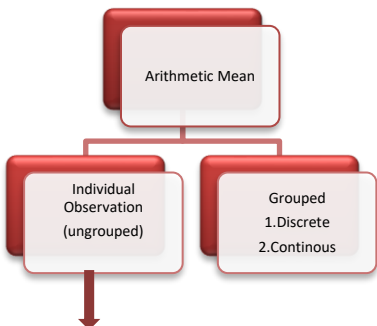
$$\bar{X} = \frac{\Sigma xi}{n}$$

$$\Sigma xi = \frac{x1 + x2 + x3 \ldots\ldots\ldots\ldots + xm}{N}$$

**Example :** 4Km,5Km,6km,8km

$$E_X = \frac{4+5+6+8}{4}$$

$$= 5.75 \ km$$

| Discrete | |
|---|---|
| Weight | No of Students |
| 20 | 4 {20,20,20,20} |
| 25 | 3 {25,25,25} |
| 30 | 2 {30,30} |
| 35 | 1 {35} |

$$\bar{X} = \frac{\Sigma f i x i}{\Sigma f i} \text{ or } \frac{\Sigma x f}{N}$$

| X | F | $F_x$ |
|---|---|---|
| 20 | 4 | 80 |
| 25 | 3 | 75 |
| 30 | 2 | 60 |
| 35 | 1 | 35 |
| Total | 10 | 250 |

$$= \frac{\Sigma x f}{N} = \frac{250}{10} = 25$$

# *Short-cut Method*

| X | F | d=X$_i$ – A | fd |
|---|---|---|---|
| 20 | 5 | -10 | -50 |
| 25 | 4 | -5 | -20 |
| 30 = A | 3 | 0 | 0 |
| 35 | 2 | 5 | 10 |
| 40 | 1 | 10 | 10 |
| | **15** | | -50 |

$$\bar{X} = A + \frac{\Sigma fidi}{N}$$

**A = Assumed Mean**
*fi = Frequency*
*di = x$_i$ – A*
*[di = Deviation About mean also called Shifting of Origin]*

$$\bar{X} = A + \frac{\Sigma fidi}{N}$$
$$\bar{X} = 30 + \frac{(-50)}{15}$$
$$\bar{X} = 26.67$$

# _Median_

**Ungrouped Data**

$Md=\left(\frac{n+1}{2}\right)$th observation

**Discrete**

$M=\left(\frac{n+1}{2}\right) of$ observation

| Median | |
|---|---|
| Ungrouped Data | Discrete |

**Ungrouped Data**

Eg: 8,9,2,3,4,5,1,0,
     0,1,2,3,4,5,8,9

$Md = \left(\frac{n+1}{2}\right) th\ observation$

$= \left(\frac{8+1}{2}\right) th\ observation$

$= 4.5^{th}$ observation

**Discrete**

| X | f | c |
|---|---|---|
| 0 | 5 | 5 |
| 1 | 7 | 12 |
| 2 | 9 | 21 |
| 3 | 3 | 24 |

$M = \left(\frac{n+1}{2}\right) th\ of\ observation$

$= \left(\frac{24+1}{2}\right) th\ of\ observation$

$= 12.5$

$Z = 2$

*12.5* comes under 21

**Eg:**

| Class | f | C |
|-------|------|---------|
| 0-10 | 5 | 5 →f |
| 10-20 | 7 (f) | 12 |
| 20-30 | 3 | 15 |
| 30 | 5 | 20 |

$$M = L + \frac{\frac{n}{2} - F}{f} \times C$$

$M = \left(\frac{n}{2}\right) th \ observation$

$= \dfrac{20}{2}$

$= 10$

$$M = L + \frac{\frac{n}{2} - F}{f} \times C$$

$$= 10 + \frac{10 - 5}{7} \times 10$$

$$= 12.857$$

# *Mode*

| Individual | D | C |
|---|---|---|
| • z = Most Frequency Observatiomn of data | • z =Obervation having Max. Frequency | • $Z = L + \dfrac{f1 - f0}{2f - f0 - f2} \times c$ |

| | | | | | | |
|---|---|---|---|---|---|---|
| Eg: 1,2,3,8,2,4,2 $$\therefore Z = 2$$ | **X** | **f** | Class | Frequency | | |
| | 5 | 17 | 0-10 | 20 | | |
| | 7 | 21 | 10-20 | 25 | | |
| | 9 | 22 | 20-30 | 15 ($f_0$) | | |
| | 11 | 18 | 30-40 | 30 ($f_1$) | | |
| | | | 40-50 | 10 ($f_2$) | | |

$$\therefore Z = 9$$

$$\therefore Model\ class = 30 - 40$$

L=10

$$Z = 10 + \frac{30 - 15}{2 \times 15 - 15 - 10} \times 10$$

$$= 10 + \frac{15}{30 - 15 - 10} \times 10$$

$$= 10 + \frac{15}{3} \times 10$$

$$Z = 60$$

## Types of Class Interval

Exclusive Class of Interval

Incusive Class of Interval

- ### *Exclusive Class Interval*

| Weight | No.of Students | Calculations |
|--------|----------------|--------------|
| 0-10   | 3              | 0-9.99       |
| 10-20  | 4              | 10-19.99     |
| 20-30  | 2              | 20-29.99     |
| 30-40  | 5              | 30-39.99     |
| 40-50  | 1              | 40-49.99     |

- ### *Inclusive Class Interval*

| Weight | No.of students | Calculations |
|---|---|---|
| 1-10 | 3 | 0.5-10.5 |
| 11-20 | 4 | 10.5-20.5 |
| 21-30 | 2 | 20.5-30.5 |
| 31-40 | 5 | 30.5-40.5 |
| 41-50 | 1 | 40.5-50.5 |

For Converting Inclusive Into exclusive

Difference

U/W $L_2$ & $L_1$ is Divided by 2

$$\frac{1}{2} = 0.5 \longrightarrow L_1(-)$$

$L_2(+)$

Now to …….

| Weight | No of Student |
|---|---|
| 0.5-10.5 | 3 |
| 10.5-20.5 | 4 |
| 20.5-30.5 | 2 |
| 30.5-40.5 | 5 |
| 40.5-50.5 | 1 |