1) Fill in the blanks.

1) If $\bar{X}$ is 10 and coefficient of variation is 40%. then variance is equal to 16

2) Less than type cumulative ~~frequency~~ frequencies are non-decreasing.

3) The median of 10 numbers is 25. If the highest number is increased by 5, then the median will ~~be~~ 25.

4) If $V(X) = 5$, then $V(3X + 2) = 45$

5) Karl Pearson's correlation coefficient lies between $-1$ or $+1$

8) State whether the following statements are True or False

1) Two regression lines never intersect each other

→ False.

2) Arithematic mean can be determined graphically.

→ False

3) Standard deviation is always non-negative.

→ True.

Solve the following Questions.

1) Define mode. State its two merits and two demerits.

→ The observation with maximum frequency or the most repeated observation is called as mode.

formula :- $$\text{Mode} = l + \left(\frac{f_m - f_1}{2f_m - f_1 - f_2}\right) \times h$$

Ex: X :- 10, 12, 11, 10, 15, 10
Mode is 10.

Merits :-

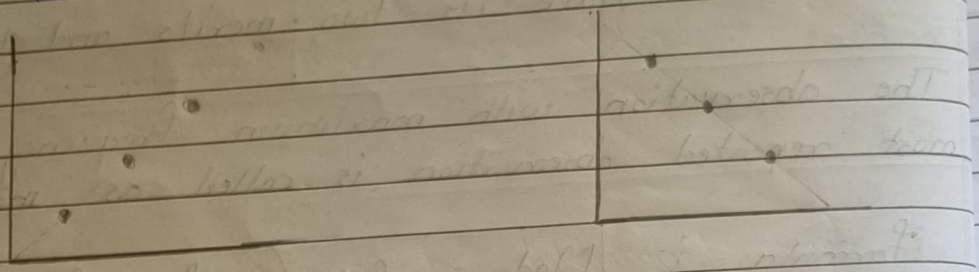
1) It is simple to understand and easy to compute.
2) It is applicable for quantitative and qualitative data.
3) It is not affected by extreme obs.
4) It can be computed for distribution with open end class.
5) It can be determined graphically.

Demerits :-

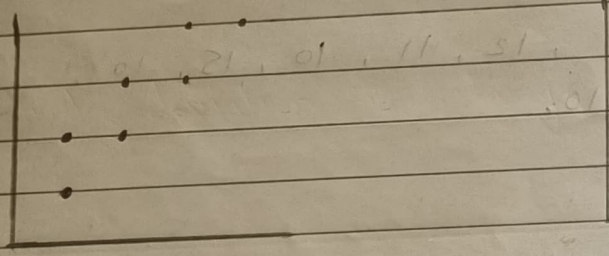
1) It is not based on all the obs.
2) It is not capable of further math. treatment.
3) It is not rigidly defined like Arithematic Mean.
4) It is indeterminate if the modal class is of the extreme of the distribution.

2) Discribe scatter diagram and explain how it used to measure correlation.

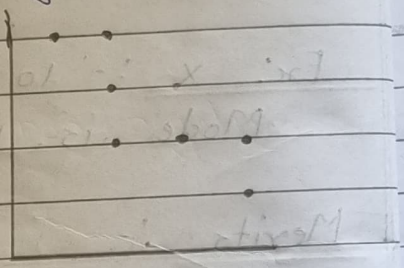
→



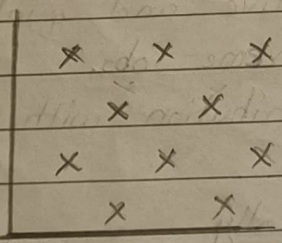
Positive Perfect correlation



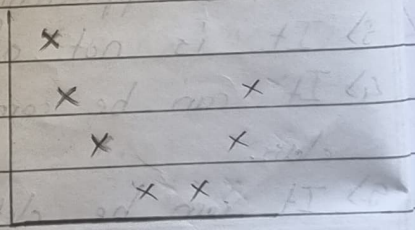
Negative Perfect correlat



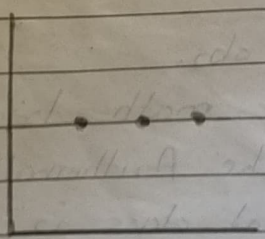
Positive Correlation



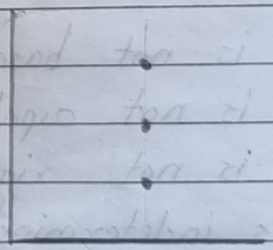
Negative correlat



No correlation



Non-linear correlati



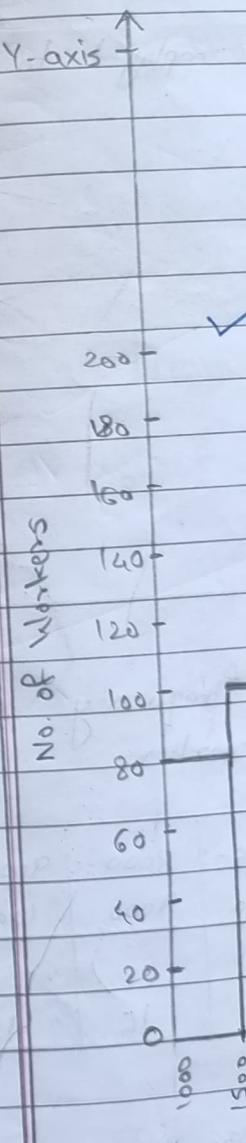
No correlation

No correlation

Draw histogram

Weekly Income
No. of workers

| 3500 - 4000 |
| --- |
| 100 |



3) Draw histogram for the following income distribution.

| Weekly Income | 1000-1500 | 1500-2000 | 2000-2500 | 2500-3000 | 3000-3500 | 3500-4000 |
|---|---|---|---|---|---|---|
| No. of workers | 80 | 100 | 150 | 120 | 140 | 100 |

Scale
X-axis = 1cm = 500 units
Y-axis = 1cm = 20 units

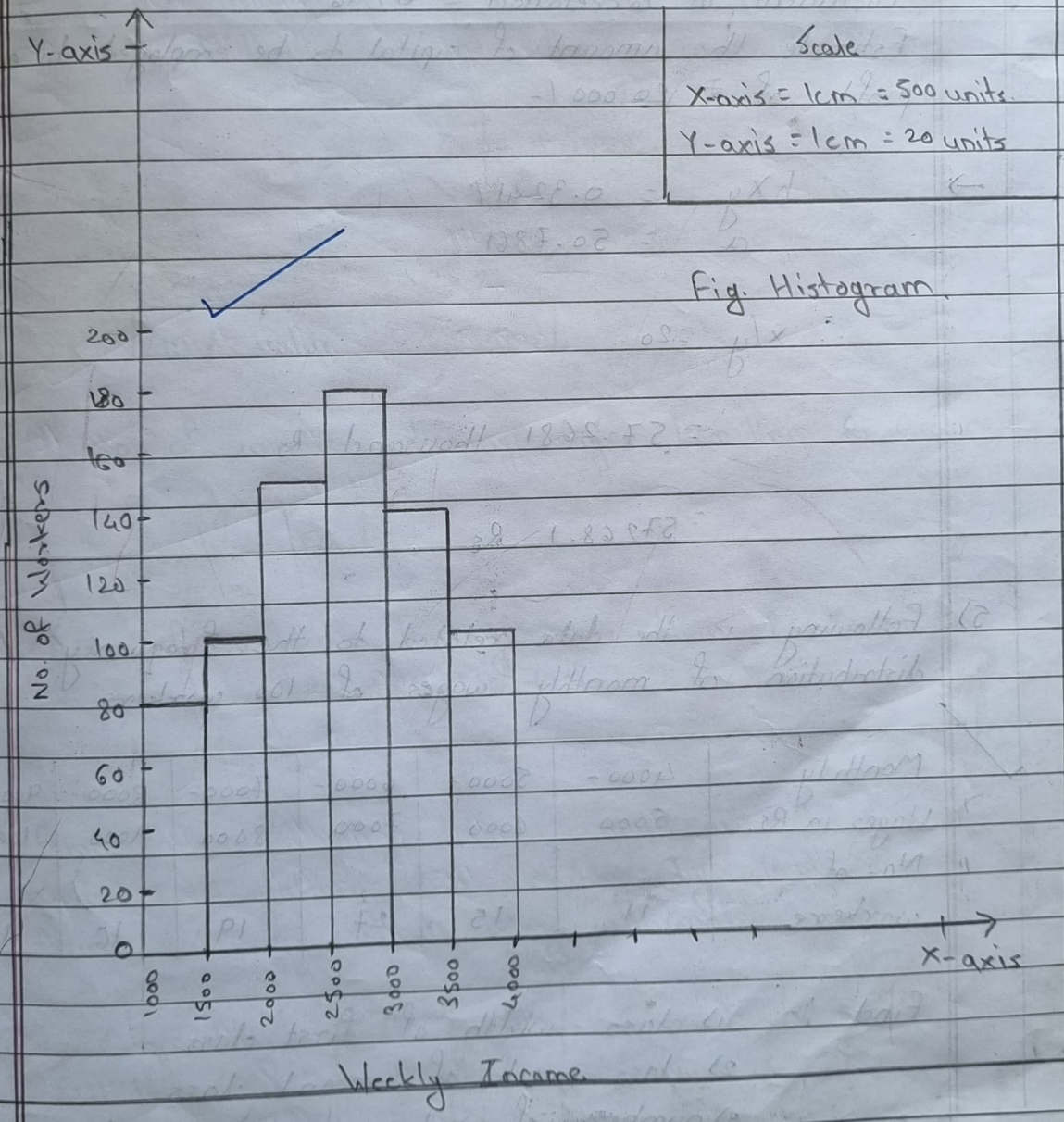



Fig. Histogram

4) The following results of capital employed and profit earned by a firm in 10 successive years are calc

| | Mean | Standard Deviation |
|---|---|---|
| Capital employed (₹ thousand) | 55 | 28.7 |
| Profit earned (₹ thousand) | 13 | 85 |

Coefficient of correlation = 0,96
Estimate the amount of capital to be employed to ea profit of ₹ 20,000 /-.

→ $b_{xy} = 0.3241$
$a = 50.7861$

$\therefore x/y = 20$

$= 57.2681$ thousand Rs.

$= 57268.1$ Rs

5) Following is the data related to the frequency distribution of monthly wages of 100 workers.

| Monthly Wages in Rs. | 4000 - 5000 | 5000 - 6000 | 6000 - 7000 | 7000 - 8000 | 8000 - 9000 | 900 1000 |
|---|---|---|---|---|---|---|
| No. of workers | 11 | 15 | 27 | 19 | 16 | |

Find :- 1) class - width of first class.
2) class mark of second class.
3) number of workers having wages less tha

4) number of workers having wages more than Rs. 6,000/-

→ 1) Width = Difference between two successive lower limits.

= 5000 - 4000

Class Width = 1000

2) class marks of second class

→ class mark = Mid value.

Mid value = $\frac{\text{upper limit + Lower Limit}}{2}$

= $\frac{6000 + 5000}{2}$

= $\frac{11000}{2}$

Mid value = 5,500

3) No. of workers having wages less than Rs. 6,000/-

= 11 + 15

= 26

4) No. of workers having more than Rs. 6,000/-

= 27 + 19 + 16 + 12

= 74

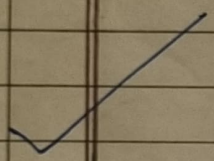
6) From the following data, compute an index for the year 2012 taking 2011 as base by simple average of Price Relatives method using arithmetic mean.

| Commodity | A | B | C | D |
|---|---|---|---|---|
| 2011 Price (Rs) | 1 | 2 | 3 | 4 |
| 2012 Price (Rs) | 5 | 4 | 3 | 2 |

→ Price Index No = $\frac{\Sigma\left(\frac{P_1}{P_0}\right)}{N} \times 100$

$= \frac{850}{4}$

∴ Price Index No. = 212.5



Solve the Questions.

1) Define variable. Explain discrete variable and continuous variable with example.

→ **Variable** :- A quantitative characteristics (which changes its value) like weight of person, examination marks, population of a country, profit of a salesman is called as variable.

Types of variables :- 1) Discrete Variable
2) Continuous Variable.

1) **Discrete Variable** :- A variable taking only particular values or isolated values is called as discrete variable.

Ex. :- No. of a students in a class, No. of articles produced by a machine, population of a country, no. of workers in a factory etc.

2) **Continuous Variable** :- A variable taking all possible values in a certain range is called as continuous variable.

Ex. :- Weight of a person, length of a screw produced by a machine, temperature at a certain place, agricultural production, electricity consumption of a family, speed of a vehicle.

2) Explain the concept of index number. State its of it.

→ Index no. is a tool used to measure the chan in price of commodities, industrial and mineral production, sales, imports, exports etc. It was fi developed by an Italian economist Mr. carli in for comparison of prices of commodities.

Definition :- "Index no. is a no. designed to measure the average change in the values a group of variables over ~~two~~ two different situations.

* Uses of Index Number :-

1) Bombay stock Exchange (BSE) SENSEX index number.
2) NSE index Number.
3) All India wholesale price index no.
4) Consumer price index no.
5) Index no. of Industrial production.
6) Cost inflation index.
7) Index no. of agricultural production.

3) A survey revealed the following frequency dist

| Distance travelled in km per litre of petrol (x) | 40-45 | 45-50 | 50-55 | 55 |
|---|---|---|---|---|
| No. of motor cycles (f) | 10 | 17 | 23 | 4 |

Find :- 1) mean 2) mode of distance travelled per l

→ 1) **Mean = Sum of the observations / Number of observations**

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

| class | Mid-value (x) | f | fx |
|---|---|---|---|
| 40-45 | 42.5 | 10 | 42.5 |
| 45-50 | 47.5 | 17 | 807.5 |
| 50-55 | 52.5 | 23 $= f_1$ | 1207.5 |
| 55-60 | 57.5 | 40 $= f_m$ | 2300 |
| 60-65 | 62.5 | 10 $= f_2$ | 625 |
| | | $\Sigma f = 100$ | $\Sigma fx = 5365$ |

Mean = $\bar{x} = \frac{\Sigma fx}{\Sigma f}$ ... (formula)

$= \frac{5365}{100}$

$\bar{x} = 53.65$

2) Mode $= l + \left(\frac{f_m - f_1}{2f_m - f_1 - f_2}\right) \times h$ ... formula.

$l$ = Lower boundry = 55
$f_m$ = frequency of modal class = 40
$f_1$ = frequency of pre modal class = 23
$f_2$ = frequency of post modal class = 10
$h$ = Width of modal class = 5

By using the formula.

$$\text{Mode} = l + \left(\frac{f_m - f_1}{2f_m - f_1 - f_2}\right) \times h$$

Put the values in formula.

$$\text{Mode} = 55 + \left(\frac{40 - 23}{2 \times 40 - 23 - 10}\right) \times 5$$

$$= 55 + \left(\frac{17}{47}\right) \times 5$$

$$= 55 + 0.36 \times 5$$

$$= 55 + 1.8$$

$$\therefore \text{Mode} = 56.8$$

4) Calculate quartile deviation and coefficient of qu deviation for the following data.

35, 52, 48, 69, 30, 40, 42, 38, 48, 36, 52

→ To find Quartile Deviation,
We arrange the observation in ascending or

30, 35, 36, 38, 40, 42, 48, 48, 52, 52, 69

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

$$= \left(\frac{11+1}{4}\right)^{th} \text{ obs.}$$

$$= \left(\frac{12}{4}\right)^{th} \text{ obs.}$$

$$Q_1 = 3^{rd} \text{ obs.}$$

$$\boxed{Q_1 = 36}$$

$$\boxed{Q_3 = \left(\frac{3n+1}{4}\right)^{th} \text{ obs.}}$$

$$= \left(\frac{3 \times (11+1)}{4}\right)^{th} \text{ obs.}$$

$$= \left(\frac{3 \times 12}{4}\right)^{th} \text{ obs.}$$

$$= \left(\frac{36}{4}\right)^{th} \text{ obs.}$$

$$Q_3 = 9^{th} \text{ obs.}$$

$$\boxed{Q_3 = 52}$$

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

$$= \frac{52 - 36}{2}$$

$= \frac{16}{2}$

Quartile Deviation = 8

Coefficient of Quartile Deviation = $\frac{Q_3 - Q_1}{Q_3 + Q_1}$

$= \frac{52 - 36}{52 + 36}$

$= \frac{16}{88}$

Coefficient of Quartile Deviation = 0.18

5) The two regression equations are $3x - y - 5 = 0$ $4x - 3y = 0$. Find

1) arithematic means of X and Y.
2) regression coefficients of X on Y and Y on X.

→ 1) $\bar{X} = 3$
$\bar{Y} = 4$

2) $b_{xy} = \frac{1}{3}$

$b_{yx} = \frac{4}{3}$

6) The median for the following frequency distribution is 27 (in hundreds of Rs). Find missing frequencies of the data.

| Expenditure (in hundreds of Rs) | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | Total |
|---|---|---|---|---|---|---|
| Number of families | 3 | – | 20 | 11 | – | 80 |

→

| Class | frequency | C.F |
|---|---|---|
| 0-10 | 3 | 3 |
| 10-20 | x | 3+x |
| 20-30 | 20 | 23+x |
| 30-40 | 11 | 34+x |
| 40-50 | Y | 34+x+Y |

Total is 80 (Given)
Median is 27 (Given)
$\therefore \Sigma f = 80$

$$34 + x + y = 80$$
$$x + y = 80 - 34$$
$$x + y = 46 \quad \cdots (I)$$

$\therefore$ L = Lower class cont. median
N = No. of families
f = frequency of class cont. median.
cf = before the median class
h = upper limit - lower limit.
Median = 27 (given)
which lies in the range 20-30

$L = 20$

$N = 80$

$f = 20$

$C.f = 3 + x$

$h = 10 - 0 = 10$

By using the formula.

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

$$27 = 20 + \left( \frac{\frac{80}{2}^{40} - (3+x)}{20_2} \right) \times 10_1$$

$$27 - 20 = \left( \frac{40 - 3 - x}{2} \right)$$

$$7 = \frac{40 - 3 - x}{2}$$

cross multiplication

$$14 = 37 - x$$

$$x = 37 - 14$$

$$\therefore x = 23$$

Substituting $x = 23$ in eqn (I) we get

$$x + y = 46$$

$$23 + y = 46$$

$$y = 46 - 23$$

$$\therefore y = 23$$

∴ Hence the missing frequencies are 23 and 23.

Q.4) Solve the Questions.

1) Define regression. State any three properties of regression coefficients.

→ Technique of prediction on the basis of correl is called as regression.
Since correlation measures the linear relation bet two variables, we find a linear equation in these variables. In otherwords, we state the relation in terms of equation of straight line. Using scatter dia we get an idea of correlation. One can obtain a line passing through these points. However, if correlation is perfect then several lines can be drawn through th points. Out of those lines, how to choose the best line is a problem. So a line which minimizes the tota of sum of squares of differences between true va and the value given by straight line is chosen. Th principle is called as least square principle. The equation so obtained is called as least square regression line.

## Properties of Regression Coefficient.

1) Correlation coefficient and regression coefficients ha same algebraic signs.
2) Correlation coefficient is a square root of produ of regression coefficients. or correlation coefficient is geometric mean of regression coefficients.
3) Both regression coefficients cannot exceed unity simultaneously.

2) What do you mean by Central tendency? State the requirements of good measure of Central tendency.

→ Single value is treated as representative of data and it is referred to an average or central value or measure central tendency.

* Measure of central Tendency is also known as measure of central value or measure of location or average of first order. It is statical measure and calculates the location or position of the central point to explain central tendency of the goal quantity of the data.

According to M.R. Speigal, "Average is a value which is typical or representative of a set of data.

## Requirements of good measure of Central Tendency.

1) It's should be easy to understand and easy to calculate.
2) It should be based on all observations in the data.
3) It should be capable for further mathematical treatment
4) It should based on all atoms in the series.
5) It should be list affected by extreme observation.
6) It should be rigidly defined.

3) Draw a pie diagram to represent the following information of a company during a year.

| Item of cost | Rs. in crore |
|---|---|
| Labour Cost | 10 |
| Overheads cost | 30 |
| Materials cost | 60 |

→ Labour cost = $\frac{10}{100} \times 360^\circ$

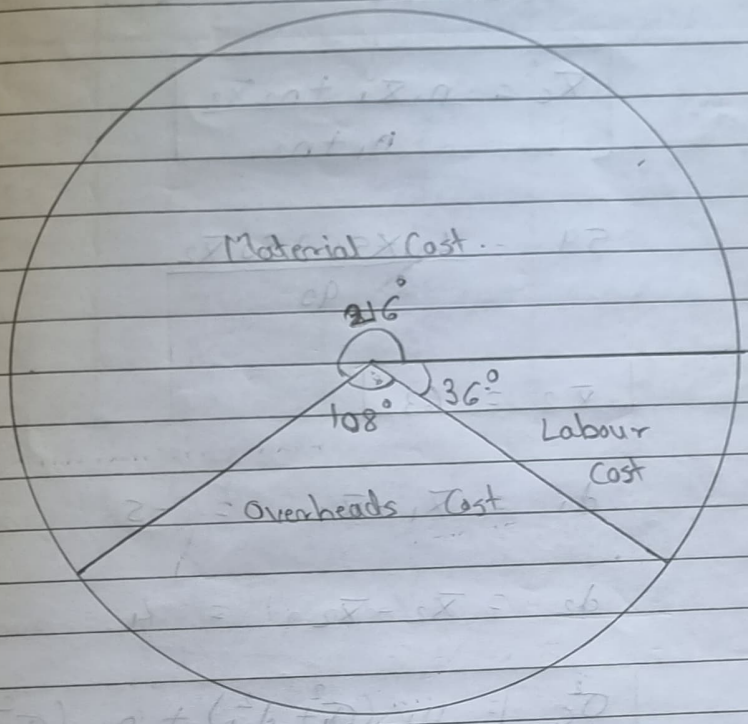
Labour Cost = $36^\circ$

Overheads cost = $\frac{30}{100} \times 360^\circ$

Overheads Cost = $108^\circ$

Materials cost = $\frac{60}{100} \times 360^\circ$

Materials cost = $216^\circ$




Pie Diagram.

1) For a set of 90 items, the mean and standard deviation are 54 and 9 respectively. For 40 items selected from these 90 items, the mean and standard deviation are 5[illegible] respectively. Find the mean and standard deviation of remaining items.

→ We have.

| Group 1 | Group 2 | Combined Group |
|---|---|---|
| $n_1 = 40$ | $n_2 = 50$ | $n = 90$ |
| $\bar{x}_1 = 54$ | $\bar{x}_2 = ?$ | $\bar{x}_c = 54$ |
| $\sigma_1 = 6$ | $\sigma_2 = ?$ | $\sigma_c = 9$ |

To find $\bar{x}_2$ we use $\bar{x}_c$.

$$\bar{x}_c = \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2}$$

$$59 = \frac{40 \times 54 + 50\,\bar{x}_2}{90}$$

$$\bar{x}_2 = 63.$$

$$d_1 = \bar{x}_1 - \bar{x}_c = -5$$

$$d_2 = \bar{x}_2 - \bar{x}_c = 4$$

$$\sigma_c^2 = \frac{n_1(\sigma_1^2 + d_1^2) + n_2(\sigma_2^2 + d_2^2)}{n_1 + n_2}$$

$$81 = \frac{40(36 + 25) + 50(\sigma_2^2 + 16)}{90}$$

$$\sigma_2 = 9$$

5) Calculate Spearman's rank correlation coefficient the following data.

| | | | | | |
|---|---|---|---|---|---|
| X | 49 | 69 | 39 | 44 | 29 |
| Y | 59 | 59 | 59 | 44 | 39 |

| X | Y | Rank of X $x_i$ | Rank of Y $y_i$ | $d_i = x_i - y_i$ | $d_i^2$ |
|---|---|---|---|---|---|
| 49 | 59 | 4 | 5 | 1 | 1 |
| 69 | 59 | 6 | 5 | -1 | 1 |
| 39 | 59 | 3 | 5 | 2 | 4 |
| 49 | 49 | 4 | 4 | 0 | 0 |
| 29 | 39 | 2 | 3 | 1 | 1 |
| Total | - | - | - | - | 7 |

By using the formula.

Spearman's rank correlation $= 1 - \frac{6 \Sigma d_i^2}{n(n^2-1)}$

$= 1 - \frac{6 \times 7}{5(5^2-1)}$

$= 1 - \frac{42}{5(25-1)}$

$= 1 - \frac{42}{5(24)}$

$= 1 - \frac{42}{120}$

$= 1 - 0.35$

Spearman's rank correlation $= 0.65$

Q.1) Solve the Question.

1) From the following data compute price index num for the current year by using.

i) Laspeyre's method.
ii) Paasche's method

| Commodity | Base Year | | Base Year | |
|---|---|---|---|---|
| | Price (Rs). | Quantity (kg.) | Price (Rs). | Quantity |
| A | 1 | 6 | 5 | 8 |
| B | 2 | 7 | 4 | 7 |
| C | 3 | 8 | 3 | 6 |
| D | 4 | 9 | 2 | 5 |

→

| Commodity | $P_0$ | $q_0$ | $P_1$ | $q_1$ | $P_0q_0$ | $P_1q_1$ | $P_0q_1$ | $P_1q_0$ |
|---|---|---|---|---|---|---|---|---|
| A | 1 | 6 | 5 | 8 | 6 | 40 | 8 | 30 |
| B | 2 | 7 | 4 | 7 | 14 | 28 | 14 | 28 |
| C | 3 | 8 | 3 | 6 | 24 | 18 | 18 | 24 |
| D | 4 | 9 | 2 | 5 | 36 | 10 | 20 | 18 |
| Total | | | | | 80 | 96 | 60 | 100 |

i) By using the formula.

$$\text{Laspeyre's price I. No.} = P_{01}^{L} = \frac{\Sigma P_1 q_0}{\Sigma P_0 q_0} \times 100$$

$$= \frac{100}{80} \times 100$$

Laspeyre's price I. No. = $P_{01}^{L}$ = 125

ii) By using the formula.

Paasche's price I. No. = $P_{01}^{P} = \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1} \times 100$

$= \frac{96}{60} \times 100$

Paasche's price I. No. = $P_{01}^{P}$ = 160