Code No: 183BJ **R22**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year I Semester Examinations, February - 2024
MATHEMATICAL AND STATISTICAL FOUNDATIONS
(Common to CSE(AI&ML), AI&DS, AI&ML)

Time: 3 Hours **Max. Marks: 60**

Note: This question paper contains two parts A and B.
i) **Part- A** for 10 marks, ii) **Part - B** for 50 marks.
- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of **ten questions** (numbered from 2 to 11) **carrying 10 marks each**. From each unit, there are two questions and the student should answer one of them. Hence, the student should answer five questions from Part-B.

PART – A

(10 Marks)

1.a) State division algorithm. [1]
b) Define Fermat number. [1]
c) What is meant by discrete probability mass function? Define it. [1]
d) Write linear regression equations of y on x. [1]
e) If z is normally distributed with mean 0 and variance 1, evaluate P ($z \geq -1.64$). [1]
f) What is meant by statistic and parameter? [1]
g) Write formula to compute the confidence interval for large samples. [1]
h) State interval of estimation. [1]
i) Define Markov process. [1]
j) Is the matrix $\begin{bmatrix} 1 & 0 \\ -1 & 0 \end{bmatrix}$ stochastic? [1]

PART – B

(50 Marks)

2.a) Show that the Fermat number F_5 is not a prime number.
b) Factorize 6077 using the method of Fermat factorization. [6+4]

OR

3.a) Show that $\sqrt{2}$ is not a rational number.
b) Find the integers x and y such that $256x+116y=4$. [5+5]

4. Calculate the regression equation of Y on X from the data given below taking deviations from actual means of X and Y.

Price x	10	12	13	12	16	15
Amount Demanded y	40	38	43	45	37	43

Estimate the likely demand when the price is Rs. 20. [10]

OR

5. Determine the discrete probability distribution, expectation, variance, standard deviation of a discrete random variable X which denotes the minimum of the two numbers that appear when a pair of fair dice is thrown once. [10]

6.a) Write the properties of normal distribution.

b) Assume that the life span X is normally distributed and the average life span of computers produced by a company is 2040 hours with standard deviation of 60 hours. Find the expected number of computers whose life span is

i) more than 2150 hours,

ii) less than 1950 hours

iii) more than 1920 hours and less than 2160 hours from a pool of 2000 computers. [3+7]

OR

7. Find the mean and standard deviation of sampling distribution of variances for the population 2, 3, 4, 5 by drawing samples of size two (a) with replacement, (b) without replacement. [5+5]

8. The pulse rate of 50 yoga practitioners decreased on the average by 20.2 beats/min. with standard deviation of 3.5.

a) If $\bar{x} = 20.2$ is used as a point estimate of the true average decrease in the pulse rate, what can we assert with 95% confidence about the maximum error E?

b) Construct 99% confidence interval for the true average decrease in pulse rate. [5+5]

OR

9.a) To estimate the percentage of all "taxi" drivers exceeding 60 kmph speed on NH 5, compute the size of the smallest sample required to be at least 99% confidence that the error of estimate (sample percentage) is at most 3.5%.

b) If the percentage (of all drivers) *p* to be estimated in (a) is known and is at most 40%, how large a sample is required? [6+4]

10. Compute the equilibrium vector for the transition matrix $P = \begin{pmatrix} 0.5 & 0.2 & 0.3 \\ 0.1 & 0.4 & 0.5 \\ 0.2 & 0.2 & 0.6 \end{pmatrix}$. [10]

OR

11. Identify all absorbing states in the Markov chains having the following matrices. Decide whether the Markov chain is absorbing or not? [5+5]

(a)
$$\begin{array}{c} \\ 1 \\ 2 \\ 3 \end{array}\begin{array}{c} \begin{array}{ccc} 1 & 2 & 3 \end{array} \\ \begin{bmatrix} 1 & 0 & 0 \\ 0.3 & 0.5 & 0.2 \\ 0 & 0 & 1 \end{bmatrix} \end{array},$$

(b)
$$\begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \end{array}\begin{array}{c} \begin{array}{cccc} 1 & 2 & 3 & 4 \end{array} \\ \begin{bmatrix} 0.6 & 0 & 0.4 & 0 \\ 0 & 1 & 0 & 0 \\ 0.9 & 0 & 0.1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \end{array}$$

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