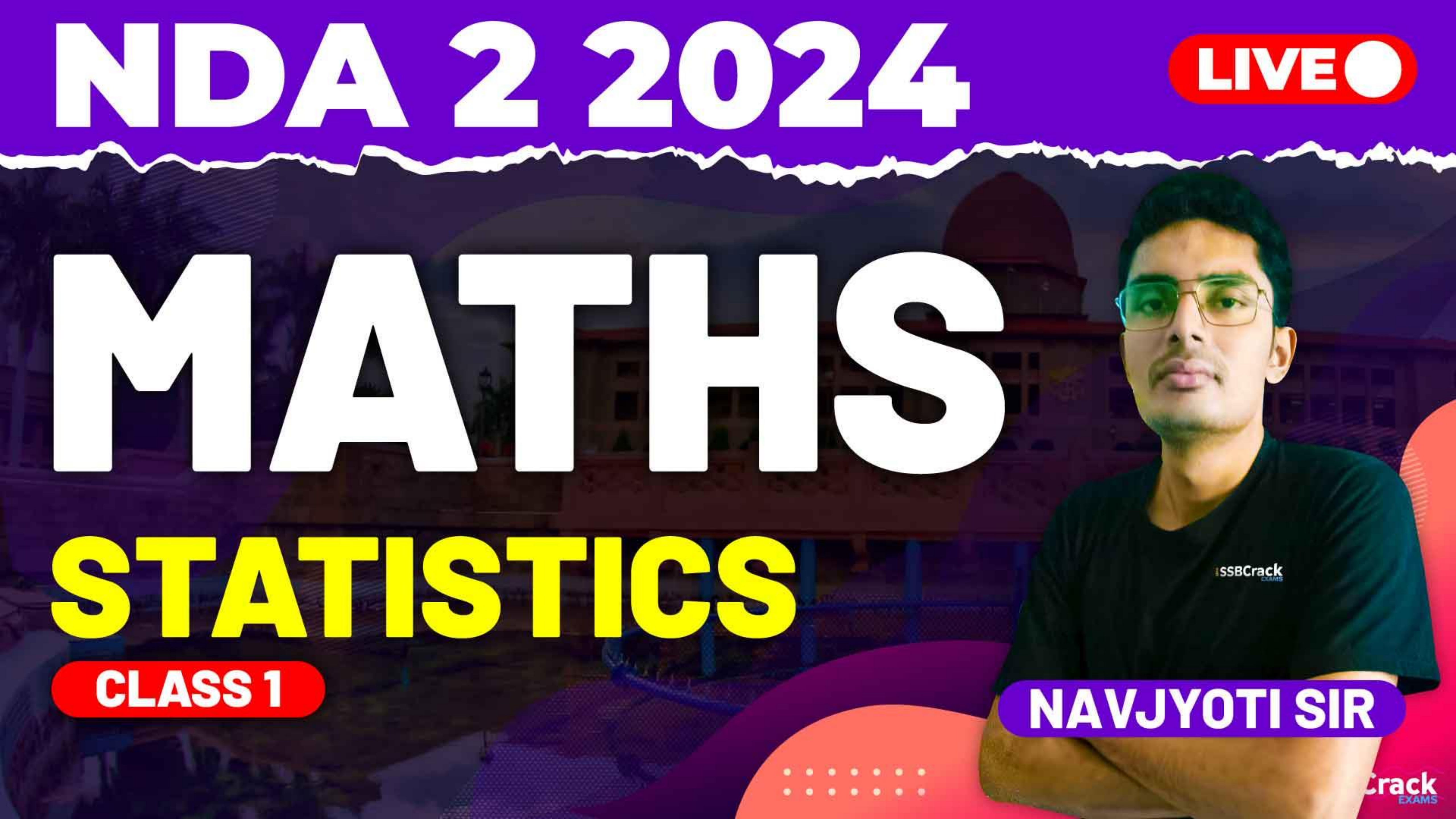

NDA 2 2024
LIVE
MATHS
STATISTICS
CLASS 1
NAVJYOTI SIR

08 July 2024 Live Classes Schedule

8:00AM	08 JULY 2024 DAILY CURRENT AFFAIRS	RUBY MA'AM
9:00AM	08 JULY 2024 DAILY DEFENCE UPDATES	DIVYANSHU SIR

SSB INTERVIEW LIVE CLASSES

9:00AM	OVERVIEW OF SRT & SDT	ANURADHA MA'AM

NDA 2 2024 LIVE CLASSES

1:00PM	GS - PHYSICS - CLASS 7	NAVJYOTI SIR
4:00PM	MATHS - STATISTICS - CLASS 1	NAVJYOTI SIR

CDS 2 2024 LIVE CLASSES

1:00PM	GS - PHYSICS - CLASS 7	NAVJYOTI SIR

STATISTICS

Definition: Statistics – science of collecting, analyzing, and interpreting data in such a way that the conclusions can be objectively evaluated.

3 Phases:

1. Collecting data
2. Analyzing data
3. Interpreting data

CLASSIFICATION OF DATA

Primary

(finding data yourself)

Secondary

(Using resource)

REPRESENTATION OF DATA

(Age of people in locality)

23, 14, 16, 12, 11, 9 (Raw - data)

Age	No. of people of that age
9	8
10	12
12	4
15	10
16	4
18	9

(frequency)

Discrete Data (fix values)

CLASSES	frequency
0 – 5	15
5 – 10	16
10 – 15	18
15 – 20	20
20 – 25	30

Continuous data

(Intervals)/(Range)

(CLASSES)

(size

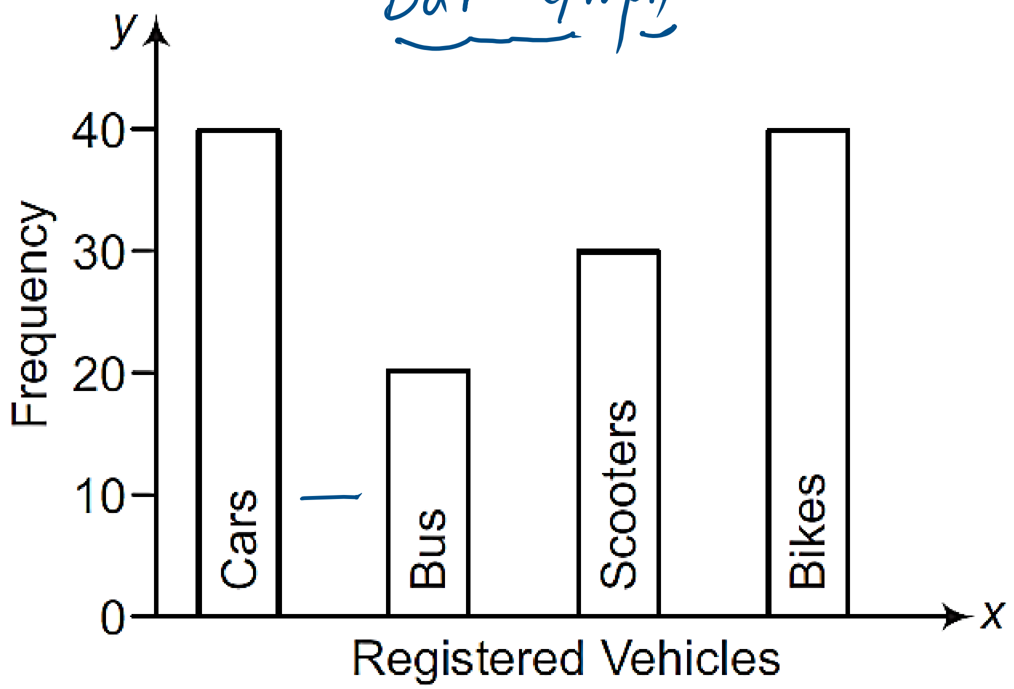
BAR DIAGRAM

In bar diagrams, only the length of the bars are taken into consideration. The width of each bar can be any, but widths of all the bars is same and space between these bars should be same. The width of the bar has no special meaning.

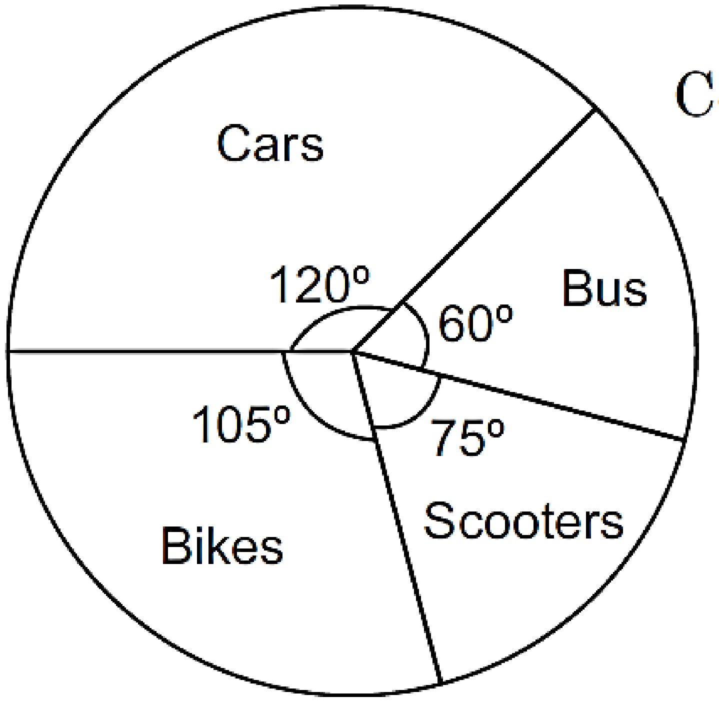
e.g., The bar diagram of the following data is

Registration of vehicles in 2011	Car	Bus	Scooters	Bikes
No. of vehicles	40	20	25	35

Bar Graph



PIE DIAGRAM

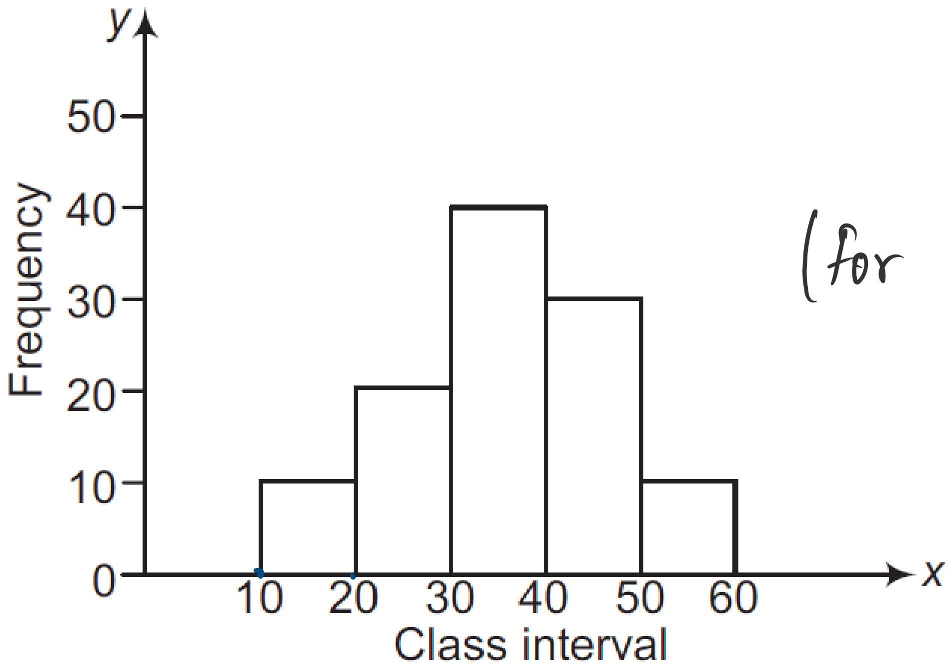


$$\text{Central angle} = \left[\frac{\text{frequency} \times 360°}{\text{total frequency}}\right]$$

(part of whole)

Pie-chart

HISTOGRAM



(for continous data) — with classes,

(

10 - 20 —— 10

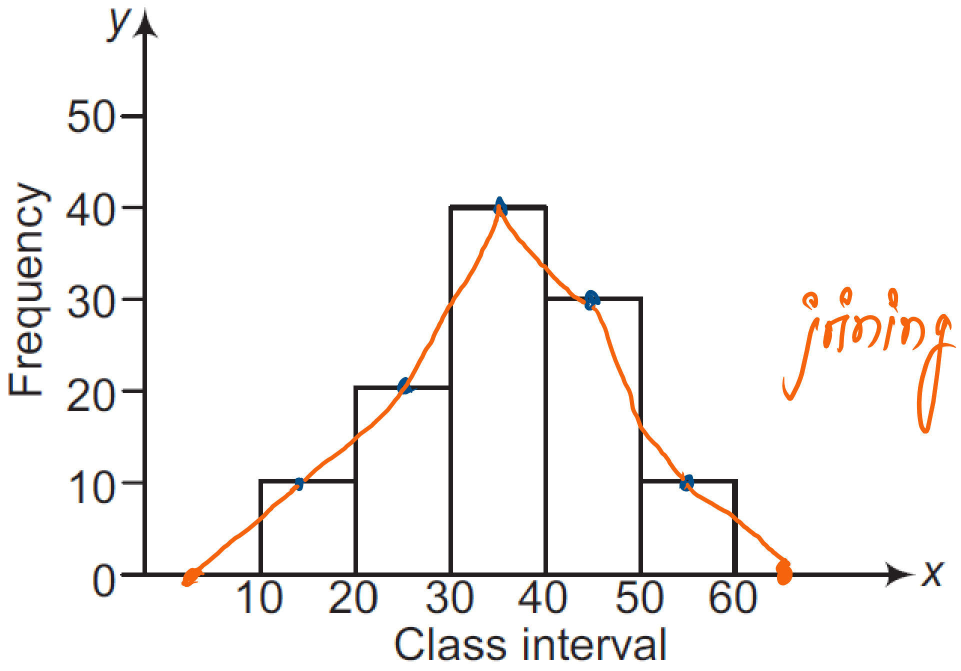
20 - 30 —— 20

30 - 40 —— 40

40 - 50 —— 30

50 - 60 —— 10

FREQUENCY POLYGON



joining mid-points of rectangles.

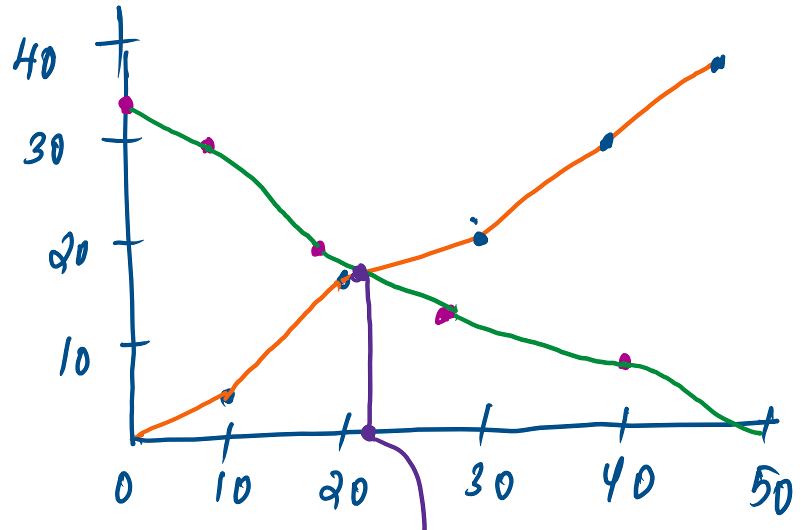
OGIVE – CUMULATIVE FREQUENCY CURVE

Less than — More than

class	freq.	cum freq. (Less than)	Cum. freq. (More than)
0 – 10	2	2	32 (30+2)
10 – 20	12	14 (2+12)	30 (18+12)
20 – 30	3	17 (14+3)	18 (15+3)
30 – 40	8	25 (17+8)	15 (7+8)
40 – 50	7	32 (25+7)	7

(10, 2)

(40, 7)



(Median)

Less than 10 — 2 (10, 2)

" " 20 — 2+12 = 14 (20, 14)

" " 30 — 17

" " 40 — 25

" " 50 — 32

More than 40 — 7 (40, 7)

" " 30 — 7+8 = 15 (30, 15)

" " 20 — 18 (20, 18)

" " 10 — 30

" " 0 — 32

MEASURES OF CENTRAL TENDENCY

Generally average value of a distribution in the middle part of the distribution such type of values are known as measures of central tendency.

An average of a distribution is the value of the variable which is representative of the entire distribution.

The following are the five measures of central tendency.

1. Arithmetic Mean
2. Geometric Mean
3. Harmonic Mean
4. Median
5. Mode

SSBCrack EXAMS

ARITHMETIC MEAN

Let $x_1, x_2, \ldots, x_n$ are n observations, corresponding frequencies are $f_1, f_2, \ldots, f_n$, then

$$\bar{x} = \frac{x_1 f_1 + x_2 f_2 + \ldots + x_n f_n}{\underbrace{f_1 + f_2 + \ldots + f_n}} = \frac{\sum_{i=1}^{n} f_i x_i}{\sum_{i=1}^{n} f_i}$$

(discrete)

or

$$\bar{x} = A + \frac{\sum_{i=1}^{n} f_i d_i}{\sum_{i=1}^{n} f_i}$$

where, A = assumed mean and $d_i = x_i - A$

class	class mark
0 – 10	5
10 – 20	15
20 – 30	25

discrete data

EXAMPLE

The mean for following distribution is

(a) 22.33 (b) 23.24 (c) 24.56 (d) 25.56

$\frac{\text{lower limit} + \text{upper limit}}{2}$

Class Interval	Frequency (f_i)	class mark (x_i)	$d_i = x_i - A$	$u_i = d_i/10$	$u_i f_i$
0–10	22	5	−20	−2	−44
10–20	38	15	−10	−1	−38
20–30	46	25	0	0	0
30–40	35	35	10	1	35
40–50	20	45	20	2	40

Assumed Mean

Mean,

$$\bar{x} = \sum u_i f_i$$

EXAMPLE

The mean for following distribution is

(a) 22.33 (b) 23.24 (c) 24.56 (d) 25.56

Class Interval	Frequency
0–10	22
10–20	38
20–30	46
30–40	35
40–50	20

Ans: (c)

SSBCrack EXAMS

COMBINED MEAN

If two sets of observations are given, then combined mean for the two sets can be calculated with the help of following formula

$$\bar{x}_{12} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2}$$

where, $\bar{x}_{12}$ = combined mean of two sets of observations

$\bar{x}_1$ = mean of first set of observations

n_1 = number of observations in first set

$\bar{x}_2$ = mean of second set of observations

n_2 = number of observations in second set

EXAMPLE

Arithmetic mean of 9 observations is 100 and arithmetic mean of 6 observations is 80, then the arithmetic mean of 5 observations is

(a) 90 (b) 91

(c) 92 (d) 93

$$\frac{9\times 100 + 6\times 80}{9+6} = \frac{900+480}{15} = \frac{1380}{15} = \underline{92} \text{ (for } \underline{15 \text{ obs.}})$$

for 5 observations,

$$\frac{\text{Total}}{\text{no.}} = \frac{5\times 92}{5} = 92$$

Mean

change in observations, $(+, -, \times, \div)$ $\xrightarrow[\text{in}]{\text{results}}$ same change in mean,

Mean is not independent of scale and origin

→ change in origin ⟶ change in mean,

$x + d \longrightarrow \underbrace{\bar{x} + d}$ (each observation is added with a number)

→ change in scale ⟶

$dx \longrightarrow \underbrace{d\bar{x}}$ (each observation is multiplied with a no.)

EXAMPLE

Arithmetic mean of 9 observations is 100 and arithmetic mean of 6 observations is 80, then the arithmetic mean of 5 observations is

(a) 90 (b) 91

(c) 92 (d) 93

Ans: (c)

MEDIAN (Mid-value)

arrange in ascending order

Median of a discrete series First, arrange the value of given observations (or variables) in ascending order, then find the cumulative frequency.

(a) If n is an odd number, then Median = value of $\left(\frac{n+1}{2}\right)$th term

(b) If n is an even number, then

Median

$$= \frac{\text{value of } \left(\frac{n}{2}\right)\text{th term} + \text{value of } \left(\frac{n}{2}+1\right)\text{th term}}{2}$$

SSBCrack EXAMS

MEDIAN

Median of a continuous series First find the cumulative frequency table of given observations, then find the group (median group) of $\frac{n}{2}$th observation. Then,

n = sum of frequencies of all classes,

$$\therefore \quad \text{Median} = l + \frac{\left(\frac{n}{2} - c\right)}{f} \times h$$

where, l = lower limit of median group/ median class

f = frequency of median group

h = size of median group

c = cumulative frequency of a group before to median group

EXAMPLE

The median for the following distribution is

Class Interval	Frequency	cf
0–10	22	22
10–20	38	22+38 = 60
20–30	46	22+38+46 = 106
30–40	35	22+38+46+35 = 141
40–50	20	22+38+46+35+20 = 161

(a) 20 (b) 22.46 (c) 24.46 (d) 25

$\Sigma f = n = 161$

$\frac{n}{2} = \frac{161}{2} = 80.5$

median class = 20-30

$= l + \frac{\left(\frac{n}{2} - cf\right)}{f} \times h = 20 + \frac{(80.5 - 60)}{46} \times 10$

EXAMPLE

The median for the following distribution is

Class Interval	Frequency
0–10	22
10–20	38
20–30	46
30–40	35
40–50	20

(a) 20 (b) 22.46 (c) 24.46 (d) 25

Ans: (c)

MODE (maximum occurence)

Mode of a discrete series The mode of a discrete series is that value of variable for which the frequency is maximum.

Mode of a continuous series First find the modal group, which has maximum frequency, then

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$$

where, l = lower limit of modal group

h = size of modal group

f_1 = frequency of modal group

f_0 = frequency of a group before to modal group

f_2 = frequency of a group next to modal group

EXAMPLE

The mode of the following distribution is

Class Interval	Frequency
0–20	17
20–40	28 f_0
40–60	32 f_1
60–80	24 f_2
80–100	19

(a) 40 (b) 42.67 (c) 46.67 (d) 7

modal group = 40 – 60

(l)

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$= 40 + \left(\frac{32 - 28}{64 - 28 - 24}\right) \times 20$$

EXAMPLE

The mode of the following distribution is

Class Interval	Frequency
0–20	17
20–40	28
40–60	32
60–80	24
80–100	19

(a) 40 (b) 42.67 (c) 46.67 (d) 7

Ans: (c)

$$\boxed{\text{Mode} = 3\,\text{Median} - 2\,\text{Mean}}$$ (approximate value)

MEASURES OF DISPERSION

- RANGE
- MEAN DEVIATION
- VARIANCE & STANDARD DEVIATION

RANGE

The range is the difference of maximum and minimum observation of observations of a distribution. If L and S are maximum and minimum observation of distribution then,

$$\text{Range} = L - S$$

and $$\text{Coefficient of range} = \frac{L - S}{L + S}$$

MEAN DEVIATION

Mean

Median

For frequency distribution mean deviation from the average A (usually mean, median ~~or modes~~) is given by

$$\text{MD} = \frac{\sum_{i=1}^{n} f_i \, |x_i - A|}{\sum_{i=1}^{n} f_i}$$

mean, median

VARIANCE AND STANDARD DEVIATION

Variance $(\sigma^2) = \frac{\Sigma f x^2}{n} - \left(\frac{\Sigma f x}{n}\right)^2$ } $n = \Sigma f$ = sum of frequencies,

Standard deviation $(\sigma) = \sqrt{\text{Variance}}$

Variance — origin — independent

Variance — scale — $\text{Var.} = d^2(\text{Var(original)})$

(d x obs.)

SSBCrack EXAMS

EXAMPLE

The variance of the following distribution is

x_i	2	3	11
f_i	1/3	1/2	1/6

(a) 10 (b) 16 (c) 22 (d) 32

x_i	f_i	x_i^2	$f_i x_i$	$f_i x_i^2$
2	1/3	4		
3	1/2	9		
11	1/6	121		
	$\Sigma f_i = 1$		$\Sigma f_i x_i$	$\Sigma f_i x_i^2$

$$Var = \frac{\Sigma f_i x_i^2}{\Sigma f_i} - \left(\frac{\Sigma f_i x_i}{\Sigma f_i}\right)^2$$

$=$

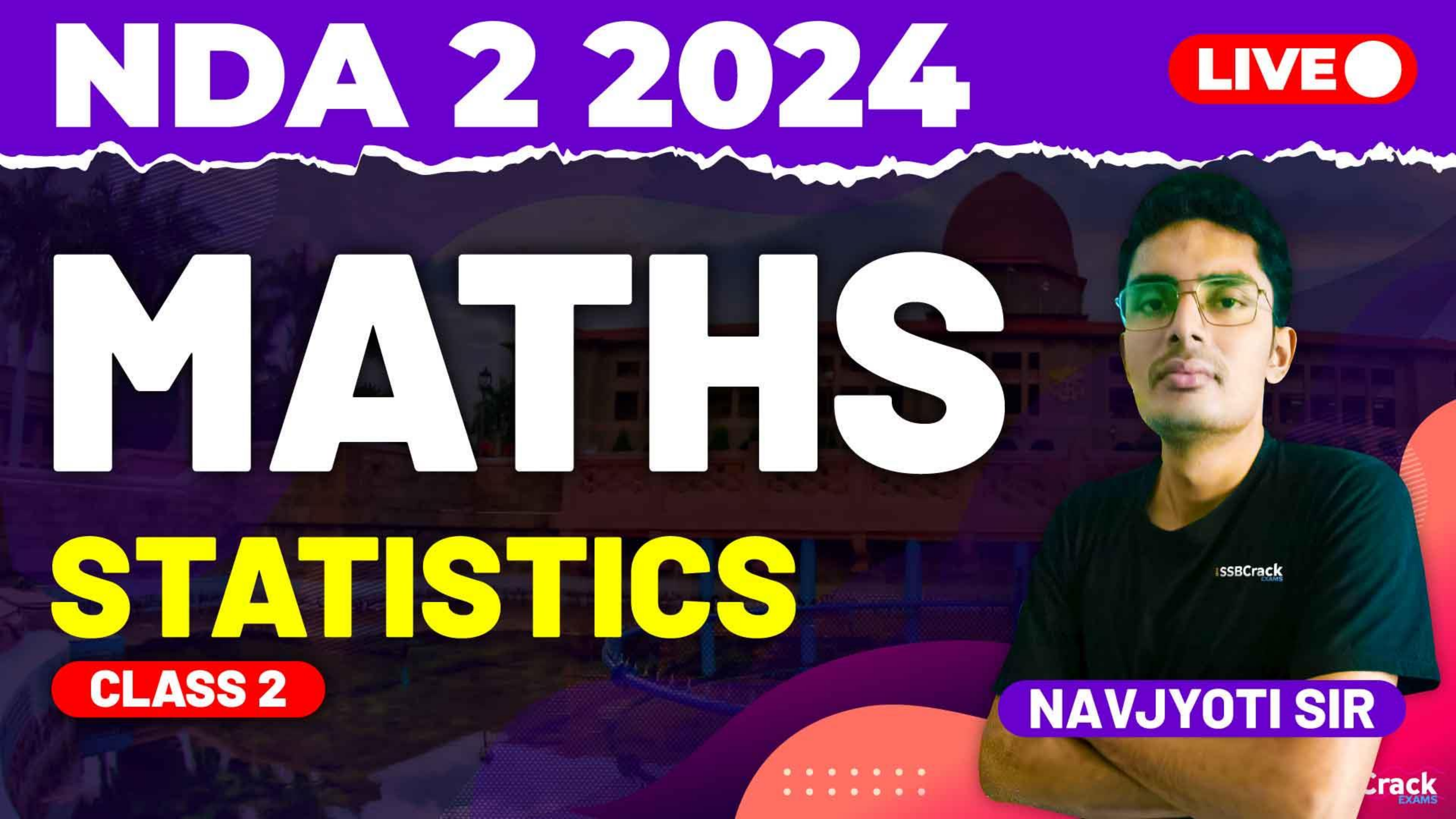
EXAMPLE

The variance of the following distribution is

x_i	2	3	11
f_i	1/3	1/2	1/6

(a) 10 (b) 16 (c) 22 (d) 32

Ans: (a)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