



Name : Muhammad Musa

Department : BS(CS)

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ID # : 15366

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Subject : Probability and Statistics

Submitted To : Daud Khan Khalil Sir

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BS (CS) Muhammad Musa, ID # 15366, M. Davd Sir

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## Probability and Statistics

Q1. Solution:

Ans(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	395	34.5-39.5	1692	775
40-44	450	39.5-44.5	2092	400

C.B =  $\Delta$  = LCL of 2<sup>nd</sup> class - UCL of 1<sup>st</sup> class

$$C.B = 5 - 4$$

$$C.B = \frac{1}{2}$$

$$C.B = \frac{\Delta}{2} = \frac{1}{2}$$

$$C.B = 0.5$$

(a) Now  $15 : 81 = 18 : x$

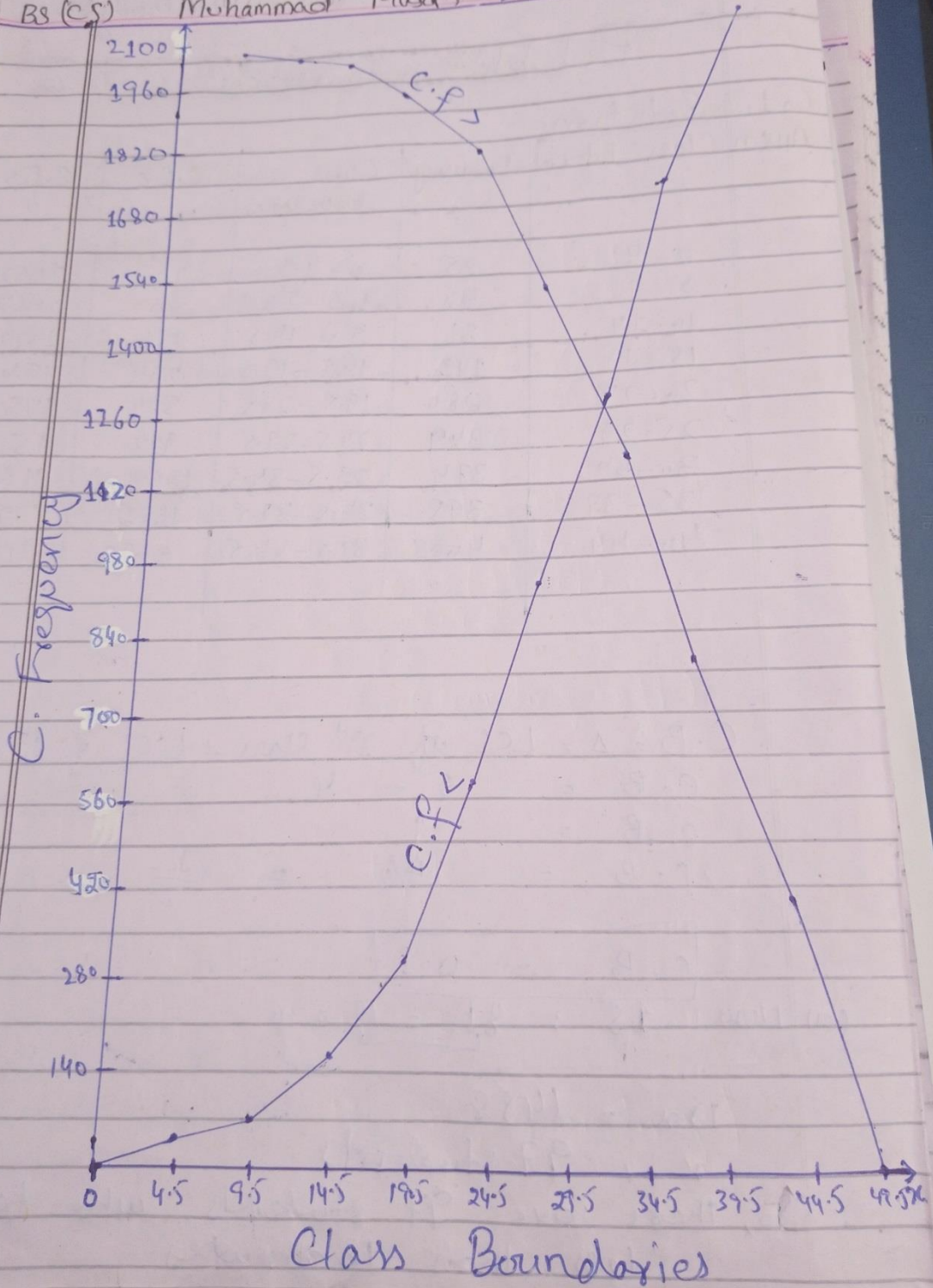
$$15x = 1458$$

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

So, there are 97 students who take less than 18 minutes.

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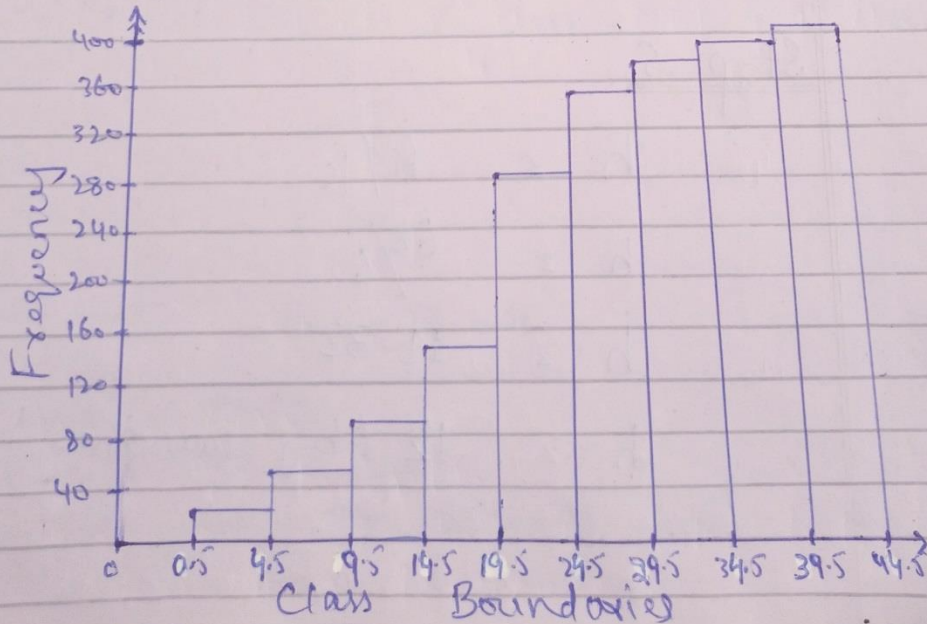
Q1:

Ans(b) Class Interval | Frequency | Class Boundaries

0-9	70
10-19	284
20-29	
30-39	
40-49	

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



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Q2.

Ans. 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:

$$K = 1 + 3.33 \log N$$

$$K = 1 + 3.33 \log (30)$$

$$K = 1 + 3.33 (1.477)$$

$$K = 1 + 4.92$$

$$K = 5.92$$

$$K = 6 \text{ (rounding off)}$$

Step 5:

$$h = R/K$$

$$h = 68/6$$

$$h = 11.33$$

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



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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 (f)	C.f	Tally
363-374	362.5-374.5	368.5	4	4	
375-386	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:-

$$\bar{x} = \frac{423 + 369 + 387 + 411 + 393 + 394 + 371 + 377 + 389 + 409 + 392 + 408 + 431 + 401 + 363 + 391 + 405 + 382 + 400 + 381 + 399 + 415 + 428 + 422 + 396 + 372 + 410 + 419 + 386 + 390}{30}$$

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

$$\bar{x} = 397$$

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Mode:

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

Here  $l = 387$ ,  $f_m = 8$ ,  $f_1 = 4$   
 $f_2 = 7$ ,  $h = 12$

So

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

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

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

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

$$\text{Mode} = 387 + 9.6$$

$$\text{Mode} = 396.6$$

$$\boxed{\text{Mode} = 397}$$

Quartiles:

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

$$Q_1 = 7.5$$

which corresponds to value in class



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375-386. Therefore

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

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

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

$$Q_1 = 375 + 10.5$$

$$Q_1 = 385.5$$

$$\boxed{Q_1 = 386}$$

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

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

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

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

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



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$$Q_3 = 399 + 11$$

$$Q_3 = 410$$

Q4:

Ans: 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	5	174.5	30450.25	872.5	152251.25
185-204	13	194.5	37830.25	2528.5	491793.25
	$\Sigma = 94$			$\Sigma = 11575.5$	$\Sigma = 1565029.75$

Variance:

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

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

$$s^2 = 16649.26 - 15164.35$$

$$s^2 = 1484.9$$

$$s^2 = 1485$$

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### Standard Deviation:

Taking square root of  
equ (1), we have

$$\sqrt{S^2} = \sqrt{1485}$$

$$S = 38.5$$

Q3

Ans: Solution:

First data:

3, 6, 2, 1, 7, 5

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

$$\text{Mean} = \frac{24}{6}$$

$$\text{Mean} = 4$$

$x$	$x^2$	S. Deviation = $\sqrt{\frac{\sum x^2}{N} - \left(\frac{\sum x}{N}\right)^2}$
3	9	$S.D = \sqrt{\frac{124}{6} - \frac{576}{36}}$
6	36	
2	4	$S.D = \sqrt{\frac{144 - 576}{36}}$
1	1	
7	49	$S.D = \sqrt{\frac{168}{36}}$
5	25	
$\Sigma = 24$	$\Sigma = 124$	



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

$$S.D = 2.2$$

Second Data:

11, 17, 9, 7, 19, 15

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

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

$$\text{Mean} = 13$$

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

$x$	$x^2$	
11	121	$S.D = \sqrt{\frac{1126}{6} - \frac{6084}{36}}$
17	289	$S.D = \sqrt{\frac{6756}{36} - \frac{6084}{36}}$
9	81	
7	49	
19	361	$S.D = \sqrt{\frac{672}{36}}$
15	225	
$\Sigma = 78$	$\Sigma = 1126$	

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

$$S.D = 4.3$$



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1<sup>st</sup> data Mean = 4  
1<sup>st</sup> data S.D = 2.2  
2<sup>nd</sup> data Mean = 13  
2<sup>nd</sup> data S.D = 4.3

The required relation is that

→ Mean of 2<sup>nd</sup> data is greater than mean of 1<sup>st</sup> data and Standard deviation of 2<sup>nd</sup> data is double the standard deviation of 1<sup>st</sup> data.

Q5:

Ans: 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.

Ans(b) Comment:

No, it does not mean every student is hopeless. Those students whose marks are less than 30, some have 30 marks and some students have greater than 30 marks. There can be few.

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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.  
The king income will be much  
more than servants.

<^> The END <^>