B. L. D. E. Association's

S. B. ARTS & K. C. P. SCIENCE COLLEGE, VIJAYAPUR U15KM22S0124

I^st INTERNAL TEST 2022 -2023 UUCMS: 0124

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Subject/ವಿಷಯ : Statistics Semester/ಸೆಮಿಸ್ಟರ್ : I^st Exam Seat No / ಪರೀಕ್ಷೆ ಸ್ಥಳಾಂಕ :

Invigilator's Signature / ಕೊಠಡಿ ಮೇಲ್ವಿಚಾರಕರ ಸಹಿ Signature of Evaluator / ಪರೀಕ್ಷಕರ ಸಹಿ Marks obtained/ ಪಡೆದ ಅಂಕಗಳು 30 / 30

PART-A

I. (Any 5)

1. Simple Random Sampling (SRS) is a technique of drawing a sample from the population in which each unit has an equal and independent chance of being included in the sample. 2

2. Quantitative Data: The data which can be numerically expressed or measurable is called quantitative data.
eg:- Height and weight of students.

Qualitative Data: The data which cannot be numerically expressed or non-measurable is called qualitative data. 2
eg:- Ability and intelligence of students.

4. First N natural numbers are 1, 2, 3, ..., n
Arithmetic Mean is given by

$$\bar{X} = \frac{\sum_{i=1}^{n} x_i}{n}$$

$$= \frac{1+2+3+\dots+n}{n}$$ 2

$$= \frac{\cancel{n}(n+1)}{2\cancel{n}} \quad \left\{ \because \text{Sum of n natural numbers} = \frac{n(n+1)}{2} \right.$$

$$\boxed{\bar{X} = \frac{n+1}{2}}$$

$\therefore$ A.M of first n-Natural numbers is $\frac{n+1}{2}$

5. The Merits of Mode are:-
i) It is based on all the observations of the given data.

ii) It is suitable for further mathematical treatment.

iii) It is rigidly defined. 2

iv) It is simple to understand and easy to calculate.
v) It is not affected by extreme values.

6. The properties of A.M are:-

i) The sum of deviations of given values from their Arithmetic Mean is zero.

ii) The sum of squares of deviations of given values from their Arithmetic Mean is minimum.

iii) If each observation in the given is increased or decreased by a constant value, then their Arithmetic Mean is also increased or decreased by that same constant value.

i.e, $\bar{Y} = \bar{X} \pm A$

Part-B

II. (Any 2)

2. Statement:- The sum of deviations of given values from their Arithmetic Mean is zero.

$\Rightarrow$ Let $x_1, x_2, \dots, x_n$ are given n observation.

Arithmetic Mean is given by

$$\bar{X} = \frac{\sum_{i=1}^{n} x_i}{n}$$

$$n\bar{X} = \sum_{i=1}^{n} x_i \quad \rightarrow ①$$

Sum of deviations from A.M is

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

$$= n\bar{x} - n\bar{x} \quad \left\{ \begin{array}{l} \text{From eq}^n ① \text{ and} \\ \bar{x} + \bar{x} + \dots \bar{x} = n\bar{x} \\ \sum_{i=1} \bar{x} = n\bar{x} \end{array} \right.$$

$$= 0$$

$$\therefore \sum_{i=1}^{n} (x_i - \bar{x}) = 0$$

So, the sum of deviations of given values from their Arithmetic Mean is zero.

PART-A

I

3. · Time Series is a set of statistical analysis/observations arranged in chronological order.

· It is done in specified times in equal intervals of time.

· It consists of statistical data which are collected, recorded

3. The following given n observations are $1^2, 2^2, \dots, n^2$

Arithmetic Mean is given by

$$\bar{X} = \frac{\sum_{i=1}^{n} x_i}{n}$$

Here, $\sum_{i=1}^{n} x_i = 1^2 + 2^2 + \dots + n^2$

$$= \frac{n(n+1)(2n+1)}{6} \quad \left\{ \begin{array}{l} \text{i.e, the sum of squares of} \\ \text{n natural numbers} \\ = \frac{n(n+1)(2n+1)}{6} \end{array} \right.$$

$$\bar{X} = \frac{\frac{n(n+1)(2n+1)}{6}}{n}$$

$$= \frac{\cancel{n}(n+1)(2n+1)}{6\cancel{n}}$$

$$\bar{X} = \frac{(n+1)(2n+1)}{6}$$

$\therefore$ Arithmetic Mean of $1^2, 2^2, \dots, n^2 = \frac{(n+1)(2n+1)}{6}$

1. Tabulation is the ~~proce~~ systematic arrangement of classified data in rows and column to form a table.

Format of table:-

Table No.

Title

(Subtitle / Headnote)

Stubs/ Row heading	Captions/ Column heading	Total
Row entries	Body of the table	

Foot Note

Source

Extra

Part - C.

III. (Any 1.)

12. Let a and b are given 2 observations.

$n = 2$.

~~AM~~ Arithmetic Mean is given by

$$AM = \frac{a+b}{2}$$

Geometric Mean is given by

$$GM = \sqrt{ab}$$

Harmonic Mean is given by

$$HM = \frac{2}{\frac{1}{a}+\frac{1}{b}} = \frac{2ab}{a+b}$$

i) $AM - GM = \frac{a+b}{2} - \sqrt{ab}$

$$= \frac{a+b-2\sqrt{ab}}{2}$$

$$= \frac{(a^{1/2})^2+(b^{1/2})^2-2a^{1/2}b^{1/2}}{2}$$

$$= \frac{(a^{1/2}-b^{1/2})^2}{2} \geq 0$$

10

$AM - GM \geq 0$

$AM \geq GM \rightarrow ①$

$GM - HM = \sqrt{ab} - \frac{2ab}{a+b}$

$$= \frac{(a+b)\sqrt{ab}-2ab}{a+b}$$

$$= \frac{(a+b)\,a^{1/2}b^{1/2} - 2(a^{1/2})^2(b^{1/2})^2}{a+b}$$

$$= \frac{a^{1/2}b^{1/2}\,(a+b-2a^{1/2}b^{1/2})}{a+b}$$

$$= \frac{a^{1/2}b^{1/2}\left[(a^{1/2})^2+(b^{1/2})^2-2a^{1/2}b^{1/2}\right]}{a+b}$$

$$= \frac{a^{1/2}b^{1/2}\,(a^{1/2}-b^{1/2})^2}{a+b} \geq 0$$

$GM - HM \geq 0$

$GM \geq HM \rightarrow ②$

From eqⁿ ① and ②, we get

$AM \geq GM \geq HM$.

ii) $A.H = \frac{(a+b)}{2} \cdot \frac{2ab}{(a+b)}$

$$= ab$$

$$= (\sqrt{ab})^2$$

$A.H = G^2$

$\therefore A.H = G^2$

1. Tabulation is the systematic arrangement of classified data in rows and columns to form a table.

Format of the table:-

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Stubs/ Row heading	Captions/ Column heading	Total
Row entries	Body of the table	

Foot Note

Source

i) Table No.:- The number should be given to each and every table to distinguish. It is generally written at the right hand corner at the top of table.

ii) Title:- Title should be given to every table. It indicates in short the contents of the table. It is written at the top of table in bold letters.

iii) Subtitle / Headnote:- It is written below the title and should be put in brackets. The statistical measurements such as 000'Rs, kg, million, ton, etc can be included.

iv) Stubs :- They are row-headings. They explain what row represents.

v) Captions:- They are column-headings. They explain what column represents.

vi) Row entries:- They are entries in a row such as marks/ subjects/ objects/ facts, etc.

vii) Body of the table :- The body of the table is ~~wr~~ filled with numbers. The table should be well balanced.

viii) Foot Note:- It is written below the table. It explains in brief precisely clear anything special referring to table such as remarks, conclusions, additions, abbrevations, etc.

ix) Source:- It is written below the foot note. Sources may be mentioned for verification to the reader.

Good

B. L. D. E. Association's

S. B. ARTS & K. C. P. SCIENCE COLLEGE, VIJAYAPUR

Second INTERNAL TEST 2022 -2023

Name / ಹೆಸರು : Vijayalaxmi, Hadimani Roll No./ಸ್ಥಳಾಂಕ : Date /ದಿನಾಂಕ : 11-01-2023

Subject/ವಿಷಯ : Statistics Semester/ಸೆಮಿಸ್ಟರ್ : I st Exam Seat No / ಪರೀಕ್ಷೆ ಸ್ಥಳಾಂಕ :

UUCMS No.:- U15KM22S0072

Invigilator's Signature / ಕೊಠಡಿ ಮೇಲ್ವಿಚಾರಕರ ಸಹಿ Signature of Evaluator / ಪರೀಕ್ಷಕರ ಸಹಿ Marks obtained/ ಪಡೆದ ಅಂಕಗಳು 30/30

12/01/2

I

1) Standard deviation is defined as the positive root of the Arithmetic mean of the squared deviations. when the deviations taken from mean.

For ungrouped data :- $\sigma = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i-\bar{x})^2}$

For grouped data :- $\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{n}f_i(x_i-\bar{x})^2}$

2

2)

i) Mesokurtic => The peak of Mesokurtic distribution is neither high nor low rather it is consider as normal curve. Here $\beta_2 = 3$

1

ii) Platykurtic => Platykurtic distribution has less peakedness than mesokurtic. Here $\beta_2 < 3$

1

4) Correlation :- Correlation is the statistical device which helps in the analysing the covariation of two or more variables.

2

7) Demerits of Mean Deviation :-

* it ~~bis~~ is not suitable for further mathematical treatment.
* it is much affected by extreme values.
* it is much affected by sampling fluctuations.

2

8) i) Negative Correlation :-
If the two variables moving in the opposite direction is called negative correlation.
Here one variable is increases and other variable is decreases.

ii) Positive Correlation :-
If the two variables are correlated and moving in the same direction is called positive correlation.
Here both the variables are either increases or decreases.

II.

9) Quartile Deviation :-
it is a deviation defined as follows;

$$\text{Quartile Deviation} = \frac{Q_3 - Q_1}{2}$$

where Q_3 = upper Quartile
Q_1 = lower Quartile

The co-efficient of Quartile Deviation

$$= \frac{Q_3 - Q_1}{Q_3 + Q_1}$$

Merits of Q.D :-

1) it is rigidly defined
2) it is simple to understand and easy to calculate.
3) it is not affected by extreme values.
4) it can be calculated for openend classes without any assumptions.

Demerits of Q.D :-

1) it is not based on all observations of given data.
2) it is not suitable for further mathematical treatments.
3) it is much affected by sampling fluctuations

11) Correlation Coefficient lies b/w -1 & +1

Proof :-

$$r_{xy} = \frac{Cov(x,y)}{\sigma_x \cdot \sigma_y}$$

$$r_{xy} = \frac{\frac{1}{n}\Sigma(x_i-\bar{x})\cdot(y_i-\bar{y})}{\sqrt{\frac{1}{n}\Sigma(x_i-\bar{x})^2 \cdot \frac{1}{n}\Sigma(y_i-\bar{y})^2}}$$

Put $(x-\bar{x}) = a$. $(y-\bar{y}) = b$.

$$r_{xy} = \frac{\frac{1}{n}\Sigma a.b}{\sqrt{\frac{1}{n}\Sigma a^2 \cdot \frac{1}{n}\Sigma b^2}}$$

$$r_{xy} = \frac{\frac{1}{n}\Sigma ab}{\sqrt{\frac{1}{n}\Sigma a^2}\cdot\sqrt{\frac{1}{n}\Sigma b^2}}$$

r_{xy} = squaring of both side.

$$r^2_{xy} = \frac{\left(\frac{1}{n}\right)^2(\Sigma ab)^2}{\left(\sqrt{\frac{1}{n}\Sigma a^2}\right)^2\cdot\left(\sqrt{\frac{1}{n}\Sigma b^2}\right)^2}$$

$$r^2_{xy} = \frac{\left(\cancel{\frac{1}{n}}\right)^2(\Sigma ab)^2}{\cancel{\frac{1}{n}}\Sigma a^2 \cdot \cancel{\frac{1}{n}}\Sigma b^2}$$

$$r_{xy}^2 = \frac{(\Sigma ab)^2}{\Sigma a^2 \cdot \Sigma b^2}$$

$$(\Sigma ab)^2 \leq \Sigma a^2 \cdot \Sigma b^2$$

$$\therefore \Sigma r_{xy}^2 = \frac{\cancel{\Sigma a^2 \cdot \Sigma b^2}}{\cancel{\Sigma a^2 \cdot \Sigma b^2}}$$

$$\therefore r_{xy}^2 = 1$$

$$r_{xy} = \sqrt{1}$$

$$r_{xy} = \pm 1$$

$$\therefore -1 < r_{xy} < +1$$

Hence proved.

III

12) Spearman's Rank correlation Coefficient:

The coefficient of correlation between ranks of two variables x & y is called Spearman's Rank Correlation coefficient.

It is defined as / denoted by

$$\rho = 1 - \frac{6\Sigma d^2}{n(n^2-1)}$$

where $d = R_x - R_y$

R_x = ranks for x variables

R_y = ranks for y variable

n = number of observations.

Proof :- Let x_i & y_i $(i = 1, 2, ---, n)$ be the ranks of i^{th} individual of two characteristics. and each variable takes the value $1, 2, ---, n$.

i.e., $x_i = 1, 2, ---, n$.

$y_i = 1, 2, ---, n$.

$$\therefore \bar{x} = \frac{1+2+---+n}{n}$$

$$= \frac{\cancel{n}\left(\frac{n+1}{2}\right)}{\cancel{n}}$$

$$\boxed{\bar{x} = \frac{n+1}{2}}$$

Similarly $\bar{y} = \frac{1+2+---+n}{n}$

$$= \frac{\cancel{n}\left(\frac{n+1}{2}\right)}{\cancel{n}}$$

$$\boxed{\bar{y} = \frac{n+1}{2}}$$

$$\therefore \bar{x} = \bar{y} = \frac{n+1}{2}$$

Now,

$$\sigma_x^2 = \frac{1}{n}\Sigma x_i^2 - \bar{x}^2$$

$$\sigma_x^2 = \frac{1^2+2^2+---+n^2}{n} - \left(\frac{n+1}{2}\right)^2$$

$$= \frac{\frac{\cancel{n}(n+1)(2n+1)}{6}}{\cancel{n}} - \frac{(n+1)^2}{4}$$

$$= \frac{(n+1)(2n+1)}{6} - \frac{(n+1)^2}{4}$$

$$= \frac{2n^2+n+2n+1}{6} - \frac{n^2+1^2+2n}{4}$$

$$= \frac{2n^2+3n+1}{6} - \frac{n^2+1+2n}{4}$$

$$= \frac{4n^2+6n+2-(3n^2+3+6n)}{12}$$

$$= \frac{4n^2+\cancel{6n}+2-3n^2-3-\cancel{6n}}{12}$$

$$\sigma_x^2 = \frac{n^2-1}{12}$$

Similarly $\sigma_y^2 = \frac{n^2-1}{12}$ $\left(\because \sigma_x^2 = \sigma_y^2\right)$.

But ingeneral $x_i \neq y_i$

$$d_i = x_i - y_i$$

$$d_i = (x_i-\bar{x})-(y_i-\bar{y}) \quad (\because \bar{x}=\bar{y})$$

$$\frac{1}{n}\Sigma d_i^2 = \frac{1}{n}\Sigma\left[\underbrace{(x_i-\bar{x})}_{a}-\underbrace{(y_i-\bar{y})}_{b}\right]^2$$

$$\frac{1}{n}\Sigma d_i^2 = \frac{1}{n}\Sigma(x_i-\bar{x})^2+\frac{1}{n}\Sigma(y_i-\bar{y})^2-2\frac{1}{n}\Sigma(x_i-\bar{x})(y_i-\bar{y})$$

$$\frac{1}{n}\Sigma d_i^2 = \sigma_x^2+\sigma_y^2-2\,\mathrm{cov}(x,y)$$

$$\frac{1}{n}\Sigma d_i^2 = 2\sigma_x^2-2r\sigma_x^2$$

$$\boxed{\begin{array}{l}\because \sigma_x^2=\sigma_y^2 \\ \because \dfrac{\mathrm{cov}(x,y)}{\sigma_x\cdot\sigma_y}=r.\end{array}}$$

10

$$\frac{1}{n}\Sigma d_i^2 = 2\sigma_x^2(1-r)$$

$$\frac{\frac{1}{n}\Sigma d_i^2}{2\sigma_x^2} = 1-r$$

$$\therefore r = 1-\frac{\frac{1}{n}\Sigma d_i^2}{2\sigma_x^2}$$

$$r = 1-\frac{\frac{1}{n}\Sigma d_i^2}{\cancel{2}\left(\frac{n^2-1}{\cancel{12}\,6}\right)}$$

$$r = 1-\frac{\frac{1}{n}\Sigma d_i^2}{\frac{n^2-1}{6}}$$

$$r = 1-\frac{6\Sigma d_i^2}{n(n^2-1)} \;//.$$

Here ρ and r both are same