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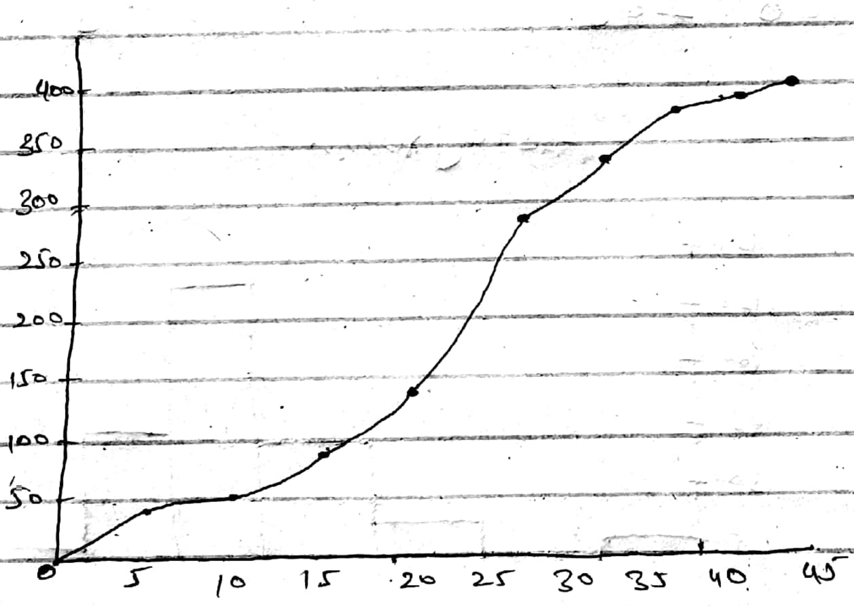
Q1:- Students were asked how long it took them to walk to School on a Particular morning. A cumulative frequency distribution was formed.

Time taken	<5	<10	<15	<20	<25	<30	<35	<40	<45
frequency	25	45	81	143	280	349	374	395	400

a) Draw a Cumulative frequency Curve and estimate how many students took less than 18 minutes.
b) Take equal class intervals of 0-, 5-, 10-, etc Construct frequency distribution and draw a histogram.

Solution :-

Height	frequency	cumulative frequency
<5	25	25
<10	45	70
<15	81	151
<20	143	294
<25	280	574
<30	349	923
<35	374	1297
<40	395	1692
<45	400	2092



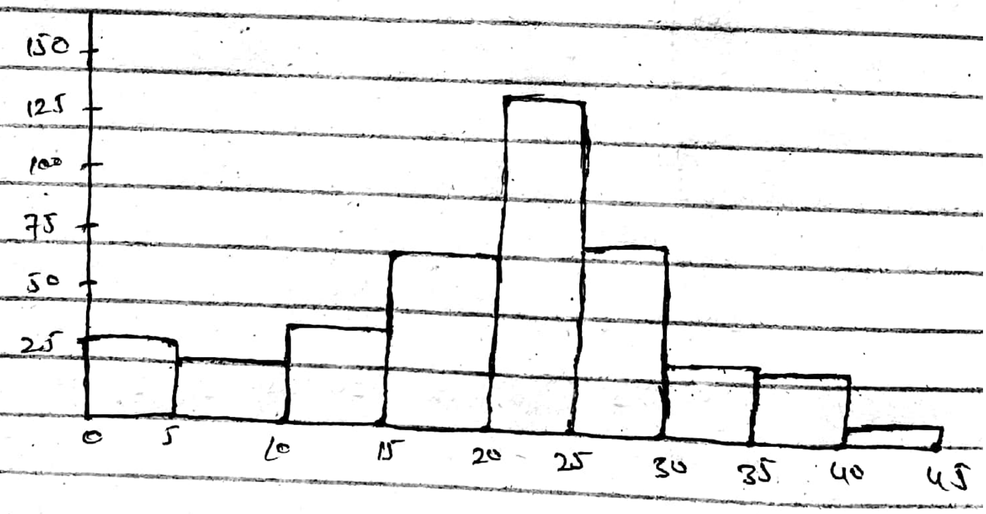
There are 128 students take less than 18 minutes.

Q1b) Take equal class intervals of 0-, 5-, 10-, etc construct frequency distribution and draw a histogram.

frequency distribution.

Time Taken	frequency
0 – 5	25
5 – 10	20
10 – 15	36
15 – 20	62
20 – 25	137
25 – 30	69
30 – 35	25
35 – 40	21
40 – 45	5

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

Solution :-

Range = largest value − Smallest value

= 431 − 363 = 68

$= \frac{68}{5} = 13.6$

Class Size = 14 Approx

Class	Tally	frequency	x	xf	cf	Class boundries
363 − 377	𝍸	5	370	1850	5	362.5 − 377.5
378 − 392	𝍸 IIII	9	385	3465	14	377.5 − 392.5
393 − 407	𝍸 II	7	400	2800	21	392.5 − 407.5
408 − 422	𝍸 I	6	415	2490	27	407.5 − 422.5
423 − 437	III	3	430	1290	30	422.5 − 437.5
Total →		30		11895		

To Find Mean, Mode & Quartiles.

$$\text{Mean} = \frac{\Sigma xf}{\Sigma f} = \frac{11895}{30}$$

$$\boxed{\text{Mean} = 396.5}$$

Mode = The number of values lies in 378 – 392 mode.

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

$$= 378 + \left(\frac{9+5}{2(9)-5-7} \right) \times 14$$

$$= 378 + \left(\frac{4}{18-12} \right) \times 14$$

$$= 378 + \left(\frac{4}{6} \right) \times 14$$

Mode = 378 + 9.33

$\boxed{\text{Mode} = 387}$

Quartiles :-

$$Q_1 = \frac{n}{4}^{th} \text{ item}$$

$$= \frac{30}{4}^{th} \text{ item}$$

$$Q_1 = 7.5^{th} \text{ item}$$

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

$Q_1 = 377.5 + \frac{15}{9}(7.5 - 5)$

$Q_1 = 377.5 + 15/9 \; (2.5)$

$Q_1 = 377.5 + 4.16$

$\boxed{Q_1 = 381}$

$Q_2 = 2\frac{n}{4}^{th}$ item

$Q_2 = \frac{n}{2}^{th}$ item

$= \frac{30}{2}^{th}$ item

$= 15^{th}$ item

Q_2 lies in $392.5 - 407.5$

$Q_2 = l + h/f \; (2n/4 - CF)$

$Q_2 = 392.5 + 15/21 \; (15 - 14)$

$\boxed{Q_2 = 393.2}$

Q3: By multiplying each of the number 3, 6, 2, 1, 7, 5 by 2 and than 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.

Solution:

$$S.d\,(2x+5) = 2\,Sd$$
$$Mean\,(2x+5) = 2\,mean(x) + 5$$

x_1	$x-\bar{x}$	$(x-\bar{x})^2$
3	-1	1
6	2	4
2	-2	4
1	-3	9
7	3	9
5	1	1
24		28

$$Mean\,(x_1) = \frac{\Sigma x_1}{n_1} = \frac{24}{6} = 4$$

$$Mean\,(x_1) = 4$$

$$Sd\,(x_1) = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n}}$$

$$Sd\,(x_1) = \sqrt{\frac{56}{6}} = \sqrt{9.3}$$

$$= 3.04$$

x_2		$(x-\bar{x})^2$
11	-2	4
17	4	16
9	-4	16
7	-6	36
19	6	36
15	2	4
		112

$$m(x_2) = \frac{\sum x_2}{n_2} = \frac{78}{6} = 13$$

$$M(x_2) = 13$$

$$Sd(x_2) = \sqrt{\frac{\sum (x_2 - \bar{x})^2}{n_2}} = \sqrt{\frac{112}{6}} = \sqrt{18.67}$$

$$Sd(x_2) = 4.320$$

$$\text{Mean}(2x+5) = 2\,\text{Mean}(x) + 5$$

$$Sd(2x+5) = 2\,Sd(x)$$

pooled

$$\text{Mean}(2x+5) = 2\,\text{mean}(x)+5$$

$$= 2(4)+5 = 13$$

$$Sd(2x+5) = 2\,Sd\,x = 2(2.14)$$

$$= 4.28$$

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

Solution :-

Class	f	x	xf	$(x-\bar{x})$	$(x-\bar{x})^2$	$f(x-\bar{x})^2$
64-84	15	74	1110	-49.14	2414.7	36220.5
85-104	18	94.5	1701	-28.64	820.24	14764.32
105-124	27	114.5	3091.5	-8.64	74.64	2015.28
125-144	10	134.5	1345	11.36	129.04	1290.4
145-164	6	154.5	927	31.36	983.44	5900.64
165-184	5	174.5	872.5	51.36	2637.8	13189
185-204	13	194.5	2528.5	71.36	5092.2	66198.6
Total →	94		11575.5			723742.1

$$\text{For } (x) = \frac{\sum f(x-\bar{x})}{\sum f}$$

$$\text{For } \bar{x} = \frac{\sum fx}{\sum f}$$

$$\bar{x} = \frac{11575.5}{94} = 123.14$$

$$\text{Formula} = S^2 = \frac{\sum f(x-\bar{x})^2}{n}$$

Put values in Formula.

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$$S^2 = \frac{723742.1}{94}$$

$Var(x) = 7699.38$

Now Take both sides square root

$$\sqrt{S^2} = \sqrt{7699.38}$$

$S = 87.74$ (standard deviation)

Q5: Comment on the following sentences.

a) 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

Comments:-

All people of height 5ft can not cross the river of average depth 5ft being not uniformly deep as its depth varies to 2ft, 7ft, 5ft and 6ft at a various points.

b) The average marks of one class of students are 30. Therefore every student is hopeless.

Comments :-

The marks mentioned in the question are average marks which mean not necessoraly be equal to 30 but it will be around 30 i.e greater than 30 or lesser than 30 Therefore every student must not be hopeless because there must be some student having greater marks than 30.

1) The average income of a King and his household servants is £20,000 per month, therefore all the household servants must be fabulously Paid.

Comments :-

The average income does not mean that all households will be Paid fabusly. King being superior will surely have more income than servants which have generated greater average value of Income