

Mid Semester Assignment

Spring 2020

Subject: Probability and Statistics

Q1: Students were asked how long it took them to walk to school on a particular morning. A cumulative frequency distribution was formed

| | | | | | | | | | |
|-------------------------------|----|-----|-----|-----|-----|-----|-----|-----|-----|
| Time taken(in minutes) | <5 | <10 | <15 | <20 | <25 | <30 | <35 | <40 | <45 |
| Frequency | 25 | 45 | 81 | 143 | 280 | 349 | 374 | 395 | 400 |

- Draw a cumulative frequency curve and estimate how many students took less than 18 minutes.
- Take equal class intervals of 0-, 5-, 10-, etc., construct frequency distribution and draw a histogram.

Q2: Construct a grouped distribution table for the following data and Calculate Mean, Mode and Quartiles.

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

Q3: By multiplying each of the numbers 3,6,2,1,7,5 by 2 and then adding 5, we obtain 11,17,9,7,19,15. What is the relation between the standard deviation and the means of the two sets.

Q4: For the following grouped distribution table Calculate The Variance and Standard Deviation

| | | | | | | | |
|-----------|-------|--------|---------|---------|---------|---------|---------|
| Class | 64-84 | 85-104 | 105-124 | 125-144 | 145-164 | 165-184 | 185-204 |
| Frequency | 15 | 18 | 27 | 10 | 6 | 5 | 13 |

Q5: Comment on the following sentences

- The depth of a river at four different points is 2,7,5,6 feet respectively. The average depth is 5 feet. Therefore all the people with heights 5 feet can cross it
- The average marks of one class of students are 30. Therefore every student is hopeless.
- The average income of a king and his household servants is £20,000 per month, therefore all the household servants must be fabulously paid.

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Program : BE(E)

Subject : Probability ^{Stats} Methods in Instructor : Sir, David Khan ^(SA)

Q1:

| Time taken in min | Frequency |
|-------------------|-----------|
| < 5 | 25 |
| < 10 | 45 |
| < 15 | 81 |
| < 20 | 143 |
| < 25 | 280 |
| < 30 | 349 |
| < 35 | 374 |
| < 40 | 395 |
| < 45 | 400 |

① Cumulative frequency curve

P.T.O

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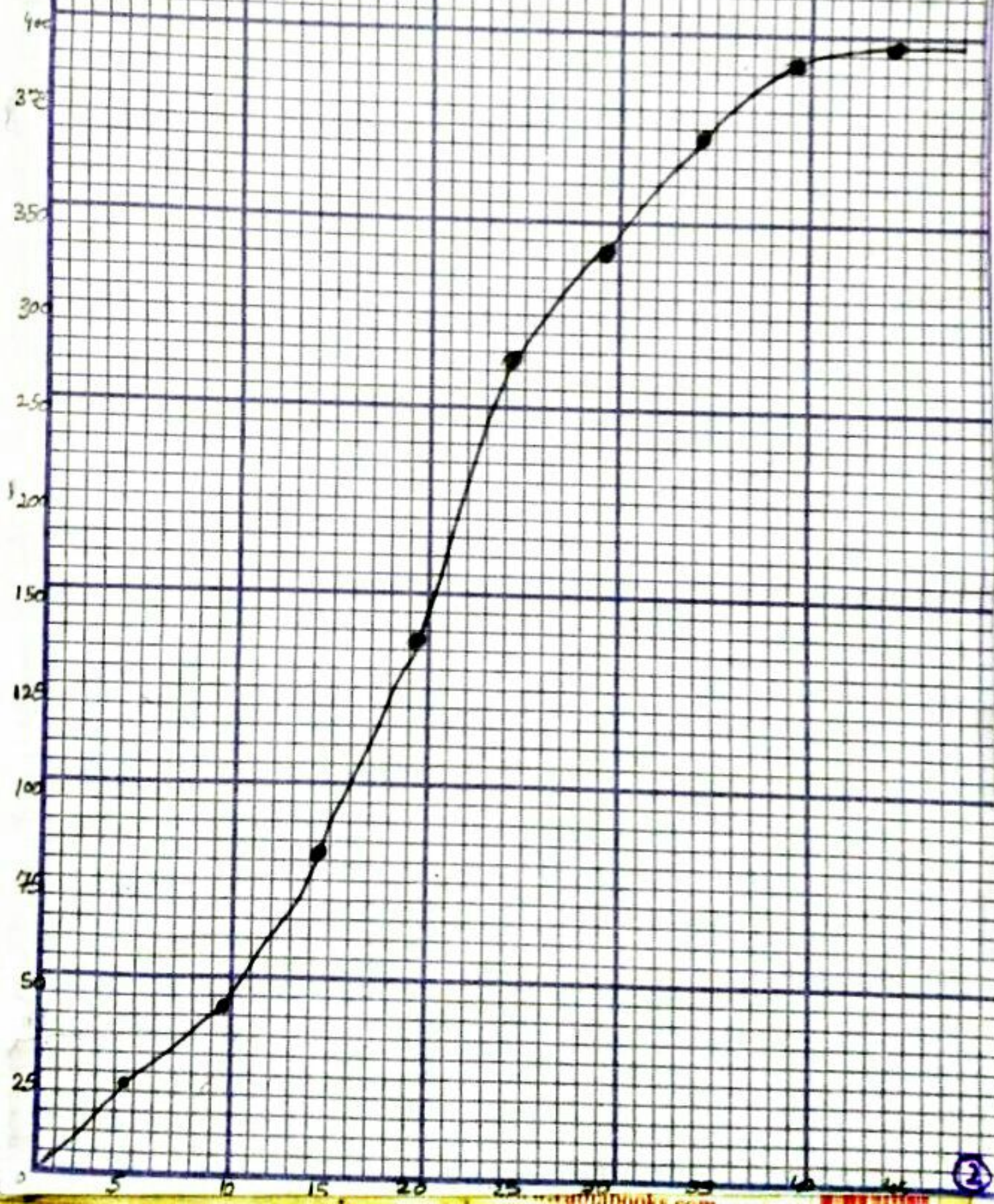
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a) 118 students took less than 18 minutes

b) Taking equal class interval

| Time | Class boundaries | frequency | C. f |
|-------|------------------|-----------|------|
| 0-4 | 0.5 — 4.5 | 25 | 25 |
| 5-9 | 4.5 — 9.5 | 20 | 45 |
| 10-14 | 9.5 — 14.5 | 36 | 81 |
| 15-19 | 14.5 — 19.5 | 62 | 143 |
| 20-24 | 19.5 — 24.5 | 137 | 280 |
| 25-29 | 24.5 — 29.5 | 69 | 349 |
| 30-34 | 29.5 — 34.5 | 25 | 374 |
| 35-39 | 34.5 — 39.5 | 21 | 395 |
| 40-44 | 39.5 — 44.5 | 5 | 400 |

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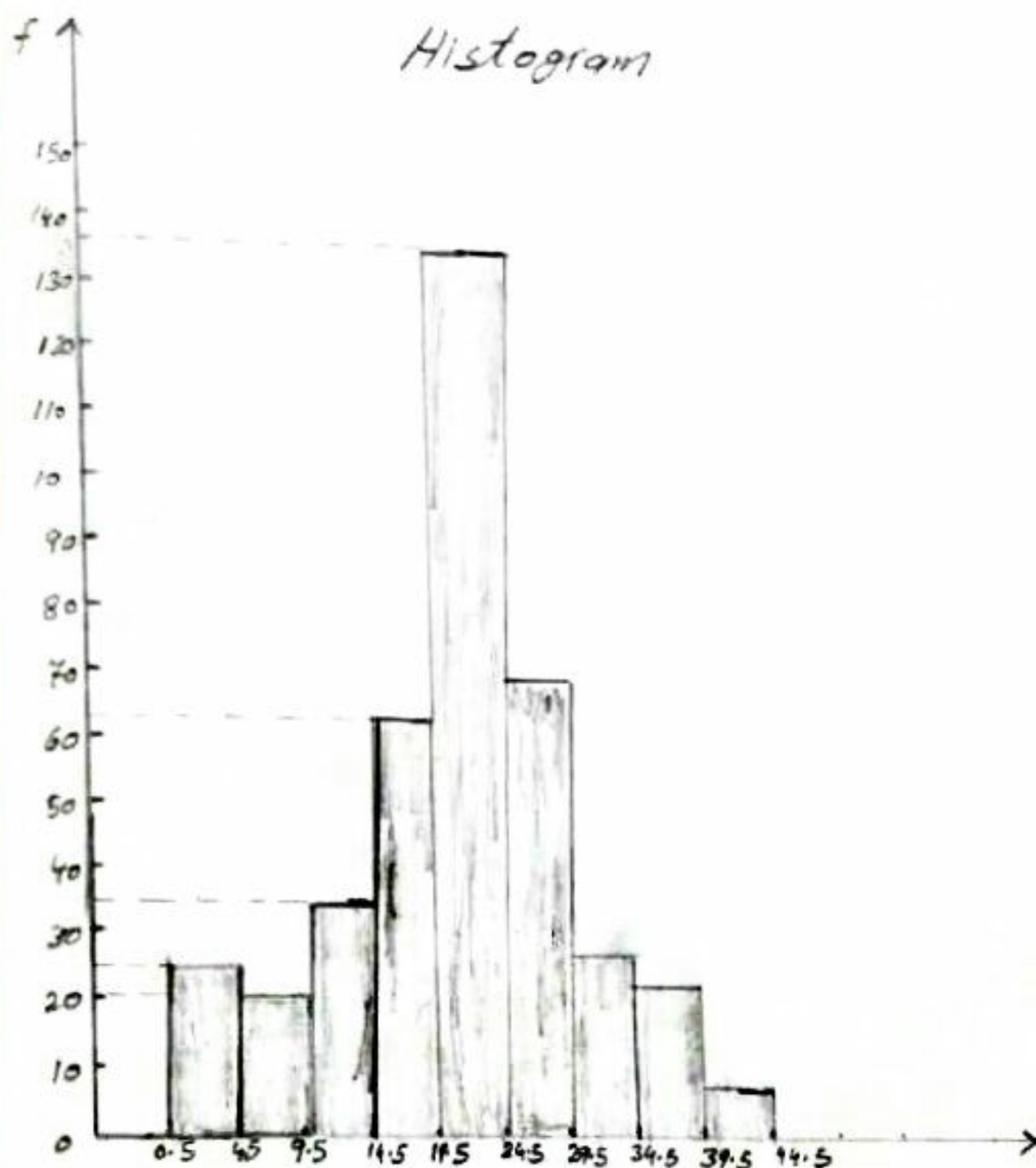
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Q

Draw a histogram



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Q2:- Construction of grouped frequency distribution.

Data:

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 .

Soln

Total No of observation = 30

Largest No = 431

Smallest No = 363

Range = $x_L - x_S$

= $431 - 363$

Range = 68

Taking class interval $h = 10$

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| Class limits | f | x | fx | C.B | C.f |
|--------------|----|-------|--------|---------------|-----|
| 361 — 370 | 2 | 365.5 | 731 | 360.5 — 370.5 | 2 |
| 371 — 380 | 3 | 375.5 | 1126.5 | 370.5 — 380.5 | 5 |
| 381 — 390 | 6 | 385.5 | 2313 | 380.5 — 390.5 | 11 |
| 391 — 400 | 7 | 395.5 | 2768.5 | 390.5 — 400.5 | 18 |
| 401 — 410 | 5 | 405.5 | 2027.5 | 400.5 — 410.5 | 23 |
| 411 — 420 | 3 | 415.5 | 1246.5 | 410.5 — 420.5 | 26 |
| 421 — 430 | 3 | 425.5 | 1276.5 | 420.5 — 430.5 | 29 |
| 431 — 440 | 1 | 435.5 | 435.5 | 430.5 — 440.5 | 30 |
| Total | 30 | | 11925 | | |

Calculation mean :

$$A.M = \frac{\sum fx}{\sum f}$$

$$= \frac{11925}{30}$$

$$= 397.5$$

$$\boxed{\text{Mean} = 397.5}$$

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Calculation of mode:

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

$$\text{Mode} = 390.5 + \frac{(7 - 6)}{(7 - 6) + (7 - 5)} \times 10$$

$$= 390.5 + \frac{1}{1 + 2} \times 10$$

$$= 390.5 + \frac{10}{3}$$

$$\boxed{\text{Mode} = 393.833}$$

Calculation of Quartiles

First Quartiles:

$$Q_1 = L_1 + \frac{h}{f} \left[\frac{n}{4} - c \right]$$
$$= 380.5 + \frac{10}{6} [7.5 - 5]$$

$$\boxed{Q_1 = 384.667}$$

$$\therefore Q_1 = 1 \left[\frac{30}{4} \right]^{\text{th}} \text{value}$$
$$= 1 \left[\frac{30}{4} \right] \text{value}$$
$$= 7.5^{\text{th}} \text{position}$$

2nd Quartiles:

$$Q_2 = L_1 + \frac{h}{f} \left[2 \frac{n}{4} - c \right]$$
$$= 390.5 + \frac{10}{7} [15 - 11]$$

$$\boxed{Q_2 = 396.214}$$

$$\therefore Q_2 = 2 \frac{30}{4}$$
$$Q_2 = 15$$

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3rd Quartile:

$$Q_3 = l_1 + \frac{h}{f} \left[3 \frac{n}{4} - c \right]$$

$$\therefore 3 \frac{30}{4}$$

$$= 400.5 + \frac{10}{5} [22.5 - 18]$$

$$= 22.5^{th}$$

$$\boxed{Q_3 = 409.5}$$

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Q 3:-

Data 1 | 3, 6, 2, 1, 7, 5

Data 2 | 11, 17, 9, 7, 19, 15

Solⁿ

$$\text{1st mean} = \frac{\sum x}{n} = \frac{3+6+2+1+7+5}{6}$$

$$= \frac{24}{6} = (4)$$

$$\text{2nd mean} = \frac{\sum x}{n} = \frac{11+17+9+7+19+15}{6}$$

$$= \frac{78}{6} = (13)$$

We know that by change of origin and scale mean is changed.

The relationship of means of those two data sets are

$$\bar{x} = 4 \quad \text{1st data}$$

multiplying by 2 and adding 5

we get

$$2\bar{x} + 5 = ~~2(4) + 5~~ 2(4) + 5$$

$$= 8 + 5 = (13)$$

(9)

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Standard deviation :

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

using 1st data set

$$S.D = \sqrt{\frac{124}{6} - 16}$$

$$S.D = \sqrt{4.666}$$

$$\boxed{S.D = 2.16}$$

Now by change of origin and scale

we know that by adding and multiplying a constant the variability of the data set is change i.e

$$S.D(cx) = |c| \cdot S.D(x)$$

$$S.D(x \pm c) = S.D(x)$$

where c is any constant

$$\text{Here } S.D = 2.16$$

By multiplying 2 and adding 5

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we have

$$\begin{aligned} S.D (2(2.16) + 5) &= 121 \text{ S.D}(x) \\ &= 2(2.16) \\ &= 4.32 \end{aligned}$$

Hence :

The standard deviation of original data set is multiplying by 2 to get S.D of New data set.

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Q4

Calculation of variance and standard deviation

| Class | f | x | fx | fx ² |
|---------|----|-------|---------|-----------------|
| 64-84 | 15 | 74 | 1110 | 82140 |
| 85-104 | 18 | 94.5 | 1701 | 160744.5 |
| 105-124 | 27 | 114.5 | 3091.5 | 353976.75 |
| 125-144 | 10 | 134.5 | 1345 | 180902.5 |
| 145-164 | 6 | 154.5 | 927 | 143221.5 |
| 165-184 | 5 | 174.5 | 872.5 | 152251.25 |
| 185-204 | 13 | 194.5 | 2528.5 | 491793.25 |
| Total | 94 | | 11575.5 | 1565029.75 |

Variance :

$$S^2 = \frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2$$

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

$$S^2 = 16649.25 - 15164.35$$

$$S^2 = 1484.9$$

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Standard deviation :-

$$S.D = \sqrt{S^2}$$

$$= \sqrt{1484.9}$$

$$S.D = 38.53$$

Q 52 Comment of Sentences.

(a)

Ans:-

May at is a swimming person or
May not be cross it. because
the depth is not constant.

(b)

Ans:

No, every students is not hopeless, there
are some students having high marks
but the ~~same~~ average ~~students~~ marks is
~~badly~~ badly effect by bad students.

Ans:-

No, the Income of kings is very very high
and the ~~mean~~ servants income are very low
as compared to king salary. So here the
king is only one and the servants are more
than one. The king income is an outlier
here. which is highly effected the average
Here using of mean is useless.

The end