-8-19

Module I

Statistical application to textiles.

→ Collection of Data.
→ Presentation of Data.
→ Analysis of Data.
→ Interpretation of Data.

Representation of Data
(Summerizing Data)

1) Following table presents the count of yarns spun in a mill A. Represent the data in frequency distribution table and draw various frequency distribution diagrams.

39.2, 39.9, 40.2, 40.7, 38.6, 39.7, 38.2, 37.8, 40.8, 42.0, 37.6, 39.9, 38.6, 40.2, 39.7, 41.1, 40.9, 38.9, 41.7, 38.2, 39.8, 40.8, 40.6, 41.8, 39.9, 40.0, 41.3, 41, 40.6, 38.8, 39.6, 40.5, 41.0, 38.7, 39.6, 39.5, 41.4, 39.2, 39.3, 40.8, 39.9, 42.5, 40.6, 39.7, 39.6, 40.0, 41.2, 39.7, 40.4, 40.8, 37.6, 40.8, 41.2, 41.5, 38.2, 41.4, 37.5, 40.9, 40.3, 39.0.

Formula:

No: of class Interval (C.I) = $\frac{0.45 \times \text{No: of observations}}{4}$

or

$= 1 + 3.3 (\log_{10} n)$.

$\frac{\text{diff}}{2}$, x — x − CM value, x + CM value

Relative frequency = $\frac{x}{60} \times 100$ (60 ↓ No: of CI)

No: of CI $= \frac{0.45 \times 60}{4} = 6.75 \approx 7$

Class width $= \frac{\text{Range}}{\text{No: of CI.}} = \frac{42.5 - 37.5}{7}$

$= \frac{5}{7} = 0.71 \approx 1$

Class Interval (CI)	Class Mark (Mid point)	Tally mark	Frequency f
37 - 38	37.5	IIII	4
38 - 39	38.5	~~IIII~~ III	8
✓ 39 - 40	39.5	~~IIII IIII~~ ~~IIII~~ I	16
40 - 41	40.5	~~IIII IIII~~ ~~IIII~~ III	18
41 - 42	41.5	~~IIII~~ ~~IIII~~ II	12
42 - 43	42.5	II	2
			$\Sigma f = 60$

Cummulative frequency (cf) < then	cf > then	Relative frequency (% f)	fx
4	60	6.66	150
12	56	13.33	308
28	48	26.66	632
46	32	30.00	729
58	14	20.00	498
60	2	3.3	85
			$\Sigma fx = 2402$

$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{2402}{60} = 40.03$

Median $= 39 + \left(\frac{60/2 - 12}{16}\right)(40 - 39)$

$= 40.125$

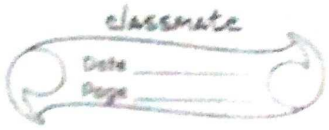
Mode $= 39 + \left(\frac{16 - 8}{2(16) - 8 - 18}\right)$

$39 + 1.33$

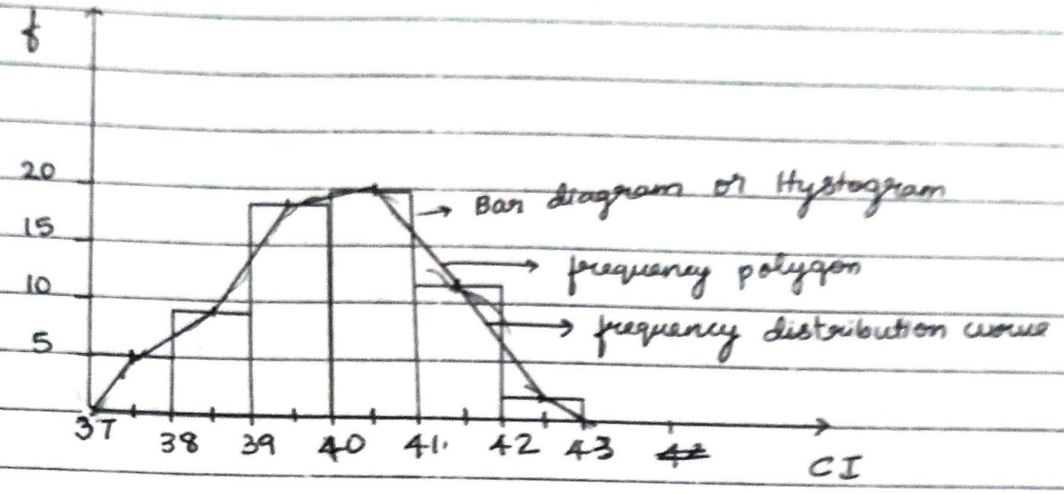
$= 40.33$

If we curve

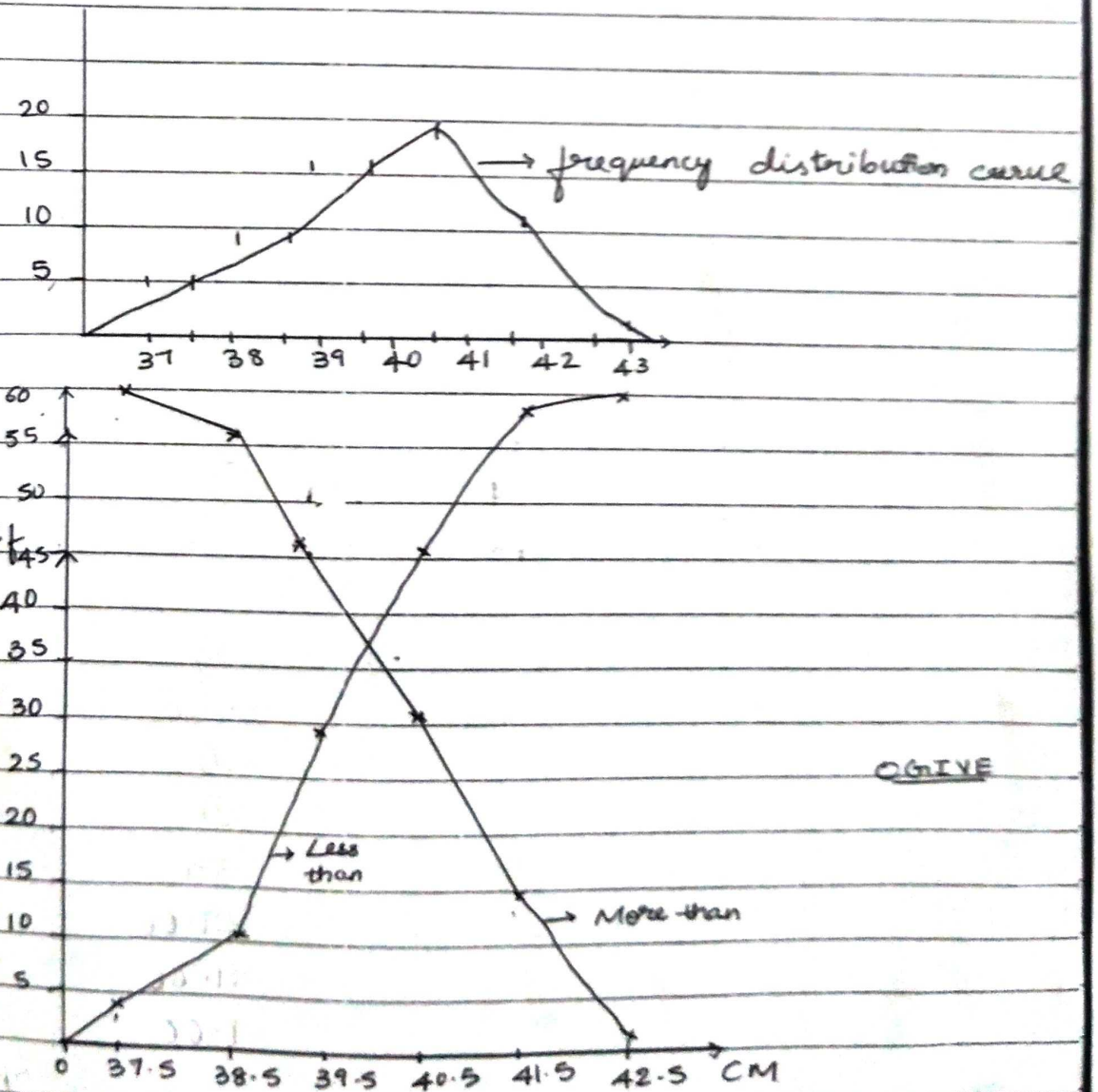
Then it is called ogive.



Pictorial representation of Data



OR



2) Mill B.

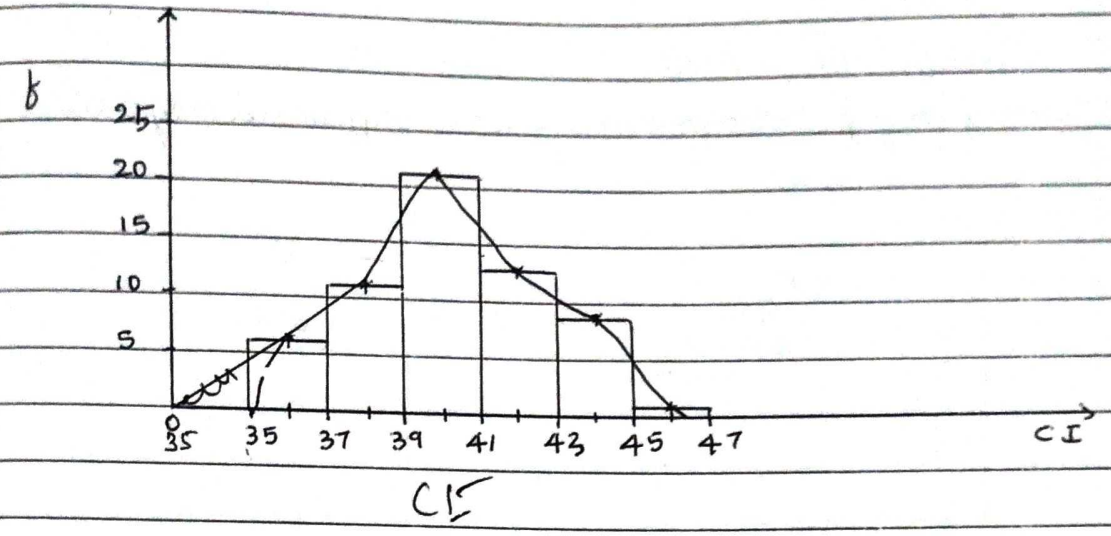
40.0, 41.0, 40.5, 39.6, 40.1, 38.7, 40.4, 44.5, 37.7, 39.8, 38.0, 39.9, 46.2, 44.1, 39.5, 38.7, 39.8, 41.2, 40.5, 40.8, 40.6, 38.7, 38.9, 39.6, 39.7, 40.0, 41.0, 41.4, 38.7, 38.9, 39.7, 42.0, 40.6, 35.0, 37.5, 37.4, 43.5, 36.4, 41.8, 43.2, 39.7, 41.4, 43.2, 37.1, 42.8, 40.2, 41.4, 43.1, 35.8, 42.9, 42.2, 39.6, 35.9, 36.7, 42.0, 39.2, 38.9, 43.9, 36.8, 42.3.

No: of CI = $\frac{0.45 \times 60}{4}$ = 6.75 ≈ 7

Class width = $\frac{46.2 - 35}{7}$ = $\frac{11.2}{7}$ = 1.6 ≈ 2

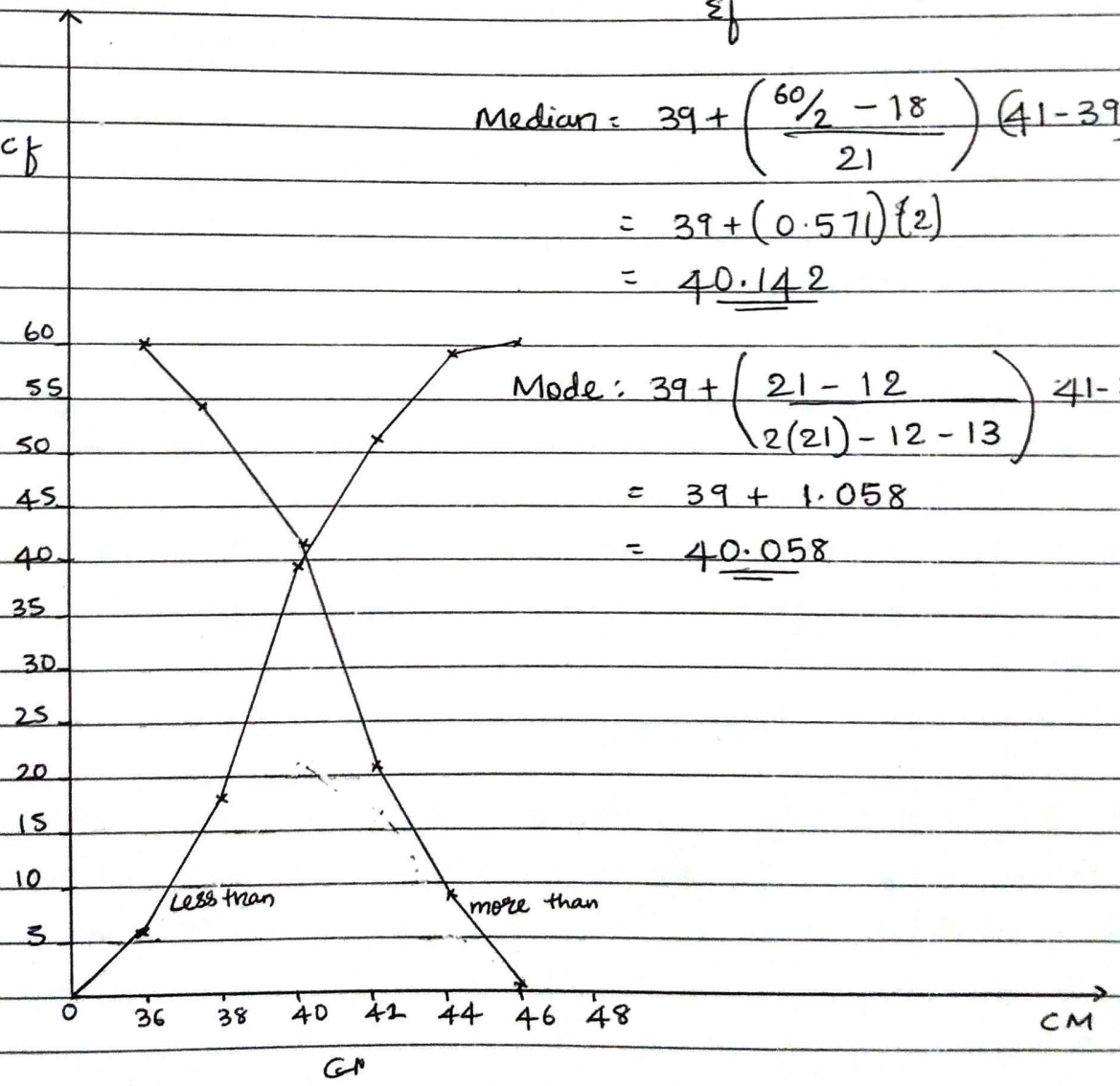
CI	CM	Tally mark	Frequency
35 - 37	36	𝍸 I	6
37 - 39	38	𝍸 𝍸 II	12
39 - 41	40	𝍸 𝍸 𝍸 𝍸 I	21
41 - 43	42	𝍸 𝍸 III	13
43 - 45	44	𝍸 II	7
45 - 47	46	I	1
			Sf = 60

cf < then	cf > then	Rf (% f)	fx
6	60	10	216
18	54	20	456
39	42	35	840
52	21	21.66	546
59	8	11.66	308
60	1	1.66	46
			Sfx = 2412



CI

$$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{2412}{60} = 40.2$$



CM

$$\text{Median} = 39 + \left(\frac{60/2 - 18}{21}\right)(41-39)$$

$$= 39 + (0.571)(2)$$

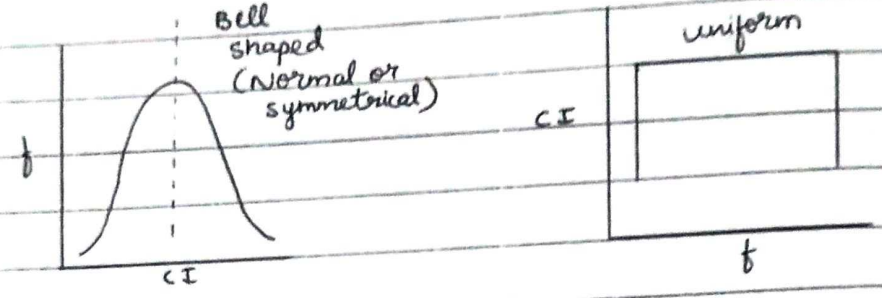
$$= 40.142$$

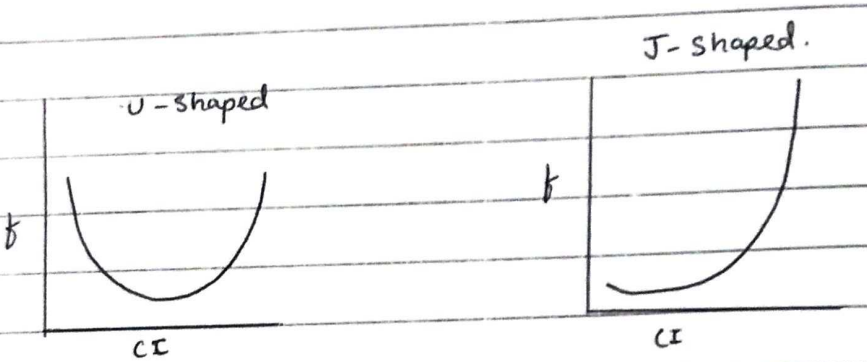
$$\text{Mode} = 39 + \left(\frac{21 - 12}{2(21) - 12 - 13}\right) 41-39$$

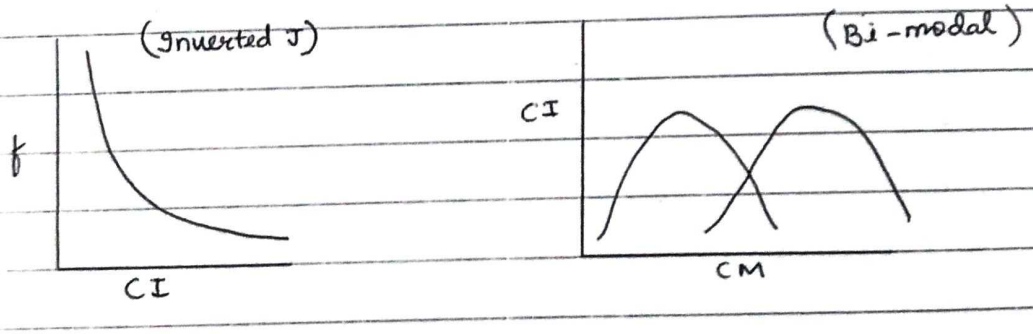
$$= 39 + 1.058$$

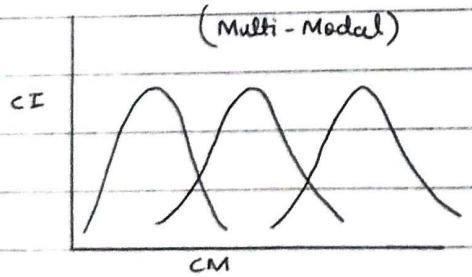
$$= 40.058$$

Shapes of FDC
(Frequency distribution curve / probability distribution curve)



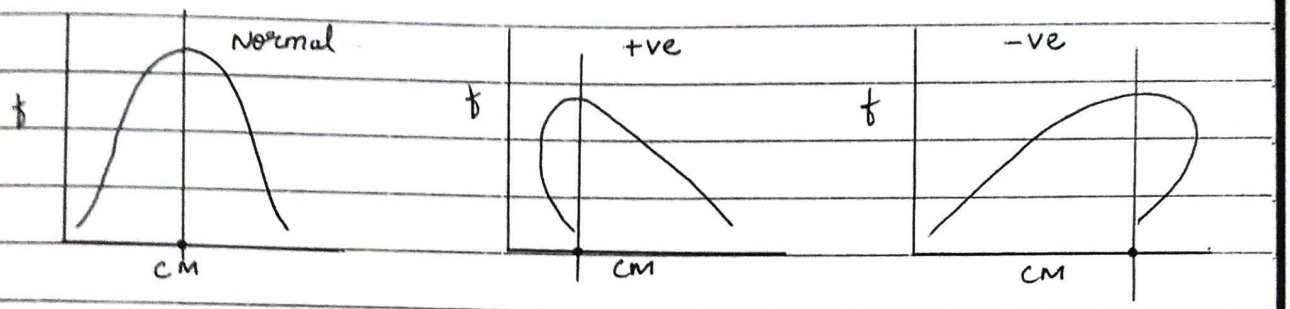




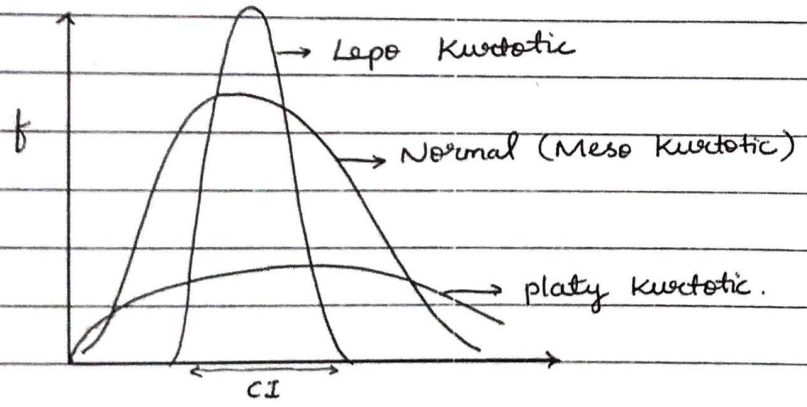


Skewness (Deviation)

Deviation of graph towards left or right side.



Kurtosis



Lepo kurtotic is best as the average is in the middle of graph.

H.W

Draw frequency distribution graphs for the following frequency distribution tables and comment on the shape of the frequency distribution curves.

CM → Class mark

Mid point	Linear density (Tex)	
	Mill A	Mill B
29.3	5	3
29.8	11	5
30.3	26	6
30.8	44	18
31.3	54	29
31.8	29	42
32.3	15	23
32.8	6	12
33.3	2	4
33.8	0	1

CI	CM	Frequency	
		(Mill A)	(Mill B)
29.05-29.55	29.3	5	3
29.55-30.05	29.8	11	5
30.05-30.55	30.3	26	6
30.55-31.05	30.8	44	18
31.05-31.55	31.3	54	29
31.55-32.05	31.8	29	42
32.05-32.55	32.3	15	23
32.55-33.05	32.8	6	12
33.05-33.55	33.3	2	4
33.55-34.05	33.8	0	1

A → better than B

More uniformity

A → Narrow, B wide

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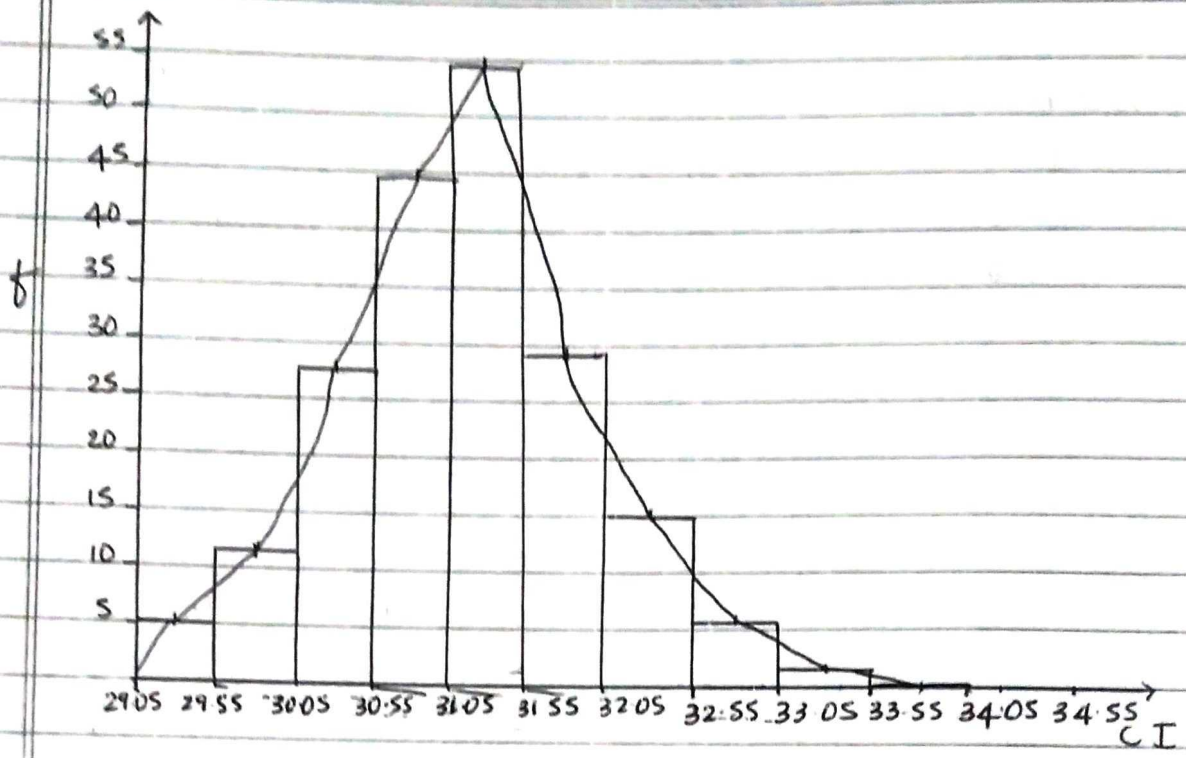
Mill A.

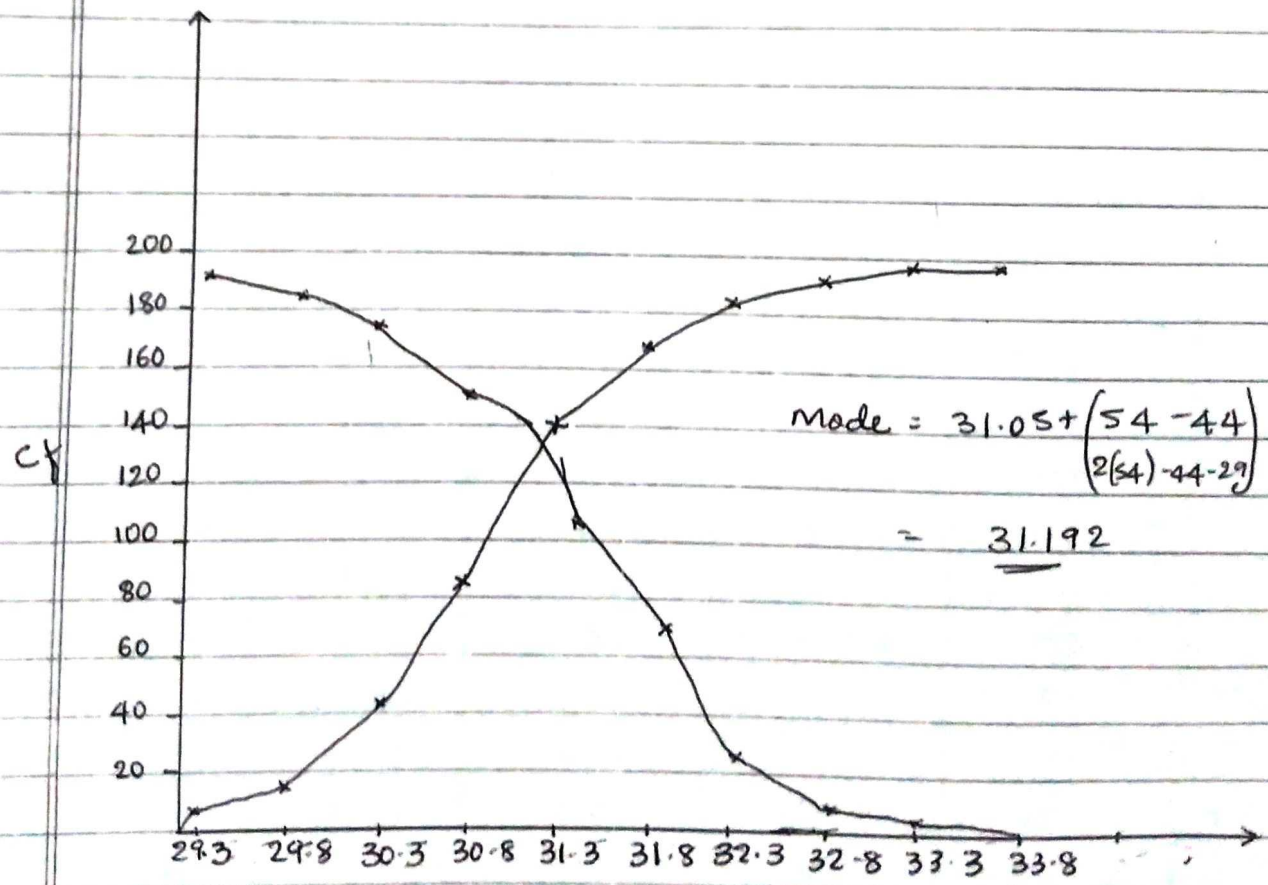
CI	CM(x)	f	cf (<)	cf (>)	fx
29.05 - 29.55	29.3	5	5	192	146.5
29.55 - 30.05	29.8	11	16	187	327.8
30.05 - 30.55	30.3	26	42	176	787.8
30.55 - 31.05	30.8	44	86	150	1355.2
31.05 - 31.55	31.3	54	140	106	1690.2
31.55 - 32.05	31.8	29	169	52	922.2
32.05 - 32.55	32.3	15	184	23	484.5
32.55 - 33.05	32.8	6	190	8	196.8
33.05 - 33.55	33.3	2	192	2	66.6
33.55 - 34.05	33.8	0	192	0	0
		$\Sigma f = 192$			$\Sigma fx = 5977.6$

Mill B.

f	CM	cf (<)	fx	cf (>)
3	29.3	3	87.9	143
5	29.8	8	149	140
6	30.3	14	181.8	135
18	30.8	32	554.4	129
29	31.3	61	907.7	111
42	31.8	103	1335.6	82
23	32.3	126	742.9	40
12	32.8	138	393.6	17
4	33.3	142	133.2	5
1	33.8	143	33.8	1
$\Sigma f = 143$			$\Sigma fx = 4519.9$	

Q11 A





$$\text{Mode} = 31.05 + \left(\frac{54-44}{2(54)-44-29}\right)(31.55-31.05)$$

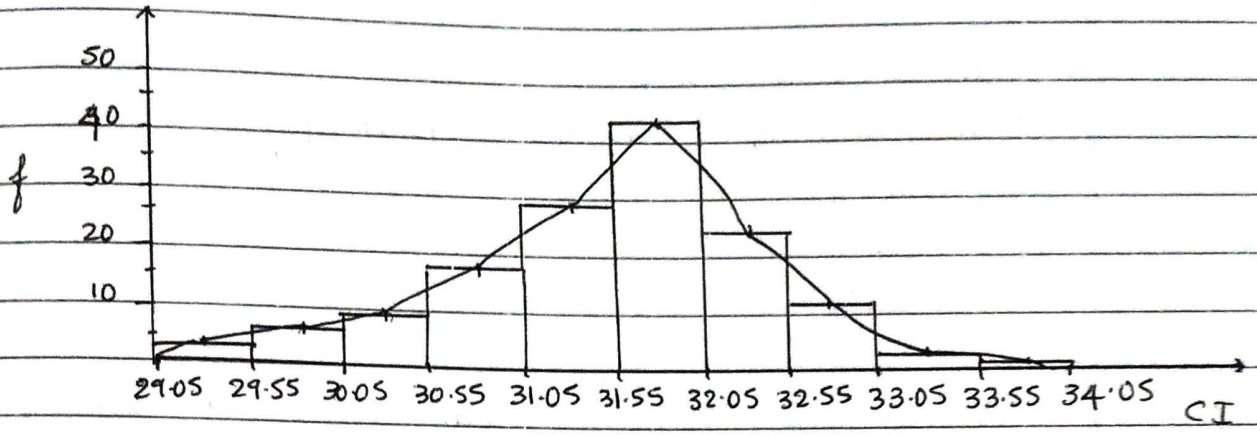
$$= \underline{31.192}$$

$$\text{Mean} = \frac{5977.6}{192} = 31.13$$

$$\text{Median} = 31.05 + \left(\frac{192/2 - 86}{54}\right)(31.55 - 31.05)$$

$$= 31.14$$

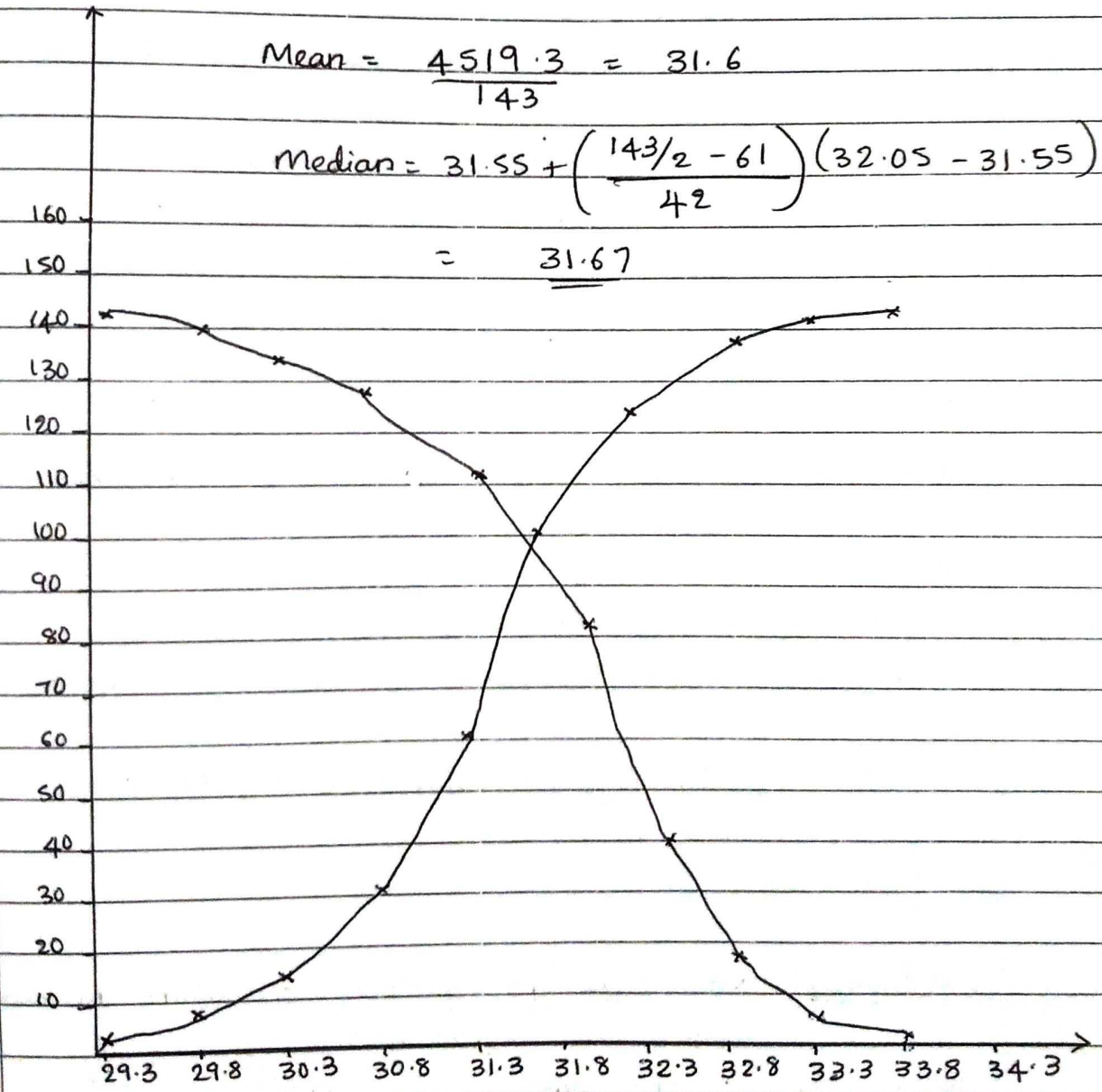
Mill B



$$\text{Mean} = \frac{4519.3}{143} = 31.6$$

$$\text{Median} = 31.55 + \left(\frac{143/2 - 61}{42}\right)(32.05 - 31.55)$$

$$= 31.67$$



$$\text{Mode} = 31.55 + \left(\frac{42 - 29}{2(42) - 29 - 23}\right)(32.05 - 31.55)$$

$$= 31.75.$$

Nominal count → count set ... Actual count → Measured count.

Summerizing Data.

Measures of central Tendency.

→ Mean (Average).

→ Mode

→ Median.

Strength of certain yarn measured using testing machine (newtons).

25, 26, 25, 23, 29, 30, 23, 25, 22.

$$\text{Mean} = \frac{X_1 + X_2 + X_3 + \cdots + X_n}{9}$$

$$= \frac{228}{9}$$

$$= 25.3$$

Disadvantage of Mean:- Gets affected by extreme numbers/values

Mode:

Most frequently occuring data.

[Arrange either in increasing order or decreasing order

22, 23, 23, **25, 25, 25**, 26, 29, 30.

Mode = 25

Disadvantage: Not useful for further calculation because same value is repeated.

Adv: Doesnot get affected by extreme values

$20\ Ne = \frac{1}{840 \times 20}$

1 hank of $20^s Ne = \frac{1}{20}$ lb

Resultant mean: Do not divide by mean/Avg.
Hormonic mean:- For Ne.

Median:

Middle Value.

22, 23, 23, 25, [25] 25, 26, 29, 30

Median :- 25.

Types of Mean

1) Arithmatic Mean.

$$\bar{x} = \frac{x_1 + x_2 + x_3 + \cdots x_n}{n}$$

2) Hormonic mean.

$$\bar{x} = \frac{n}{1/x_1 + 1/x_2 + 1/x_3 + \cdots 1/x_n}$$

3) Geometeric Mean.

$$\bar{x} = \sqrt[n]{x_1\, x_2\, x_3 \cdots x_n}$$

Used:- To determine fluctural rigidity and bending module of Textile material.

4) Weightage Average:

$$\bar{x} = \frac{w_1 x_1 + w_2 x_2 + w_3 x_3 \cdots w_n x_n}{w_1 + w_2 + w_3 + \cdots w_n}$$

Used:- Average Salary.

$w \rightarrow$ weightage.

$x \rightarrow$ Salary

Calculate the average salary of the company with the following particulars.

	(x) Monthly Income (RS)	(w) Numbers
Supervisor	300	3
Assistant Supervisor	150	6
Forman	100	10
Workers	60	20

$$\bar{x} = \frac{w_1x_1 + w_2x_2 + \cdots w_nx_n}{w_1 + w_2 + \cdots w_n}$$

$$= \frac{300 \times 3 + 150 \times 6 + 100 \times 10 + 60 \times 20}{39}$$

$$= \frac{900 + 900 + 1000 + 1200}{39}$$

$$\bar{x} = ₹\ 102.56$$

Measures of central frequency of Grouped di

1) Find out mean, modal and median lu for the following observations of cotton fibre length measured on baer sorte

(cm) x (1/6")	cf	f	CI
2.5	1	1	2-3
3.5	4	3	3-4
4.5	8	4	4-5
5.5	18	10	5-6
6.5	42	24	6-7
7.5	78	36	7-8
8.5	97	19	8-9
9.5	100	3	9-10
10.5	100	0	10-11

If 100 values : ... $= \frac{100}{2} = 50$

In grouped data : No: of observation → Total No: of Frequency.

Median → CF

CI	(cm) x	cf	f	fx
2 - 3	2.5	1	1	2.5
3 - 4	3.5	4	3	10.5
4 - 5	4.5	8	4	18
5 - 6	5.5	18	10	55
6 - 7	6.5	42	24	156
7 - 8	7.5	78	36	270
8 - 9	8.5	97	19	161.5
9 - 10	9.5	100	3	28.5
10 - 11	10.5	100	0	0
			$\Sigma f = 100$	$\Sigma fx = 702$

median group
modal group.

$$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{702}{100} = 7.02''$$

$$= \frac{7.02''}{6}$$

$\left[\text{median} = \frac{100}{2} = \frac{1}{2}\right]$

$$\text{Median} = L_1 + \left(\frac{N/2 - m}{f}\right) L_2 - L_1$$

L_1 = lower limit of median group.

L_2 = upper limit of median group.

m = cumulative frequency of class just above the median group

N = Total frequency.

f = Frequency of median group.

$$= 7 + \left(\frac{100/2 - 42}{36}\right)(8-7)$$

$$= 7 + 0.22$$

$$= \underline{\underline{7.22}}$$

$$= \frac{7.22''}{6}$$

$f = cf_2 - cf_1 =$

$$\text{Mode} = L_1 + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right)(L_2 - L_1)$$

L_1 = lower Limit of modal group.
L_2 = upper limit of modal group.
f_0 = frequency above limit of modal group.
f_1 = frequency of modal group.
f^2 = frequency below modal group.

(maximum value in frequency table)

$$= 7 + \left(\frac{36 - 24}{2(36) - 24 - 19}\right)(8 - 7)$$

$$= 7 + \left(\frac{12}{29}\right)(1)$$

$$= 7 + 0.413$$

$$= \underline{7.413}$$

$$= \frac{7.413}{6}''$$

Mean = 7.02
Median = 7.22
Mode = 7.41

2) The Table below shows the distribution of parmanganate values of certain effluent in a textile factory. Calculate the measures of ~~certain~~ central tendency of parmanganate values. } mean, median and C.V for the data

C.I	f	(mid point) (x) CM	cf	fx
6.0 - 6.4	1	6.2	1	6.2
6.5 - 6.9	4	6.7	5	26.8
7.0 - 7.4	9	7.2	14	64.8
7.5 - 7.9	14	7.7	28	107.8
8.0 - 8.4	15	8.2	43	123
8.5 - 8.9	9	8.7	52	78.3
9.0 - 9.4	5	9.2	57	46
9.5 - 9.9	2	9.7	59	19.4
10.0 - 10.4	1	10.2	60	10.2

$\Sigma f = 60$ $\Sigma fx = 482.5$

$$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{482.5}{60} = \underline{8.04}$$

Median = $\frac{60}{2} = \frac{f}{2} = 30$.

$$\text{Median} = L_1 + \left(\frac{N/2 - m}{f}\right) L_2 - L_1$$

$$= 8.0 + \left(\frac{60/2 - 28}{15}\right)(8.4 - 8.0)$$

$$= 8 + (0.13)(0.4)$$

$$= \underline{8.052}$$

$$\text{Mode} = 8.0 + \left(\frac{15-14}{2(15)-14-9}\right)(8.4-8.0)$$

$$= 8.0 + 0.056$$

$$= \underline{\underline{8.056}}$$

Find out the missing frequency of the following frequency distribution table given that mean $\bar{x} = 22.5$.

CI	f	x	fx
21 - 22	3	21.5	64.5
22 - 23	8	22.5	180
23 - 24	14	23.5	329
24 - 25	x	24.5	24.5x
25 - 26	2	25.5	51
	27+x		624.5

$$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{624.5 + 24.5x}{27+x}$$

$$22.5 = \frac{624.5 + 24.5x}{27+x}$$

~~$24.5(27+x)$~~

$$(22.5 \times 27) + 22.5x = 624.5 + 24.5x$$

$$607.5 + 22.5x = 624.5 + 24.5x$$

$$607.5 - 624.5 = 2x$$

$$-17 = 2x$$

$$\frac{-17}{2} = x$$

$$x = \underline{\underline{-8.5}}$$

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Measures of Dispersion.

Simple measure
R → Range.
MR → Mean Range
MD → Mean deviation.
σ → Standard deviation
V → Variance

Relative measure
PMR → percentage mean Ray.
PMD → percentage mean deviation
CV → co-efficient variation.

Range.
Highest value - Lowest value.

MR
$$MR = \frac{\text{Range}}{\text{Mean of given data } (\bar{x})}$$

Ex:- Tex
27, 21, 22, 35, 34, 35, 37, 36

CS.
85, 63, 55, 81, 85, 72, 56, 83.

$R_A = 16$
$R_B = 30$

$\bar{x}_A = 30.8$
$\bar{x}_B = 72.5$

$MR_A = 0.5$
$MR_B = 0.4$

Tex

x	$x - \bar{x}$	$(x-\bar{x})^2$
27	3.8	14.44
21	9.8	96.04
22	8.8	77.44
35	4.8	23.04
34	3.2	10.24
35	4.2	17.64
37	6.2	38.44
36	5.2	27.04
$\bar{x} = 30.8$	$\Sigma x - \bar{x} = 46.2$	$\Sigma(x-\bar{x}^2) = 304.32$

MD

$$MD = \frac{\Sigma(x-\bar{x})}{\bar{x}}$$

$$= \frac{46.2}{30.8}$$

$$= 1.5$$

$$\sigma = \sqrt{\frac{\Sigma(x-\bar{x})^2}{N}}$$ if $N > 30$

or

$$\sqrt{\frac{\Sigma(x-\bar{x})^2}{N-1}}$$ if $N < 30$

$N \rightarrow$ no: of observation

$$= \sqrt{\frac{304.32}{8-1}} = \cancel{10.44}\ 6.59$$

$V = \sigma^2$

$V = (6.59)^2$

$= 43.42$

$V = \sigma^2$

$= \cancel{108.99}\ 43.42$

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Cs

x	$x-\bar{x}$	$(x-\bar{x})^2$
85	12.5	156.25
63	9.5	90.25
55	17.5	306.25
81	8.5	72.25
85	12.5	156.25
72	0.5	0.25
56	16.5	272.25
83	10.5	110.25
$\Sigma x = 72.5$	$\Sigma x-\bar{x} = 88$	$\Sigma(x-\bar{x})^2 = 1164$

$$MD = \frac{\Sigma x-\bar{x}}{\bar{x}}$$

$$= \frac{88}{72.5} = 1.21$$

$$\sigma = \sqrt{\frac{\Sigma(x-\bar{x})^2}{N-1}} = 12.89 \qquad \sqrt{\frac{1164}{7}} = 4.87.$$

~~V = 116.20~~ $\quad V = \sigma^2$

$$= (12.89)^2$$

$$= 166.15$$

Tex

$$PMR = \frac{16}{30.8} \times 100 = 51.94$$

$$PMD = \frac{1.5}{30.8} \times 100 = 4.8$$

$$CV = \frac{2.49}{30.8} \times 100 = 8.08$$

Cs

$$PMR = \frac{30}{72.5} \times 100 = 41.3$$

$$PMD = \frac{1.21}{72.5} \times 100 = 1.66.$$

$$CV = \frac{4.87}{72.5} \times 100 = 6.71$$

Relative Measures of Dispersion.

→ $PMR = \frac{R}{\bar{x}} \times 100$

→ $PMD = \frac{MD}{\bar{x}} \times 100$

→ $CV = \frac{\sigma}{\bar{x}} \times 100$

Measure of dispersion for grouped data.

$$SD = \sqrt{\frac{\Sigma f (x-\bar{x})^2}{N \text{ or } N-1}}$$

$$MD = \frac{\Sigma f (x-\bar{x})}{N}$$

Determine SD, Variance and CV for the following results of length of fibres.

(cm) x	f	fx	$x-\bar{x}$	$(x-\bar{x})^2$	$f(x-\bar{x})^2$
(1.5 - 2.5) 2	1	2	4	16	16
3	3	9	3	9	27
4	4	16	2	4	16
5	10	50	1	1	10
6	24	144	0	0	0
7	36	252	1	1	36
8	19	152	2	4	76
9	3	27	3	9	27
10	0	0	4	16	0
~~$\Sigma x = 54 = 6$~~	$\Sigma f = 100$	$\Sigma fx = 652$			$\Sigma f(x-\bar{x})^2 = 208$

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$$SD = \sqrt{\frac{208}{8}} = 1.80$$

$$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{652}{100} = 6.52$$

x	f_1	fx	$x - \bar{x}$	$(x - \bar{x})^2$	$f(x-\bar{x})^2$
2	1	2	4.52	20.43	20.43
3	3	9	3.52	12.39	37.17
4	4	16	2.52	6.35	25.4
5	10	50	1.52	2.31	23.1
6	24	144	0.52	0.27	6.48
7	36	252	0.48	0.23	8.28
8	19	152	1.72	2.19	41.61
9	3	27	2.48	6.15	18.45
10	0	0	3.48	12.11	0
	$\Sigma f = 100$	$\Sigma fx = 652$		62.31	180.62

$$\bar{x} = \frac{652}{100} = 6.52$$

$$\sigma (SD) = \sqrt{\frac{\Sigma f (x - \bar{x})^2}{N}} = \sqrt{\frac{180.62}{100}} = 1.34$$

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Representation of Data.

1)

fx	f	x	$x-\bar{x}$	$(x-\bar{x})^2$	$f(x-\bar{x})$
150	4	37.5	2.53	6.40	25.6
308	8	38.5	1.53	2.34	18.72
632	16	39.5	0.53	0.280	4.48
729	18	40.5	0.47	0.220	3.96
498	12	41.5	1.47	2.16	25.92
85	2	42.5	2.47	6.10	12.2
$\Sigma fx = 2402$	$\Sigma f = 60$		$\Sigma(x-\bar{x}) = 9$		90.92

$$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{2402}{60} = 40.03$$

$$SD = \sqrt{\frac{\Sigma f(x-\bar{x}^2)}{N}}$$

$$= \sqrt{\frac{90.92}{60}}$$

$$= 1.23 \text{ NC}$$

$$\sigma = \sqrt{\frac{17.5}{5}} = 1.87$$

$$CV = \frac{1.87}{40.03} \times 100 = 4.67$$

$$CV = \frac{1.23}{40.03} \times 100 = 3.07\%$$

2).

f	x	fx	$x-\bar{x}$	$(x-\bar{x})^2$	$f(x-\bar{x})^2$
6	36	216	4.2	17.64	105.84
12	38	456	2.2	4.84	58.08
21	40	840	0.2	0.04	0.84
13	42	546	1.8	3.24	42.12
7	44	308	3.8	14.44	101.08
1	46	46	5.8	33.64	36.64
$\Sigma f = 60$		$\Sigma fx = 2412$	18	73.84	$\Sigma f(x-\bar{x})^2 = 344.6$

$$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{2412}{60} = 40.2$$

$$SD = \sqrt{\frac{344.6}{60}} = 2.39$$

$$\sigma = \sqrt{\frac{73.84}{5}} = 3.8$$

$$CV = \frac{3.8}{40.2} \times 100 = 9.45$$

$$CV = \frac{2.39}{40.2} \times 100 = 5.9$$

Linear density.

Mill A

f	x	fx	$x-\bar{x}$	$(x-\bar{x})^2$	$f(x-\bar{x})^2$
5	29.3	146.5	1.83	3.34	16.7
11	29.8	327.8	1.33	1.76	19.36
26	30.3	787.8	0.83	0.68	17.68
44	30.8	1355.2	0.33	0.10	4.4
54	31.3	1690.2	0.17	0.02	1.08
29	31.8	922.2	0.67	0.44	12.76
15	32.3	484.5	1.17	1.36	20.4
6	32.8	196.8	1.67	2.78	16.68
2	33.3	66.6	2.17	4.70	9.4
0	33.8	0	2.67	7.12	0
$\Sigma f = 192$		5977.6	12.84	22.3	$\Sigma f(x-\bar{x})^2 = 118.46$

$$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{5977.6}{192}$$

$$= 31.13$$

$$SD = \sqrt{\frac{\Sigma f(x-\bar{x})^2}{N}}$$

$$= \sqrt{\frac{118.46}{192}} = 0.78$$

$$CV = \frac{0.78}{31.13} \times 100$$

$$= 2.5$$

~~$\sigma = \sqrt{\frac{22.3}{9}} = 1.5$~~

~~$CV = \frac{1.5}{31.13} \times 100$~~

~~$= 4.81$~~

Mill B.

f	x	fx	$(x-\bar{x})$	$(x-\bar{x})^2$	$f(x-\bar{x})^2$
3	29.3	87.9	2.3	5.29	15.87
5	29.8	149	1.8	3.24	16.2
6	30.3	181.8	1.3	1.69	10.14
18	30.8	554.4	0.8	0.64	11.52
29	31.3	907.7	0.3	0.09	2.61
42	31.8	1355.6	0.2	0.04	1.68
23	32.3	742.9	0.7	0.49	11.27
12	32.8	393.6	1.2	1.44	17.28
4	33.3	133.2	1.7	2.89	11.56
1	33.8	33.8	2.2	4.84	4.84
$\Sigma f = 143$		4519.3	$\Sigma(x-\bar{x}) = 12.5$	20.65	102.97

$$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{4519.3}{143} = 31.60$$

$$SD = \sqrt{\frac{102.97}{143}}$$

$$= 0.84$$

$$CV = \frac{0.84}{31.60} \times 100$$

$$= 2.65$$

~~$\sigma = \sqrt{\frac{20.65}{9}} = 1.51$~~

~~$CV = \frac{1.51}{31.60} \times 100$~~

~~$= 4.77$~~

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Measures of central frequency of GD.

1)

x	f	fx	$x-\bar{x}$	$(x-\bar{x})^2$	$f(x-\bar{x})^2$
2.5	1	2.5	4.52	20.43	20.43
3.5	3	10.5	3.52	12.39	37.17
4.5	4	18	2.52	6.35	25.4
5.5	10	55	1.52	2.31	23.1
6.5	24	156	0.52	0.27	6.48
7.5	36	270	0.48	0.23	8.28
8.5	19	161.5	1.48	2.19	41.61
9.5	3	28.5	2.48	6.15	18.45
10.5	0	0	3.48	12.11	0
	100	702	20.52	62.79	$\Sigma f(x-\bar{x})^2 = 180.92$

$$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{702}{100} = 7.02$$

$$SD = \sqrt{\frac{180.92}{100}}$$

$$= 1.34$$

$$CV = \frac{1.34}{7.02} \times 100$$

$$= 19.08$$

~~$\sigma = \sqrt{\frac{62.79}{8}} = 2.80$~~

~~$CV = \frac{2.80}{7.02} \times 100 = 39.88$~~

2)

f	x	fx	$x-\bar{x}$	$(x-\bar{x})^2$	$f(x-\bar{x})^2$
1	6.2	6.2	1.84	3.38	3.38
4	6.7	26.8	1.34	1.79	7.16
9	7.2	64.8	0.84	0.70	6.3
14	7.7	107.8	0.34	0.11	1.54
15	8.2	123	0.16	0.02	0.3
9	8.7	78.3	0.66	0.43	3.87
5	9.2	46	1.16	1.34	6.7
2	9.7	19.4	1.66	2.75	5.5
1	10.2	10.2	2.16	4.66	4.66
$\Sigma f = 60$		482.5	10.16	15.18.	39.41

$$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{482.5}{60} = 8.04$$

$$SD = \sqrt{\frac{39.41}{60}}$$

$$= 0.81$$

$$CV = \frac{0.81}{8.04} \times 100$$

$$= 10.07$$

$$\sigma = \sqrt{\frac{15.18}{8}}$$

$$= 1.37$$

$$CV = \frac{1.37}{8.04} \times 100$$

$$= 17.03$$

Complete the frequency distribution table, Draw various frequency distribution diagram and find measures of central tendency and dispersion.

x	f	CI	cf (<)	cf (>)	Rf	$(x-\bar{x})$
2	3	1-3	3	30	10	3.8
4	7	3-5	10	27	23.33	1.8
6	12	5-7	22	20	40	0.2
8	6	7-9	28	8	20	2.2
10	2	9-11	30	2	6.66	4.2
	$\Sigma f = 30$					

fx	$(x-\bar{x})^2$	$f(x-\bar{x})^2$	$(x-\bar{x})^3$	$f(x-\bar{x})^3$	$(x-\bar{x})^4$	$f(x-\bar{x})^4$
6	14.44	43.32	54.87	164.6	208.5	625.5
28	3.24	22.68	5.83	40.81	10.49	73.43
72	0.04	0.48	0.008	0.096	0.0016	0.0192
48	4.84	29.04	10.64	63.84	23.40	140.4
20	17.64	35.28	74.08	148.16	311.13	622.26
$\Sigma fx = 174$		$\Sigma f(x-\bar{x})^2 = 130.8$		417.506		1461.6

$$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{174}{30} = 5.8$$

$$\text{Median} = 5 + \left(\frac{30/2 - 10}{12}\right)(7-5)$$

$$= 5 + \left(\frac{15-10}{12}\right)(2)$$

$$= 5 + \left(\frac{5}{12}\right)(2)$$

$$= 5 + (0.416)(2)$$

$$= 5.832$$

$$\text{Mode} = L_1 + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right)(L_2 - L_1)$$

$$= 5 + \left(\frac{12 - 7}{2(12) - 7 - 6}\right)(7 - 5$$

$$= \underline{5.90}$$

$$SD = \sqrt{\frac{\Sigma f(x-\bar{x})^2}{N}} = \sqrt{\frac{130.8}{30}} = \underline{2.08}$$

$$CV = \frac{2.08}{5.8} \times 100$$

$$= \underline{35.86}$$

Skewness =

$$\frac{\Sigma (x-\bar{x})^3}{NS^3} \quad \text{(simple data)}$$

or

$$\checkmark \frac{\Sigma f(x-\bar{x})^3}{NS^3} \quad \text{(Grouped data)}$$

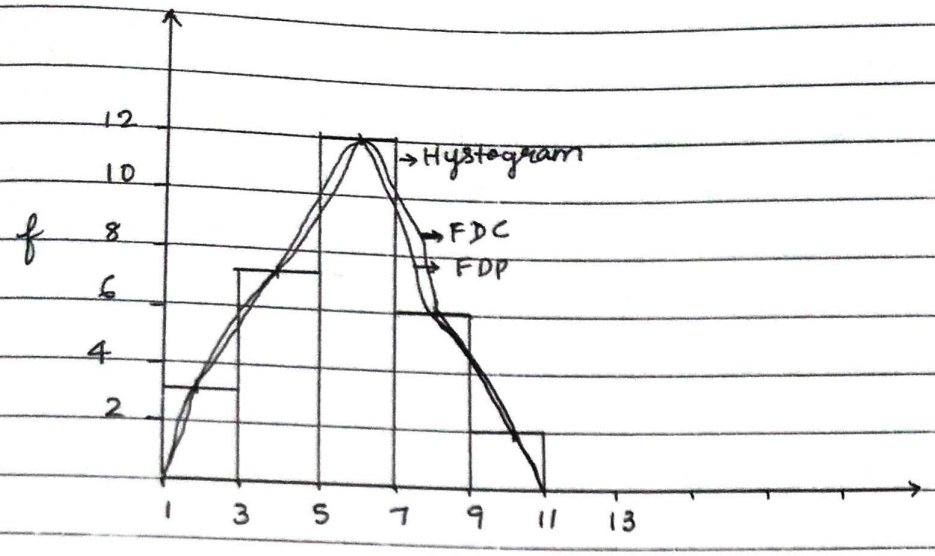
$S = \sigma$

Kurtosis

$$K = \frac{\Sigma (x-\bar{x})^4}{NS^4} \quad \text{(SD)}$$

or

$$\checkmark K = \frac{\Sigma f(x-\bar{x})^4}{NS^4} \quad \text{(GD)}$$



$$S = \frac{\Sigma f(x-\bar{x})^3}{N(s^3)} = \frac{417.506}{30 \times (2.08)^3}$$

$$= \frac{417.506}{30 \times 8.99}$$

$$= \frac{417.506}{269.7}$$

$$= 1.548$$

$$K = \frac{\Sigma f(x-\bar{x})^4}{Ns^4}$$

$$= \frac{1461.6}{30(2.08)^4}$$

$$= \frac{1461.6}{30 \times 18.66}$$

$$= \frac{1461.6}{559.8}$$

$$= 2.610$$

Formulae

1) No: of CI = $\frac{0.45 \times \text{No: of observations}}{4}$

2) Class width = $\frac{\text{Range}}{\text{No: of CI}}$

3) $\bar{x} = \frac{\Sigma fx}{\Sigma f}$ (Mean)

4) Arithmatic mean: $\bar{x} = \frac{x_1 + x_2 + x_3 + \cdots x_n}{n}$

5) Hormonic mean: $\bar{x} = \frac{n}{1/x_1 + 1/x_2 + \cdots 1/x_n}$

6) Geometric mean: $\bar{x} = \sqrt[n]{x_1 x_2 x_3 \cdots x_n}$

7) weightage average: $\bar{x} = \frac{w_1x_1 + w_2x_2 + \cdots w_nx_n}{w_1 + w_2 + w_3 + \cdots w_n}$

8) Median: $L_1 + \left(\frac{N/2 - m}{f}\right)(L_2 - L_1)$

9) Mode: $L_1 + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right)(L_2 - L_1)$

10) MD = $\frac{\Sigma(x - \bar{x})}{\bar{x}}$

11) $\sigma = \sqrt{\frac{\Sigma(x-\bar{x})^2}{N \text{ or } N-1}}$

12) $V = \sigma^2$

13) PMR = $\frac{R}{\bar{x}} \times 100$

14) PMD = $\frac{MD}{\bar{x}} \times 100$

15) CV = $\frac{\sigma}{\bar{x}} \times 100$

16) SD = $\sqrt{\frac{\Sigma f(x - \bar{x})^2}{N \text{ or } N-1}}$

17) MD = $\frac{\Sigma f(x - \bar{x})}{N}$

18) S = $\frac{\Sigma(x - \bar{x})^3}{NS^3} \rightarrow (SD)$

S = $\frac{\Sigma f(x - \bar{x})^3}{NS^3} \rightarrow (GD)$

19) K = $\frac{\Sigma(x - \bar{x})^4}{NS^4} \rightarrow (SD)$

K = $\frac{\Sigma f(x - \bar{x})^4}{NS^4} \rightarrow (GD)$