

IQRA NATIONAL UNIVERSITY

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Assignment : Mid Term

Subject : Probability and Statistics

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Probability and Statistics

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Q1. Solutions - part (a)

Class interval	Frequency	Class Boundaries	C.F <	C.F >
0-4	25	0-4.5	25	2092
5-9	45	4.5-9.5	70	2067
10-14	81	9.5-14.5	151	2022
15-19	143	14.5-19.5	294	1941
20-24	280	19.5-24.5	574	1798
25-29	349	24.5-29.5	923	1518
30-34	374	29.5-34.5	1297	1169
35-39	394	34.5-39.5	1692	795
40-44	400	39.5-44.5	2092	400

C.B = LCL & 2nd class - ucl & 1st

$$\begin{aligned}
 C.B &= \frac{5-4}{2} \\
 &= \frac{1}{2} \\
 &= 0.5
 \end{aligned}$$

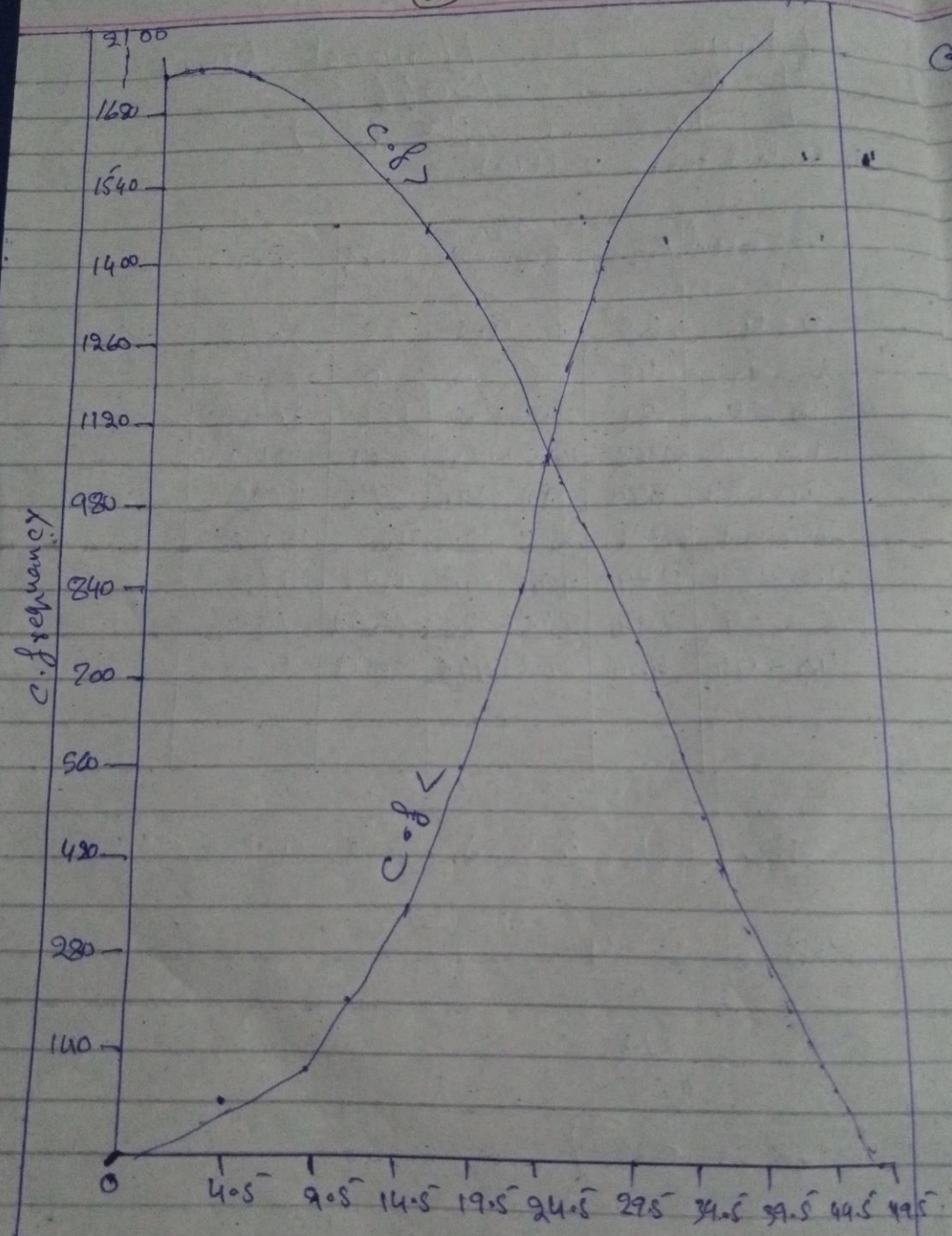
$$C.B = 0.5$$

(a) Now $15 \times 181 = 181x$

$$15x = 1458$$

$$x = 97 \text{ students}$$

(2)

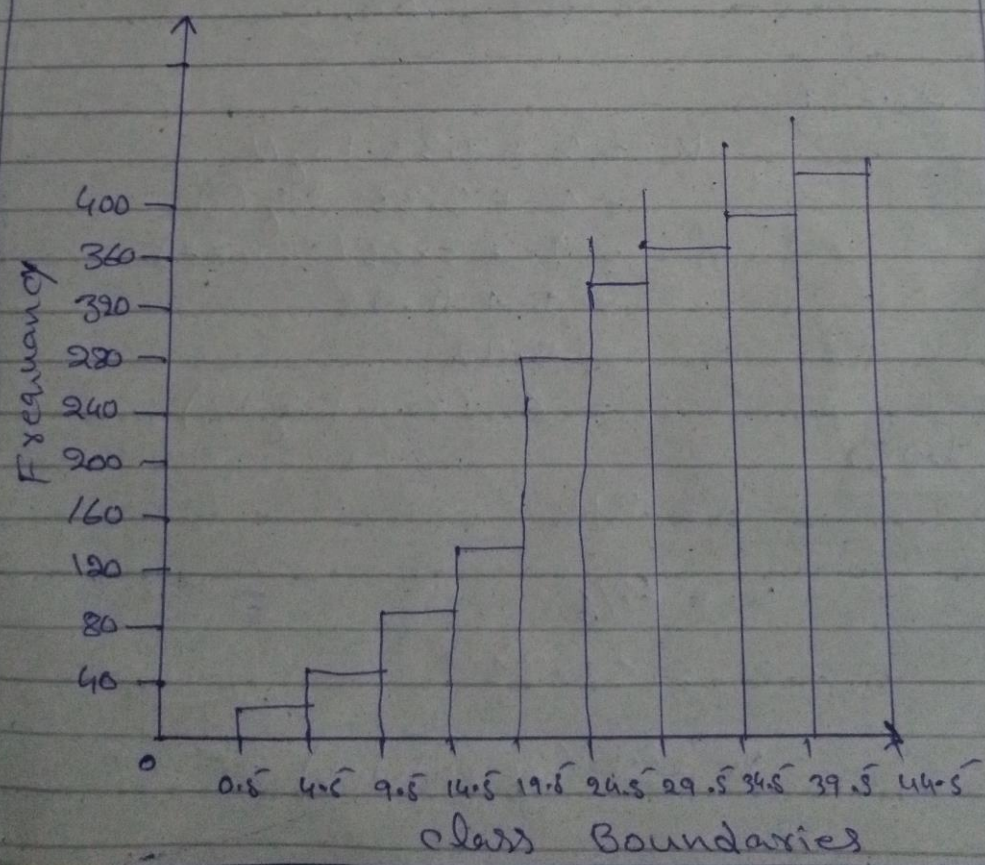


(31)

class boundaries

Q1 Part (b)

class interval	Frequency	class Boundaries
0-4	25	0.5 - 4.5
5-9	45	4.5 - 9.5
10-14	81	9.5 - 14.5
15-19	143	14.5 - 19.5
20-24	280	19.5 - 24.5
25-29	349	24.5 - 29.5
30-34	374	29.5 - 34.5
35-39	395	34.5 - 39.5
40-44	400	39.5 - 44.5



(4)

Q22
Ans 1

Group Distribution Table

Step 1

Count the number of observations, $N = 30$

Step 2

Largest value $X_m = 431$
Smallest value $X_o = 363$

Step 3

$$\begin{aligned} \text{Range } R &= X_m - X_o \\ &= 431 - 363 \\ &= 68 \end{aligned}$$

Step 4

$$\begin{aligned} k &= 1 + 3.33 \log N \\ &= 1 + 3.33 \log (30) \\ &= 1 + 3.33 (1.477) \\ &= 1 + 4.92 \\ &= 5.92 \\ &= 6 \text{ (rounding off)} \end{aligned}$$

Step 5

$$h = R/k$$

$$h = 68/6$$

$$h = 11.33$$

$$h = 12 \text{ (by rounding)}$$

(5)

Classes	Frequency (f)
363 - 374	4
375 - 386	4
387 - 398	8
399 - 410	7
411 - 422	4
423 - 434	3

→ By Tally Column :-

Classes	Class Boundaries	Class Mark	Frequency	c.f	Tally
363 - 374	362.5 - 374.5	368.5	4	4	
374 - 386	374.5 - 386.5	380.5	4	8	
387 - 398	386.5 - 398.5	392.5	8	16	
399 - 410	398.5 - 410.5	404.5	7	23	
411 - 422	410.5 - 422.5	416.5	4	27	
423 - 434	422.5 - 434.5	428.5	3	30	

Mean :-

$$\begin{aligned} \bar{x} &= \frac{493 + 369 + 387 + 411 + 393 + 394 + 371 + 377}{30} \\ &= \frac{389 + 409 + 392 + 408 + 431 + 401}{30} \\ &= \frac{363 + 391 + 405 + 382 + 400 + 381}{30} \\ &= \frac{+ 399 + 415 + 428 + 422 + 396}{30} \\ &= \frac{+ 372 + 410 + 419 + 386 + 390}{30} \end{aligned}$$

(6)

$$\bar{x} = \frac{11914}{30}$$

$$\bar{x} = 397$$

Mode

$$\text{Mode} = l + \frac{f_m - f_1}{(f_m - f_1) + (f_m - f_2)} \times h$$

$$\text{Here } l = 387, f_m = 8, f_1 = 4 \\ f_2 = 7, h = 12$$

$$\text{So Mode} = 387 + \frac{8 - 4}{(8 - 4) + (8 - 7)} \times 12$$

$$= 387 + \frac{4}{4 + 1} \times 12$$

$$= 387 + \frac{4}{5} \times 12$$

$$= 387 + \frac{48}{5}$$

$$= 387 + 9.6$$

$$\text{Mode} = 396.6$$

(7)

Quartiles :-

$$Q_1 = \frac{n}{4} = \frac{30}{4}$$

$$Q_1 = 7.5$$

which corresponds to value in class 375-386. Therefore

$$Q_1 = l + \frac{h}{f} \left(\frac{n}{4} - c \right)$$

$$Q_1 = 375 + \frac{12}{4} (7.5 - 4) \quad \because c = 4$$

$$Q_1 = 375 + 3(3.5)$$

$$Q_1 = 375 + 10.5$$

$$Q_1 = 385.5$$

$$Q_1 = 386$$

Now

$$Q_3 = \frac{3n}{4} = \frac{3 \times 30}{4}$$

$$Q_3 = \frac{90}{4} = 22.5$$

which corresponds to value in class 399-410. Therefore

(8)

$$Q_3 = l + n/f \left(\frac{3n}{4} - c \right)$$

$$Q_3 = 399 + \frac{12}{7} (22.5 - 16) \because c=16$$

$$Q_3 = 399 + \frac{12}{7} (6.5)$$

$$Q_3 = 399 + \frac{78}{7}$$

$$Q_3 = 399 + 11$$

$$Q_3 = 410$$

9

Ans

Q3

Solution :-

first data

3, 6, 2, 1, 7, 5

$$Mean = \frac{3+6+2+1+7+5}{6}$$

$$Mean = \frac{26}{6}$$

$$\boxed{Mean = 4}$$

x	x^2
3	9
6	36
2	4
1	1
7	49
5	25
Σ 24	Σ 124

$$S.D = \sqrt{\frac{\Sigma x^2}{N} - \left(\frac{\Sigma x}{N}\right)^2}$$

$$S.D = \sqrt{\frac{124}{6} - \frac{576}{36}}$$

$$S.D = \sqrt{\frac{74.4 - 576}{36}}$$

$$S.D = \sqrt{\frac{168}{36}}$$

$$S.D = \sqrt{4.7}$$

$$\boxed{S.D = 2.2}$$

(10)

Second Data :- 11, 17, 9, 7, 19, 15

$$\text{Mean} = \frac{11+17+9+7+19+15}{6}$$

$$\text{Mean} = \frac{78}{6}$$

$$\boxed{\text{Mean} = 13}$$

$$\text{S.D} = \sqrt{\frac{\sum x^2}{N} - \left(\frac{\sum x}{N}\right)^2}$$

x	x ²
11	121
17	289
9	81
7	49
19	361
15	225
$\sum = 78$	$\sum = 1126$

$$\text{S.D} = \sqrt{\frac{1126}{6} - \frac{6084}{36}}$$

$$\text{S.D} = \sqrt{\frac{6736 - 6084}{36}}$$

$$\text{S.D} = \sqrt{\frac{672}{36}}$$

$$\text{S.D} = \sqrt{18.7}$$

$$\boxed{\text{S.D} = 4.3}$$

(11)

1st data mean = 4

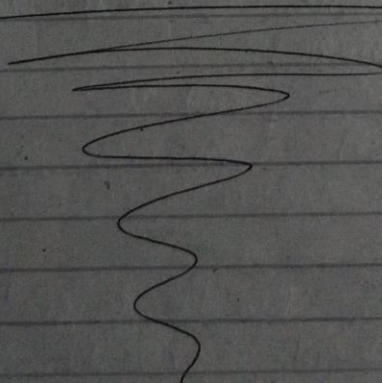
1st data S.D = 2.2

2nd data mean = 13

2nd data S.D = 4.3

The required relation is that

→ Mean of 2nd data is greater than mean of 1st data and Standard deviation of 2nd data is double the Standard deviation of 1st data.



Q.10 Solution:

Classes	f_i	x	x^2	$f_i x$	$f_i x^2$
64-84	15	74	5476	1110	82140
85-104	18	94.5	8930.25	1701	160744.5
105-124	27	114.5	13110.25	3091.5	353976.75
125-144	10	134.5	18090.25	1345	180902.5
145-164	6	154.5	23870.25	927	143221.5
165-184	8	174.5	30450.25	1396	182251.25
185-204	13	194.5	37830.25	2528.5	491793.25
		$\Sigma = 94$		$\Sigma = 11575.5$	$\Sigma = 1565029.75$

Variance:

$$S^2 = \frac{\Sigma f_i x^2}{n} - \left(\frac{\Sigma f_i x}{n} \right)^2$$

$$S^2 = \frac{1565029.75}{94} - \left(\frac{11575.5}{94} \right)^2$$

$$S^2 = 16649.26 - 15164.35$$

$$S^2 = 1484.9$$

$$S^2 = 1485$$

(13)

Standard Deviation

Taking square root of
eq (1), we have

$$\sqrt{s^2} = \sqrt{1495}$$

$$s = 38.5$$

≡

(14)

Q5

Ans (a) Comment:

No, it is not obviously that all the people have height "5" feet can easily cross it. If he did not know swimming and river is not deep uniformly. It is 2 feet at some points while 7 feet on other points. So he will cross it.

or
Ans "b"

Comment:

No it does not mean every student is hopeless. Those students whose marks are less than 30. Some have 30 marks or more and some students have greater than 30 marks.

There can be few students whose marks may be 60 or more.

Ans (c) Comment: - No it is not true that all the household servants must be paid. Average pay does not mean everyone get paid same thing. Income will be much more than servants.