2018

MCA 4th Semester Examination

OPERATION RESEARCH

&

OPTIMIZATION TECHNIQUE

PAPER—MCA-405

Subject Code—32

Full Marks : 100

Time : 3 Hours

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Answer any *five* questions.

1. (a) Define Operation Research State the methodology of Operation Research.

(b) What do you mean by basic and non-basic variables ?

(c) What is un-balanced transportations problem ? How can it be overcome ?

(d) How many types of variables and constraints can exist in linear programming problems ? Give example.

(2+3)+2+(2+1)+4

2. (a) Solve the following problem by Graphical method :

$$\text{Max } Z = 16x_1 + 15x_2$$

$$\text{subject to } 40x_1 + 31x_2 \leq 124$$

$$-x_1 + x_2 \leq 1$$

$$x_1 \leq 3$$

$$x_1, x_2 \geq 0$$

(b) A company manufacturing air-coolers has two plants located at Mumbai and Kolkata with a weekly capacity of 200 units and 100 units, respectively. The company supplies air coolers to its 04 show rooms situated at Ranchi, Delhi, Lucknow and Kanpur which have a demand of 70, 100, 100 and 30 units respectively. The cost of transportation per unit in Rs. is shown in the following table :

	Ranchi	Delhi	Lucknow	Kanpur
Mumbai	90	90	100	100
Kolkata	50	70	130	85

Plan the production programme so as to minimize the total cost of transportation. Use Vogel's Approximation Method (VAM). 8+6

3. (a) Solve the following problem by Big-M method :

$$\text{Max } Z = 5x_1 + 3x_2$$
$$\text{subject to } x_1 + 4x_2 \geq 6$$
$$2x_1 + x_2 \leq 1$$
$$x_1, x_2 \geq 0$$

(b) Briefly explain the primal dual relationship with the help of an example. 8+6

4. (a) Using two-phase method solve the LPP.

$$\text{Min } Z = 7x_1 - 3x_2$$
$$\text{subject to } 3x_1 - x_2 - x_3 \geq 3$$
$$x_1 - x_2 + x_3 \geq 2$$
$$x_1, x_2, x_3 \geq 0$$

(b) Solve the following problem using simplex method :

$$\text{Max } Z = 4x_1 + 6x_2$$
$$\text{subject to } 2x_1 - 2x_2 \leq 6$$
$$4x_1 \leq 16$$
$$x_1, x_2 \geq 0$$ 8+6

5. (a) A small construction firm specializes in building and selling single family homes. The firm offers two basic types of houses, model A and model B. Model A houses require 4000 labour hours, 2 tons of stone and 2000 board feet of lumber. Model B houses require 10,000 labour hours, B tons of stone and 2000 board feet of lumber. Due to long lead times, for ordering suppliers and the scarcity of skilled and semiskilled workers is the area, the firm will be forced to rely on its present resources for the upcoming building season. It has 4,00,000 hours of labour, 150 tons of stone and 2,00,000 board feet of lumber. Profit for model A is rupees 1 lakh per unit and model B's yield is 2 lakhs per unit. Set up the relevant LPP in equalities.

(b) A company has 5 jobs to be done of five machines. Any job can be done on any machine. The cost of doing the jobs in different machines are given below. Assign the jobs for different machines so as to minimise the total cost :

Jobs	Machines				
	A	B	C	D	E
1	13	8	16	18	19
2	9	15	24	9	12
3	12	9	4	4	4
4	6	12	10	8	13
5	15	17	18	12	20

7+7

6. (a) Solve the following LPP by simplex method :

$$\text{Maximize } Z = 2x_1 + 2x_2$$

$$\text{subject to } 5x_1 + 3x_2 \leq 8$$

$$2x_1 + 4x_2 \leq 8$$

$$x_1, x_2 \geq 0$$

(b) Write the dual of the following :

$$\text{Max } Z = 6x_1 + 10x_2$$

$$x_1 \leq 14$$

$$x_2 \leq 16$$

$$3x_1 + 2x_2 \leq 18$$

$$x_1, x_2 \geq 0$$

8+6

7. (a) Define slack variable and surplus variable.

(b) Find the sequence that minimizes the total required time is performing the following jobs of three machines. Determine the order in which the jobs should be processed in order to minimise the total time. Also find the minimum elapsed time. Processing time (in minutes) are given below :

Job	1	2	3	4	5	6
Machine A	3	12	5	2	9	11
Machine B	8	6	4	6	3	1
Machine C	13	14	9	12	8	13

(c) How does an infeasible solution to a problem is recognized ? 4+7+3

[Internal Assessment : 30]