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Paper Biostatistics

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Exam Mid

Date 14-4-2020

Semester 6

Rainfall	(f) Number of years	(x) mid-points	f x	f/x	log(x)
20-24	1	22 22	22	0.046	1.34
25-29	3	27 27	81	0.12	1.43
30-34	5	32	160	0.15	1.50
35-39	8	37	296	0.21	1.56
40-44	5	42	210	0.11	1.62
45-49	2	47	94	0.04	1.67
50-54	0	52	0	0	1.71
55-59	1	57	57	0.017	1.75
Total	25		920	0.693	

(1)

Rainfall	(f) Number of years	$f(x - \bar{x})$	(C-L) Class boundaries	(C.F) Cumulative frequency
20-24	1	14.8	19.5 - 24.5	1
25-29	3	29.4	24.5 - 29.5	4
30-34	5	24	29.5 - 34.5	9
35-39	8	1.6	34.5 - 39.5	17
40-44	5	26	39.5 - 44.5	22
45-49	2	20.4	44.5 - 49.5	24
50-54	0	0	49.5 - 54.5	24
55-59	1	20.2	54.5 - 59.5	25
Total	25	136.4		

(2)

$$\textcircled{1} \quad \text{A.M.} = \frac{\sum_{i=1}^n f_i x_i}{\sum_{i=1}^n f_i} = \frac{920}{25}$$

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

$$\textcircled{2} \quad \text{H.M.} = \frac{\sum_{i=1}^n f_i}{\sum_{i=1}^n \left[\frac{f_i}{x_i} \right]} = \frac{25}{0.693}$$

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

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

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

$$= \text{Anti-log} (1.55)$$

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

③

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

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

$$= (12.5)^{\text{th}}, \text{ which is lies b/w}$$

in the class 34.5-39.5. Therefore

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

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

$$= 34.5 + \frac{5}{8} (3.50)$$

$$= 34.5 + 2.19$$

So,

Median = 36.69

$$\textcircled{5} \text{ Range} = \text{Height class upper boundaries} \\ - \text{lowest class lower boundaries}$$

$$= 59.5 - 19.5$$

Range = 40

$\textcircled{4}$

$$\textcircled{6} \quad \text{Mode} = l + \frac{f_m - f_1}{(f_m - f_1) + (f_m - f_2)} \times h$$

l = lower class boundaries of the modal class

f_m = Frequency of the modal class

f_1 = Frequency associated with the class preceding the modal class.

f_2 = Frequency associated with the class following the modal class.

h = width of class interval

So, the Mode, can be

$$\begin{aligned} \text{Mode} &= 34.5 + \frac{\cancel{34.5} (8-5)}{(8-5) + (8-5)} \times 5 \\ &= 34.5 + \frac{3}{3+3} \times 5 \end{aligned}$$

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

$\textcircled{5}$

⑦ **Quartiles:** The Three value which divide the distribution into four equal parts are called the Quartiles.

These value are denoted by Q_1 , Q_2 and Q_3 . Q_1 is called the lower quartile and Q_3 are called upper quartile. Q_2 is called Median. So, we shall calculate Q_1 and Q_3 .

$$Q_1 = \left(\frac{n}{4}\right)th$$
$$= \left(\frac{25}{4}\right)th$$

$= (6.25)th$, which associated in the class $(29.5 - 34.5)$. Therefore

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

$$= 29.5 + \frac{5}{5} (6.25 - 4)$$
$$= 29.5 + 2.25$$

$$\boxed{Q_1 = 31.75}$$

⑥

$$Q_3 = \left(\frac{3n}{4}\right)\bar{h}$$

$$= \left(\frac{3 \times 25}{4}\right)\bar{h}$$

$= (18.75)\bar{h}$, which corresponds in the class, (39.5 - 41.5). Therefore

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

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

$$= 39.5 + 1.75$$

$$\boxed{Q_3 = 41.25}$$

(7)

⑧ Deciles: which divide The distribution into ten equal parts, are called Deciles, which is denoted by

$D_1, D_2, \dots, D_9.$

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

So, for The practice, we can calculate

$D_2.$

$$D_2 = \left(\frac{2n}{10} \right) \bar{h}$$

$$= \left(\frac{2 \times 25}{10} \right) \bar{h}$$

$= 5\bar{h}$, which corresponds in the class, $(29.5 - 34.5)$. Therefore

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

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

$$= 29.5 + 1$$

$$\boxed{D_2 = 30.5}$$

⑧

⑨ Percentile: which divide the distribution into hundred equal parts are called percentile, which is denoted by P_1, P_2, \dots, P_{99} .

As;

$$P_{30} = \left(\frac{30n}{100} \right) \bar{h}$$
$$= \left(\frac{30 \times 25}{100} \right) \bar{h}$$

$= (7.5) \bar{h}$, which associated in the class (29.5-34.5). So

$$P_{30} = l + \frac{h}{7} \left(\frac{30n}{100} - c.f \right)$$

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

$$= 29.5 + 3.50$$

$$P_{30} = 33$$

⑨

⑩

$$\begin{aligned} \text{M.D} &= \frac{\sum_{i=1}^n f_i |x - \bar{x}|}{\sum_{i=1}^n f_i} \\ &= \frac{136.4}{25} \end{aligned}$$

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

⑪

$$\begin{aligned} \text{Variance} &= \frac{\sum_{i=1}^n f_i (x - \bar{x})^2}{\sum_{i=1}^n f_i} \\ &= \frac{1373.96}{25} \end{aligned}$$

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

⑫

$$\begin{aligned} \text{Standard Deviation} &= \sqrt{\text{Variance}} \\ &= \sqrt{54.96} \end{aligned}$$

$$\boxed{\text{S.D} = 7.41}$$

⑩

(13)

Coefficient 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 $Q_1 = 31.75$

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

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

(15)

Skewness (SK) = $\frac{\text{Mean} - \text{Mode}}{S.D}$

where, Mean = 36.80, Mode = 37

and S.D = 7.41

(11)

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

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

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

← x → x →

x	$1/x$	$\log(x)$	$(x - \bar{x})$	$(x - \bar{x})^2$	$ x - \bar{x} $
22	0.045	1.34	-14.8	219.04	14.8
(27)	0.037	1.4313	-9.8	96.04	9.8
27	0.037	1.4313	-9.8	96.04	9.8
27	0.037	1.4313	-9.8	96.04	9.8
32	0.0312	1.5051	-4.8	23.04	4.8
32	0.0312	1.5051	-4.8	23.04	4.8
32	0.0312	1.5051	-4.8	23.04	4.8
32	0.0312	1.5051	-4.8	23.04	4.8
32	0.0312	1.5051	-4.8	23.04	4.8
37	0.027	1.5682	0.2	0.04	0.2
37	0.027	1.5682	0.2	0.04	0.2
37	0.027	1.5682	0.2	0.04	0.2
37	0.027	1.5682	0.2	0.04	0.2
37	0.027	1.5682	0.2	0.04	0.2
37	0.027	1.5682	0.2	0.04	0.2
37	0.027	1.5682	0.2	0.04	0.2
37	0.027	1.5682	0.2	0.04	0.2
42	0.0238	1.6232	5.2	27.04	5.2
42	0.0238	1.6232	5.2	27.04	5.2
42	0.0238	1.6232	5.2	27.04	5.2
42	0.0238	1.6232	5.2	27.04	5.2
42	0.0238	1.6232	5.2	27.04	5.2
47	0.0212	1.6720	1.76	3.10	1.76
47	0.0212	1.6720	1.76	3.10	1.76
57	0.019	1.7558	20.2	408.04	20.2
Total	0.73	38.92		1172.12	136.40

$$\textcircled{1} \quad A.M = \frac{\sum_{i=1}^n X_i}{n} = \frac{920}{25}$$

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

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

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

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

$$= \text{Anti-log} \left[\frac{38.92}{25} \right]$$

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

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

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

Mode :

So,

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

$\textcircled{14}$

(1) (5) Median : Median is the mid-value of a data set.

$$\text{Median} = \left[\left(\frac{n}{2} \right) + 1 \right] \text{th}$$

$$= \left[\left(\frac{25}{2} \right) + 1 \right] \text{th}$$

$$= (12 + 1) \text{th}$$

Median = 13th, Integer } a data set

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

(6) Quartiles :

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

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

$$= (6.25 + 1) \text{th}$$

$$= (7.25) \text{th}$$

$$= 7 \text{th}$$

$$\boxed{Q_1 = 32}$$

(15)

$$\begin{aligned}
 Q_3 &= \left[\left(\frac{3n}{4} \right) + 1 \right] \bar{h} \\
 &= \left[\left(\frac{3 \times 25}{4} \right) + 1 \right] \bar{h} \Rightarrow (19.75) \bar{h} \\
 &= (20) \bar{h}, \text{ Integer}
 \end{aligned}$$

$$\boxed{Q_3 = 42}$$

(7) Deciles:

$$\begin{aligned}
 \text{As, } D_2 &= \left[\left(\frac{2n}{10} \right) + 1 \right] \bar{h} \Rightarrow \left[\left(\frac{2 \times 25}{10} \right) + 1 \right] \bar{h} \\
 &= (5+1) \bar{h} \Rightarrow 6 \bar{h}, \text{ Integer}
 \end{aligned}$$

$$\boxed{D_2 = 32}$$

(8) Percentile:

$$\begin{aligned}
 \text{As, } P_{30} &= \left[\left(\frac{30n}{100} \right) + 1 \right] \bar{h} \\
 &\Rightarrow \left[\left(\frac{30 \times 25}{100} \right) + 1 \right] \bar{h} \\
 &= (7.50+1) \bar{h} \Rightarrow (8.50) \bar{h}
 \end{aligned}$$

$$P_{30} = 9 \bar{h}, \text{ Integer}$$

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

$$\begin{aligned} \text{Range} &= \text{Largest value} - \text{Smallest value} \\ &= 57 - 22 \end{aligned}$$

$$R = 35$$

$$Q.D = \frac{Q_3 - Q_1}{2}$$

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

$$Q.D = 5$$

$$\text{Skewness} = \frac{\text{Mean} - \text{Mode}}{S.D}$$

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

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

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

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

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

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

$$C.V = 20.14$$

(17)

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

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

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

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

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

$$\boxed{\text{Variance} = 46.88}$$

$$(15) \text{ S.D} = \sqrt{\text{Var}}$$

$$= \sqrt{46.88}$$

$$\boxed{\text{S.D} = 6.857}$$

(18)

Q 2(a)

Mean Consumption of Fresh vegetables
for Men = $\frac{204+259+266+317}{4}$

$$= \frac{1046}{4}$$
$$= 261.5 \text{ Per grams.}$$

Mean Consumption of fruits for Men

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

$$= \frac{250}{4}$$
$$= 62.5 \text{ Per grams.}$$

Mean Consumption of rice for men

$$= \frac{367+337+269+246}{4}$$

$$= \frac{1219}{4}$$
$$= 304.75 \text{ Per grams.}$$

Mean Consumption of fish for men

$$\begin{aligned}
 &= \frac{23+28+31+44}{4} \\
 &= \frac{126}{4} \\
 &= 31.5 \text{ grams}
 \end{aligned}$$

Mean Consumption of Meat for men

$$\begin{aligned}
 &= \frac{70+61+69+77}{4} \\
 &= \frac{277}{4} \\
 &= 69.25 \text{ grams}
 \end{aligned}$$

Women

Mean Consumption of Vegetables for women

$$\begin{aligned}
 &= \frac{178+235+266+304}{4} \\
 &= \frac{983}{4} \\
 &= 245.75 \text{ grams}
 \end{aligned}$$

Page :- 3

$$\text{Mean Consumption of fruits for women} \\ = \frac{28+46+70+121}{4}$$

$$= \frac{265}{4}$$

$$= 66.25 \text{ grams}$$

$$\text{Mean Consumption of ice for women} \\ = \frac{315+276+243+220}{4}$$

$$= \frac{1054}{4}$$

$$= 263.5 \text{ grams}$$

$$\text{Mean Consumption of fish for women} \\ = \frac{19+21+28+46}{4}$$

$$= \frac{114}{4}$$

$$= 28.5 \text{ grams}$$

Page: - 4
Mean Consumption of meat for women

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

$$= \frac{208}{4}$$

$$= 52 \text{ grams}$$

Standard deviation \rightarrow

Standard deviation in vegetable.

$$\text{Mean} = \sqrt{\frac{\sum (204-261.5)^2 + (259-261.5)^2 + (266-261.5)^2 + (317-261.5)^2}{4}}$$

$$= \sqrt{\frac{\sum (-57.5)^2 + (2.5)^2 + (4.5)^2 + (55.5)^2}{4}}$$

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

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

$$= \sqrt{1603.25}$$

S.D in vegetable Per gram: ≈ 40.04 gram

$$\text{S.D in fruits Mem} = \sqrt{\frac{\sum (31-62.5)^2 + (45+62.5)^2 + (69-62.5)^2 + (105-62.5)^2}{4}}$$

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

$$= \sqrt{\frac{\sum 992.25 + 306.25 + 42.25 + 1806.25}{4}}$$

$$= \sqrt{\frac{3147}{4}}$$

$$= \sqrt{786.75}$$

S.D for fruits = ≈ 28.049

Page 6:-

$$SD \text{ of rice Mean} = \sqrt{\frac{\sum (367-304.75)^2 + (337-304.75)^2 + (269-304.75)^2 + (246-304.75)^2}{4}}$$

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

$$= \sqrt{\frac{\sum (3875.06) + (1040.062) + (1278.062) + (3451.5625)}{4}}$$

$$= \sqrt{\frac{9644.7465}{4}}$$

$$= \sqrt{2411.186625}$$

$$SD \text{ rice} = 49.1$$

S.D. of Meat

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

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

$$= \sqrt{\frac{0.5625 + 68.0625 + 68.0625 + 60.0625}{4}}$$

$$= \sqrt{\frac{196.75}{4}}$$

$$= \sqrt{49.1875}$$

S.D. of Meat =

7.023

women

S.D of vegetable (women)

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

$$= \sqrt{\frac{\sum (-10.75)^2 + (-67.75)^2 + (20.25)^2 + (58.25)^2}{4}}$$

$$= \sqrt{\frac{\sum \{115.5625\}^2 + (4590.0625) + (410.0625) + (3393.0625)}{4}}$$

$$= \sqrt{\frac{8508.75}{4}}$$

Q1 Ans

Date:

$$\sqrt{2127.1875}$$

$$\text{S.D of vegetables} = 46.12$$

Q2

A) The purpose of census is to count the entire population of a country and individual at location where they actually live. census count the numbers of living in the home their age sex and race. It helps in the forming and important base for the planning policy of the department and decreasing the numbering.

b) In census each and every unit of the population is studied in the sampling. The census refer to the pedriatic of information about the populace from entire population. It is more suitable to use census method the population in some in nature. The census survey is much bigger in population compare to sample survey. census survey takes more time however it is margin for error in sample survey while census survey while census is more correct.

c) obviously not having a full a rate of the census for the accuracy of census as insufficient ratio will be collected to know about population and following base for planning and policy of the development.

d) Ironic Response to the census by the Public signify their attitude to the survey and their carelessness in following accurate data questions of these types are invalidated with such abuse response.

e) Not all of the population is internet friendly so may be the response rate may be less other areas of concern are cost pressure

Solutions:

Entertaining workshop for bringing awareness of labness of online census should be conducted after BLWD.

Q1 (Remains Part)

⑥ Milk consumption is very low for both men and women in Q1 and Q2
But it rises slightly in Q3 and again in Q4
So those who eat those vegetables consume much more milk than
those who eat less fresh vegetables.

c) Rice consumption falls for men and women as fresh vegetable
consumption rises. It is only the broad group to show this
pattern

d) Parallel bar chart back to back bar chart or simple line
graphs to compare men and women

e) Divide men's figure by 1.2 or multiply women's figure 1.2

f) Fresh vegetable	170	178
Fruits	26	28
Rice	306	315
wheat flour	66	56
meat	58	48
Fish	19	19

No very large differences in patterns of consumption (1)
But men eat more meat and wheat flour (1)
while women eat more rice and fresh vegetable.