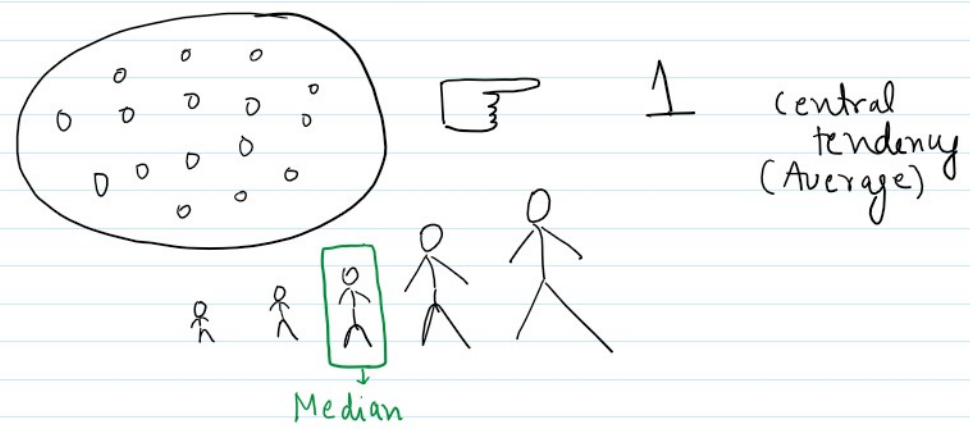


CH: **POSITIONAL AVERAGES**
(Median + Mode)

I **MEDIAN** - The median is that value of the variable which divides the group into **two equal parts**



Individual Series

eg ① Following are the observations :-
5, 8, 2, 1, 7, 6, 11, 3

Find Median.

Sol: - Step 1 **ASCENDING ORDER**

- ①st 1
- ②nd 2
- ③rd 3
- ④th 5
- ⑤th 6
- ⑥th 7
- ⑦th 8
- ⑧th 11

Step ② $Me = \left(\frac{N+1}{2} \right)^{th}$ item

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

$= \left(\frac{9}{2} \right)^{th}$ item





$$= \left(\frac{9}{2}\right)^{\text{th}} \text{ item}$$

$$= 4.5^{\text{th}} \text{ item}$$

$$= \frac{4^{\text{th}} \text{ item} + 5^{\text{th}} \text{ item}}{2}$$

$$= \frac{5 + 6}{2}$$

$$= \frac{11}{2} = 5.5$$

eg ② Following are the observations :-

2, 9, 20, 11, 3, 7, 6

Find Median

Sol:-

2, 3, 6, 7, 9, 11, 20

↓ ↓ ↓ ↓ ↓ ↓ ↓
1st 2nd 3rd 4th 5th 6th 7th

$$M_e = \left(\frac{N+1}{2}\right)^{\text{th}} \text{ item} = \left(\frac{7+1}{2}\right)^{\text{th}} \text{ item}$$

$$= 4^{\text{th}} \text{ item}$$

$M_e = 7$ Answer.

DISCRETE SERIES

eg ①

| Marks | No. of Students |
|--------|-----------------|
| 10 | 2 |
| 20 | 8 |
| 30 | 16 |
| 40 | 26 |
| 50 | 20 |
| 60 | 16 |
| 70 | 7 |
| 80 | 4 |
| N = 99 | |

| Cf |
|----|
| 2 |
| 10 |
| 26 |
| 52 |
| 72 |
| 88 |
| 95 |
| 99 |

$$= 2 + 8$$

$$= 2 + 8 + 16$$

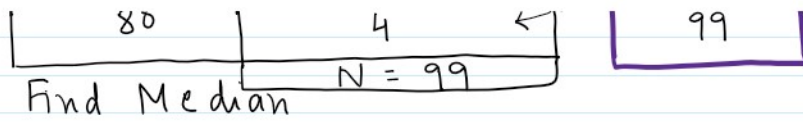
$$= 2 + 8 + 16 + 26$$

$$= 2 + 8 + 16 + 26 + 20$$

$$= 2 + 8 + 16 + 26 + 20 + 16$$

$$= 2 + 8 + 16 + 26 + 20 + 16 + 7$$

Find Median



Sol:-

Step ① Cumulative frequency

Step ②

$$M_e = \left(\frac{N+1}{2} \right)^{\text{th}} \text{ item}$$

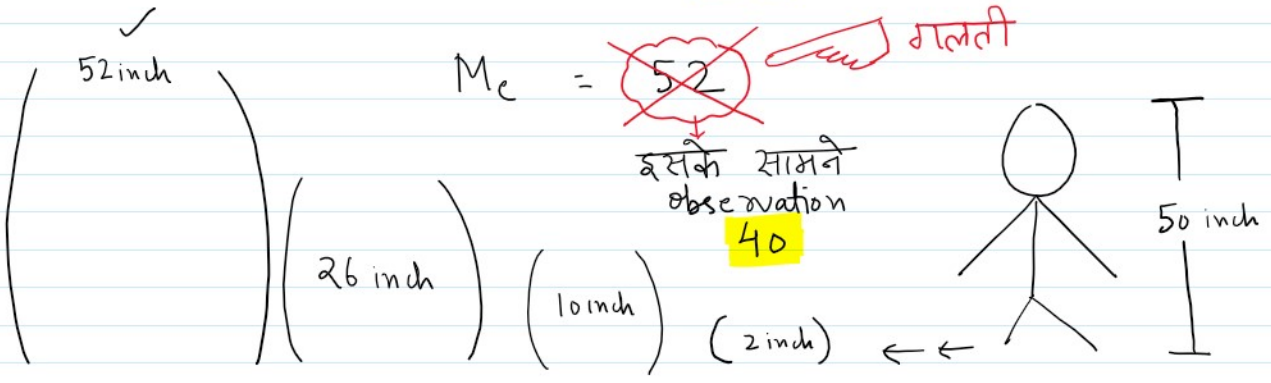
$$= \left(\frac{99+1}{2} \right)^{\text{th}} \text{ item}$$

$$= 50^{\text{th}} \text{ item}$$

N
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(Answer आ गया)

Step ③ Check in which of 50th item lies



eg ②

| Marks | No of students |
|-------|----------------|
| 50 | 20 |
| 70 | 15 |
| 80 | 12 |
| 100 | 15 |
| 110 | 18 |

| Cf |
|----|
| 20 |
| 35 |
| 47 |
| 62 |
| 80 |

find Median

$$M_e = \left(\frac{N+1}{2} \right)^{\text{th}} \text{ item} = \left(\frac{80+1}{2} \right)^{\text{th}} \text{ item}$$

$$= 40.5^{\text{th}} \text{ item}$$

$M_e = 80$

CONTINUOUS SERIES



eg ①

| C. I | f | Cf |
|-------|----|----|
| 0-10 | 2 | 2 |
| 10-20 | 8 | 10 |
| 20-30 | 10 | 20 |
| 30-40 | 7 | 27 |
| 40-50 | 5 | 32 |

find Median

Sol:- Step ① :- Cumulative Frequency

Step ② :- Check $\left(\frac{N}{2}\right)^{\text{th}}$ item = $\left(\frac{32}{2}\right)^{\text{th}}$ item
= 16^{th} item

Step ③ :- Which Cf in which 16^{th} item lies

Median class 20-30

Step ④ :-

$$M_e = L + \frac{\frac{N}{2} - Cf}{f} \times i$$

L = lower limit = 20

Cf = preceding total = 10

f = Median class frequency = 10

i = class length = 10

$$M_e = 20 + \frac{\frac{32}{2} - 10}{10} \times 10$$

$$= 20 + \frac{(16 - 10)}{10} \times 10$$

$$= 20 + 6 = 26$$

* \cap \cup \cap \sqcap *

* MODE *

→ Mode is that value of observation which occurs **most frequently** in a given set of observations and **around** which other items of the set are **most densely** or **heavily concentrated**.

INDIVIDUAL SERIES

eg:- following are the observations :-

2, 11, 3, 9, 7, 3, 18, 3, 2, 21

Find Mode

Sol:- **Mode = 3**

DISCRETE SERIES

eg:-

| Wages (x) | No. of workers (f) |
|-----------|--------------------|
| ₹ 125 | 3 |
| ₹ 175 | 8 |
| ₹ 225 | 21 |
| ₹ 275 | 6 |
| ₹ 325 | 4 |
| ₹ 375 | 2 |

Find Mode

Sol:- **Mode = 225** [Highest frequency is 21]

(ii) Grouping Method

| Wages (x) | No. of workers (f) | ② | ③ | ④ | ⑤ | ⑥ |
|-----------|--------------------|----|----|----|----|----|
| 125 | 3 | 11 | | | | |
| 175 | 8 | 11 | 29 | 32 | | |
| 225 | 21 | 27 | 29 | 32 | 35 | |
| 275 | 6 | 27 | 10 | 12 | 35 | 31 |
| 325 | 4 | 6 | | | | |
| 375 | 2 | 6 | | | | |

| | | | | | |
|------------|--------|---|----|----|----|
| 325 375 | 4 2 | 6 | 10 | 12 | 14 |
|------------|--------|---|----|----|----|

Step ① Column ② i.e. Frequencies grouped in twos

Step ② Column ③ i.e. Frequencies grouped in twos, leaving the first

Step ③ Column ④ i.e. Frequencies grouped in threes

Step ④ Column ⑤ i.e. Frequencies grouped in threes, leaving the first

Step ⑤ Column ⑥ i.e. Frequencies grouped in threes, leaving first two

Analysis Table

| ways Column | 125 | 175 | 225 | 275 | 325 | 375 |
|----------------|-----|-----|-----|-----|-----|-----|
| 1 | | | ✓ | | | |
| 2 | | | ✓ | ✓ | | |
| 3 | | ✓ | ✓ | | | |
| 4 | ✓ | ✓ | ✓ | | | |
| 5 | | ✓ | ✓ | ✓ | | |
| 6 | | | ✓ | ✓ | ✓ | |
| Total | 1 | 3 | 6 | 3 | 1 | 0 |

$$\therefore \text{MODE} = 225$$

CONTINUOUS SERIES

eg :-

| C. I | f | |
|-------|----|-------|
| 10-20 | 12 | f_0 |
| 20-30 | 30 | f_1 |
| 30-40 | 24 | f_2 |
| 40-50 | 20 | |
| 50-60 | 12 | |
| 60-70 | 2 | |

$L = 20$
 $i = 10$

Modal class
20-30

Find Mode.

Sol:-

$$M_0 = L + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i$$

If $2f_1 - f_0 - f_2$ is 0 or negative then

$$M_0 = L + \frac{f_1 - f_0}{|f_1 - f_0| + |f_1 - f_2|} \times i$$

- f_1 = frequency of Modal class
- f_0 = frequency of preceding class
- f_2 = frequency of succeeding class
- L = Lower limit of modal class
- i = class length

$$\begin{aligned} M_0 &= L + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i \\ &= 20 + \frac{30 - 12}{2 \times 30 - 12 - 24} \times 10 \\ &= 20 + \frac{18}{60 - 36} \times 10 \end{aligned}$$

$$= 20 + \frac{180 - 60 \times 15}{24 - 8} \times 10$$

$$= 20 + 7.5 = 27.5$$

(ii) Grouping Method

| C.I | f ₁ | (2) | (3) | (4) | (5) | (6) |
|-------|-------------------|-----|-----|-----|-----|-----|
| 10-20 | 12 | 42 | 54 | 66 | 74 | 86 |
| 20-30 | 30 f ₀ | | | | | |
| 30-40 | 24 f ₁ | 44 | 32 | 34 | 56 | 56 |
| 40-50 | 20 f ₂ | | | | | |
| 50-60 | 12 | 14 | 14 | 14 | 14 | 14 |
| 60-70 | 2 | | | | | |

$L = 30$
 $i = 10$

Analysis table

| C.I Columns | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 |
|----------------|-------|-------|-------|-------|-------|-------|
| 1 | | ✓ | | | | |
| 2 | | | ✓ | ✓ | | |
| 3 | | ✓ | ✓ | | | |
| 4 | ✓ | ✓ | ✓ | | | |
| 5 | | ✓ | ✓ | ✓ | | |
| 6 | | | ✓ | ✓ | ✓ | |
| Total | 1 | 4 | 5 | 3 | 1 | 0 |

∴ MODAL CLASS = 30-40

$$M_0 = L + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i$$

$$= 30 + \frac{24 - 30}{2 \times 24 - 30 - 20} \times 10$$

$$= 30 + \frac{24 - 30}{2 \times 24 - 30 - 20} \times 10$$

Negative

FORMULA INVALID :- (:- (

Now

$$M_0 = L + \frac{|f_1 - f_0|}{|f_1 - f_0| + |f_1 - f_2|} \times i$$

$$= 30 + \frac{|24 - 30|}{|24 - 30| + |24 - 20|} \times 10$$

$$= 30 + \frac{6}{6 + 4} \times 10$$

$$= 30 + \frac{6}{10} \times 10$$

$$= 36$$

x ————— x ————— x ————— x ————— x ————— x