

Q.6

Attempt any two:

- i. Comments on degree of correlation between sales and expenses using Karl-pearson's coefficient of correlation. Given: **5**

Sales (1000)	50	50	55	60	65	65	65	60	60	50
Expenses (1000)	11	13	14	16	16	15	15	14	13	13

- ii. Define regression analysis and write the properties of regression of coefficient. **5**
- iii. Obtain the equation of lines of regression from the following data: **5**

x	1	2	3	4	5
y	6	8	7	6	8

*Total No. of Questions: 6**Total No. of Printed Pages: 4***Enrollment No.....**

Knowledge is Power

Faculty of Management Studies**End Sem Examination Dec-2023****MS3CO16 Business Mathematics & Statistics**

Programme: BBA

Branch/Specialisation: Management

Duration: 3 Hrs.**Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

- Q.1 i. How many years, will 5450 amount to 8175, if invested at simple interest at the rate of 12.5% per annum? **1**

(a) 5 (b) 2 (c) 4 (d) None of these

- ii. If A and B are in the ratio 3:4, and B and C in the ratio 12:13, then A and C will be in the ratio: **1**

(a) 3:13 (b) 9:13 (c) 36:13 (d) None of these

- iii. Cardinality of the set $A = \{E, X, A, M\}$ is: **1**

(a) 4 (b) 3 (c) 2 (d) None of these

- iv. If $A = \begin{bmatrix} 2 & 0 \\ -1 & -8 \end{bmatrix}$, then $-2A$ is: **1**

(a) $\begin{bmatrix} 4 & 0 \\ 2 & 16 \end{bmatrix}$ (b) $\begin{bmatrix} -4 & 0 \\ 2 & 16 \end{bmatrix}$ (c) $\begin{bmatrix} -4 & 0 \\ -2 & -16 \end{bmatrix}$ (d) None of these

- v. First stage of the statistic is: **1**

(a) Analysis (b) Collection of data

(c) Interpretation (d) None of these

- vi. A method of graphing continuous data into discrete ranges is: **1**

(a) Pie chart (b) Sub-divided graph

(c) Histogram (d) None of these

- vii. Relation between Mean, Median and Mode is: **1**

(a) $3\text{Median} = \text{Mode} - 2\text{Mean}$ (b) $3\text{Median} = \text{Mode} + 2\text{Mean}$ (c) $3\text{Mean} = \text{Mode} - 2\text{Median}$

(d) None of these

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- viii. The standard deviation of the distance (in km) travelled by a group of 30 cars is $8.6\ km$. What is the variance of their distance? **1**
- (a) $33.65\ km^2$ (b) $77.88\ km^2$
 (c) $73.96\ km^2$ (d) None of these
- ix. The range in which the correlation r lies: **1**
- (a) $[0, \infty)$ (b) $(-\infty, \infty)$ (c) $[-1,1]$ (d) None of these
- x. In a linear regression $y = a + bx$, b indicates: **1**
- (a) Slope (b) Intercept (c) Variable (d) None of these
- Q.2** i. A basket contains 350 eggs. If 12% of the eggs are rotten, find the number of eggs, good enough to be sold. **2**
- ii. Which term of arithmetic progression $27, 24, 21, \dots$ is 0? **3**
- iii. Write a short note on CAGR and EMI.
- OR** iv. Its compulsory to answer 10 questions in an examination choosing at least 4 questions from each part A and part B. If there are 6 questions in part A and 7 questions in part B, in how many ways can 10 questions be attempted? **5**
- Q.3** i. In a survey, it is found that 21 people read English newspaper, 26 people read Hindi newspaper, and 29 people read regional language newspaper. If 14 read both English and Hindi newspapers; 15 people read both Hindi and regional language newspapers; 12 people read both English and regional language newspaper and 8 read all types of newspapers, find how many people were surveyed? **4**
- ii. If $A = \begin{bmatrix} 0 & 2 & 2 \\ 2 & -1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$, find A^{-1} . **6**
- OR** iii. Define any four types of matrices with an example. **6**
- Q.4** i. What do you understand by the term frequency polygon in statistics. **2**
- ii. Present the following data by a sub-divided bar diagram. **3**
- | Subject | Number of Students | |
|------------|--------------------|---------|
| | 2011-12 | 2012-13 |
| Statistics | 25 | 30 |
| Economics | 40 | 42 |
| History | 35 | 28 |

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- iii. Write the scope of statistics in the field of Management. **5**
- iv. Graph the following data in the form of 'more than' ogives. **5**

Marks	Number of students
0-5	7
5-10	10
10-15	20
15-20	13
20-25	17
25-30	10
30-35	14
35-40	9

Q.5

- Attempt any two:
- i. The data relating to the market price of the shares of three companies are as follows: **5**

Company	Average	Standard deviation
ONIDA	150	50
BPL	200	40
VIDEOCON	125	20

From the above statement

- (a) Which company's share has more stability in prices fluctuation?
- (b) Which one would you like to dispose off anyway?
- ii. Define Measure of Central Tendency and write the characteristics of a good measure of central tendency. **5**
- iii. Calculate mode from the following distribution: **5**

Marks	Frequency
10-20	2
20-30	17
30-40	7
40-50	18
50-60	6
60-70	18
70-80	4
80-90	8

Course Code: M33C016 Branch: Management
course Name: Business Mathematics & Statistics

Q.1. MCQ.

- i) (c) 4
- ii) (b) 9:13
- iii) (a) 4 $\begin{bmatrix} 4 \\ 2 \\ 16 \end{bmatrix}$
- iv) (b) $\begin{bmatrix} 4 \\ 2 \\ 16 \end{bmatrix}$
- v) (b) Collection of data
- vi) (c) Histogram
- vii) (b) $3 \text{ Median} = \text{mode} + 2 \text{ mean}$
- viii) (c) 73.96 km^2
- ix) (c) $[-1, 1]$
- x) (a) Slope

Q2.i)

$$\text{No. of eggs} = 350$$

$$\% \text{ of rotten egg} = 12\%$$

$$\text{No. of rotten egg} = \frac{350 \times 12}{100}$$

$$= [42]$$

$$\text{No. of good egg} = 350 - 42$$

Ans.

$$Q2.ii) AP \rightarrow 27, 24, 21, \dots$$

$$d = 24 - 27 = [-3]$$

$$a = 27$$

$$a_n = 0$$

$$a_n = a + (n-1)d$$

$$0 = 27 + (n-1)(-3)$$

+1

+1

+1

+1

+1

+1

(2)

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Q2 (ii) CAGR

Compound annual growth rate is the mean annual growth rate of an investment over a specified period of time +!
longer than one year. It represents one of the most accurate ways to calculate and determine returns for individual assets, investment portfolios, and anything that seems rise or fall in value over time.

$$\text{CAGR} = \left(\frac{\text{Ending value}}{\text{Beginning value}} \right)^{\frac{1}{n}} - 1$$

EMI

An Equated Monthly Installment is a fixed payment amount made by a borrower to a lender at a specified date each calendar month. Equated monthly installments are applied to both interest and principal each month so that over specified number of years, the loan is paid off in full.
Example : To buy mobile phone we can take use EMT option to pay.

OR

(Q.ii) Total no. of questions in part-A = 6
Total no. of questions in part-B = 7

A student can choose 10 questions from the given 13 questions in the following pattern —

1. 4 from part A and 6 from part B
2. 5 from part A and 5 from part B + 1
3. 6 from part A and 4 from part B
4. Total no. of ways can be chosen 10 questions.

$$= \binom{6}{C_4} \times \binom{7}{C_6} + \binom{6}{C_5} \times \binom{5}{C_5} + \binom{6}{C_6} \times \binom{7}{C_4} + 2$$

$$\left[: n_{C_x} = \frac{n!}{(n-x)!} x! \right] + 1$$

$$= (15 \times 7) + (6 \times 21) + (1 \times 35) + 1$$

$$= 266$$

Hence no. of ways can the student choose 10 questions are 266.

Q3. ii)

$E \equiv$ people who read English newspaper.

$H \equiv$ people who read Hindi newspaper

$R \equiv$ people who read Regional newspaper.

$$n(E) = 21 \quad n(H) = 26 \quad n(R) = 29$$

$$n(E \cap H) = 14, \quad n(H \cap R) = 15 \quad n(E \cap R) = 12$$

$$n(E \cap H \cap R) = 8$$

No. of people surveyed = $n(E \cup H \cup R)$

$$= n(E) + n(H) + n(R) - n(E \cap H)$$

$$- n(H \cap R) - n(E \cap R) + n(E \cap H \cap R) + 1.5$$

$$= 21 + 26 + 29 - 14 - 15 - 12 + 8 = \boxed{43} + 1$$

Ans.

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Q3 (i) $A = \begin{bmatrix} 0 & 2 & 2 \\ 2 & -1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$

$$A^{-1} = \frac{1}{|A|} \text{adj}(A)$$

$$|A| = 0 \begin{vmatrix} -1 & 0 \\ 0 & 0 \end{vmatrix} - 2 \begin{vmatrix} 2 & 0 \\ 1 & 0 \end{vmatrix} + 2 \begin{vmatrix} 2 & -1 \\ 1 & 0 \end{vmatrix}$$

$$\begin{aligned} |A| &= 0 - 2 \times 0 + 2(+1) \\ &+ 2 \end{aligned}$$

$$\text{adj}(A) = \begin{bmatrix} C_{11} & C_{12} & C_{13} \\ C_{21} & C_{22} & C_{23} \\ C_{31} & C_{32} & C_{33} \end{bmatrix}^T + 1$$

where C_{ij} 's are cofactors.

$$C_{ij} = (-1)^{i+j} M_{ij}, M_{ij} \text{ minor of } a_{ij} + 1$$

$$C_{11} = \begin{vmatrix} -1 & 0 \\ 0 & 0 \end{vmatrix} = 0$$

$$C_{12} = - \begin{vmatrix} 2 & 0 \\ 1 & 0 \end{vmatrix} = 0$$

$$C_{13} = \begin{vmatrix} 2 & -1 \\ 1 & 0 \end{vmatrix} = 1$$

$$C_{21} = - \begin{vmatrix} 2 & 2 \\ 0 & 0 \end{vmatrix} = 0$$

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$$C_{22} = \begin{vmatrix} 0 & 2 \\ 1 & 0 \end{vmatrix} = -2$$

$$C_{23} = -\begin{vmatrix} 0 & 2 \\ 1 & 0 \end{vmatrix} = -(-2) = 2$$

$$C_{31} = \begin{vmatrix} 2 & 2 \\ -1 & 0 \end{vmatrix} = 2$$

$$C_{32} = -\begin{vmatrix} 0 & 2 \\ 2 & 0 \end{vmatrix} = -(-4) = 4$$

$$C_{33} = \begin{vmatrix} 0 & 2 \\ 2 & -1 \end{vmatrix} = -4 + 1$$

$$\text{Adj } A = \begin{bmatrix} 0 & 0 & 1 \\ 0 & -2 & 2 \\ 2 & 4 & -4 \end{bmatrix}^T$$

$$\text{Adj } A = \begin{bmatrix} 0 & 0 & 2 \\ 0 & -2 & 4 \\ 1 & 2 & -4 \end{bmatrix}$$

$$A^{-1} = \frac{1}{2} \begin{bmatrix} 0 & 0 & 2 \\ 0 & -2 & 4 \\ 1 & 2 & -4 \end{bmatrix}$$

Ans

+ 1

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OR Q3 (iv)

Four Types of Matrix :

1. Square Matrix :

A matrix in which no. of column is equal to no. of rows is known as square matrix + 1

Ex $\begin{bmatrix} 2 & 1 \\ 3 & 0 \end{bmatrix}_{2 \times 2}$

2. Null matrix :

A matrix in which every element is zero is known as null matrix. + 1

Ex $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

3. Diagonal Matrix

A square matrix in which all non-diagonal elements are zero. + 1
is known as diagonal matrix.

Ex $\begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$

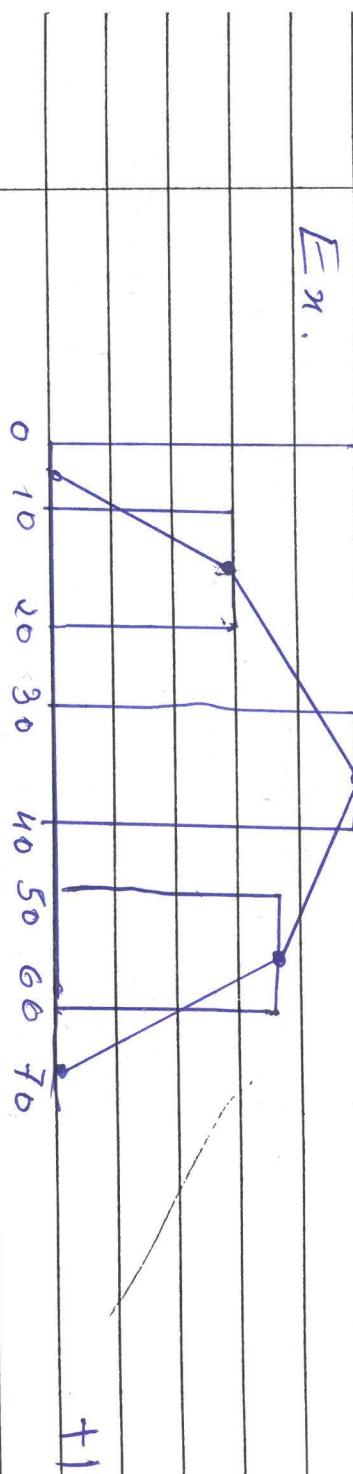
4. Scalar Matrix

A square matrix in which all non-diagonal elements are zero and all diagonal elements are same.

is known as scalar matrix + 1

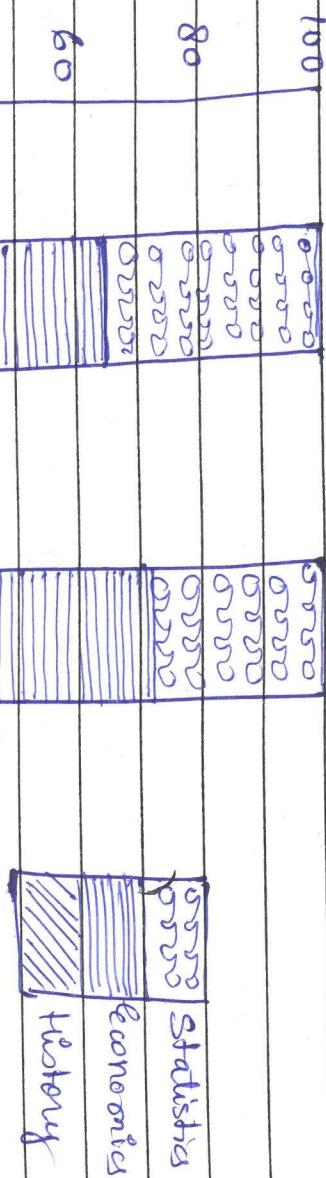
$$Ex \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

Q4(i) A frequency polygon is a line graph of class frequency plotted against class midpoint + 1



Q4(ii)

Subject	2011 - 12		2012 - 13	
	No. of student	Cumulative %	No. of student	Cumulative %
Statistics	25	25	30	30
Economics	40	65	42	72
History	35	100	28	100



Q4 (a) Scope of Statistics in the field of Management :-

1. Understanding the behavior of the consumer.

By the sample Survey we can know the consumer preference for different products.

2. Helping in policy formation;

Statistics guides us in formulating policies in social, economic & business sphere.

3. Helping in forecasting and prediction.

Statistical methods are employed not only for analysis present facts but also for forecasting and predicting.

4. Studying Relation and Association

Statistics establish relationship between two or more parts. Identifying cause and effect of relation.

5. Systematic Collection and presentation of facts.

Statistics ensure that data is collected in a systematic manner without subjectivity.

(9)

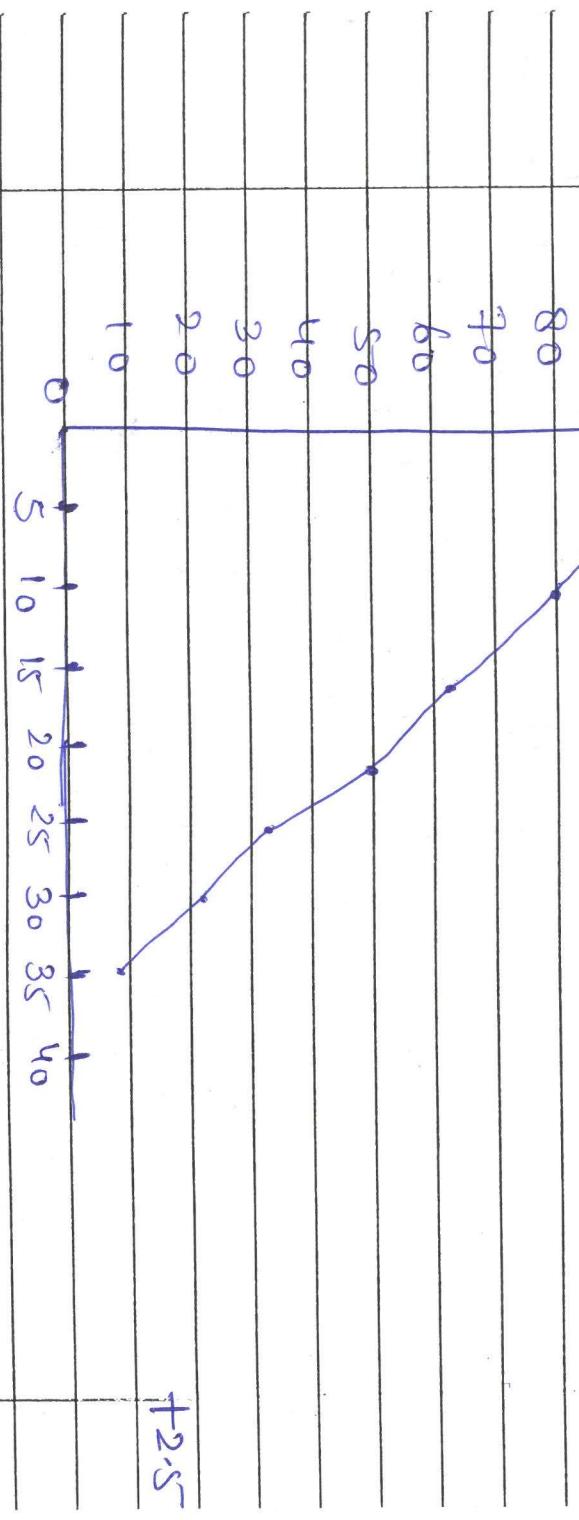
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Q4 iv)

frequency .

more than 35	9
more than 30	23
more than 25	33
more than 20	50
more than 15	63
more than 10	80
more than 5	93
more than 0	100

more than agree .



Q5 i)

a) Stability can be measured by

coefficient of variance .

Coefficient of variance for OIDA

$$\begin{aligned}
 &= \frac{\sigma}{X} \times 100 = \frac{50}{150} \times 100 \\
 &= [33.33\%] + 1
 \end{aligned}$$

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Coefficient of variance for BPL company

$$= \frac{\sigma}{\bar{x}} \times 100 = \frac{40}{200} \times 100$$

= 20%

Coefficient of variance for VIDEOCON company

$$\frac{\sigma}{\bar{x}} \times 100 = \frac{20}{125} \times 100$$

= 16%

Since coefficient of variance is less for share of VIDEOCON company

Hence share of VIDEOCON company is more stable. +1

- b) we would like to dispose of shares of ONIDA company, +1
- o their coefficient of variation is highest.

Q5 (a) By Croxton and Cowden.

An average value is a single value within the range of the data that is used to represent all of the value in the series.

Since an average is somewhere within the range of the data, it is also called a measure of central value.

+1

Characteristics of a good measure of central tendency:

→ Average should be rigidly defined.

Average should be defined properly in +1 unique form.

→ Average should be based on all the observations:

An average represents the entire population through the single value. Hence it is necessary that it should be obtained through all the population observations. +1

→ Average should be calculated with reasonable ease and rapidly. +1

→ Average should be a little affected as may be possible, by fluctuations of sampling. +1

Q5 (iv)

Grouping Table.

Marks	I	II	III	IV	V	VI
10-20	2		19	(24)	26	
20-30	17					
30-40	7		(25)		(42)	
40-50	(18)			(24)		(31)
50-60	6					
60-70	(18)		24	(12)	28	
70-80	4		22		30	+2
80-90	8					

Analysis Table

column	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90
I				✓				
II			✓	✓				
III		✓	✓	✓				
IV				✓	✓			
V		✓	✓	✓	✓			
VI			✓	✓	✓			
								+1.5

from analysis table it is clear
that the model class 40-50.

$$M_0 = \lambda_1 + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} (\lambda_2 - \lambda_1)$$

$$\lambda_1 = 40, \lambda_2 = 50 \quad f_1 = 18, f_0 = 7, f_2 = 6$$

$$\text{Mode.} = 40 + \frac{18 - 7}{2 \times 18 - 7 - 6} (50 - 40)$$

$$= 40 + \frac{11}{23} \times 10$$

$$\boxed{\text{Mode} = 44.78}$$

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Q6 9) Mean of x series (\bar{x}) = $\frac{\sum x}{n} = \frac{580}{10} = 58$

$$\bar{x} = 58$$

$$\text{Mean of y series } (\bar{y}) = \frac{\sum y}{n} = \frac{140}{10} = 14$$

$$\bar{y} = 14$$

+1

x	$\sum dx = x - 58$	$\sum dx^2$	y	$\sum dy = y - 14$	$\sum dy^2$	$\sum dxdy$
50	-8	64	11	-3	9	24
50	-8	64	13	-1	1	8
55	-3	9	14	0	0	0
60	2	4	16	2	4	4
65	7	49	16	2	4	14
65	7	49	15	1	1	7
65	7	49	15	1	1	7
60	2	4	14	0	0	0
60	2	4	13	-1	-1	-2
50	-8	64	13	-1	-1	8
Σx	$\sum dx$	$\sum dx^2$	$\sum y$	$\sum dy$	$\sum dy^2$	$\sum dxdy$
= 580	= 0	= 360	= 140	= 0	= 22	= 70

Karl Pearson's coefficient of correlation
is given by :

$$r_{xy} = \frac{\sum (dx)(dy)}{n} = \left(\frac{\sum dx}{n} \right) \left(\frac{\sum dy}{n} \right)$$

$$r_{xy} = \frac{\sqrt{\sum dx^2 - (\sum dx)^2}}{\sqrt{\sum dy^2 - (\sum dy)^2}} \sqrt{\frac{\sum dx}{n} \cdot \frac{\sum dy}{n}} + 1$$

$$r_{xy} = \frac{\sum dxdy}{\sqrt{\sum dx^2 \sum dy^2}} = \frac{-70}{\sqrt{360} \sqrt{22}}$$

$$= 70$$

$$18.97 \times 4.69$$

$$= 70 = [0.79] \text{ Ans.}$$

It shows moderate degree of +1 positive correlation.

Q6 ii) By M. M. Blair, "Regression analysis is orthogonal measure of the average relationship between two or more variables in form of the original units of the data".

Properties of Regression coefficient.

- Regression coefficient - ranges from $-\infty$ to $+\infty$. +1
- The maximum value of $b_{xy} \cdot b_{yx} = 1$, because $b_{xy} \cdot b_{yx} = r^2$
- ∴ max. value of $r = 1$ ∴ max value of $r^2 = 1 + 1$
- Regression coefficient - are not symmetric i.e. $b_{yx} \neq b_{xy}$. +1
- Regression coefficient - is not independent of units of measurement -.

Q6 (ii)



x	x^2	y	y^2	xy
1	1	6	36	6
2	4	8	64	16
3	9	7	49	21
4	16	6	36	24
5	25	8	64	40

$$\sum x = 15$$

$$\sum x^2 = 55$$

$$\sum y = 35$$

$$\sum y^2 = 249$$

$$\sum xy = 107$$

$$\text{Mean of } x \text{ series} (\bar{x}) = \frac{\sum x}{n} = \frac{15}{5} = 3$$

$$\text{Mean of } y \text{ series} (\bar{y}) = \frac{\sum y}{n} = \frac{35}{5} = 7$$

coefficient of regression y on x by x

$$= \frac{n \sum xy - \sum x \sum y}{n \sum x^2 - (\sum x)^2}$$

$$b_{yx} = \frac{5(107) - (15)(35)}{5(55) - (15)^2} = \frac{535 - 525}{275 - 225} = 1$$

$$b_{yx} = \frac{10}{50} = [0.2]$$

+1

coefficient of regression x on y by x

$$= \frac{n \sum xy - \sum x \sum y}{n \sum y^2 - (\sum y)^2}$$

$$b_{xy} = \frac{5(107) - (15)(35)}{5(249) - (35)^2}$$

$$b_{xy} = \frac{10}{20} = [0.5]$$

+1

Regression equation of x on y

$$(x - \bar{x}) = b_{xy} (y - \bar{y})$$

$$(x - 3) = 0.5 (y - 7)$$

$$x = 0.5y - 0.5$$

+1

Regression equation of y on x

$$(y - \bar{y}) = b_{xy} (x - \bar{x})$$

$$(y - 7) = 0.2(x - 3)$$

$$y = 0.2x + 6.4$$

+1

xx