

11 MAY 2019

Code: 3125

M.B.A. Semester – 1

Paper – 107: Operations Research

Time: 2½ Hours

Total Marks: 70

Q.1 (a) Solve the following Linear Programming Problem using graphical method: [7]

Maximize: $Z = 18x + 16y$

Subject to: $15x + 25y \leq 375$; $24x + 11y \leq 264$; $y \leq 5$; $x, y \geq 0$.

(b) Write dual of the following primal LP problems: [7]

(i) Maximize: $Z_x = -180x_1 - 20x_2 + 20x_3 + 10x_4$
Subject to: $-4x_1 - x_2 + x_3 + x_4 \leq 2$; $-2x_1 + x_2 - x_3 \leq 1$;
 $x_1, x_2, x_3, x_4 \geq 0$

(ii) Minimize: $Z_x = 2x_1 + x_2$
Subject to: $4x_1 - 2x_2 \geq -180$; $-x_1 + x_2 \geq -20$; $x_1 - x_2 \geq 20$
 $x_1 \geq 10$, $x_1, x_2 \geq 0$

OR

Q.1 (a) What is linear programming? Explain Solution and Feasible solution of an LPP. [7]

(b) A media marketing firm has contracted with a company to market its product. [7]
The company wants its TV and radio advertising to reach different numbers of customers within three age groups: over 50, between 30 and 50, and under 30 year old. One minute of TV commercial time costs Rs. 6000 and will reach an average of 15000 viewers in the over 50 group, 10000 customers in the 30 to 50 group, and 8500 in the under 30 group. One minute of radio time costs Rs. 2000 and will reach 4000 listeners in the over 50 age group, 8000 in the 30 to 50 age group, and 12000 in the under 30 group. The company wants to have a total exposure of 50000 in the over 50 group, 75000 in the 30-50 age-group, and 65000 in the under-30 group. Formulate an LP model to determine the amount of different commercial minutes to use at the minimum cost.

Q.2 (a) Write down steps of Vogel's Approximation Method. [7]

(b) Following is the transportation problem with initial basic solution. Figures in bracket indicate allocation in that cell. Apply MODI method and find optimal solution: [7]

		Destination				Supply
		D ₁	D ₂	D ₃	D ₄	
Source	A	20	15	13	5 [13]	13
	B	16 [5]	17	11 [10]	22	15
	C	30 [3]	25 [7]	17	35 [12]	22
	Demand	8	7	10	25	

OR

- Q.2 (a) The Hardrock Concrete Company has plants in three locations and is currently working on three major construction projects, each located at a different site. The shipping cost (in hundred Rs.) per truckload of concrete, daily plant capacities, and daily project requirements are provided in the accompanying table. [7]

From \ To	Project A	Project B	Project C		Plant Capacities
Plant 1	500	750	300	450	12
Plant 2	650	800	400	600	17
Plant 3	400	700	500	550	11
Project Requirements	10	10	10	10	

Find initial feasible solution to Hardrock's transportation problem using Vogel's Approximation Method.

- (b) A departmental head has four subordinates and four tasks to be performed. The subordinates differ in efficiency and the tasks differ in their intrinsic difficulty. His estimates of the time that each man would take to perform each task is given in the matrix below: [7]

		Tasks			
		I	II	III	IV
Subordinates	A	12	11	8	14
	B	10	9	10	8
	C	14	8	7	11
	D	6	8	10	9

How should the tasks be allocated to subordinates so as to minimize the total man-hours?

- Q.3 (a) Discuss different types of decision-making environment. [7]
 (b) Discuss Two-Person Zero-Sum Game. Also explain value of game and saddle point. [7]

OR

- Q.3 (a) Determine the optimum strategy from the following profit matrix using criterion (i) Optimism (ii) Pessimism (iii) Laplace: [7]

		State of Nature (Market condition)		
		N1	N2	N3
Strategies	S1	7,00,000	3,00,000	1,50,000
	S2	5,00,000	4,50,000	0
	S3	3,00,000	3,00,000	3,00,000

- (b) For what value of p and q in the following pay-off matrix, the (2, 2) entry be a saddle point? Justify your answer. [7]

		Player – B		
		B1	B2	B3
Player – A	A1	2	4	5
	A2	10	7	q
	A3	4	p	6

- Q.4 Draw a network diagram and then find critical path from the following sequence of activities for a project. [14]

Activity	A	B	C	D	E	F	G	H	I	J	K	L	M
Predecessor activity	---	A	B	A	D	E	-	G	J,H	-	A	C,K	I,L
Duration (Days)	6	4	7	2	4	10	2	10	6	13	9	3	5

OR

- Q.4 (a) Draw a network diagram from the following sequence of activities: [7]

Activity	A	B	C	D	E	F	G	H
Predecessor activity	---	A	A	B	B,C	E	D, F	G

- (b) The initial cost of a machine is Rs. 6100. Its maintenance cost and resale value at the end of different years are given in the following table. When should the machine be replaced? [7]

Year:	1	2	3	4	5	6	7	8
Maintenance Cost (Rs.)	100	250	400	600	900	1200	1600	2000
Resale Value (Rs.)	800	700	600	550	500	450	410	380

- Q.5 (a) A ready-made garments manufacturer has to process five items through 2 stages of production, viz. cutting and sewing. The time taken for each of these items at the different stages is given below (in hours). Determine an order in which these jobs should be processed so as to minimize the total processing time. Also find the total elapsed time and idle time for each machine. [7]

		Item:	1	2	3	4	5
Processing Time(hours)	Cutting		5	7	3	4	6
	Sewing		2	6	7	5	9

- (b) Write down the Johnson's procedure to solve sequencing problem of n -jobs through three machines. [7]

OR

- Q.5 (a) The MDH Masala company has to process five items on three machines:- A, B & C. [7]
 Processing times are given in the following table. Find the sequence that minimizes the total elapsed time. Also find the total elapsed time and idle time for Machine A.

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

- (b) The Lajawab Bakery Shop keeps stock of a popular brand of cake. Previous experience [7]
 indicates the daily demand as given below:

Daily Demand	0	15	25	35	45	50
Probability	0.01	0.15	0.20	0.50	0.12	0.02

Simulate the cake demand for next 10 days using the random number sequence 21, 27, 47, 54, 60, 39, 43, 91, 25, 20 and estimate the daily average demand of cakes.
