

Class X Mathematics

Chapter-5 : STATISTICS (ପରିସଂଖ୍ୟାନ)

(Textbook Pages: 77–100)

5.1 INTRODUCTION | ପରିଚୟ

English

Statistics is a branch of Mathematics which deals with the **collection, organisation, presentation, analysis and interpretation of numerical data.**

In daily life, we come across data like marks, height, weight, income, rainfall, population, etc. Statistics helps us to understand such large data easily.

ଓଡ଼ିଆ

ପରିସଂଖ୍ୟାନ ହେଉଛି ଗଣିତର ଏକ ଶାଖା, ଯାହା ସଂଖ୍ୟାତ୍ମକ ତଥ୍ୟର ସଂଗ୍ରହ, ବିନ୍ୟାସ, ପ୍ରଦର୍ଶନ, ବିଶ୍ଳେଷଣ ଓ ବ୍ୟାଖ୍ୟା ସହିତ ସଂପୃକ୍ତ ।

ଦୈନନ୍ଦିନ ଜୀବନରେ ଆମେ ପରୀକ୍ଷା ମାର୍କ, ଉଚ୍ଚତା, ଓଜନ, ଆୟ ଇତ୍ୟାଦି ତଥ୍ୟ ସହିତ ସମ୍ବନ୍ଧୀୟ ହୁଅ । ପରିସଂଖ୍ୟାନ ଏହି ବଡ଼ ତଥ୍ୟକୁ ସହଜରେ ବୁଝିବାରେ ସାହାଯ୍ୟ କରେ ।

Types of Data | ତଥ୍ୟର ପ୍ରକାର

English **ଓଡ଼ିଆ**

Numerical Data ସଂଖ୍ୟାତ୍ମକ ତଥ୍ୟ

Primary Data ପ୍ରାଥମିକ ତଥ୍ୟ

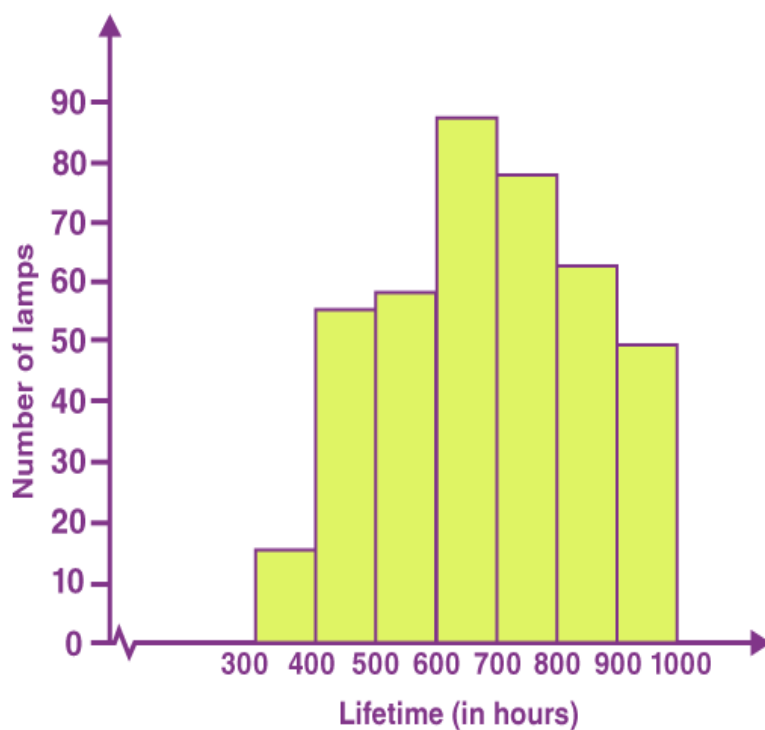
Secondary Data ଦ୍ୱିତୀୟିକ ତଥ୍ୟ

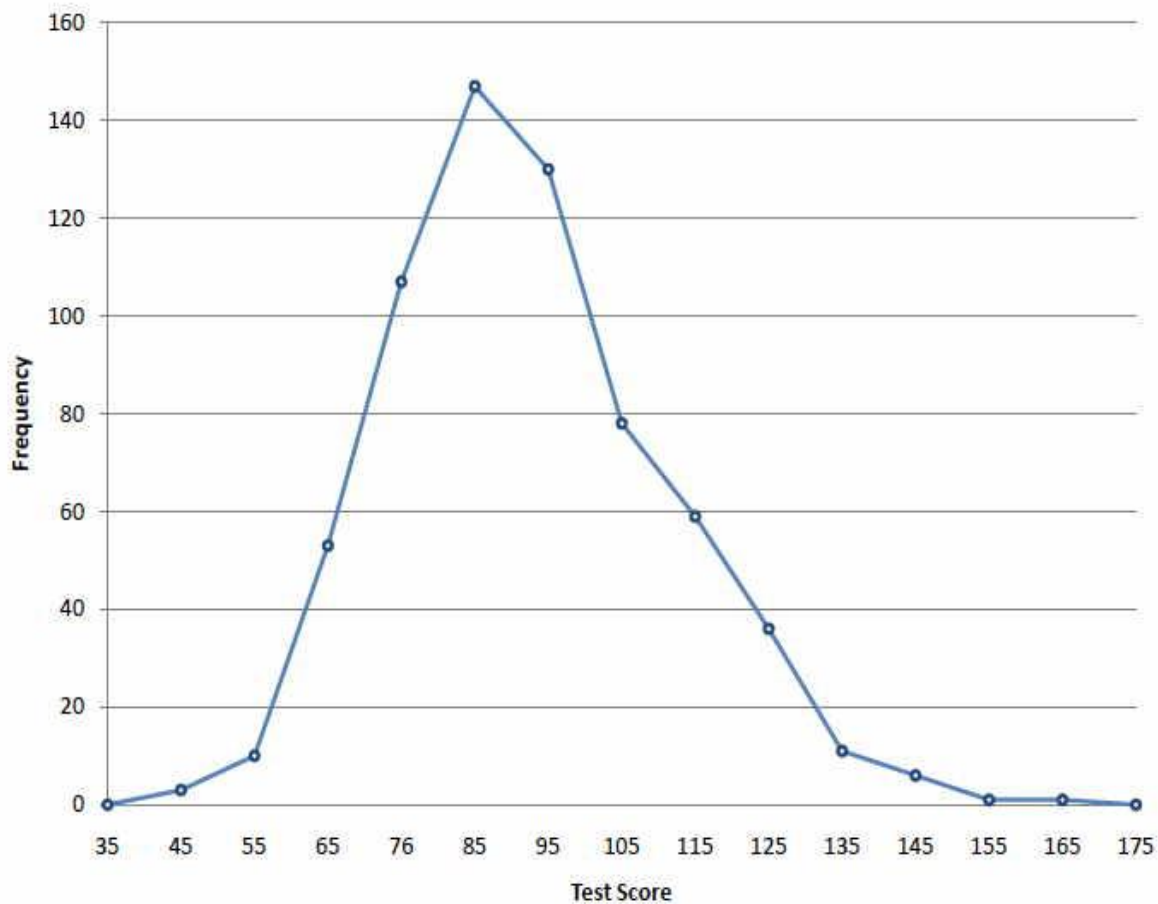
Presentation of Data | ତଥ୍ୟ ପ୍ରଦର୍ଶନ

- Frequency Distribution Table (ବାରମ୍ବାରତା ସାରଣୀ)
- Histogram
- Frequency Polygon
- Pie Chart
- Pictograph

Cumulative Frequency Distribution Table

Class Interval	Tally Marks	Frequency	Cumulative Frequency (cf)
20 - 30		2	2
30 - 40		4	6
40 - 50	/	6	12
50 - 60		2	14
60 - 70	/	6	20
70 - 80		4	24





Objective of the Chapter | ଅଧ୍ୟାୟର ଉଦ୍ଦେଶ୍ୟ

- **English:** To represent a large data set by **one representative value**.
- **ଓଡ଼ିଆ:** ବଡ଼ ପରିମାଣର ତଥ୍ୟକୁ ଗୋଟିଏ ପ୍ରତିନିଧି ସଂଖ୍ୟା ଦ୍ୱାରା ପ୍ରଦର୍ଶନ କରିବା।

5.2 CENTRAL TENDENCY | କେନ୍ଦ୍ରୀୟ ପ୍ରବଣତା

Measures | ମାପ

1. **Mean (ମାନ)**
2. **Median (ମଧ୍ୟକ)**
3. **Mode (ମୋଡ଼)**

5.2.1 MEAN (ମାନ)

Definition | ସଂଜ୍ଞା

- **English:** Mean is the **average** of all observations.
- **ଓଡ଼ିଆ:** ମାନ ହେଉଛି ସମସ୍ତ ତଥ୍ୟର ହାରାହାରି ମୂଲ୍ୟ।

(A) Mean of Individual Series

ବ୍ୟକ୍ତିଗତ ଶ୍ରେଣୀର ମାନ

Formula / ସୂତ୍ର

$$M = \frac{\sum x}{n} \quad M = \frac{\sum x}{n}$$

Example / ଉଦାହରଣ

Marks: 65, 67, 85, 78, 69, 78

$$\sum x = 442, n = 6 \Rightarrow M = 73.67$$

(B) Mean of Discrete Frequency Distribution

ବିଚ୍ଛିନ୍ନ ଶ୍ରେଣୀର ମାନ

$$M = \frac{\sum fx}{\sum f} \quad M = \frac{\sum fx}{\sum f}$$

Example

Mean = 70.5

(C) Shortcut / Deviation Method

ସଂକ୍ଷିପ୍ତ / ବିଚ୍ୟୁତି ପଦ୍ଧତି

$$M = A + \frac{\sum fy}{\sum f} \quad M = A + \frac{\sum fy}{\sum f}$$

Where

- A = Assumed Mean (ଧାରଣା ମାନ)
- $y = x - A$

(D) Step Deviation Method (Board Favourite)

ପଦକ୍ରମ ବିଚ୍ୟୁତି ପଦ୍ଧତି

$$M = A + \frac{\sum fy' \times c}{\sum f} \quad M = A + \frac{\sum fy' \times c}{\sum f}$$

Assumed Mean Method



$$\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$$

- a is assumed mean,
- f_i is frequency of i th class,
- $d_i = x_i - a$ is derivation of i_{th} class,
- $\sum f_i = n$ is total number of observations
- x_i is class mark and is equal to $(\text{upper class limit} + \text{lower class limit})/2$

Properties of Mean | ମାତ୍ରର ଗୁଣଧର୍ମ

- $\sum (x - M) = 0$ \sum (x - M) = 0
- Adding a number increases mean by same number
- Multiplying data multiplies mean

5.2.2 MEDIAN (ମଧ୍ୟକ)

Definition | ସଂଜ୍ଞା

- **English:** Median is the **middle value** of arranged data.
- **ଓଡ଼ିଆ:** ସଜାଯାଇଥିବା ତଥ୍ୟର ମଧ୍ୟ ମୂଲ୍ୟକୁ ମଧ୍ୟକ କୁହାଯାଏ।

(A) Individual Data | ବ୍ୟକ୍ତିଗତ ତଥ୍ୟ

- Odd: $n+1 \div 2$ th term
- Even: Average of two middle terms

(B) Grouped Data | ଗ୍ରୁପ୍ଡ ତଥ୍ୟ

Median = $l + \frac{(n/2 - cf)}{f} \times h$

$$M_m = l + \left(\frac{\frac{n}{2} - cf}{f} \right) h$$

Where

l = lower limit of median class,

n = number of observations,

cf = cumulative frequency of class preceding the median class,

f = frequency of median class,

h = class size (assuming class size to be equal)

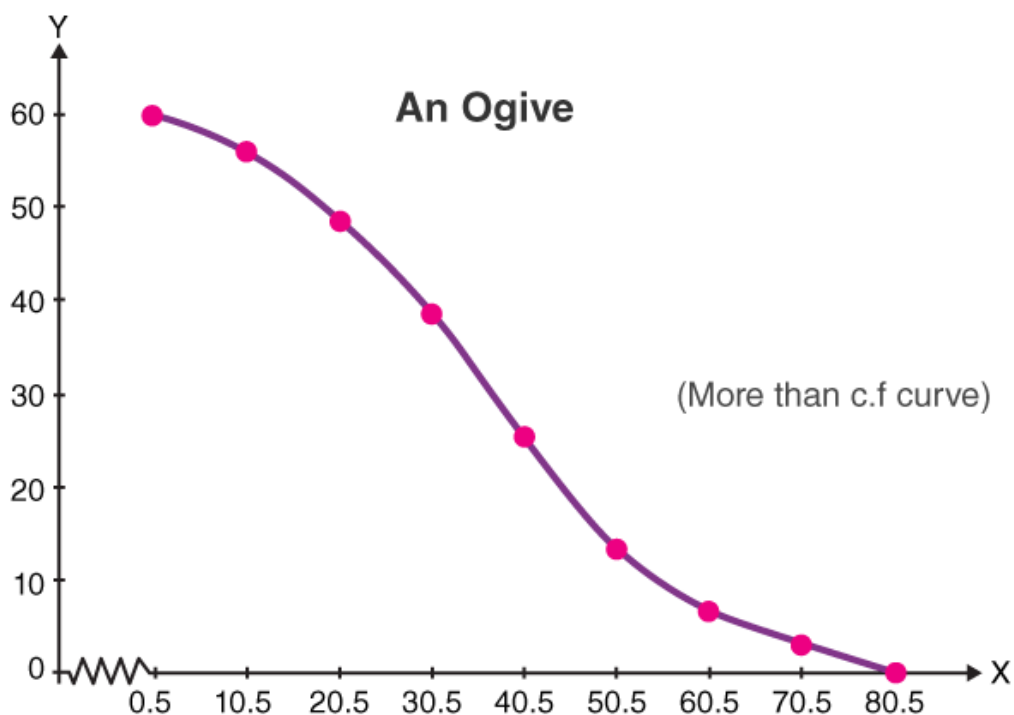
Class-Intervals (X)	Frequency (f)	Cumulative Frequency (c.f.)
0-10	10	10
10-30	30	40 (c.f.)
(l_1) 30-60	60 (f)	100 (Median Class)
30-60	16	116
80-90	4	120
	$N = \sum f = 120$	

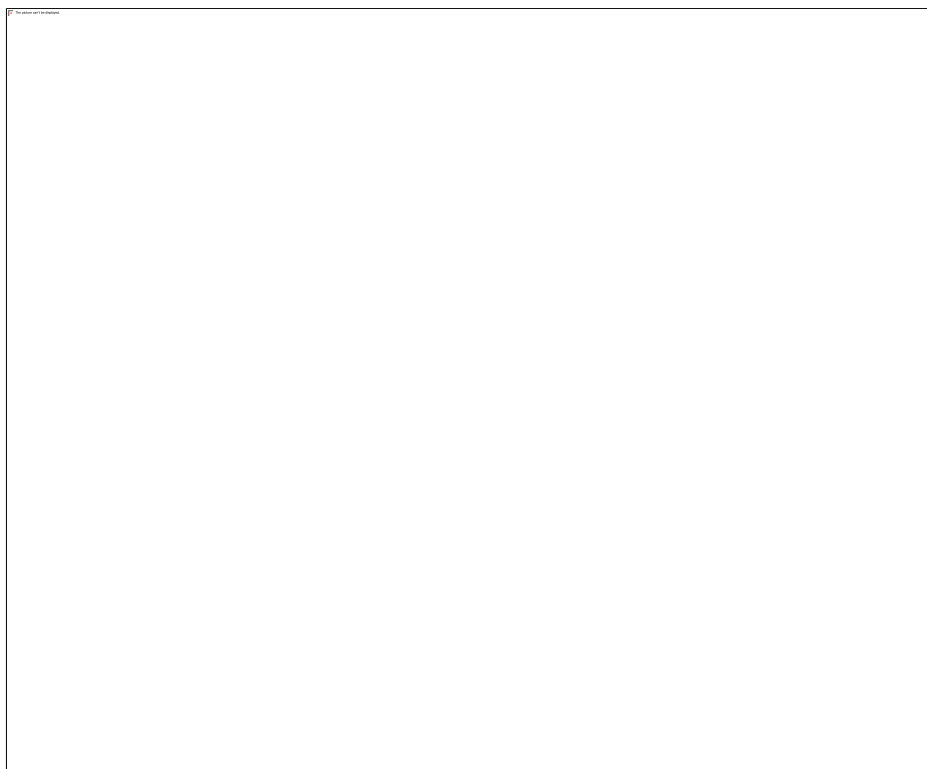
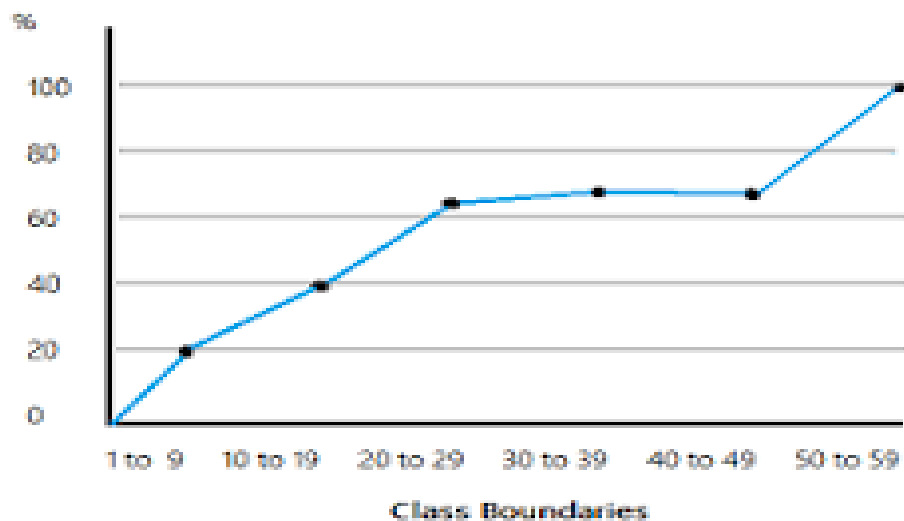
(C) Median by Ogive

ଓଜାଈଭୁ ଦ୍ଵାରା ମଧ୍ୟକ

Steps (English + Odia):

1. Prepare cumulative frequency table
2. Ogive ଚିତ୍ର ଆଙ୍କ
3. $n/2$ ଚିହ୍ନଟ କର
4. X-axis ଉପରେ ମଧ୍ୟକ ପାଓ





5.2.3 MODE (ମୋଡ଼)

Definition | ସଂଜ୍ଞା

- **English:** Mode is the value with **highest frequency**.
- **ଓଡ଼ିଆ:** ସର୍ବାଧିକ ବାର ଆସୁଥିବା ମୂଲ୍ୟକୁ ମୋଡ଼ କୁହାଯାଏ।

Example

Data: 19, 20, 21, 21, 22, 22, 22, 24

Mode = **22**

Empirical Relation | ଅନୁଭୂତିକ ସମ୍ପର୍କ

$$\text{Mode} = 3(\text{Median}) - 2(\text{Mean})$$
$$\text{Mode} = 3(\text{Median}) - 2(\text{Mean})$$

BOARD-PATTERN QUESTIONS & ANSWERS

ପରୀକ୍ଷା ଆଧାରିତ ପ୍ରଶ୍ନୋତ୍ତର

1 Mark

Q: What is Mean?

Ans: Mean is the average of observations.

ଉ: ମାନ ହେଉଛି ହାରାହାରି।

2 Marks

Q: Write median formula for grouped data.

Ans:

$$\text{Median} = l + \frac{(n/2 - cf)}{f} \times i$$
$$\text{Median} = l + \left(\frac{\frac{n}{2} - c}{f} \right) \times i$$

3 Marks

Q: Find mean of 6, 8, 5, 7, 4.

Ans: Mean = 6

5 Marks

Q: Find median of grouped data.

Ans: Median = 25.5

SECTION – A

MCQs (1 Mark Each)

1. The arithmetic mean of 5, 10, 15, 20 is

5, 10, 15, 20 ର ମାନ କେତେ?

(a) 10 (b) **12.5** (c) 15 (d) 20

Ans: (b)

2. Which of the following is a measure of central tendency?

ନିମ୍ନଲିଖିତ ମଧ୍ୟରୁ କେଉଁଟି କେନ୍ଦ୍ରୀୟ ପ୍ରବଣତାର ମାପ?

(a) Range (b) Variance (c) **Mean** (d) Frequency

Ans: (c)

3. If mean = 10, then $\sum(x - \text{mean})$ equals

ଯଦି ମାନ = 10, ତେବେ $\sum(x - \text{ମାନ})$ କେତେ?

(a) 10 (b) -10 (c) **0** (d) 1

Ans: (c)

4. The middle value of arranged data is called

ସଜାଯାଇଥିବା ତଥ୍ୟର ମଧ୍ୟ ମୂଲ୍ୟକୁ କୁହାଯାଏ

(a) Mean (b) Mode (c) **Median** (d) Range

Ans: (c)

5. Mode is the value which

ମୋଡ଼ ହେଉଛି ଯେଉଁ ମୂଲ୍ୟ

(a) Comes first

(b) Comes last

(c) **Has highest frequency**

(d) Is average

Ans: (c)

6. The empirical relation is

ଅନୁଭୂତିକ ସମ୍ପର୍କ ହେଉଛି

(a) Mean = Median

(b) Mode = Mean + Median

(c) **Mode = 3Median – 2Mean**

(d) Median = Mean – Mode

Ans: (c)

7. If 3 is added to each observation, mean will

ପ୍ରତ୍ୟେକ ମୂଲ୍ୟରେ 3 ଯୋଗ କଲେ, ମାନ

(a) Increase by 3 (b) Decrease by 3 (c) Same (d) Zero

Ans: (a)

8. Median of 7 observations lies at

7ଟି ମୂଲ୍ୟର ମଧ୍ୟକ ରହିଥାଏ

(a) 3rd (b) 4th (c) 5th (d) 7th

Ans: (b)

SECTION – B

VSA (Very Short Answer) – 1 Mark

1. Define Statistics.

Statistics is the study of collection, organisation, analysis and interpretation of numerical data.

ପରିସଂଖ୍ୟାନ: ସଂଖ୍ୟା

ମୂଳ ତଥ୍ୟର ସଂଗ୍ରହ, ବିନ୍ୟାସ, ବିଶ୍ଳେଷଣ ଓ ବ୍ୟାଖ୍ୟା।

2. Write the formula of Mean.

$$\text{Mean} = \frac{\sum x}{n}$$

3. What is Median?

Median is the middle value of arranged data.

ମଧ୍ୟକ: ସଜାଯାଇଥିବା ତଥ୍ୟର ମଧ୍ୟ ମୂଲ୍ୟ।

4. What is Mode?

Mode is the value with highest frequency.

ମୋଡ଼: ସର୍ବାଧିକ ବାର ଆସୁଥିବା ମୂଲ୍ୟ।

5. Name one graphical representation of data.

Histogram / Pie chart / Ogive

ଚିତ୍ରାତ୍ମକ ପ୍ରଦର୍ଶନ: ହିଷ୍ଟୋଗ୍ରାମ / ପାଇ ଚାର୍ଟ / ଓଜାଇଭ୍

SECTION – C

SA (Short Answer) – 2–3 Marks

1. Find the mean of 6, 8, 5, 7, 4.

$\sum x = 30, n = 5 \Rightarrow \text{Mean} = 6$ $\sum x = 30, n = 5 \Rightarrow \text{Mean} = 6$

ଉତ୍ତର: 6

2. Write the median formula for grouped data.

$\text{Median} = l + \frac{(n/2 - cf)}{f} \times i$

ଓଡ଼ିଆ: l = ନିମ୍ନ ଶ୍ରେଣୀର ନିମ୍ନ ସୀମା, cf = ପୂର୍ବ ସଂଚୟିତ ବାରମ୍ବାରତା, f = ନିମ୍ନ ଶ୍ରେଣୀର ବାରମ୍ବାରତା, i = ଶ୍ରେଣୀ ପ୍ରସ୍ଥ।

3. Find the median of: 4, 7, 9, 10, 12

Median = 9

ଉତ୍ତର: 9

4. State any two properties of Mean.

- $\sum (x - \text{Mean}) = 0$
- Adding a constant increases mean by the same constant.

ଓଡ଼ିଆ: ମାନର ଦୁଇଟି ଗୁଣଧର୍ମ ଲେଖ।

5. Distinguish between Mean and Mode (any two).

Mean (ମାନ)	Mode (ମୋଡ଼)
Average	Most frequent
Affected by extremes	Not affected

SECTION – D

LA (Long Answer) – 5 Marks

1. Find the Mean using Step Deviation Method.

Class Frequency

0–10 5
10–20 7
20–30 10
30–40 8
40–50 5

Answer: Mean = 25.5

ଓଡ଼ିଆ: ପଦକ୍ରମ ବିଚ୍ୟୁତି ପଦ୍ଧତି ଦ୍ୱାରା ମାନ = 25.5

2. Find the Median of the following distribution.

Class Frequency

0–10 5
10–20 7

Class Frequency

20–30 10

30–40 8

40–50 5

Answer: Median = **25.5****ଓଡ଼ିଆ:** ମଧ୍ୟକ = **25.5****3. Draw an Ogive and find the Median.****Class Frequency**

0–10 7

10–20 12

20–30 18

30–40 22

40–50 24

Answer: Median $\approx$ **32****ଓଡ଼ିଆ:** ଓଜାଇଭ୍ ଚିତ୍ର ଆଙ୍କି ମଧ୍ୟକ $\approx$ **32****4. Find the Mode using empirical relation if Mean = 20 and Median = 22.**

$$\text{Mode} = 3(22) - 2(20) = 26$$

Answer: **26****ଓଡ଼ିଆ:** ମୋଡ୍ = **26****5. The mean of 10 observations is 15. If each observation is multiplied by 2, find the new mean.**New Mean = **30****ଓଡ଼ିଆ:** ନୂତନ ମାନ = **30****JAI HIND! - BINAYA**