K25FY3039 Pages: 3 Reg No:.....
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Third Semester FYUGP Degree Examination NOVEMBER 2025

KU3VACCMT202// - LINEAR PROGRAMMING

2024 Admission onwards

Time : 1.5 hours Maximum Marks : 50

Section A

Answer any 6 questions. Each carry 2 marks.

1. A maximization assignment problem is transformed into a minimization problem by:

   (a) subtracting each element of the profit matrix from the highest element of the matrix

   (b) subtracting all the elements in a column from the highest element of that column

   (c) subtracting all the elements in a row from the highest element of that row

   (d) none of the above

2. The minimum number of lines covering all zeroes in a reduced cost matrix of order n can be at least:

   (a) n

   (b) $n-1$

   (c) $n+1$

   (d) at most n (Note: The options provided in the source are mixed. The minimum number of lines is $\leq n$.)

3. Given a system of m simultaneous linear equations in n unknowns ($m < n$), then the number of basic variables will be:

   (a) m

   (b) $n-m$

   (c) $m+n$

   (d) n

4. Define **surplus variable.**

5. Which of the following is not the characteristics of linear programming
   (a) Resources must be limited
   (b)Only one objective function;
   (c)Parameters value remains constant during the planning period
   (d)The problem must be of minimization type

6. Define a convex set with an example.

7. What is **degeneracy** in a Transportation problem?

8. The initial solution of a T.P. can be obtained by applying any known method. However, the only condition is that:

   (a) The solution must be optimum.

   (b) The solution should be non-degenerate.

   (c) The $\sum$ supply $= \sum$ demand conditions are satisfied.

   (d) All of the above.

Section B

Answer any 4 questions. Each carry 6 marks.

9. What are the advantages of Linear programming ?

10. What are the components of Linear programming model,Explain briefly.

11. Solve by graphical method. Maximize $Z = 2x_1 + x_2$ subject to

$$x_1 + 2x_2 \leq 10$$
$$x_1 + x_2 \leq 6$$
$$x_1 - x_2 \leq 2$$
$$x_1 - 2x_2 \leq 1$$

$$x_1, x_2 \geq 0$$

12. Write the **general mathematical model** of a transportation problem.

13. Find an **initial basic feasible solution** to the following transportation problem using **Matrix-Minima method** (Least Cost Method).

	D_1	D_2	D_3	D_4	Supply
S_1	6	4	1	5	14
S_2	8	9	2	7	16
S_3	10	3	6	2	5
Demand	6	10	15	4	

14. Use **VAM method** (Vogel's Approximation Method) to find an **initial BFS** to the following Transportation problem.

Warehouses	I	II	III	IV	Supply
A	5	1	3	3	34
B	3	3	5	4	15
C	6	4	4	3	12
D	4	1	4	2	19
Demand	21	25	17	17	80

Section C

Answer any 1 questions. Each carry 14 marks.

15. (a) An advertising company has to assign four projects (P_1, P_2, P_3, P_4) to four designers (D_1, D_2, D_3, D_4). The expected profit (in thousands) is given below. Use the **Hungarian Method** to find the assignment that **maximizes total profit.**

Designers	$\mathbf{P_1}$	$\mathbf{P_2}$	$\mathbf{P_3}$	$\mathbf{P_4}$
$\mathbf{D_1}$	82	83	69	92
$\mathbf{D_2}$	77	37	49	92
$\mathbf{D_3}$	11	69	5	86
$\mathbf{D_4}$	8	9	98	23

(b) A company has four machines and four jobs to be assigned. The cost of assigning each machine to each job (in rupees) is given in the following table:

Machines / Jobs	**Job 1**	**Job 2**	**Job 3**	**Job 4**
Machine A	9	2	7	8
Machine B	6	4	3	7
Machine C	5	8	1	8
Machine D	7	6	9	4

Use the **Hungarian Method** to find the optimal assignment that minimizes the total cost.Find the **minimum total cost** of the assignment.

16. Use simplex method to solve the L.P.P.:

$$\begin{aligned} \text{Maximize} \quad & z = 2x_1 + 3x_2 \\ \text{subject to} \quad & x_1 + x_2 \leq 4, \\ & -x_1 + x_2 \leq 1, \\ & x_1 + 2x_2 \leq 5, \\ & x_1, x_2 \geq 0. \end{aligned}$$