DHANAMANJURI UNIVERSITY

Examination- 2023 (Dec)

Three year course B.Sc. 5th Semester

Name of Programme	:	**B.A/B.Sc. Mathematics (Honours)**
Semester	:	**5th**
Paper Type	:	**DSE-I (Theory)**
Paper Code	:	**EMA-301**
Paper Title	:	**Mathematical Programming and its applications**

Full Marks : 100

Pass Marks : 40 **Duration: 3 Hours**

The figures in the margin indicate full marks for the questions
Answer all the questions:

1. **Answer the following questions:**

   a) Define LPP and write the canonical forms of LPP.

   b) Write the standard form of the mathematical model for the transportation problem.

   c) Write the standard form of the mathematical model for the Assignment problem

   d) Define

      i) Basic solution

      ii) Artificial Variable

      iii) Degenerate basic feasible solution

      iv) Optimization   2+2+2+4=10

2. Answer the following questions: $\qquad$ **5+5=10**

   a) An oil company has two units A and B which produces three different grades of oil super fine, medium and low grade oil. The company has to supply 12,8,24 barrels of super fine, medium and low grade oils respectively per week. It costs the company Rs. 2,000 and Rs. 1,000 per day to run the units A and B respectively. On a day Unit A produces 16, 12 and 14 barrels and the unit B produces 12, 12 and 22 barrels of super fine, medium and low grade oil per day. The manager has to decide on how many days per week should each unit be operated in order to meet the requirement at minimum cost. Formulate the LPP model.

   b) Write the dual of the following linear programming problem

      Minimise $\qquad Z = 3x_1 - 2x_2 + 4x_3$

      Subject to $\qquad 3x_1 + 5x_2 + 4x_3 \geq 7$

$$6x_1 + x_2 + 3x_3 \geq 4$$
$$7x_1 - 2x_2 - x_3 \leq 10$$
$$x_1 - 2x_2 + 5x_3 \geq 3$$
$$4x_1 + 7x_2 - 2x_3 \geq 2$$
$$x_1, x_2, x_3 \geq 0$$

3. Answer the following questions: $\qquad$ **5+5=10**

   a) Find all the basic solutions to the system of linear equations

$$x_1 + 2x_2 + x_3 = 4$$
$$2x_1 + x_2 + 5x_3 = 5$$

   b) Solve the following linear programming problem by graphical method

      Minimize $\qquad Z = 2x_1 + x_2$

      Subject to the constraints

$$5x_1 + x_2 \leq 50$$

$$x_1 + x_2 \geq 1$$

$$x_2 \leq 4$$

$$x_1, x_2 \geq 0$$

4. Obtain an initial basic feasible solution to the following transportation problem using the Vogel's approximation method, North west corner and matrix minima method

	D$_1$	D$_2$	D$_3$	D$_4$	Capacity
O$_1$	1	2	3	4	6
O$_2$	4	3	2	0	8
O$_3$	0	6	8	6	10
Demand	4	6	8	6	24

4+3+3=10

5. Use Simplex method to solve the following LPP.

Maximise $\quad Z = x_1 + 9x_2 + x_3$

Subject to $\quad x_1 + 2x_2 + 3x_3 \leq 9$

$\quad\quad\quad\quad 3x_1 + 2x_2 + 2x_3 \leq 15$

$\quad\quad\quad\quad x_1, x_2, x_3 \geq 0$ $\hspace{3cm}$ 10

6. Use big M method to solve the following LPP. $\hspace{1.5cm}$ 15

Maximise $\quad Z = 3x_1 - x_2$

Subject to $\quad 2x_1 + x_2 \geq 2$

$\quad\quad\quad\quad x_1 + 3x_2 \leq 2$

$\quad\quad\quad\quad x_2 \leq 4 \hspace{2cm} x_1, x_2 \geq 0$

7. Use Two phase simplex method to solve the following LPP. $\hspace{0.5cm}$ 15

Maximize $\quad z = 2x_1 + x_2 - x_3$

Subject to the constraints

$$4x_1 + 6x_2 + 3x_3 \leq 8$$

$$3x_1 - 6x_2 - 4x_3 \leq 1$$

$$2x_1 + 3x_2 - 5x_3 \geq 4$$

$$x_1, x_2, x_3 \geq 0$$

8. A Company has three cement factories located in cities 1,2,3 which supply cement to four projects located in towns A,B,C and D. Each plant can supply daily 6,1,10 truckloads of cement respectively and the daily cement requirements of the projects are respectively 7,5,3,2 truckloads. The following table depicts the transportation cost per truckloads of cement (in hundreds of rupees) from each plant to each project site. Determine the optimal distribution for the company so as to minimize the total transportation cost.   10

	A	B	C	D	Supply
Sources-1	2	3	11	7	6
Sources-2	1	0	6	1	1
Sources-3	5	8	15	9	10
Demand	7	5	3	2	

9. Five different machines can do any of the required five jobs with different profits resulting from each assignment as given below

Jobs/Machines	Machine A	Machine B	Machine C	Machine D	Machine E
Job1	40	47	50	38	50
Job2	50	34	37	31	46
Job3	50	42	43	40	45
Job4	35	48	50	46	46
Job5	39	72	51	44	49

Find out the maximum profit possible through optimal assignment.   10

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