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Discipline : MLT 6th

Subject : Biostatistics

Q2.

a) Calculation of overall mean consumption and standard deviations of the data given in the table.

➤ Overall mean for men

		overall means
Fresh vegetables	(204+259+266+317)/4	= 261.5 grams
Fruits	(31+45+69+105)/4	= 62.5 grams
Rice	(367+337+269+243)/4	= 304.75 grams
Fish	(23+28+31+44)/4	= 31.5 grams
Meat	(70+61+69+77)/4	= 69.25 grams

➤ Overall mean for women

		overall mean
Fresh vegetable	(178+235+266+304)/4	245.7 gm
fruits	(28+46+70+121)/4	66.2 g
Rice	(315+276+243+220)/4	263.5 g
Fish	(19+21+28+46)/4	28.5 g
meat	(48+43+54+63)/4	52 g

Standard deviation

Formula : $\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}$

Standard deviation For men

Fresh vegetable (Men) Mean is 261.5 so,

put value $\sigma = \sqrt{\frac{(204-261.5)^2+(259-261.5)^2+(266-261.5)^2+(317-261.5)^2}{4}}$

$\sigma = \sqrt{\frac{(-57)^2+(-2.5)^2+(4.5)^2+(55.5)^2}{4}}$

$\sigma = \sqrt{\frac{(3306.25)+6.25+20.25+3080.25}{4}}$

$\sigma = \sqrt{\frac{6413}{4}} = \sqrt{1603.25}$

$\sigma = 40.04$

Fruits (Men) Mean = 62.5

put value $\sigma = \sqrt{\frac{(31-62.5)^2+(45-62.5)^2+(69-62.5)^2+(105-62.5)^2}{4}}$

$\sigma = \sqrt{(-31.5)^2 + (-17.5)^2 + (6.5)^2 + (42.5)^2/4}$

$\sigma = \sqrt{992.25 + 306.25 + 42.25 + 1806.25/4}$

$\sigma = \sqrt{3147/4} = \sqrt{786.75} = 28.04$

Rice (Men)

Mean = 304.75

put value

$$\sigma = \sqrt{\frac{(367-304.75)^2+(337-304.75)^2+(269-304.75)^2+(246-304.75)^2}{4}}$$

$$\sigma = \sqrt{\frac{(62.25)^2+(32.25)^2+(-35.75)^2+(-58.75)^2}{4}}$$

$$\sigma = \sqrt{\frac{9644.74}{4}} = \sqrt{2411.1}$$

$$\sigma = \boxed{49.1}$$

Fish (Men)

Mean = 31.5

Put value

$$\sigma = \sqrt{\frac{(23-31.5)^2+(28-31.5)^2+(31-31.5)^2+(44-31.5)^2}{4}}$$

$$\sigma = \sqrt{\frac{(-8.5)^2+(-3.5)^2+(-0.5)^2+(12.5)^2}{4}}$$

$$\sigma = \sqrt{\frac{72.25+12.25+(0.25)+156.25}{4}}$$

$$\sigma = \sqrt{\frac{241}{4}}$$

$$\sigma = \sqrt{60.25}$$

$$\sigma = \boxed{7.8}$$

Meat (Men)

Mean = 69.25

put value

$$\sigma = \sqrt{\frac{(70-69.25)^2+(61-69.25)^2+(69-69.25)^2+(77-69.25)^2}{4}}$$

$$\sigma = \sqrt{\frac{(0.75)^2+(-8.25)^2+(-0.25)^2+(7.75)^2}{4}}$$

$$\sigma = \sqrt{\frac{0.56+68.06+0.06+60.06}{4}}$$

$$\sigma = \sqrt{\frac{128.74}{4}} = \sqrt{32.2}$$

$$\sigma = \boxed{5.7}$$

Standard deviation (women)

SD Formula $\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}$

∴ Standard deviation of Fresh vegetables (women) Mean = 245.75

Put value $\sigma = \sqrt{\frac{(178-245.75)^2+(235-245.75)^2+(266-245.75)^2+(304-245.75)^2}{4}}$

$\sigma = \sqrt{\frac{4590+115.6+410+3393}{4}}$

$\sigma = \sqrt{\frac{8508.6}{4}} = \sqrt{2127}$

$\sigma = \boxed{46.1}$

∴ Standard deviation of Fruits (women)
Mean = 66.25

put value $\sigma = \sqrt{\frac{(28-66.25)^2+(46-66.25)^2+(70-66.25)^2+(124-66.25)^2}{4}}$

$\sigma = \sqrt{\frac{1463+410+14+2997}{4}} = \sqrt{\frac{4884}{4}}$

$\sigma = \sqrt{1221} = \boxed{\sigma = 34.95}$

∴ Standard deviation of Rice (women)

Mean = 263.5

Put value

$$\sigma = \sqrt{\frac{(315-263.5)^2+(276-263.5)^2+(243-263.5)^2+(220-263.5)^2}{4}}$$

$$\sigma = \sqrt{\frac{2652.25 + 156.25 + 420.25 + 1892.25}{4}}$$

$$\sigma = \sqrt{\frac{5121}{4}} = \sqrt{1280.2}$$

$$\sigma = \boxed{71.6}$$

∴ Standard deviation of Fish (women)

Mean = 28.5

Put value $\sigma = \sqrt{\frac{(19-28.5)^2+(21-28.5)^2+(28-28.5)^2+(46-28.5)^2}{4}}$

$$\sigma = \sqrt{\frac{(-9.5)^2 + (-7.5)^2 + (-0.5)^2 + (17.5)^2}{4}}$$

$$\sigma = \sqrt{\frac{90.25 + 56.25 + 0.25 + 306.25}{4}} = \sqrt{\frac{453}{4}}$$

$$\sigma = \sqrt{113.2} = \boxed{10.6}$$

∴ Standard deviation of Meat (women) mean = 52

Put value $\sigma = \sqrt{\frac{(48-52)^2 + (43-52)^2 + (54-52)^2 + (63-52)^2}{4}}$

$$\sigma = \sqrt{\frac{16 + 81 + 4 + 121}{4}} = \sqrt{\frac{222}{4}}$$

$$\sigma = \sqrt{55.5} = \boxed{7.4}$$

Q1

(b) Milk

The data given in the chart indicates that the intake of milk is very less for both genders.

Root vegetable

The root vegetable is also intake in very less amount for both genders, although men consumption is greater the women.

Wheat flour

The consumption of wheat flour is also below average

Milk, Root vegetable and wheat flour are essential foods or nutrients for women as well as men health. It must provided in the required amount.

Q1)

© Rice

The mean consumption of men is 304 grams while the women is 263 grams which indicates that men consumption is higher than women, That's why men are more energetic

Fruit

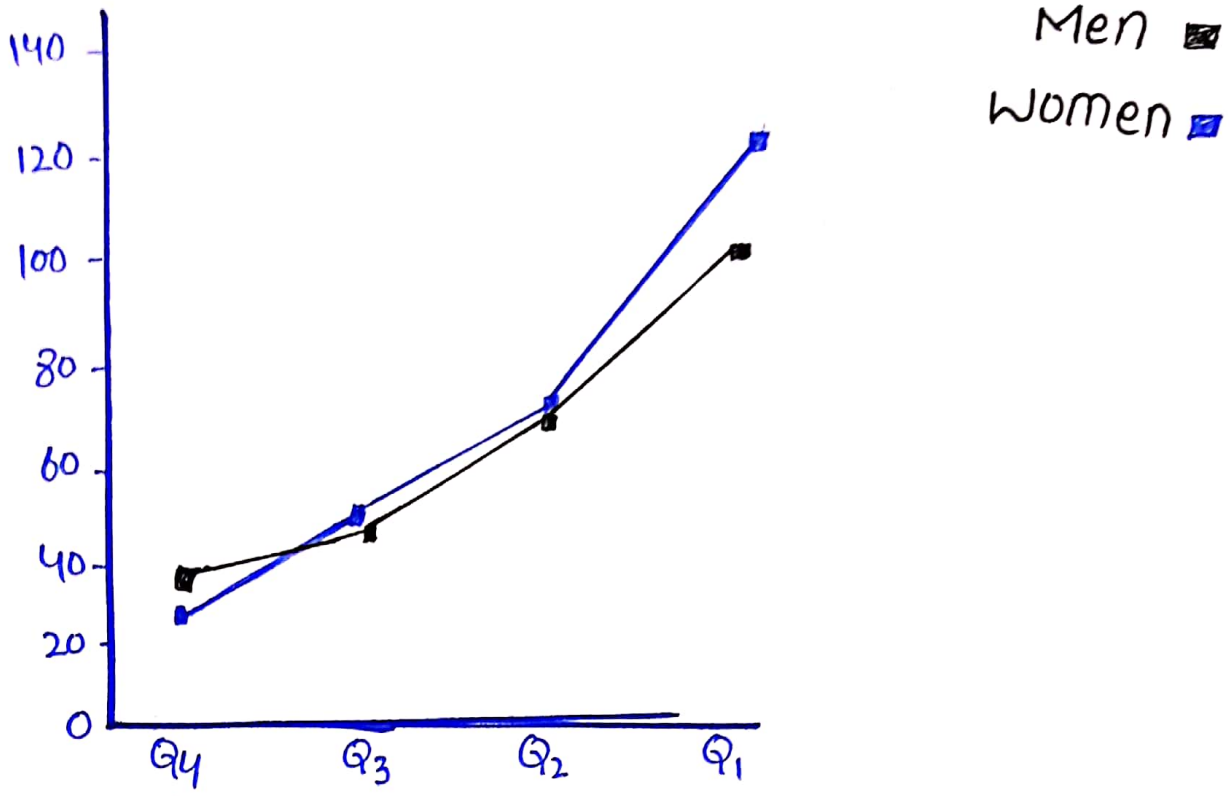
The mean of men is 62.5 grams while the mean consumption of women is 66.25 grams, it indicates the women consumed little much more than men. essential for meneral & vitamins.

Fish

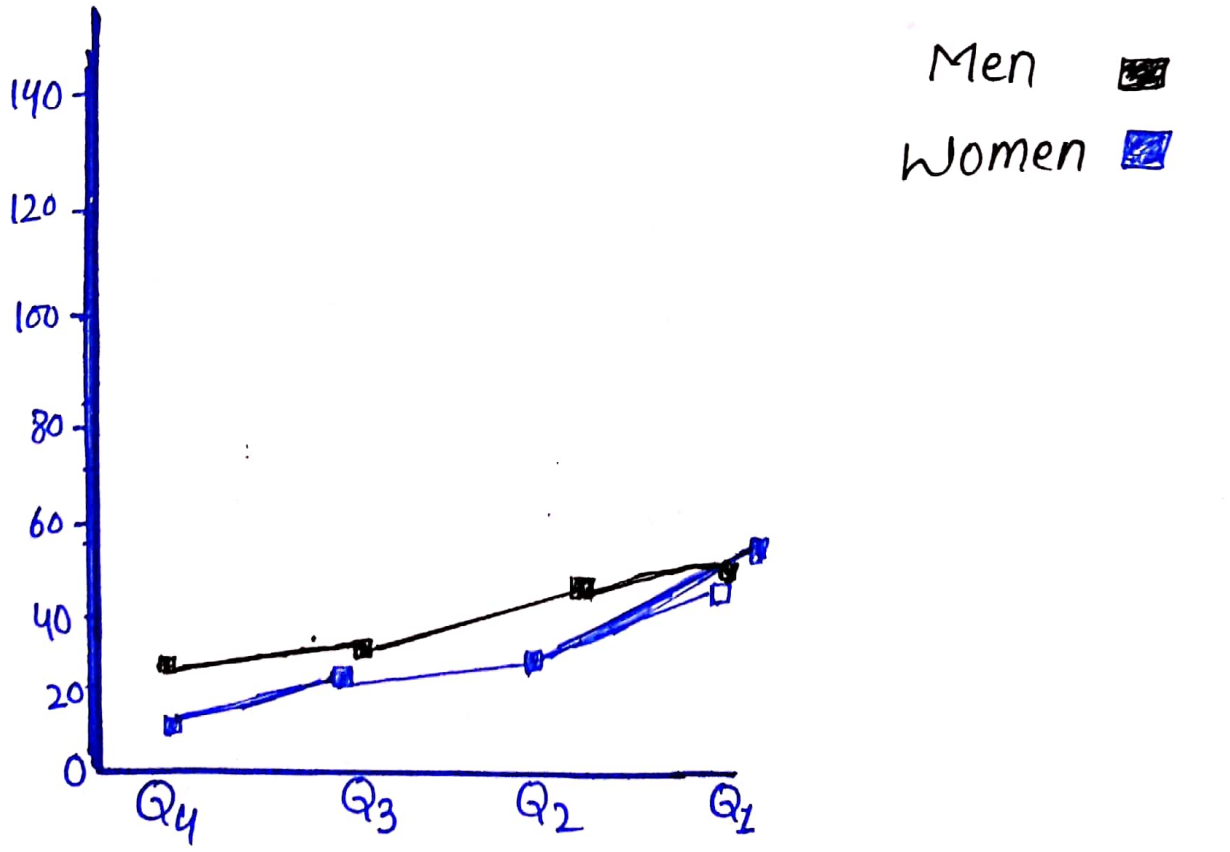
The mean consumption for men is 31.5 grams while for women is 28.5 grams, indicates the consumption of men is more than women, That's why men have more stronger immune system than women.

In rice both women and women are are gradually increases.

Q1
(d)



Comparison of fruit consumption between men & women



Q1.

(e) In fresh vegetable Q1 women are more than Q4 men, each woman consumed 78 grams while men consumed 62 grams.

Q1.

(f) In fruit men standard deviation is less than women.
In Rice standard deviation for women is greater than men.
In fish and meat standard deviation for women is greater than men.
In fresh vegetable standard deviation for women is greater than men.

Q1 END

Q2.

a) Describe the purpose of a Census

purpose of Census:-

The purpose of Census is to count the entire population of country & location of every person of the country.

b)

Census	Survey
- The collection of data about every member of the Population.	- The collection of data from a part or community of the population.
- Detailed information is collected that takes long time to complete	- Information are collected briefly that takes short time to complete
- Conducted by the government.	Can conducted by anyone.

c) From the given information 2011 UK census attached a response rate of 94% indicates that it represents the requirments of the people that may be accurate.

(d) Asking such questions about a specific religion indicate harsh behavior & religion hated public/members in the population, such type of questions about religion are invalidate.

(e) - Problems conducted

i) Guideline: people do not understand that how to fill the census paper

How to Overcome: To guide people that how to fill online census paper.

ii) Lack of Knowledge: People don't understand theme of the questions.

How to overcome: Appropriate Knowledge should be provided.

iii) Lack of interest: People may not take interest to fill the census form.

How to overcome: To tell them about the importance of census that it is for your good well, to take interest in it.

Q2

f) Potential problems in incorporating additional data held by govt agencies.

Census is such a difficult task to perform, such problems occuring during performing censes;

(i) Server required: A large server is required to incorporate the additional data.

(ii) Experts are required: Experts are required to conduct & maintain the data.

(iii) Less accuracy:- The data collected may not be accurate.

Q3

Part (a)

Rain fall (inches)	f	x	fx	Log x	f log x	|x 36.81	f|x-36.8|
20 - 24	1	22	22	1.3424	1.3424	14.8	14.8
25 - 29	3	27	81	1.4313	4.2940	9.8	29.4
30 - 34	5	32	160	1.5051	7.5257	4.8	24
35 - 39	8	37	296	1.5628	12.5456	0.2	1.6
40 - 44	5	42	210	1.6232	8.1162	5.2	26
45 - 49	2	47	94	1.6720	3.3441	10.2	20
50 - 54	0	52	0	1.7160	0	15.2	0
55 - 59	1	57	57	1.7558	1.7558	20.2	20.2
	25		920		38.9238		136.4

☞ Arthmetic mean.

as Arthmetic mean

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

$$A.m = \frac{920}{25}$$

$$A.m = 36.8$$

So the Arthmetic mean is 36.8 inches.

Geometric mean.

$$G.M = \text{Anti-log} = \left[\frac{\Sigma f \log x}{\Sigma f}\right]$$

$$GM = \text{Antilog} = \left(\frac{38.9238}{25}\right)$$

$$GM = \text{Antilog}\ (1.5569)$$

$$\boxed{GM = 36.05}$$

Hormonic mean

as we know $\frac{AM \times HM}{AM} = \frac{(GM)^2}{AM}$

$$\frac{\cancel{AM} \times HM}{\cancel{AM}} = \frac{(GM)^2}{AM}$$

$$HM = \frac{(GM)^2}{AM}$$

$$HM = \frac{(36.05)^2}{36.8}$$

$$HM = \frac{1299.6}{36.8}$$

$$\boxed{HM = 35.31}$$

MEDIAN

Rain fall (inches)	f	class boundaries	cumulative frequency
20 – 24	1	19.5 – 24.5	1
25 – 29	3	24.5 – 29.5	4
30 – 34	5	29.5 – 34.5	9
35 – 39	8	34.5 – 39.5	17
40 – 44	5	39.5 – 44.5	22
45 – 49	2	44.5 – 49.5	24
50 – 54	0	49.5 – 54.5	24
55 – 59	1	54.5 – 59.5	25
	25		

$$\text{Median} = L + \frac{h}{f}\left(\frac{n}{2} - c\right)$$

Here $n = \sum f = 25$

$= \left(\frac{n}{2}\right)^{th}$ term, put value $= \left(\frac{25}{2}\right)^{th}$ term

$= 12.5^{th}$ term

Since 12.5 lies b/w 34.5–39.5

Now $L = 34.5$, $h = 5$, $f = 8$, $c = 9$

P-T-O

$$\text{Median} = 34.5 + \frac{5}{8}\left(\frac{25}{2} - 9\right)$$

$$= 34.5 + \frac{5}{8}(12.5 - 9)$$

$$= 34.5 + \frac{5}{8}(3.5)$$

$$= 34.5 + \frac{17.5}{8}$$

$$= 34.5 + 2.18$$

Median = 36.68

➢ MODE

as we know

$$\text{Mode} = L + \frac{fm - f_0}{2fm - f_0 - f_1} \times h$$

Here the model frequency is "8" which Lies b/w 34.5 - 39.5

Now $L = 34.5,\ fm = 8,\ f_0 = 5,\ f_1 = 5,\ h = 5$

put value

$$\text{Mode} = 34.5 + \frac{8-5}{2(8) - 5 - 5} \times 5$$

$$= 34.5 + \frac{3 \times 5}{6}$$

$$= 34.5 + 2.5$$

Mode = 37 inches

Quartiles

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

$\Rightarrow$ Here $n = \Sigma f = 25$

$\Rightarrow$ Now $\left(\frac{n}{4}\right)^{th}$ term

$\Rightarrow$ $\left(\frac{25}{4}\right)^{th}$ term

$\Rightarrow$ 6.25^{th} term

$\Rightarrow$ Since 6.25 lies b/w 29.5 – 34.5

and so ; $L = 29.5, h = 5, f = 5, c = 4$

$\Rightarrow$ Now put value $Q_1 = 29.5 + \frac{5}{5}\left(\frac{25}{4} - 4\right)$

$Q_1 = 29.5 + (6.25 - 4)$

$\Rightarrow$ $Q_1 = 29.5 + 2.25$

$\Rightarrow$ $Q_1 = 31.75$ inches

$\Rightarrow$

Q_2 = Mean

$Q_2 = 36.68$ inches

Q3

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

$\left(\frac{3n}{4}\right)^{th}$ term

as $n=25 \Rightarrow \left(\frac{3\times 25}{4}\right)^{th}$ term

$\Rightarrow \left(\frac{75}{4}\right)^{th}$ term

$\Rightarrow$ 18.75^{th} term

Since 18.75 lies between 39.5 — 44.5

Now : $L = 39.5$, $h = 5$, $f = 5$, $c = 17$

put value in $L + \frac{h}{f}\left(\frac{3n}{4} - c\right)$

$\Rightarrow 39.5 + \frac{5}{5}\left(\frac{3\times 25}{4} - 17\right)$

$\Rightarrow 39.5 + \left(\frac{75}{4} - 17\right)$

$\Rightarrow 39.5 + (18.75 - 17)$

$\Rightarrow 39.5 + 1.75$

$\Rightarrow$ **41.25 inches**

DECILE

$$D_1 = L + \frac{h}{f}\left(\frac{n}{10} - c\right)$$

$\Rightarrow \left(\frac{n}{10}\right)$th term

put value of $n = 25$

$\Rightarrow \left(\frac{25}{10}\right)^{th}$ term

$\Rightarrow$ 2.5 th term

Since 2.5 lies between 24.5 – 29.5

as $L = 24.5$, $h = 5$, $f = 3$, $c = 1$

put value in $\Rightarrow D_1 = 24.5 + \frac{5}{3}\left(\frac{25}{10} - 1\right)$

$\Rightarrow D_1 = 24.5 + \frac{5}{3}(25 - 1)$

$\Rightarrow D_1 = 24.5 + (1.66)(15)$

$\Rightarrow D_1 = 24.5 + 2.5$

$\Rightarrow$ **$D_1 = 27$ inches**

$$D_2 = L + \frac{h}{f}\left(\frac{2n}{10} - c\right)$$

$\Rightarrow \left(\frac{2n}{10}\right)^{th}$ term

$\Rightarrow$ Put value of $n = 25$ $\Rightarrow \left(\frac{2 \times 25}{10}\right)^{th}$ term

$\Rightarrow \left(\frac{50}{10}\right)^{th}$ term

$\Rightarrow$ 5th term

Since 5 lies b/w 29.5 — 34.5

So put value of L = 29.5, h = 5, f = 5

and c = 4

$$D_2 = 29.5 + \frac{5}{5}\left(\frac{2\times25}{10} - 4\right)$$

$$D_2 = 29.5 + (5 - 4)$$

$$D_2 = 29.5 + 1$$

$$\boxed{D_2 = 30.5 \text{ inches}}$$

$$D_3 = L + \frac{h}{f}\left(\frac{3n}{10} - c\right)$$

$\left(\frac{3n}{10}\right)^{th}$ term

Put value of n = 25

$\Rightarrow \left(\frac{3\times25}{10}\right)^{th}$

$\Rightarrow \left(\frac{75}{10}\right)^{th}$ term $\Rightarrow$ 7.5 th term

As lies b/w 29.5 — 34.5

Now $D_3 = 29.5 + \frac{5}{5}\left(\frac{3\times25}{10} - 4\right)$

$\Rightarrow D_3 = 29.5 + (7.5 - 4)$

$D_3 = 29.5 + 3.5$

$$\boxed{D_3 = 33 \text{ inches}}$$

$$D_4 = L + \frac{h}{f}\left(\frac{4n}{10} - c\right)$$

$\left(\frac{4n}{10}\right)^{th}$ term

Put value of $n = 25$

$\Rightarrow \left(\frac{4 \times 25}{10}\right)^{th}$ term $\Rightarrow \left(\frac{100}{10}\right)^{th}$ term

$\Rightarrow 10^{th}$ term

Since 10 lies between 34.5 — 39.5

Now $L = 34.5$, $h = 5$, $f = 8$, $c = 9$

$$D_4 = 34.5 + \frac{5}{8}\left(\frac{4 \times 25}{10} - 9\right)$$

$$D_4 = 34.5 + \frac{5}{8}(10 - 9)$$

$$D_4 = 34.5 + 0.62$$

$$\boxed{D_4 = 35.1}$$

$$D_5 = L + \frac{h}{f}\left(\frac{5n}{10} - c\right)$$

$\left(\frac{5n}{10}\right)^{th}$ term $\Rightarrow \left(\frac{5 \times 25}{10}\right)^{th}$ term

$\Rightarrow \left(\frac{125}{10}\right)^{th}$ term

$\Rightarrow 12.5^{th}$ term

P.T.O

$\Rightarrow$ 12.5 lies b/w 34.5 — 39.5

Now as $L = 34.5$, $h = 5$, $f = 8$, $c = 9$

Put value

$$D_5 = 34.5 + \frac{5}{8}(12.5 - 9)$$

$$D_5 = 34.5 + 2.18$$

$$\boxed{D_5 = 36.8 \text{ inches}}$$

$$D_6 = L + \frac{h}{f}\left(\frac{6n}{10} - c\right)$$

$\left(\frac{6n}{10}\right)^{th}$ term $\Rightarrow$ Put value of $n = 25$

$$\Rightarrow \left[\frac{6 \times 25}{10}\right]^{th} \text{ term}$$

$$\Rightarrow \left(\frac{150}{10}\right)^{th} \text{ term} \Rightarrow 15^{th} \text{ term}$$

Since ~~12.5~~ 15 lies b/w 34.5 — 39.5

Now as $L = 34.5$, $h = 5$, $f = 8$, $c = 9$

Put value in D_6

$$D_6 = 34.5 + \frac{5}{8}\left(\frac{6 \times 25}{10} - 9\right)$$

$$\Rightarrow D_6 = 34.5 + \frac{5}{8}(15 - 9)$$

$$\Rightarrow D_6 = 34.5 + \frac{5}{8}(6)$$

$$\Rightarrow D_6 = 34.5 + 3.75 \Rightarrow \boxed{D_6 = 38.25}$$

$$D_7 = L + \frac{h}{f}\left(\frac{7n}{10} - c\right)$$

$\left(\frac{7n}{10}\right)^{th}$ term

$\Rightarrow \left(\frac{7 \times 25}{10}\right)^{th}$ term

$\Rightarrow \left(\frac{175}{10}\right)^{th}$ term

$\Rightarrow$ **17.5 th term**

Now put value according to, since 17.5 lies b/w 39.5 — 44.5

$$D_7 = 39.5 + \frac{5}{5}\left(\frac{7 \times 25}{10} - 17\right)$$

$$\Rightarrow D_7 = 39.5 + (17.5 - 17)$$

$$\Rightarrow D_7 = 39.5 + 0.5$$

$$\Rightarrow \boxed{D_7 = 40 \text{ inches}}$$

$$D_8 = L + \frac{h}{f}\left(\frac{9n}{10} - c\right)$$

$\left(\frac{9n}{10}\right)^{th}$ term $\Rightarrow$ put value of $n = 25$

$\Rightarrow \left(\frac{9 \times 25}{10}\right)^{th}$ term $\Rightarrow \left(\frac{225}{10}\right)^{th}$ term

$\Rightarrow$ 22.5 th term

P-T-O

$$D_8 = L + \frac{h}{f}\left(\frac{8n}{10} - C\right)$$

$\left(\frac{8n}{10}\right)^{th}$ term $\Rightarrow$ put value of $n = 25$

$\Rightarrow \left(\frac{8 \times 25}{10}\right)^{th}$ term

$\Rightarrow \left(\frac{200}{10}\right)^{th}$ term

$= 20^{th}$ term.

Since 20 lies b/w 39.5 — 44.5

Now 20 lies blw 39.5 - 44.5 and

$L = 39.5$, $h = 5$, $f = 5$, $C = 17$

put value in D_8

$$D_8 = 39.5 + \frac{8}{5}\left(\frac{8 \times 25}{10} - 17\right)$$

$$D_8 = 39.5 + (20 - 17)$$

$$D_8 = 39.5 + 3$$

$$\boxed{D_8 = 42.5 \text{ inches}}$$

P-T-O

$$D_q = L + \frac{h}{f}\left(\frac{qn}{10} - c\right)$$

$\left(\frac{qn}{10}\right)^{th}$ term $\Rightarrow$ put value of $n = 25$

$\Rightarrow \left[\frac{q \times 25}{10}\right]^{th}$ term

$\Rightarrow$ 22.5^{th} term

Since 22.5^{th} term

225 lies b/w 44.5 — 49.5

and $L = 44.5$, $h = 5$, $f = 2$, $c = 22$

Put value in D_q.

$$D_q = 44.5 + \frac{5}{2}\left(\frac{9 \times 25}{10} - 22\right)$$

$$D_q = 44.5 + \frac{5}{2}(22.5 - 22)$$

$$D_q = 44.5 + \frac{5}{2}(0.5)$$

$$D_q = 44.5 + 1.25$$

$$\boxed{D_q = 45.75 \text{ inches}}$$

➢ Mean deviation $= \frac{\sum f|x - \bar{x}|}{\sum f}$

put value $MD = \frac{136.4}{25}$ $\Rightarrow \boxed{MD = 5.45}$

Rainfall	f	x	fx	fx^2
20 – 24	1	22	22	484
25 – 29	3	27	81	2187
30 – 34	5	32	160	5120
35 – 39	8	37	296	10952
40 – 44	5	42	210	8820
45 – 49	2	47	94	4417
50 – 54	0	52	0	0
55 – 59	1	57	57	3249
	25		920	35229

- Range

Range = Max — Min

here max = 59.5

Min = 19.5

Put value

Range = 59.5 − 19.5

Range = 40 inches

Variance

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

$\frac{3.5229}{25} - \left(\frac{920}{25}\right)^2$

$\Rightarrow$ $1409.1 - (36.8)^2$

$\Rightarrow$ $1409.1 - 1354.2$

$\Rightarrow$ **Variance = 54.9**

Standard deviation

$SD = \sqrt{\text{variance}}$

put value of variance

$SD = \sqrt{54.9}$

SD = 7.4

Co-efficient of Variation

$CV = \frac{SD}{\bar{X}} \times 100$

put value

$\Rightarrow$ $CV = \frac{7.4}{36.8} \times 100$

$\Rightarrow$ **CV = 20.1 %**

Skewness

As, $\text{Skewness} = \dfrac{Q_3 + Q_1 - 2Q_2}{Q_3 - Q_1}$

Now $Q_1 = 31.75$, $Q_2 = 36.68$ and $Q_3 = 41.25$

∴ put value

$$\text{Skewness} = \frac{41.25 + 31.75 - 2(36.68)}{41.25 - 31.75}$$

$$\text{Skewness} = \frac{0.36}{95}$$

$$\text{Skewness} = -0.037$$

So the data is negative skewed.

Quartile deviation

As $QD = \dfrac{Q_3 - Q_1}{2}$

where $Q_3 = 41.25$ and $Q_1 = 31.75$

Put value $QD = \dfrac{41.25 - 31.75}{2}$

$$QD = \frac{9.5}{2}$$

$$\boxed{QD = 4.75}$$

Percentile.

To divide the distribution into hundred equal parts are called percentile, denoted by

$$P_1, P_2 \text{ ---- } P_{99}$$

As $P_{30} = \left(\frac{30n}{100}\right)^{th}$

$$P_{30} = \left(\frac{30 \times 25}{100}\right)^{th}$$

$$P_{30} = \left(\frac{750}{100}\right)^{th}$$

$$P_{30} = 7.5^{th}$$

Since 7.5 lies b/w 29.5 – 34.5

So $P_{30} = L + \frac{h}{f}\left(\frac{30n}{100} - c\right)$

put value $P_{30} = 29.5 + \frac{5}{5}(7.5 - 4)$

$$P_{30} = 29.5 + 3.5$$

$$\boxed{P_{30} = 33}$$

According to $P_{30} = 33$ inches the following are;

$P_{10} = 27$ inches
$P_{20} = 32$ inches
$P_{40} = 37$ inches
$P_{50} = 37$ inches
$P_{60} = 37$ inches
$P_{70} = 42$ inches
$P_{80} = 42$ inches
$P_{90} = 47$ inches

Q3

Part "b"

⇒ Now the ungrouped data is 22, 27, 27, 27, 32, 32, 32, 32, 32, 37, 37, 37, 37, 37, 37, 37, 37, 42, 42, 42, 42, 42, 47, 47, 57.

X	Log X	1/X	|X-38.61	X^2
22	1.3424	0.0459	14.8	484
27	1.4313	0.0370	9.8	729
27	1.4313	0.0370	9.8	729
27	1.4313	0.0370	9.8	729
32	1.5051	0.03125	4.8	1024
32	1.5051	0.03125	4.8	1024
32	1.5051	0.03125	4.8	1024
32	1.5051	0.03125	4.8	1024
32	1.5051	0.03125	4.8	1024
37	1.5682	0.0270	0.2	1369
37	1.5682	0.0270	0.2	1369
37	1.5682	0.0270	0.2	1369
37	1.5682	0.0270	0.2	1369
37	1.5682	0.0270	0.2	1369
37	1.5682	0.0270	0.2	1369
37	1.5682	0.0270	0.2	1369
37	1.5682	0.0270	0.2	1369
42	1.6232	0.0238	5.2	1764
42	1.6232	0.0238	5.2	1764
42	1.6232	0.0238	5.2	1764
42	1.6232	0.0238	5.2	1764
42	1.6232	0.0238	5.2	1764
47	1.6720	0.0212	10.2	2209
47	1.6720	0.0212	10.2	2209
57	1.7558	0.0175	20.2	3249
820	38.9241	0.7081	136.4	35230

Arthmetic Mean

$$As, \quad AM = \frac{\sum_{i=1}^{n} x_i}{n}$$

So put value

$$AM = \frac{920}{25}$$

$$\boxed{AM = 36.8}$$

Geometric Mean

$$As, \quad GM = Antilog\left[\frac{\sum_{i=1}^{n} \log(x_i)}{n}\right]$$

$$GM = Antilog\left[\frac{38.92}{25}\right]$$

$$GM = Anti\text{-}log(1.56)$$

So The $\boxed{GM = 36.05 \text{ inches}}$

Harmonic Mean

$$as \quad HM = \frac{n}{\sum_{i=1}^{n} (1/x_i)}$$

Put value, $HM = \frac{25}{0.73}$

$$\boxed{HM = 34.25}$$

Mode

As Mode

$$L + \frac{f_m - f_1}{(f_m - f_i) + (f_m - f_2)} \times h$$

So

$$M = 34.5 + \frac{(8-5)}{(8-5)+(8-5)} \times 5$$

$$M = 34.5 + \frac{3}{6} \times 5$$

$$M = 34.5 + 2.5$$

$$\boxed{M = 37}$$

Median

$$\text{as, } M = \left[\frac{n}{2} + 1\right]^{th}$$

$$M = \left(\frac{25}{2} + 1\right)^{th}$$

$$M = (12.5 + 1)^{th}$$

$$\boxed{M = 13.5^{th}}$$

$$\Rightarrow \boxed{\text{Median} = 37 \text{ inches}}$$

Quartiles

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

$$Q_1 = \left(\frac{25+1}{4}\right)^{th} \text{ term}$$

$$Q_1 = \left(\frac{26}{4}\right)^{th} \text{ term}$$

$$Q_1 = 6.5^{th} \text{ term}$$

$$\Rightarrow Q_1 = 6^{th} \text{ term} + 0.5(7^{th} \text{ term} - 6^{th} \text{ term})$$

$$Q_1 = 32 + 0.5(32 - 32)$$

$$\boxed{Q_1 = 32.05 \text{ inches}}$$

Q_2.

As Q_2 = median and median = 37

So $\boxed{Q_2 = 37 \text{ inches}}$

$$Q_3 = \left[\left(\frac{3n}{4}\right) + 1\right]^{th}$$

$$Q_3 = \left[\frac{(3 \times 25)}{4} + 1\right]^{th}$$

$$\Rightarrow Q_3 = 19.75^{th} \ (20^{th})$$

So, Q_3 = 19th term + 0.5 (20th term − 19th term)

$$Q_3 = 42 + 0.5(42 - 42)$$

$$\boxed{Q_3 = 42 \text{ inches}}$$

DECILE

as, $D_2 = \left[\left(\frac{2n}{10}\right) + 1\right]^{th}$

$\Rightarrow D_2 = \left(\frac{2 \times 25}{10} + 1\right)^{th}$

$\Rightarrow D_2 = \frac{50}{10} + 1$

$D_2 = (5 + 1)$

$D_2 = 6^{th}$

So $\boxed{D_2 = 32 \text{ inches}}$

Percentile

As, $P_{30} = \left[\left(\frac{30n}{100}\right) + 1\right]^{th}$

$= \left(\left(\frac{30 \times 25}{100}\right) + 1\right)^{th}$

$= \left(\frac{750}{100} + 1\right)^{th}$

$= 7.5 + 1$

$= 8.5^{th}$

$P_{30} =$ 9th integer

$\boxed{P_{30} = 32}$

Range

as Range = Max - Mini

Put value

Range = 57 - 22

$$R = 35$$

Quartile Deviation

$$QD = \frac{Q_3 - Q_1}{2}$$

Put value

$$QD = \frac{42 - 32}{2}$$

$$QD = \frac{10}{2}$$

$$QD = 5$$

Skewness

$$\text{Skewness} = \frac{\text{mean} - \text{mode}}{\text{S-deviation}}$$

put value.

$$\text{Skewness} = \frac{36.8 - 37}{7.41}$$

$$\text{Skewness} = \frac{-0.2}{7.41}$$

$$\text{Skewness} = -0.03$$

Co-efficient of Variation

$$CV = \frac{SD}{\bar{X}} \times 100$$

$$CV = \frac{7.41}{36.8} \times 100$$

$$\boxed{CV = 20.14}$$

Mean Deviation

$$MD = \frac{\sum_{i=1}^{n} |x - \bar{x}|}{n}$$

∴ put value

$$MD = \frac{136.4}{25}$$

$$\boxed{MD = 5.4}$$

Variation

$$\text{Variation} = \frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n}$$

put value

$$V = \frac{1172.12}{25}$$

$$\Rightarrow \boxed{\text{Variance} = 46.8}$$

Standard deviation

$$SD = \sqrt{\text{variation}}$$

∴ Put value

$$SD = \sqrt{46.8}$$

$$\boxed{SD = 6.85}$$