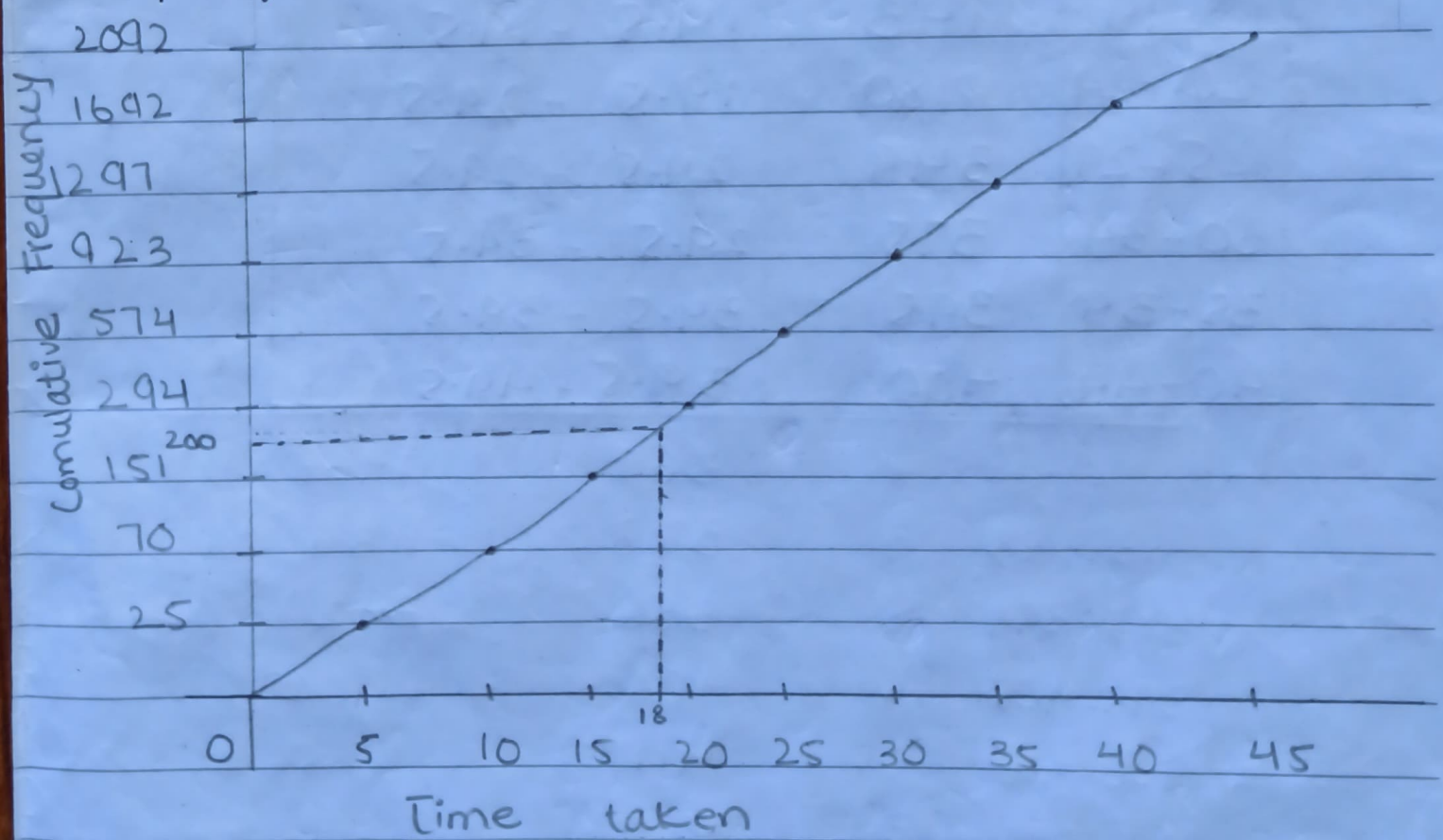
Question #1.

Part 'A'

Draw a commutative frequency curve and estimate how many students took less than 18 minutes.

Time Taken	5	10	15	20	25	30	35	40	45
Frequency	25	45	81	143	280	349	374	395	400
C. Frequency	25	70	151	294	574	923	1297	1692	2092

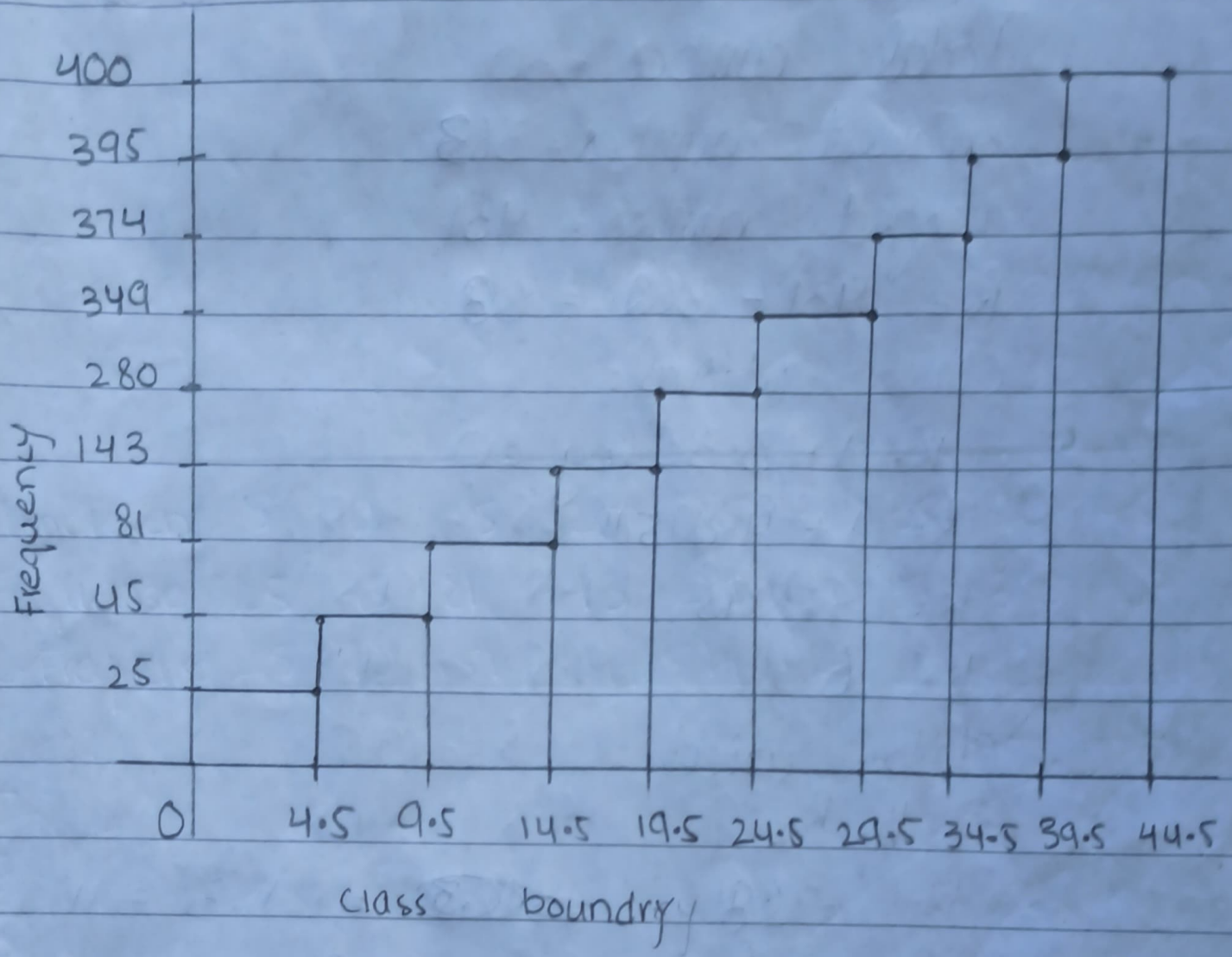


while students go to school approximately, 200 students take less than 18 minutes.

Q1: Part "B"

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

Class interval	Frequency	Class boundary
0-4	25	0.05 - 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	375	29.5 - 34.5
35-39	395	34.5 - 39.5
40-44	400	39.5 - 44.5



Q 2: 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, 389, 400, 381, 399, 415, 428, 422, 396, 372, 410, 419, 386, 390.

Total numbers = 30

Smallest numbers = 363

Largest number = 431

$R = 431 - 363 = 68$

Class interval:

$K = 1 + 3.33 \log 30$

$K = 1 + 4.8951$

$K = 5.895$

$K = 6$

Class width:

$h = R/K$

Put values

$h = 68/6$

$= 11.3$

$= 11$

Classes	f	Mid-P(x)	f.x	C.f
363-374	4	368.5	1474	4
374-385	3	379.5	1138.5	7
385-396	8	390.5	3124	15
396-407	5	401.5	2007.5	20
407-418	5	412.5	2062.5	25
418-429	4	423.5	1694	29
429-440	1	434.5	434.5	30
	$\Sigma f = 30$		$\Sigma fx = 11935$	

Grouped Distribution table

model group

MEAN :→

As $\text{mean} = \frac{\Sigma fx}{\Sigma f}$

and from table we have

$\Sigma fx = 11935$ and

$\Sigma f = 30$

Put values in formula

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

$\bar{x} = \frac{11935}{30}$

$\boxed{\bar{x} = 397.83}$.

MODE :→

As $\text{mode} = l + \left[\frac{fm - fo}{2fm - fo - f_1}\right] \times h$

for mode we have to select model group in table.

So,

from table we

$l = 385$

$fm = 8$

$fo = 3$

$f_1 = 5$

and $h = 11$

Put values in formula

$$= 385 + \left[\frac{8-3}{2(8)-3-5}\right] \times 11$$

$$= 385 + \left(\frac{5}{8}\right) \times 11$$

$$= 385 + (0.625) \times 11$$

$$= 385 + 6.875$$

$$\boxed{\text{Mode} = 391.875}$$

QUARTILES :⟶

$$Q_1 = \frac{1}{4}(n+1)^{th} \text{ item}$$

$n = 30$

Put values

$$Q_1 = \frac{1}{4}(30+1)^{th} \text{ item}$$

$$= \frac{31}{4}$$

$$= (7.75)^{th} \text{ item}$$

So,

Q_1 lies in class 385 - 396

$$Q_1 = l + \frac{h}{f}\left(\frac{n+1}{4} - c.f\right)$$

Put values

$$Q_1 = 385 + \frac{11}{8}(7.75 - 7)$$

$$= 385 + 1.375\ (0.75)$$

$$= 385 + 1.031$$

$$\boxed{Q_1 = 386.03}$$

$Q_2 :\rightarrow$

$$Q_2 = \frac{2}{24}(n+1)$$

$$= \frac{30+1}{2}$$

$$= \frac{31}{2}$$

$$= 15.5$$

So, Q_2 lies in class 396 - 407

$$Q_2 = l + \frac{h}{f}\left(2\left(\frac{n+1}{4}\right)\right) - c.f$$

$$= 396 + \frac{11}{5}\left(2\left(\frac{31}{4}\right)\right) - 15$$

$$= 396 + \frac{11}{5}(15.5 - 15)$$

$= 396 + 2.2\ (0.5)$

$= 396 + 1.1$

$\boxed{Q_2 = 397.1}$

$Q_3 :\longrightarrow$

$Q_3 = \frac{3}{4}(n+1)^{th}$ item

$= \frac{3}{4}(31)^{th}$ item

$= 0.75\ (31)^{th}$ item

$Q_3 = 23.25$

So, Q_3 lies in class $407 - 418$

$$Q_3 = L + \frac{h}{f}\left[3\left(\frac{n+1}{4}\right)\right] - c.f$$

Put values.

$$Q_3 = 407 + \frac{11}{5}(23.25 - 20)$$

$= 407 + 2.2\ (3.25)$

$= 407 + 7.15$

$\boxed{Q_3 = 414.15}$

Q.3 :→ By multiplying each ---------- of the two sets.

FIRST we have to find that

Mean of 2nd set = 2 x mean of 1st set + 5

Mean of 2nd set

$$\text{Mean} = \bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

or

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

So

$$\bar{x} = \frac{11+17+9+7+19+15}{6}$$

$$\bar{x} = \frac{78}{6}$$

$$\boxed{\bar{x} = 13} \rightarrow (i)$$

Mean of first set

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

$$\bar{x} = \frac{24}{6}$$

$$\bar{x} = 4$$

So,

$$\Rightarrow 2 \times 4 + 5$$

$$\Rightarrow 13 \longrightarrow \text{ii}$$

From (i) and (ii) it is proved that

Mean of 2nd set = 2 × mean of 1st set + 5 proved.

$$S.D = \sqrt{\frac{\Sigma (x - \bar{x})^2}{n}}$$

and

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

$$\bar{x} = \frac{3+6+2+1+7+5}{6} = \frac{24}{6} = 4$$

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

Table of Set 1st

$$S.D = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n}}$$

$$= \sqrt{\frac{28}{24}}$$

$$= \sqrt{1.16}$$

$$S.D = 1.26 \longrightarrow (i)$$

x	$x - \bar{x}$	$(x - \bar{x})^2$
11	-2	4
17	4	16
9	-4	16
7	-6	36
19	6	36
15	2	4
$n = 78$		$\Sigma(x - \bar{x})^2 = 112$

Table for 2nd set.

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

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

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

$$\bar{x} = 13$$

$$S.D = \sqrt{\frac{\Sigma(x - \bar{x})^2}{n}}$$

put values

$$= \sqrt{\frac{112}{78}}$$

$$= \sqrt{1.43}$$

S.D = 1.195 $\Rightarrow$ 2nd set

S.D = 1.2 $\longrightarrow$ ii

It is proved that (from i) the S.D is also and ii). equal.

Q4: For the following grouped distribution table calculate The variance and Standard Deviation.

STANDARD DEVIATION :→

$$S.D = \sqrt{\frac{\Sigma f(x-\bar{x})^2}{\Sigma f}}$$

VARIANCE :→

$$S^2 = \frac{\Sigma f(x-\bar{x})^2}{\Sigma f}$$

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

Classes	f	x	fx	$x-\bar{x}$	$(x-\bar{x})^2$	$f(x-\bar{x})^2$
64-84	15	74	1110	-49.14	2414.73	36220.9
85-104	18	94.5	1701	-28.64	820.24	14764.3
105-124	27	114.5	3091.5	-8.64	74.64	2015.2
125-144	10	134.5	1345	11.36	129.04	1290.4
145-164	6	154.5	927	31.36	983.44	5900.6
165-184	5	174.5	872.5	51.36	2637.84	13189.2
185-204	13	194.5	2528.5	71.36	5092.24	66199.12
	$\Sigma f=94$		$\Sigma fx=$			$\Sigma f(x-\bar{x})^2$
			11575.5			$=139579.91$

Table

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

put values

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

$$\bar{x} = 123.14$$

$$S.D = \sqrt{\frac{\Sigma f(x-\bar{x})^2}{\Sigma f}}$$

put values

$$S.D = \sqrt{\frac{139579.91}{94}}$$

$$= \sqrt{1484.89}$$

$$\boxed{S.D = 38.53}$$

Variance :

$$S^2 = \frac{\Sigma f(x - \bar{x})^2}{\Sigma f}$$

Put values

$$S^2 = \frac{139579.91}{94}$$

$$\boxed{S^2 = 1484.89}$$

Q5:→ Comment on the following sentences

ANSWER FOR POINT A:→

Shows the high level of dispersion as it can be observed from given data i.e 2, 7, 5, 6

while the average = 5 reflects all other points are different from average value shows dispertion.

ANSWER FOR POINT B :→

Point 2 Reflects that all students average marks are 30 while reflects the poor performance of whole class

ANSWER FOR POINT C :→

Point C reflects the direct correlation amoung average income of King family and payments to their servants i.e

Kings family Income ↑ → Payment to servants ↑