

Subject Title :- Bio Statistics

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Semester 6<sup>th</sup>

Rainfall	(b) No. of years	$x$ mid point	$\sum x$	$\sum f/x$	$\log(x)$	$f \log(x)$	$x - \bar{x}$	$(x - \bar{x})^2$	$\sum (x - \bar{x})$
20-24	1	22	22	0.046	1.34	1.34	-14.8	219.04	219.04
25-29	3	27	81	0.12	1.43	4.29	-9.8	96.04	288.12
30-34	5	32	160	0.15	1.50	7.5	-4.8	23.04	115.2
35-39	8	37	296	0.21	1.56	12.48	0.2	0.04	0.32
40-44	5	42	210	0.11	1.62	8.1	5.2	27.04	135.2
45-49	2	47	94	0.04	1.67	3.34	10.2	104.04	208.4
50-54	0	52	0	0	1.71	0	15.2	231.04	0
55-59	1	57	57	0.017	1.75	1.75	20.2	408.04	408.04
Total	25		920	0.693	38.8			<del>1373.96</del>	1373.96

1

14.8

19.5-24.5

3

29.4

24.5-29.5

5

24

29.5-34.5

8

1.6

34.5-39.5

5

2.6

39.5-44.5

2

20.4

44.5-49.5

0

0

49.5-54.5

1

20.2

54.5-59.5

3

① A.M

$$\frac{\sum_{i=1}^n f_i x_i}{\sum_{i=1}^n f_i} = \frac{920}{25}$$

$$\boxed{A.M = 36.80}$$

② H.M

$$\frac{\sum_{i=1}^n f_i}{\sum_{i=1}^n \left[ \frac{f_i}{x_i} \right]} = \frac{25}{0.693}$$

$$\boxed{H.M = 36.08}$$

$$\textcircled{3} G.M = \text{Anti-log} \left[ \frac{\sum_{i=1}^n f_i \log(x_i)}{\sum_{i=1}^n f_i} \right]$$

$$= \text{Anti-log} \left[ \frac{38.8}{25} \right]$$

$$= \text{Anti-log} (1.552)$$

$$\boxed{G.M = 35.48}$$

$$\textcircled{4} \text{ Median} = \left(\frac{n}{2}\right)^{\text{th}}$$

$$= \left(\frac{25}{2}\right)^{\text{th}}$$

$= (12.5)^{\text{th}}$ , which lies b/w in the class  $34.5 - 39.5$  therefore

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

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

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

$$= 34.5 + 2.1875$$

$$\boxed{\text{So, Median} = 36.6875}$$

$\textcircled{5}$  Range = Height class upper boundary

Range = lowest class lower boundary

$$= 59.5 - 19.5$$

$$\boxed{\text{Range} = 40}$$

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

$l$  = lower class boundary of modal class

$f_m$  = frequency of the modal class

$f_1$  = Frequency associated with the class following the modal class.

$h$  = width of class interval.

So, the mode can be

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

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

$$\boxed{\text{Mode} = 37}$$

⑦ **Quantiles:** The <sup>⑥</sup> three values which divide the distribution into four equal parts are called the quantiles.

These values are denoted by  $Q_1, Q_2, Q_3$ ,  $Q_1$  is called the lower quartile and  $Q_3$  are called upper quartile,  $Q_2$  is called Median.

So, we calculate  $Q_1$  and  $Q_3$

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

$$= \left(\frac{25}{4}\right)^{\text{th}}$$

$= (6.25)^{\text{th}}$ , which associated in the class  $(29.5 - 34.5)$  Therefore

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

$$= 29.5 + \frac{5}{2} (6.25 - 4)$$

$$= 29.5 + 2.25$$

$$\boxed{Q_1 = 31.75}$$

$$Q_3 = \left( \frac{3n}{4} \right)^{\text{th}} \quad (7)$$

$$= \left( \frac{3 \times 25}{4} \right)^{\text{th}}$$

$= (18.75)^{\text{th}}$ , which correspond in class,  $(39.5 - 44.5)$  therefore

$$Q_3 = \left( 1 + \frac{h}{f} \left( \frac{3n}{4} - cf \right) \right)$$

$$= 39.5 + \frac{5}{8} (18.75 - 17)$$

$$= 39.5 + 17.5$$

$$\boxed{Q_3 = 41.25}$$



Deciles Decile which divided a distribution into ten (10) equal parts are called deciles which is denoted by  $D_1, D_2, D_3, \dots, D_{10}$

The calculation of each decile to be calculated is too large and time consuming

So, for the periodic we can calculate  $D_2$

$$D_2 = \left( \frac{2n}{10} \right)^{th}$$

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

$= 5^{th}$ , which correspond in class (29.5 — 34.5) Therefore

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

$$= 29.5 + \frac{5}{5} (5 - 4)$$

$$= 29.5 + 1$$

$$\boxed{D_2 = 30.5}$$

percentile which is divided the distribution into hundred equal parts are called percentile, which is denoted by

$$P_1, P_2, P_3 \dots P_{99}$$

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

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

$= (7.5)$  the which associated in the class  $(29.5 - 34.5)$  so,

$$P_{30} = \left( 1 + \frac{h}{7} \left( \frac{30n}{100} - cf \right) \right)$$

$$= 29.5 + \frac{5}{5} (7.5 - 4)$$

$$= 29.5 + 3.50$$

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

10

$$M.D = \frac{\sum_{i=1}^n f_i |x - \bar{x}|}{\sum_{i=1}^n f_i}$$

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

$$\boxed{M.D = 5.46}$$

$$(11) \text{ variance} = \frac{\sum_{i=1}^n f_i (x - \bar{x})^2}{\sum_{i=1}^n f_i}$$

$$= \frac{1373.96}{25}$$

$$\boxed{\text{variance} = 54.96}$$

$$(12) \text{ standard deviation} = \sqrt{\text{variance}}$$

$$= \sqrt{54.96}$$

$$\boxed{SD = 7.41}$$

(13) classification of variation (C.V) =

$$\frac{S.D}{\bar{x}} \times 100$$
$$= \frac{7.41}{36.80} \times 100$$

$$\boxed{C.V = 20.14}$$

(14) Quartile deviation (Q.D) =  $\frac{Q_3 - Q_1}{2}$

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

$$Q.D = \frac{41.25 - 31.75}{2}$$

$$\boxed{Q.D = 4.75}$$

(15) Skewness (sk) =  $\frac{\text{mean} - \text{mode}}{S.D}$

where, mean = 36.80, mode = 37

and, S.D = 7.41

$$sk = \frac{36.80 - 37}{7.41}$$

$$= \frac{-0.20}{7.41}$$

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

0.045	1.34
0.037	1.4313
0.037	1.4313
0.037	1.4313
0.0312	1.5051
0.0312	1.5051
0.0312	1.5051
0.0312	1.5051
0.027	1.5051
0.027	1.5682
0.027	1.5682
0.027	1.5682
0.027	1.5682
0.027	1.5682
0.027	1.5682
0.027	1.5682
0.0238	1.6232
0.0238	1.6232
0.0238	1.6232
0.0238	1.6232
0.0238	1.6232
0.0212	1.6720
0.0212	1.6720
0.019	1.7558
0.73	38.92

$$\textcircled{1} \text{ A.M.} = \frac{\sum_{i=1}^n x_i}{n} = \frac{930}{25}$$

$$\text{A.M.} = 36.8$$

$$\textcircled{2} \text{ H.M.} = \frac{n}{\sum_{i=1}^n (1/x_i)} = \frac{25}{0.73}$$

$$\boxed{\text{H.M.} = 34.25}$$

$$\textcircled{3} \text{ G.M.} = \text{Anti-Log} \left[ \frac{\sum_{i=1}^n \log(x_i)}{n} \right]$$

$$= \text{Anti-Log} \left[ \frac{38.93}{25} \right]$$

$$= \text{Anti-Log} (1.56)$$

$$\boxed{\text{G.M.} = 36.04}$$

$\textcircled{4}$  Mode: Most repeated value is called mode

So,  $\boxed{\text{Mode} = 37}$

⑤ Median: is the mid-value of a data set

$$\begin{aligned} \text{Median} &= \left[ \left( \frac{n}{2} \right) + 1 \right] \text{th} \\ &= \left[ \left( \frac{25}{2} + 1 \right) \right] \text{th} \\ &= (12 + 1) \text{th} \end{aligned}$$

Median = 13th, Integer of a data set

$$\text{Median} = 37$$

⑥ Quartiles:

$$\begin{aligned} Q_1 &= \left[ \left( \frac{n}{4} \right) + 1 \right] \text{th} \\ &= \left[ \left( \frac{25}{4} \right) + 1 \right] \text{th} \\ &= (6.25 + 1) \text{th} \\ &= (7.25) \text{th} \\ &= 7 \text{th} \end{aligned}$$

$$Q_1 = 32$$

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

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$$= \left[ \left( \frac{3 \times 25}{4} \right) + 1 \right] \text{th} \Rightarrow (19.75) \text{th}$$

= (20)th, Integer

$$\boxed{Q_3 = 42}$$

⑦

Deciles :

$$\text{As, } D_2 = \left[ \left( \frac{2n}{10} \right) + 1 \right] \text{th} \Rightarrow \left[ \left( \frac{2 \times 25}{10} + 1 \right) \right]$$

= (5+1)th  $\Rightarrow$  6th, Integer

$$\boxed{D_2 = 32}$$

⑧

Percentile %

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

$$= \left[ \left( \frac{30 \times 25}{100} \right) \right] \text{th}$$

= (7.50+1)th  $\Rightarrow$  (8.50)th

$P_{30} = 9$ th, Integer

$$\boxed{P_{30} = 327}$$



$$(9) \text{ Range} = \text{largest value} - \text{smallest value}$$

$$R = 57 - 22$$

$$R = 35$$

$$(10) \text{ Q.D} = \frac{Q_3 - Q_1}{2}$$

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

$$\text{Q.D} = 5$$

$$(11) \text{ Skewness} = \frac{\text{Mean} - \text{mode}}{\text{S.D}}$$

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

$$= \frac{-0.20}{7.41}$$

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

$$(12) \text{ Coefficient of variation (C.V)}$$

$$= \frac{\text{S.D}}{\bar{x}} \times 100$$

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

$$\text{C.V} = 20.14$$

$$\textcircled{13} \quad \text{Mean Deviation} = \frac{\sum_{i=1}^n |x - \bar{x}|}{n}$$

$$= \frac{136.40}{25}$$

$$\text{M.D} = 5.46$$

$$\textcircled{14} \quad \text{Variance} = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}$$

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

$$\text{Variance} = 46.88$$

$$\textcircled{15} \quad \text{S.D} = \sqrt{\text{Variance}}$$

$$= \sqrt{46.88}$$

$$\boxed{\text{S.D} = 6.85}$$

Ans(a) - For Men  
 $\bar{x} =$  overall mean consumption of fresh vegetable

$$\text{Mean} = \frac{204 + 259 + 266 + 317}{4}$$

$$= 236.5$$

→ Mean of fruits:

$$\text{Mean} = \frac{31 + 45 + 69 + 105}{4} = 62.5$$

→ Mean of Rice

$$\bar{x} = \frac{(367 + 337 + 369 + 246)}{4}$$

$$= 304.75$$

→ Mean of fish

$$\bar{x} = \frac{23 + 28 + 31 + 44}{4}$$

$$= 31.5$$

→ For women

Mean of fresh vegetable

$$\bar{x} = \frac{178 + 235 + 266 + 304}{4}$$

$$= 245.75$$

→ Mean of Fruit

$$\bar{x} = \frac{28 + 46 + 70 + 121}{4}$$
$$= 66.25$$

→ Mean of rice

$$\bar{x} = \frac{315 + 276 + 243 + 220}{4}$$
$$= 263.5$$

→ Mean of Meat

$$\bar{x} = \frac{48 + 43 + 54 + 63}{4}$$
$$= 52$$

→ Mean of Fish

$$\bar{x} = \frac{19 + 21 + 28 + 46}{4}$$
$$= 28.5$$

Combined Mean

Combined Mean for men

C.M of fresh vegetable

$$\bar{x}_{comb} = \frac{\bar{x}_{n1} + \bar{x}_{n2} + \bar{x}_{n3}}{n_1 + n_2 + n_3}$$
$$= \frac{[(236.5)(204) + (236.5)(259) + (236.5)(266) + (236.5)(47)]}{204 + 259 + 266 + 217}$$
$$= 236.5$$

### Combined Mean<sup>③</sup> of Rice

$$\bar{x}_c = \frac{(367)(304.75) + (337)(304.75) + (269)(304.75) + (246)(304.75)}{371.25}$$

### → Combined Mean of Fish

$$\bar{x}_c = \frac{(25)(31.5) + (31.5)(28) + (31)(31.5)}{23 + 28 + 31 + 44}$$

$$\bar{x}_c = 31.5$$

### C. Mean of Meat

$$\bar{x}_c = \frac{(69.25)(70) + (69.25)(62) + (69.25)(69) + (69.25)(70)}{70 + 61 + 69 + 70}$$

$$\bar{x}_c = 69.25$$

### Combined Mean of Women

$$\bar{x}_c = \frac{[(245.75)(178) + (245.75)(235) + (245.75)(266) + (245.75)(304)]}{178 + 235 + 266 + 304}$$

$$\bar{x}_c = 245.75$$

(4)  
C. mean of Meat

$$\bar{x}_c = \frac{(52)(48) + (52)(43) + (52)(54) + (52)(63)}{48 + 43 + 54 + 63}$$

$$\bar{x}_c = 52$$

→ C. mean of Fish

$$\bar{x}_c = \frac{(28.5)(19) + (28.5)(21) + (28.5)(28) + (28.5)(46)}{19 + 21 + 28 + 46}$$

$$\bar{x}_c = 28.5$$

C. mean of Rice

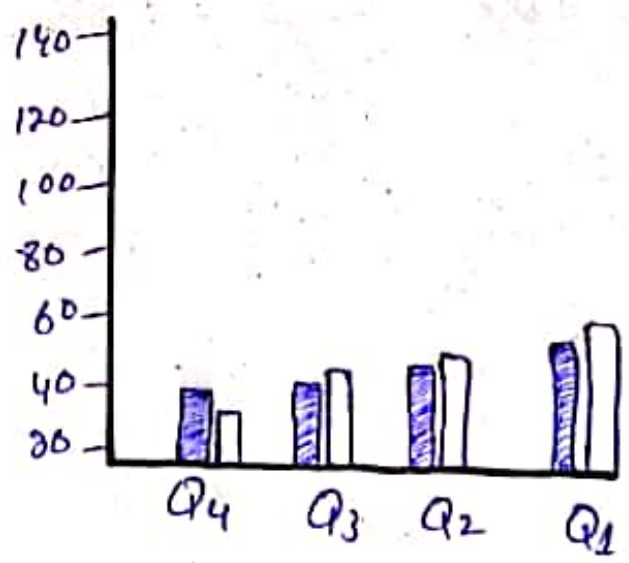
$$\bar{x}_c = \frac{(263.5)(315) + (263.5)(276) + (263.5)(243) + (263.5)(220)}{315 + 276 + 243 + 220}$$


$$\bar{x}_c = 263.5$$

Ans: Milk, Fruit, vegetable and wheat flours are very low for both men and women in  $Q_4$  and  $Q_3$  but it rises high in  $Q_2$  and  $Q_1$  So those who eat most vegetable consume much more root vegetable and wheat flours than those who eat less fresh-vegetable.

Ans: In fruit and fish the value of mean increasing from  $Q_4$  to  $Q_1$  in men and women. But in Rice the value of mean decreasing from  $Q_4$  to  $Q_3$ .

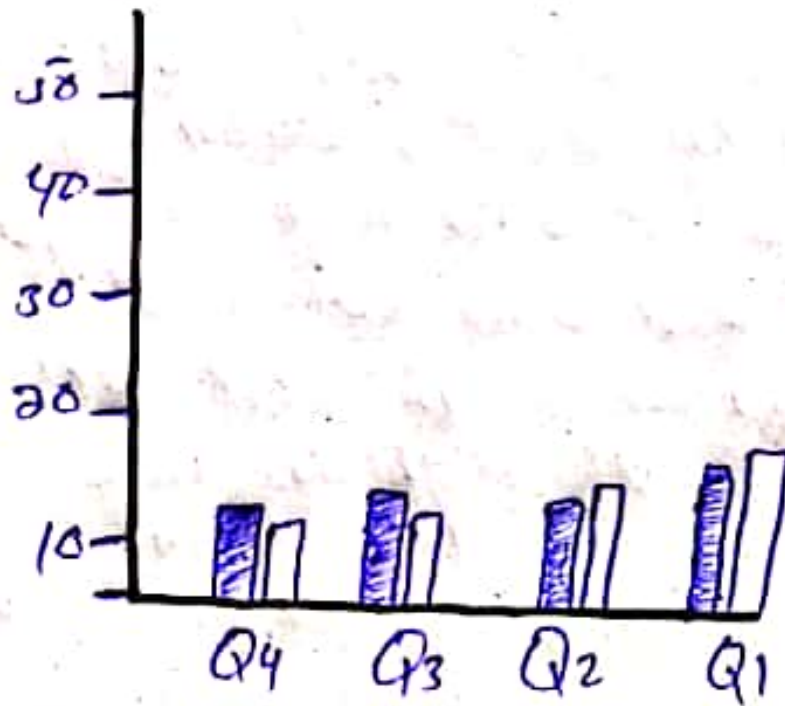
Ans: Draw a Suitable diagram for Fruits.


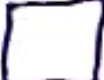


Men = 

(6)

# Food Fish



Men =   
Women = 

Ans:

Standard deviation =  $S.E \sqrt{n}$   
By using above formula the value of standard deviation of men more than women wheat, flour, vegetable, fruit whole grain.



Question No 21.

10

Ans a) i. The purposes of Census to count the entire population of a country and individuals to get location where the actual lives. Census count the number of lives in the home, their age, sex, race, It help in the forming and important base for planning policy developing and decreasing numbering.

part b)

Ans In census each and every unit of the population is studied in the sampling, the census refer to periodic collection of information about the population from this more suitable to use census methode if the population compare to sample survey. Census survey take more time, however it is margin for error in sample survey while census survey is more correct.

Part c

Ans

obviously not having a full response rate to the census problem for the accuracy of census as insufficient data will be collected to know about population and of following base for planning and policy development

Part d

Ans

ironic response to the census by the public signify there into word attitude to the survey and their carelessness in following accurate data.

Part e

Ans

By using the information of given table it is true that men need more food to maintain its energy level.

Part F

Ans

census, itself meant the study of every object under the observation. It is such a difficult task to perform also it is quite to government to go to every single person and collect the whole lot of things that have been done by these agencies not only an error may increase error further.