

Q.6 i. Explain Positive and Negative Correlation. In a perfect negative correlation b_{xy} and b_{yx} calculated are respectively -0.365 and +0.649. Comment. 4

ii. In a partially destroyed laboratory record on analysis of correlation data the following results only are legible: 6

Variance of $x=9$

Regression equations: $8x-10y+66=0$

$40x-18y=214$

What were:

- (a) Mean values of x and y
- (b) Co-efficient of correlation between x and y
- (c) Standard deviation of y ?

OR iii. From the following data calculate co-efficient of correlation: 6

X	100	200	300	400	500	600	700
Y	30	50	60	80	100	110	130



Enrollment No.....

Faculty of Management

End Sem (Odd) Examination Dec-2018

MS3CO02 Business Mathematics and Statistics

Programme: BBA

Branch/Specialisation: All

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.

- Q.1 i. If $a : b = 3 : 4$, then ratio of $3a : 2b$ should be 1
- (a) 9:8
 - (b) 8: 9
 - (c) 7 : 5
 - (d) 5 : 7
- ii. At what rate of compound interest per annum will a sum of Rs. 1200 become Rs. 1348.32 in 2 years? 1
- (a) 6%
 - (b) 2. 6.5%
 - (c) 3. 7.5%
 - (d) 4. 7%
- iii. If A and B are sets and $A \cup B = A \cap B$, then 1
- (a) $A = \Phi$
 - (b) $B = \Phi$
 - (c) $A = B$
 - (d) None of these
- iv. What is a , if $B = \begin{bmatrix} 1 & 4 \\ 2 & a \end{bmatrix}$ is a singular matrix? 1
- (a) 5
 - (b) 6
 - (c) 7
 - (d) 8
- v. Histograms, pie charts and frequency polygons are all types of 1
- (a) One dimension diagrams
 - (b) Two dimension diagrams
 - (c) Cumulative diagrams
 - (d) Dispersion diagrams
- vi. Class frequency is divided by number of observations in frequency distribution to convert it into 1
- (a) Relative margin distribution
 - (b) Relative variable distribution
 - (c) Relative frequency distribution
 - (d) Relative width distribution
- vii. In statistics out of 100, marks of 21 students in final exams are as 90, 95, 95, 94, 90, 85, 84, 83, 85, 81, 92, 93, 82, 78, 79, 81, 80, 82, 85, 76, 85 then mode of data is 1
- (a) 85
 - (b) 95
 - (c) 90
 - (d) 81

[2]

1

1

1

5

8

Q.2

Attempt any two:

- i. If ${}^nC_{r-1} : {}^nC_r : {}^nC_{r+1} = 3 : 4 : 5$ find n and r. 5

ii. If the sum of an infinite G.P. is 20 and the sum of the squares of its terms is 100, find the progression. 5

iii. An overdraft of Rs. 50,000 is to be paid back in equal annual instalments over a period of 20 years. Find the value of the instalment, if the interest is compounded annually at 14% per annum. (Given $(1.14)^{20} = 13.7439$) 5

5

5

8

Q.3 i. Explain diagonal matrix and transpose of matrix with suitable example. 2

ii. In a survey of 25 MBA students, it was found that 15 had taken Marketing, 12 had taken Finance and 11 had taken H.R., 5 had taken Marketing and H.R., 9 had taken Marketing and Finance, 4 had taken Finance and H.R. and 3 had taken all the three subjects. Find the number of Students that had 8

- (a) Only H.R.
- (b) Only Marketing
- (c) Only Finance
- (d) Finance and H.R. but not Marketing
- (e) Marketing and Finance but not H.R.

[3]

- (f) Only one of the subjects
 (g) At least one of the three subjects
 (h) None of the subjects

OR iii. Compute A^{-1} and prove that $A^2 = A^{-1}$ If 8

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

Q.4 i. Construct Histogram for the following distribution: 3

Variable	35-40	40-45	45-50	50-55	55-60
frequency	12	30	22	30	28

ii. What do you mean by term Statistics? Discuss the limitations of Statistics. Discuss the use of Statistics in context of various fields.

OR iii. What is a Frequency distribution table? What are various types of Frequency distributions? What are the general rules to frame a frequency distribution? 7

Q.5 i. From the following data, Calculate Mean and Median 4

Marks more than	0	10	20	30	40	50	60
No. of students	180	170	150	120	70	30	0

ii. Two batsman A and B made the following scores in a series of cricket matches: 6

A	14	13	26	53	17	29	79	36	84	49
B	37	22	56	52	14	10	37	48	20	4

Calculate Standard Deviation. Who is more consistent player? Answer on the basis of coefficient of variation, taking 35 as working mean.

OR iii. The daily expenditure of 1000 families is given below: 6

Daily exp. (Rs.)	40-59	60-79	80-99	110-119	120-139
No. of families	50	?	500	?	50

The value of both median and mean for the distribution is 87.5. Calculate the missing frequencies.

P.T.O.

Faculty of Management

END SEM (ODD) Examination Dec-2018

MS3C002 Business Mathematics and Statistics

Programme: BBA

Max. marks. 60.

Answers - 1

(Q1.) (i) (a) 9:8

(ii) (a) 6%

(iii) (c) $A = B$

(iv) (d) 8

(v) (b) Two dimension diagrams

(vi) (c) Relative frequency Distribution

(vii) (a) 85

(viii) (c) Coefficient of variation

(ix) (a) Perfect +ve relationship b/w two variables.

(x) (b) Regression Analysis.

Answer - 2

Ans(i)

$$\frac{n_{Cr-1}}{n_{Cr}} = \frac{3}{4} \quad \text{--- (1)}$$

$$\text{and } \frac{n_{Cr}}{n_{Cr+1}} = \frac{4}{5} \quad \text{--- (2)}$$

from (1)

$$\frac{r}{n-r+1} = \frac{3}{5}, \quad \frac{r+1}{n-r} = \frac{4}{5} \quad \text{--- (3)}$$

from (2)

$$\frac{r}{n-r+1} = \frac{3}{5}, \quad \frac{r+1}{n-r} = \frac{4}{5} \quad \text{--- (4)}$$

$\Rightarrow 3n - 7x = -3$ and $4n - 9x = 5$
on solving these
we get

$$n = 62$$

$$x = 27$$

+2

+

ns. (ii)

Let a, ar, ar^2, \dots be a Geometric Progression.

Given, sum of infinite G.P. is 20

$$\text{i.e. } a + ar + ar^2 + \dots = 20$$

or

$$\frac{a}{1-r} = 20$$

(1)

+1

Sum of square of its terms is 100

$$\text{i.e. } a^2 + ar^2 + a^2r^4 + \dots = 100$$

$$\text{i.e. } \frac{a^2}{1-r^2} = 100$$

$$\text{i.e. } \frac{a \cdot a}{(1-r)(1+r)} = 100$$

$$\frac{a}{1+r} = 5$$

-2 (from 1)

+1

Divide eqn ① by eqn ②

$$\frac{a}{1-r} \cdot \frac{1+r}{1-r} = \frac{20}{5}$$

$$\frac{1+r}{1-r} = \frac{4}{1}$$

$$\boxed{\frac{r}{1-r} = \frac{3}{5}}$$

+1

Put r in eqn ①

we get

$$\boxed{a=8}$$

+1

$$\therefore a=8 \text{ and } r=\frac{3}{5}$$

\therefore G.P. is

$$8, 8\left(\frac{3}{5}\right), 8\left(\frac{3}{5}\right)^2, 8\left(\frac{3}{5}\right)^3, \dots$$

+1

Ans(iii) Given

$$A = \text{Amount} = 50,000/-$$

interest rate, $i = 14\%$ per annum

$$n = \text{no. of periods} = 20 \text{ years}$$

We know that

$$A = \frac{a}{i} \cdot ((1+i)^n - 1)$$

+1

$$\therefore (14\%)a = 50,000 \times \frac{1}{14\%} \cdot ((1+14\%)^{20} - 1)$$

$$a = 50,000 \times \frac{1}{14\%} \times 54.7$$

$$50,000 = \frac{a}{0.14} ((1.14)^{20} - 1)$$

$$50,000 \times 0.14 = a(13.7439 - 1) + 2$$

(Given)

$$\frac{50,000 \times 0.14}{13.7439} = a$$

$$a = 549.282$$

+ 2

\therefore value of instalment = 549.28 p

Answer - 3

Ans(i) Diagonal matrix :- Definition + Example 0.5+0.5

Transpose matrix :- Definition + Example 0.5+0.5

Ans(ii) Let A = Set of students who had taken
marketing

B = set of students who had taken
Finance

C = set of students who had taken
H.R.

Total students = 25

$n(A) = 15, n(B) = 12, n(C) = 11,$
 $n(A \cap B) = 9, n(B \cap C) = 4, n(A \cap C) = 5$
 and $n(A \cap B \cap C) = 3$

(a) No. of students that had only H.R.
i.e. $n(A' \cap B' \cap C)$

$$n(A' \cap B' \cap C) = n(C) - n(A \cap C) - n(B \cap C) + n(A \cap B \cap C)$$

$$= 11 - 5 - 4 + 3$$

$$n(A' \cap B' \cap C) = 5 \quad \star \quad +1$$

(b) No. of students that had only
marketing i.e. $n(A \cap B' \cap C')$

$$n(A \cap B' \cap C') = n(A) - n(A \cap B) - n(A \cap C) + n(A \cap B \cap C)$$

$$n(A \cap B' \cap C') = 4 \quad \star \quad +1$$

(c) No. of students that had only
Finance i.e. $n(A' \cap B \cap C')$

$$n(A' \cap B \cap C') = n(B) - n(A \cap B) - n(B \cap C) + n(A \cap B \cap C)$$

$$n(A' \cap B \cap C') = 2 \quad \star \quad +1$$

(d) Finance and H.R. but not Marketing
i.e. $n(A \cap B \cap C')$

$$n(A \cap B \cap C') = n(B \cap C) - n(A \cap B \cap C)$$

$$= 4 - 3 = 1 \quad \star \quad +1$$

(e) Marketing and Finance but not H.R.
i.e. $n(A \cap B \cap C')$

$$n(A \cap B \cap C') = n(A \cap B) - n(A \cap B \cap C) = 6 \quad \text{not } +1$$

(f) only one of the subject

$$\begin{aligned} &= n(A) + n(B) + n(C) - 2n(A \cap B) - 2n(B \cap C) \\ &\quad - 2n(C \cap A) \\ &\quad + 3n(A \cap B \cap C) \end{aligned}$$

$$= 11 \quad \text{not } +1$$

+1

(g) At least one of the three subjects i.e. $n(A \cup B \cup C)$

$$\begin{aligned} n(A \cup B \cup C) &= n(A) + n(B) + n(C) - n(A \cap B) \\ &\quad - n(B \cap C) - n(C \cap A) + n(A \cap B \cap C) \end{aligned}$$

$$n(A \cup B \cup C) = 23 \quad \text{not } +1$$

+1

(h) None of the subjects

$$n(A' \cap B' \cap C') = \text{Total students}$$

$$(A \cup B \cup C)' = n(A \cup B \cup C)$$

$$= 25 - 23 = 2 \quad \text{not } +1$$

+1

Q. Ans (ii)

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

$$\text{To Prove } A^2 = A - I$$

first we find.

$$A^2 = A \cdot A = \begin{bmatrix} 0 & 0 & 1 \\ 0 & -1 & 2 \\ 1 & -1 & 1 \end{bmatrix} \quad \textcircled{-1} \quad +2$$

Now find A^{-1}

$$A^{-1} = \frac{\text{Adj } A}{|A|} \quad \textcircled{-2} \quad +1$$

first find $|A| = 1 \neq 0$ so inverse exist, $+1$
~~first~~ find co-factors $\textcircled{3}$

co-factor matrix, $C = \begin{bmatrix} 0 & 0 & 1 \\ 0 & -1 & -1 \\ 1 & 2 & 1 \end{bmatrix} \quad +1$

Now,

Adjoint of A , $\text{Adj } A = \text{Transpose of co-factor matrix}$

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

Put value $\textcircled{3}$ and $\textcircled{4}$ in $\textcircled{2}$

we get

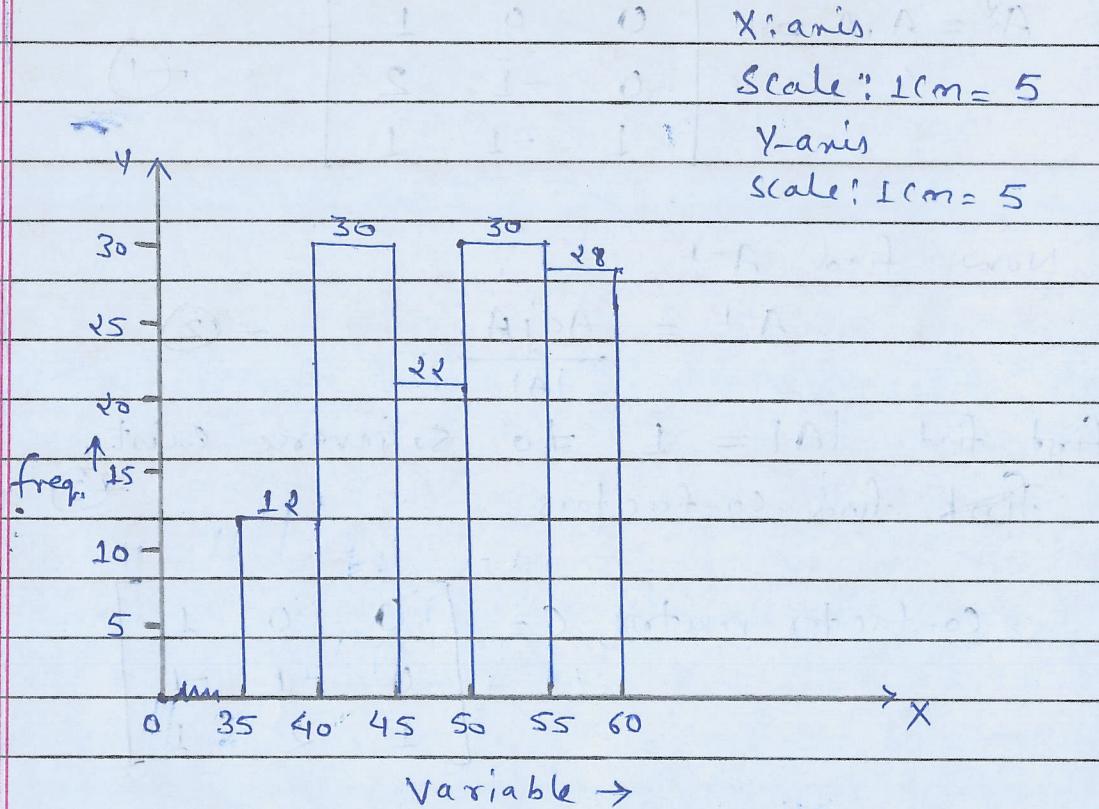
$$A^{-1} = \begin{bmatrix} 0 & 0 & 1 \\ 0 & -1 & 2 \\ 1 & -1 & 1 \end{bmatrix} \quad \textcircled{5} \quad +1$$

from $\textcircled{1}$ & $\textcircled{5}$

$$A^2 = A \cdot A^{-1} \quad +1$$

Answer - 4

Ans(i)



Note: student may take different scale for frequency.

Ans(ii)

Statistics Definition:

1 marks

+1

Limitation of statistics:

3 marks

+3

(At least three with 1 mark each)

Use of statistics:

3 marks

+3

(At least three with 1 mark each).

(with 1 mark each).

Ans(iii)

Frequency Distribution table :-

2 marks

+2

Types of Frequency Distribution :-

3 marks

+3

(1) Individual (2) Discrete (3) Continuous

[Definitions]

General Rule to frame frequency distribution :-

2 marks

+2

Answer - 5

Ans (i) Here we are given cumulative frequency
So we first find frequency and class interval.

Mean

A = 35

class	f	mid-value (m)	d = m - A	fd
0-10	180 - 170 = 10	5	-30	-300
10-20	170 - 150 = 20	15	-20	-400
20-30	30	25	-10	-300
30-40	50	35	0	0
40-50	40	45	10	400
50-60	30	55	20	600
60-70	6	65	30	180
	$\sum f = 180$			$\sum fd =$ 5400 0

$$\text{mean, } \bar{X} = A + \frac{\sum fd}{\sum f}$$

$$\bar{X} = 35 + \frac{0}{180}$$

$$\bar{X} = 35 + 0$$

$$\boxed{\bar{X} = 35} \quad \underline{\underline{}}$$

+1

NOTE! student can find mean by direct method also.

To find median

class	f	c.f.
0-10	10	10
10-20	20	30
20-30	30	60
30-40	50	110
40-50	40	150
50-60	30	180

median = Size of $(\frac{N}{2})^{\text{th}}$ term

= size of $(\frac{180}{2})^{\text{th}} = 90^{\text{th}}$ term.

C.f. just greater than 90 is 110.
So median class is 30-40.

$$\text{Median} = L + \left(\frac{\frac{N}{2} - \text{c.f.}}{f} \times i \right)$$

$$L = 30$$

$$i = 10$$

$$f = 50$$

$$N = 180$$

$$\text{c.f.} = 60$$

$$\text{Median} = 30 + \left(\frac{\frac{180}{2} - 60}{50} \times 10 \right)$$

$$= 30 + 6$$

$$\boxed{\text{Median} = 36}$$

Ans.(ii)

For A

Here Assumed mean $A = 35$ (Given)

x	$d = x - A$	d^2	
14	-21	441	
13	-22	484	
26	-9	81	
53	18	324	
17	-18	324	+1
29	-6	36	
79	44	1936	
36	1	1	
84	49	2401	
49	14	196	
$\sum x = 400$	$\sum d = 50$	$\sum d^2 = 6224$	

$$\text{S.D. for } A, \sigma_A = \sqrt{\frac{\sum d^2}{n} - \left(\frac{\sum d}{n}\right)^2}$$

$$\sigma_A = \sqrt{\frac{6224}{10} - \left(\frac{50}{10}\right)^2}$$

$$\text{S.D. } \sigma_A = \sqrt{597.4} = 24.441 \quad +1$$

$$\bar{x}_A = \frac{\sum x}{n} = \frac{400}{10} = 40$$

$$\text{C.V. for } A = \frac{\sigma_A \times 100}{\bar{x}_A} = \frac{24.441}{40} \times 100$$

$$\text{C.V.}(A) = 61.1\% \quad -1$$

Similarly for B

$$\text{S.D. } \sigma_B = 17.54 \quad +1$$

$$\text{C.V.}(B) = 58.47\% \quad -2 \quad +1$$

B is more consistent because
 $C.V.(B)$ is less than $C.V.(A)$. +1

Ans(iii)

first convert inclusive series to exclusive
 by adding 0.5 to upper limit and
 a. Subtract 0.5 from lower limit.

Daily Expenses	f	₹	midvalue (m)	fm	
59.5 - 59.5	50	5	49.5	2475	
59.5 - 79.5	a		69.5	69.5a	
79.5 - 99.5	500		89.5	44750	+1
99.5 - 119.5	b		109.5	109.5b	
119.5 - 139.5	50	5	129.5	6475	
$\sum f = 1000 = 600 + a + b$ (given)				$\sum fm =$	
				53700 + 69.5a + 109.5b	

Given mean = 87.5

$$\text{mean, } \bar{X} = \frac{\sum fm}{\sum f}$$

$$87.5 = \frac{53700 + 69.5a + 109.5b}{1000}$$

$$33800 = 69.5a + 109.5b \quad \boxed{-} \quad +1$$

Also Given frequency, $\sum f = 1000$

and actual $\sum f = 600 + a + b$

$$\therefore 1000 = 600 + a + b$$

$$a+b = 400 \quad (2)$$

+1

Put a from (2) into (1)
we get

$$\boxed{b = 150 \\ \text{and } a = 250}$$

+2

NOTE:- Student may also use median formula for finding missing frequency.

Answer - 6

- Ans (i) Positive Correlation: Define 1 marks +1
Negative Correlation: Define 1 marks +1

$$b_{xy} = -0.365$$

$$b_{yx} = 0.649$$

+2

Both coefficient should have same sign. So given Statement is wrong.

- Ans (ii) ~~best answer~~

Given, Variance, $\sigma^2 = 9$ r.s. S.D., $\sigma = 3$

$$8x - 10y = -66 \quad (1)$$

$$40x - 18y = 214 \quad (2)$$

Assume eqn (1) as regression line

Y on X

and eqn (2) as regression line

X on Y

Eqn ① Von X

$$Y = 0.8x + 6.6$$

$$\therefore b_{yx} = 0.8$$

+1

Eqn ② X on Y

$$X = 0.45y + 5.35$$

$$\therefore b_{xy} = 0.45$$

+1

(a) Mean Value of X and Y.

Solve eqn ① & ②

we get value of

X and Y

$$X = 13 \quad } \text{mean value}$$

$$Y = 17 \quad }$$

+2

(b) Correlation Coefficient

$$\gamma = \sqrt{b_{xy} \times b_{yx}}$$

$$\gamma = \sqrt{0.45 \times 0.8}$$

$$\boxed{\gamma = 0.6} \quad \text{Ans}$$

+1

(c) S.D. of Y

$$\text{W.K.T. } b_{xy} = \gamma \frac{s_x}{s_y}$$

$$0.45 = 0.6 \times \frac{3}{5}$$

$$\boxed{\bar{y} = 4} \quad +1$$

+1

Ans(iii) $A_x = 400 \quad A_y = 80$

X	Y	$U = X - A_x$	$V = Y - A_y$	U^2	V^2	UV	
100	30	-300	-50	90,000	2500	15000	
200	50	-200	-30	40,000	900	6000	
300	60	-100	-20	10,000	400	2000	
400	80	0	0	0	0	0	
500	100	100	20	10,000	400	2000	+3
600	110	200	30	40,000	900	6000	
700	130	300	50	90,000	2500	15000	
		$\sum U = 0$	$\sum V = 0$	$\sum U^2$	$\sum V^2$	$\sum UV$	
				280,000	7600	19000	

NOTE: [Student can use Direct method Also]

Karl Pearson's coefficient correlation

$$\gamma = \frac{n \sum uv - \sum u \sum v}{\sqrt{n \sum u^2 - (\sum u)^2} \sqrt{n \sum v^2 - (\sum v)^2}}$$

+1

$$\gamma = \frac{7(19000) - 0}{\sqrt{7(280,000) - 0} \sqrt{7(7600) - 0}}$$

$$= \frac{133,000}{\sqrt{1960000} \sqrt{53200}}$$

+1

$$\gamma = \frac{133,000}{1400 \times 230,065} = \frac{133,000}{322911.75} = 0.41$$