

Time: 3HRS

Max. Marks: 80

N.B.: 1) Question No.1 is **compulsory**.

2) Attempt any **three** from the remaining **five** questions.

3) Figures to the right indicate full marks

4) Scientific calculator is allowed.

Q.1 A) Find Spearman's rank correlation for the following data [05]

Marks in MFCS	37	46	49	48	47	45	35
Marks in SPM	37	32	36	34	33	35	40

B) The following table shows the distribution of digits in numbers chosen at random from telephone directory. Digit and its frequency is as follows. [05]

Digit	0	1	2	3	4	5	6	7	8	9
Freq.	1026	1107	997	966	1075	933	1107	972	964	853

Test whether the digits may be taken to occur equally frequently in the directory. (given for 9 degrees of freedom at 5% level of significance, the table value of  $\chi^2$  is 16.92)

C) A box contains 15 chips where 5 are defective. If the random samples of 3 chips are drawn, what is the probability that exactly two are defective? [05]

D) It is known that 5% of the books bound at a bindery have defective bindings. Find the probability that 2 out of 100 books bound by this bindery will have defective bindings. [05]

Q.2 A) The following data gives the number of car accidents in the city during a random time period. Calculate Bowley's coefficient of skewness for the following distribution [10]

Class	5-10	10-15	15-20	20-25	25-30	30-35	35-40
Frequency	7	9	16	22	14	12	3

B) The joint PDF of a two dimensional random variable (x, y) is given by [10]

$$f(x, y) = \begin{cases} 2 & 0 < x < 1, \quad 0 < y < x \\ 0 & \text{otherwise} \end{cases}$$

(i) Find the marginal and conditional density functions of X and Y

(ii) Find the conditional density function of Y|X and X|Y

(iii) Check for independence of X and Y

Q.3 A) The art competition has entries from three painters Radha, Meera and Sana. [10]

(i) Radha put in 15 paintings, 4% of her works have won first prize.

(ii) Meera put in 5 paintings, 6% of her works have won first prize.

(iii) Sana put in 10 paintings, 3% of her works have won first prize.

What is the probability (chance) that Radha will win first prize?

- B) The following data represents 10 students marks in statistics (X) and probability (Y). [10]  
Find Karl Pearson's coefficient of correlation for the following data.

X	56	55	58	58	57	56	60	54	59	57
Y	68	67	67	70	65	68	70	66	68	66

- Q.4 A) Given the following what is bivariate probability distribution of X and Y obtain [10]

- (i) Marginal distribution of X and Y  
(ii) The conditional distribution of X given  $Y = 2$

X \ Y	-1	0	1
0	1/15	2/15	1/15
1	3/15	2/15	1/15
2	2/15	1/15	2/15

- B) Find a cubic least square fit for the following data. [10]

$x_i$	-3	-2	-1	0	1	2	3
$y_i$	7.5	3	0.5	1	3	6	14

- Q.5 A) In a manufacturing process of a certain component, two types of defect are likely to occur with respective probabilities 0.05 and 0.1 What is the probability that a randomly chosen component (i) Does not have either kind of defects? (ii) Is defective? (iii) How one kind of defect, given that it is found to be defective? [10]

- B) A certain injection administrated to 12 patients resulted in the following changes of blood pressure 5, 2, 8, -1, 3, 0, 6, -2, 1, 5, 0, 4 Can it be concluded that the injection will be in general accompanied by an increase in blood pressure ? [the value of  $t_\alpha$  at 5% level of significance for 11 degrees of freedom is 2.201] [10]

- Q.6 A) From the following data on age of employee, calculate the Karl Pearson's coefficient of skewness [10]

Age (years)	20-25	25-30	30-35	35-40	40-45	45-50	50-55
No. of employees	8	12	20	25	15	12	8

- B) For a certain type of computers, the length of time between charges of the battery is normally distributed with a mean of 50 hours and a standard deviation of 15 hours. John owns one of these computers and wants to know the probability that the length of time will be between 50 and 70 hours. [10]

The relevant extract of the Area table is given below:

z	0	0.5	0.75	1.00	1.33	1.5	1.57
Area	0.5	0.6915	0.7734	0.8413	0.9082	0.9332	0.9418

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