MCA (SEM- II)
Probability and Statistics
(OCT-16)

N.B (1) Question No1 is compulsory.
(2) Attempt any four questions out of remaining six questions.
(3) Assume necessary data but justify the same
(4) Figures to the right indicate full marks
(5) Use of scientific calculator is allowed

Q1. (a) [10]

Age in years	20-25	25-30	30-35	35-40	40-45	45-50
No. of policy holders	2	7	5	2	4	5

For the above frequency distribution Find
i) Inter Quartile Range
ii) Quartile Deviation and its coefficient
iii) Bowley's coefficient of skewness
iv) Range and its coefficient

Q1. (b) What is the probability that all vowels come together in the word "COMMERCE"? [05]

Q1. (c) Prove that geometric distribution is memory less [05]

Q2. (a) The joint probability density function of two dimensional random variable (X, Y) is given by [08]

$$f(x,y)= 2-x-y \quad 0 \le x \le 1, 0 \le y \le 1$$
$$=0, \quad \text{otherwise}$$

i) Find marginal density functions of x and y.
ii) Find the conditional density function of x|y and y|x.
iii) Find Expectation of (x) and Expectation(Y)

Q2. (b) If X and Y are independent Poisson variates show that the conditional distribution of X given X+Y is binomial [07]

Q2. (c) Theory predicts that the proportion of beans, in four groups A, B, C, D should be 9:3:3:1. In an experiment among 1,600 beans, the number in the four groups was 882, 313, 287 and 118. Does the experimental result support the theory? [05]
(tabulated value for $\chi 2$ for 3 d.f. at 5% LOS is 7.81)

Q3. (a) Find the Karl Pearson's skewness coefficient for the following data [08]

Class Interval	0 - 10	10 – 20	20 – 30	30 - 40	40 - 50
frequency	11	25	61	93	70

Q3. (b) In manufacturing a certain component, two types of defects are likely to occur with respective probabilities 0.05 and 0.1. what is the probability that a randomly chosen component [07]
  i) does not have either kind of defects
  ii) Is defective?
  iii) Has one kind of defect, given that it is found to be defective?

Q3. (c) Trains arrive at the yard every 15 minutes and the service time is 33 minutes. If the line capacity of the yard is limited to 4 trains, find [05]
  i)   probability that the yard is empty
  ii)   The average number of trains in the system

Q4. (a) In an experiment of tossing of four coins, if X denotes 'number of heads, find [08]
  i)   The probability mass function of X,
  ii)   The distribution function of X
  iii) $P(X \leq 3)$
  iv)   Variance of X

Q4. (b) The height of a group of 1000 students follows a normal distribution with mean 165cm and standard deviation 5 cm. Find the number of students having height [07]
  (i)   up to 171 cm,
  (ii)   below 165 cm
  (iii)   between 160 to 170
  [Given $P(0 \leq Z \leq 1.2)=0.3849$, $P(0 \leq Z \leq 1)=0.3413$ where Z is a standard normal variate]

Q4. (c) A machine is designed to produce insulation washers for electrical devices of average thickness of 0.025 cm. A random sample of 10 washers was found to have an average thickness of 0.024 cm with a standard deviation of 0.002 cm. Test the significance of the deviation. Value of t for 9 degrees of freedom at 5% level is 2.262 [05]

Q5. (a) A committee of 4 persons is to be appointed from 3 officers of the production department, 4 officers of purchase department, 2 officers of sales department and 1 charted accountant. Find the probabilities of forming the committee in the following manner. [08]
  i)   There must be one from each category
  ii)   There must be at least one person from purchase department

Q5. (b) In a sample of 12 fathers and their eldest sons gave the following data about their height in inches. [07]

| Father | 65 | 63 | 67 | 64 | 68 | 62 | 70 | 66 | 68 | 67 | 69 | 71 |
| Son | 68 | 66 | 68 | 65 | 69 | 66 | 68 | 65 | 71 | 67 | 68 | 70 |

Calculate rank correlation coefficient.

Q5. (c) The letters of the word 'failure' are arranged at random. Find the probability that the consonants may occupy only odd positions [05]

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Q6. (a) X and Y are two random variables having joint density function [08]

X\Y	0	1	2
0	1/12	1/6	1/12
1	1/24	1/12	1/24
2	1/8	1/4	1/8

    i) Find the marginal Density functions of X and Y
    ii) Find the conditional distribution of Y for X=x.
    iii) Are X and Y independent?
    iv) Are X and Y uncorrelated?

Q6. (b) Prove with example that three events may be mutually independent [07] but need not pair wise independent.

Q6. (c) The size, mean and standard deviation of three samples is shown in [05] the table below Find the combined mean and combined standard deviation.

Sample -->	Sample1	Sample2	Sample3
Sample size	75	150	25
Mean	20	25	30
Standard Deviation	5	7	6

Q7. (a) Suppose a random variable X takes on the values -3,-1,2 and 5 with [08] probabilities

x	-3	-1	2	5
p(x)	$\dfrac{2k-3}{10}$	$\dfrac{k-2}{10}$	$\dfrac{k-1}{10}$	$\dfrac{k+1}{10}$

    i) Determine k and pmf of x
    ii) Determine the distribution function of x
    iii) Find the expected value of x
    iv) Find the Variance of X
    v)

Q7. (b) Find the mean and variance of beta distribution of first kind [07]

Q7. (c) Calculate Modal marks for the following. [05]

Marks	10-30	30-50	50-70	70-90	90-110	110-130
No of students	4	10	14	12	8	6