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(FOR THE CANDIDATES ADMITTED
DURING THE ACADEMIC YEAR 2022 ONLY)

22UMS512

REG.NO. :

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI

END-OF-SEMESTER EXAMINATIONS : NOVEMBER-2024

COURSE NAME: B.Sc.-MATHEMATICS **MAXIMUM MARKS: 50**

SEMESTER: V **TIME : 3 HOURS**

PART - III
SKILL ENHANCED COURSE: OPERATIONS RESEARCH - I

SECTION – A (10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS.
MULTIPLE CHOICE QUESTIONS. (K1)

1. The standard form of an LPP requires:_____.
   a) All variables to be non-negative
   b) The objective function to be linear
   c) Constraints to be in the form of inequalities
   d) All of the above

2. Which of the following is an application of the Simplex Method?
   a) Solving linear equations
   b) Optimization in resource allocation problems
   c) Calculating the determinant of a matrix
   d) Solving quadratic programming problems

3. The Dual Simplex Method is primarily used when:_____.
   a) The primal problem has no feasible solution
   b) The primal solution is optimal but not feasible
   c) The dual problem has infeasible solutions
   d) The dual problem is non-linear

4. The objective of the Transportation Problem in Linear Programming is:_____.
   a) To maximize profit
   b) To minimize transportation costs
   c) To balance supply and demand
   d) To find multiple solutions to the problem

5. In the Replacement Problem, when the value of money changes with time, the decision to replace equipment is made by:
   a) Minimizing the total operational cost of equipment
   b) Comparing the present value of future costs with the current cost
   c) Finding the average cost of maintaining equipment
   d) Replacing equipment after a fixed time interval, regardless of cost

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES. (K2)

6. What is the objective function in a Linear Programming Problem (LPP)?

7. What does degeneracy in linear programming refer to?

(CONTD…….2)

8. What is a primal-dual pair in linear programming?

9. What does the MODI Method help to determine in the transportation problem?

10. What is the Hungarian Assignment Method used for?

SECTION – B (5 X 3 = 15 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. (K3)

11. a) A company has three operational departments (weaving, processing, packing) with capacity to produce three different types of clothes namely suitings, shirtings and woollens yielding a profit of Rs. 2, Rs.4 and Rs.3 per metre respectively. One metre of suiting requires 3 minutes in weaving, 2 minutes in processing and 1 minute in packing. Similarly one metre of shirting requires 4 minutes in weaving, 1 minute in processing and 3 minutes in packing. One metre of woollen requires 3 minutes in each department. In a week, total run time of each department is 60, 40 and 80 hours for weaving, processing and packing respectively. Formulate the linear programming problem to find the product mix to maximize the profit.

(OR)

b) Reduce the following LPP to its standard form:
Maximize $Z^* = 3x + 4y + 6z$ subject to the constraints: $2x + y + 2z \geq 6$; $3x + 2y = 8$; $7x - 3y + 5z \geq 9$; $x \geq 0$, $y \geq 0$ and z unrestricted in sign.

12.a) Obtain all the basic solutions to the following system of linear equations: $x + 2y + z = 4$ and $2x + y + 5z = 5$

(OR)

b) Find the initial basic feasible solution of the LPP: Maximize $Z = 2x - y + z$ subject to constraints: $3x + y + z \leq 60$; $x - y + 2z \leq 10$; $x + y - z \leq 20$ and $x, y, z \geq 0$.

13.a) Write the dual of the LPP: Minimize $Z = 4x + 6y + 18z$ subject to the constraints:

$x + 3y \geq 3$; $y + 2z \geq 5$ and $x, y, z \geq 0$.

(OR)

b) Explain the procedure of solving any LPP using Dual Simplex Method

14.a) Obtain an Initial Basic Feasible Solution to the following transportation problem using the North - West Corner Method:

	D	E	I	G	Available
A	11	13	17	14	250
B	16	18	14	10	300
C	21	225	275	250	400
Requirement	200	225	275	250	

(OR)

b) Explain the procedure of solving any LPP using Least Cost Method

(CONTD…….3)

15.a) A department head has four tasks to be performed and three subordinates differ in efficiency. The estimates of the time, each subordinate would take to perform, is given below in the matrix. How should he allocate the tasks one to each man, so as to minimize the total man-hours?

Task	Men		
	1	2	3
I	9	26	15
II	13	27	6
III	35	20	15
IV	18	30	20

(OR)

b) The data collected in running a machine, the cost of which is Rs.60,000, are given below:

Year	:	1	2	3	4	5
Resale Value (Rs.)	:	42000	30000	20400	14400	9650
Cost of spares (Rs.)	:	4000	4270	4880	5700	6800
Cost of labour (Rs.)	:	14000	16000	18000	21000	25000

Determine the optimum period for replacement of the machine.

SECTION – C (5 X 5 = 25 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

(K4 (Or) K5)

16. a) Use the Graphical method to solve the following LPP:
Minimize $Z = -x + 2y$ subject to the constraints:
$-x + 3y \leq 10$; $x + y \leq 6$; $x - y \leq 2$ and $x \geq 0$, $y \geq 0$.

(OR)

b) Use the Graphical method to solve the following LPP: Maximize $Z = 2x + 3y$ subject to the constraints:

$x + y \leq 30$; $x - y \geq 0$; $y \geq 3$; $0 \leq x \leq 20$ and $0 \leq y \leq 12$.

17.a) Find the Maximum value of $Z = 50x_1 + 30x_2$ subject to the constraints:

$2x_1 + x_2 \leq 100$; $x_1 + 2x_2 \leq 80$; and $x_1, x_2 \geq 0$.

(OR)

b) Maximize $Z = 3x + 2y$ subject to the constraints: $2x + y \leq 2$; $3x + 4y \geq 12$ and $x, y \geq 0$.

18. a) Use dual simplex method to solve the following LPP:
Minimize $Z = 3x + y$ subject to the constraints:
$x + y \geq 1$; $2x + 3y \geq 2$ and $x, y \geq 0$.

(OR)

b) Use Dual Simplex Method to solve the following LPP: Maximize $Z = -2x - y$ subject to the constraints: $3x + y \geq 3$; $4x + 3y \geq 6$; $x + 2y \geq 3$ and $x, y \geq 0$.

(CONTD…….4)

19.a) ABC Limited has three production shops supplying a product to five warehouses. The cost of production varies from shop to shop and cost of transportation from one shop to a warehouse also varies. Each shop has a specific production capacity and each warehouse has certain amount of requirement. The costs of transportation are as given below:

Shop	Warehouse					
	I	II	III	IV	V	Supply
A	6	4	4	7	5	100
B	5	6	7	4	8	125
C	3	4	6	3	4	175
Demand	60	80	85	105	70	400

The cost of manufacture of the productbat different production shops is :

Shop	Variable Cost	Fixed Cost
A	14	7000
B	16	4000
C	15	5000

Find the optimum quantity to be supplied from each shop to different warehouses at minimum total cost.

(OR)

b) A company has three plants at locations A, B and C which supply to warehouses located at D, E, F, G and H. Monthly plant capacities are 800, 500 and 900 units respectively. Monthly warehouses are 400, 400, 500, 400 and 800 units respectively. Unit transportation (in rupees) are given below:

To

From $\begin{bmatrix} 5 & 8 & 6 & 6 & 3 \\ 4 & 7 & 7 & 6 & 5 \\ 8 & 4 & 6 & 6 & 4 \end{bmatrix}$

Determine an optimum distribution for the company in order to minimize the total transportation cost .

20.a) A pharmaceutical company is producing a single product and is selling it through five agencies located in different cities. All of a sudden, there is a demand for the product in another five cities not having any agency of the company. The company is faced with the product to needy cities in such a way that the travelling distance is minimised. The distance between the surplus and deficit cities (in km) is given in the following table:

Deficit cities

Surplus cities	a	b	c	d	e
A	85	75	65	125	75
B	90	78	66	132	78
C	75	66	57	114	69
D	80	72	60	120	72
E	76	64	56	112	68

Determine the optimum assignment schedule.

(OR)

b) A firm is considering replacement of a machine, whose cost price is 12,200 and the scrap value, Rs.200. The running (maintenance and operating) costs in rupees are found from experience to be as follows:

Year	:	1	2	3	4	5	6	7	8
Running Cost	:	200	500	800	1200	1800	2500	3200	4000

When should the machine be replaces?