

**Operation Research  
(ME-408, DEC 2006)**

**Section-A**

1. a) Explain briefly the various applications of O.R.
- b) Define slack and surplus variables in LPP.
- c) Write short notes on pure strategy.
- d) What do you understand by simulation and state the limitations of it.
- e) Discuss the brief replacement procedure for the items that deteriorate with time.
- f) What are the essential characteristics of dynamic programming?
- g) State some of the important distributions of arrivals and service times.
- h) Briefly explain resource allocation.
- i) Why inventory is maintained?
- j) Write the dual form for the following:

$$\begin{aligned} \min z &= x_1 + x_2 \\ \text{subjected to } 2x_1 + x_2 &\geq 4 & x_1, x_2 \geq 0 \\ x_1 + 7x_2 &\geq 7 \end{aligned}$$

**Section-B**

2. Solve the following assignment problem.

		Man			
		1	2	3	4
Work	A	12	30	21	15
	B	18	33	9	31
	C	44	25	24	21
	D	23	30	28	14

3. Solve the following game.

		Player B			
		B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	B <sub>4</sub>
Player A	A <sub>1</sub>	2	1	0	-2
	A <sub>2</sub>	1	0	3	3

4. Derive the expression for EOQ and state the assumption made by you.
5. There are five jobs each of which must go through two machines A and B in the order of AB. Processing times are given below. Determine a sequence for five jobs that will minimize the elapse time and also calculate the total time.

Job	1	2	3	4	5
Time for A	5	1	9	3	10
Time for B	2	6	7	8	4

6. A machine owner finds from his past records that the costs per year of maintaining a machine whose purchase price is Rs. 6000 are given as below

Year	1	2	3	4	5	6	7	8
Maintenance cost	1000	1200	1400	1800	2300	2800	3400	4000
Resale price	3000	1500	750	375	200	200	200	200

Determine at what age is a replacement due

**Section-C**

7. Solve the following LPP by simplex method

$$\text{Max } z = 3x_1 + 5x_2 + 4x_3$$

Subjected to

$$2x_1 + 3x_2 \leq 8$$

$$2x_2 + 5x_3 \leq 10$$

$$3x_1 + 2x_2 + 4x_3 \leq 15$$

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

8. On an average 96 patients per 24 hours day require the service of an emergency clinic. Also an average a patient requires 10 minutes of active attention. Assume that the facility can handle one emergency at a time. Suppose that it costs the clinic Rs. 100 per patient treated to obtain an

average servicing time of 10 minutes, and that each minute of decrease in his average time would cost Rs 10 per patient treated. How much would have to be budgeted by the clinic to decrease the average size of the queue from  $1\frac{1}{2}$  patients to  $\frac{1}{2}$  patients.

9. The annual demand for a product is 500 units. The cost of storage per unit per year is 10% of the unit cost. The ordering cost is Rs.180 for each order. The unit depends upon the amount ordered. The range of amount ordered and the unit price are as follows:

Range of amount ordered	$0 \leq Q_1 < 500$	$0 \leq Q_2 < 1500$	$1500 \leq Q_3 < 3000$	$3000 < Q_4$
Unit Cost (Rs.)	25.00	24.80	24.60	24.4

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