

(3 Hours)

Marks: 80

- N.B. : (1) Answer any four questions.  
 (2) Figures to the right indicate full marks.

1.

- (a) A research laboratory has two melts of A and B of copper Nickel and Zinc alloy to make a new alloy. The composition of metal is as follows: 10

Melt	Composition		
	Copper	Nickel	Zink
A	3	2	1
B	3	2	1

To make a new alloy, at least 15 Kg. of Copper, 10 Kg of Nickel and 6 Kg of Zinc is needed. Melt A costs Rs. 45 per Kg and Melt B costs Rs. 50 per Kg.

Formulate the problem as linear programming model for the quantities of each melt to be used to minimize the cost.

- (b) Trains arrive at the yard every 12 minutes and the service time is 35 minutes. 10  
 If the capacity of the yard is limited to 4 trains; find:  
 i. Probability that yard is empty  
 ii. The average number of trains in the system  
 iii. The average number of trains in the queue

2. (a) Find the graphical solution of the problem 10

Maximize  $Z = 3x + 2y$   
 Subject to  $x \leq 3$   
 $4x + 5y \geq 20$   
 $x, y \geq 0$

Give your comment on the solution.

- (b) Discuss the advantages, limitations and uses of simulation 10

3. (a) Solve the following problem by simplex method 10

Maximize  $z = 10x_1 + 5x_2$   
 Subject to  $4x_1 + 5x_2 \leq 100$   
 $5x_1 + 2x_2 \leq 80$   
 $x_1, x_2 \geq 0$

- (b) Consider the following payoff matrix for two firms. Find the best strategy for both. Find the value for the game. 10

		Firm II		
		No Advertisement	Medium Advertisement	Large Advertisement
Firm I	No Advertisement	60	50	40
	Medium Advertisement	70	70	50
	Large Advertisement	80	60	75

4. (a) Solve the following transportation problem, by Vogel's Approximation method and find the optimum solution by uv method. 10

		To			Available
		P	Q	R	
From	A	2	7	4	5
	B	3	3	1	8
	C	5	4	7	7
	D	1	6	2	14
Required		7	9	18	

- (b) The annual demand for a product is 64,000 units. The buying cost per order is Rs. 10 and the estimated cost of carrying one unit in stock for a year is 20%. The normal price of the product is Rs.10 per unit. However the supplier offers a quantity discount of 2% on an order of at least 1,000 units at a time and a discount of 5% of the order is for at least 5,000 units. Suggest the most economic purchase quantity per order. 10

5. (a) Three buildings are to be added to the college campus. Bids are submitted by five contractors. The bid figures are given in millions of rupees and are shown in the table below: 10

Building →	A	B	C
Contractor ↓			
1	2.90	1.62	-
2	3.10	1.75	2.81
3	3.05	1.80	2.90
4	2.85	1.55	2.75
5	-	1.70	3.00

Find the assignment of buildings to contractors that will result in a minimum total cost for the building programme.

- (b) The profit for three markets as a function of sales efforts extended is given in the table below. How will you distribute a given number of salesmen by dynamic programming so as to achieve maximum profit? 10

No. of Salesmen	Market		
	I	II	III
0	40	50	50
1	42	60	60
2	50	65	70
3	60	75	80
4	66	85	88
5	75	95	105
6	82	110	115
7	90	120	130

6. (a) Solve the following problem by integer programming 10

Maximize  $z = 8x_1 + 5x_2$   
 Subject to

$$x_1 + 2x_2 \leq 10$$

$$5x_1 + 2x_2 \leq 20$$

$$x_1, x_2 \geq 0 \text{ and to be integers}$$

- (b) Find the dual of  
 Maximize  $z = 5x_1 - 6x_2 + 4x_3$   
 Subject to

$$3x_1 + 4x_2 + 6x_3 \geq 9$$

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

$$-7x_1 + 2x_2 + x_3 \geq -10$$

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

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