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3E1201

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## B.Tech. III-Sem. (Main & Back) Examination, January/February - 2024

### Artifical Intelligence & Data Science

### 3AID2-01 Advanced Engineering Mathematics

### AID, CAI, CS, IT, CCS, CDS, CIT, CSD, CSR

**Time : 3 Hours** **Maximum Marks : 70**

***Instructions to Candidates:***

***Attempt all Ten questions from Part-A, Five questions out of seven questions from Part-B and Three questions out of Five questions from Part-C.***

*Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/Calculated must be stated clearly.*

*Use of following supporting material is permitted during examination. (Mentioned in form No.205)*

## PART - A

**(Answer should be given up to 25 words only)**

**All questions are compulsory.** **(10×2=20)**

1. What is the difference between linear and nonlinear programming problem.
2. What is optimization Technique? Give example.
3. What is mean, variance and standard Deviation of Uniform Distribution and Exponential Distribution.
4. Fit a straight line of following set of observation

| x | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| y | 2 | 4 | 6 | 8 | 10 |

5. What is spearman rank correlation?
6. Write the dual of

$$\begin{aligned} Max \quad & z = x_1 + 3x_2 \\ St \quad & 3x_1 + 2x_2 \le 6 \\ & 3x_1 + x_2 = 4 \\ & x_1, x_2 \ge 0. \end{aligned}$$

7. Find the maxima and minima of $x_1^3 + x_2^3 + 9x_1^2 + 18x_2^2 + 144$

8. Find all the basic solution of the system.

$$2x + y - z = 2$$
$$3x + 2y + z = 3$$

9. What is difference between skewness and kurtosis.

10. Find the optimal assignment for the problem with minimum cost.

| | I | II | III | IV |
|---|---|---|---|---|
| A | 5 | 3 | 1 | 8 |
| B | 7 | 9 | 2 | 6 |
| C | 6 | 4 | 5 | 7 |
| D | 5 | 7 | 7 | 6 |

## PART - B

### (Analytical/Problem solving questions)

***Attempt any Five questions.*** **(5×4 =20)**

1. *Define Poisson Distribution.* Derive it a limiting case of Binomial distribution Find the mean and Variance also.

2. The joint probability mass function of $(X, Y)$ is given by

$$P_{XY}(x_i, y_j) = \begin{cases} \lambda x_i^2 y_j & i = 1,2 \; ; j = 1,2,3 \\ 0 & otherwise \end{cases}$$

i) Find $\lambda$

ii) Find the marginal probability mass function of x and y.

3. Old hens can be bought at Rs 2.00 with young.Ones at Rs 5.00 each. An old hen lays 3 eggs a young one 5 eggs a week.Each egg is sold for 30P. if the expenses incurred on their feeding be Rs 1.00 per hen per week, find how many hens of each kind a person having Rs.80 for investment can purchase to earn maximum profit , if he has accomodation only for 20 hens in his house.

4. Optimize $Z = x^2+y^2+z^2$

Subject to $4x+y^2+2z=14$

5. Use simplex method to solve the LP problem

Maximize $Z = 4x_1+3x_2$

Subject to $2x_1+x_2 \leq 10$

$3x_1+2x_2 \leq 16$

$x_1x_2 \geq 0.$

6. Obtain the optimal transportation plan from the following table.

| Market Plan | $M_1$ | $M_2$ | $M_3$ | $M_4$ | Supply |
|---|---|---|---|---|---|
| $P_1$ | 4 | 6 | 8 | 13 | 50 |
| $P_2$ | 13 | 11 | 10 | 8 | 70 |
| $P_3$ | 14 | 4 | 10 | 13 | 30 |
| $P_4$ | 9 | 11 | 13 | 8 | 50 |
| Demand | 25 | 35 | 105 | 20 | |

7. Calculate the coefficient of correlation and obtain lines of regression for the following data.

| x | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| y | 9 | 8 | 10 | 12 | 11 | 13 | 14 | 16 | 15 |

## PART - C

**(Descriptive/Analytical/Problem Solving/Design questions)**

**Attempt any Three questions.** **(3×10=30)**

1. If $\theta$ be the acute angle between the two line of regression of variables $x$ and y, show that $\tan\theta = \frac{1-r^2}{r} \frac{\sigma x \sigma y}{\sigma x^2 + \sigma y^2}$ where $r, \sigma x, \sigma y$ have their usual meaning. Explain the significance where r = 0 and r = ± 1

2. A random variable $x$ has the following probability distribution:

| $x$ | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| $P(x)$ | 0 | k | 2k | 2k | 3k | $k^2$ | $2k^2$ | $7k^2+k$ |

i) Find K.

ii) Evaluate $P(x<6)$, $P(\widehat{x \geq 6})$ *and* $P(0<x<5)$

iii) Find distribution function of $x$.

iv) Find $P\left(\frac{1.5 < x < 4.5}{x > 2}\right)$

3. Solve the following problem.

Minimize $f(x) = x_1^2 + x_2^2 + x_3^2$

Subject to $g_1(x) = 2x_4 + x_2 - 5 \le 0$

$g_2(x) = x_2 + x_1 - 2 \le 0$

$g_3(x) = 1 - x_1 \le 0$

$g_4(x) = 2 - x_2 \le 0$

$g_5(x) = -x_3 \le 0$

4. What are the engineering Application of optimization also give various classification of optimization problems.

5. Use Two phase simplex method to solve the following LPP

Max $z = 5x_1 + 8x_2$

S.t $3x_1 + 2x_2 \ge 3$

$x_1 + 4x_2 \ge 4$

$x_1 + x_2 \le 5$

$x_1, x_2 \ge 0$