

**Operations Research  
(ME-406, Dec-07)**

**Note:** Section A is compulsory. Attempt any four questions from Section B and any two from Section C.

**Section-A**

1. a) What are the advantages of using results from a mathematical model to make decision about operations?
- b) Enumerate few applications of linear programming.
- c) Name three basic parts of simplex technique.
- d) Describe the steps involved in solving transportation problem.
- e) Indicate the difference between decision making under risk and uncertainty in statistical decision theory.
- f) What is queuing problem? Explain queuing system, transient and steady state.
- g) State the 'Principle of opportunity' in dynamic programming.
- h) Explain the term Event and Path as used in network of PERT/CPM.
- i) What is the difference between age replacement and preventive maintenance?
- j) What are the disadvantages of maintaining inventories?

**Section-B**

2. A firm manufacturing pain relieving pills in two sizes A & B. Size A contains 4 grains of element a, 7 grains of element b and 2 grains of element c. Size B contains 2 grain of element a, 10 grains of element b and 8 grains of element c. It is found by users that it requires at least 12 grains of element a, 74 grains of element b and 24 grains of element c to provide immediate relief. It is required to determine the least number of pills a patient should take to get immediate relief. Formulate the problem as standard LPP.
3. Solve the following cost-minimizing transportation problem.

	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	D <sub>5</sub>	D <sub>6</sub>	Available
O <sub>1</sub>	2	1	3	3	2	5	50
O <sub>2</sub>	3	2	2	4	3	4	40
O <sub>3</sub>	3	5	4	2	4	1	60
O <sub>4</sub>	4	2	2	1	2	2	30
Required	30	50	20	40	30	10	180

4. Arrivals at a service station have been found to follow Poisson process. The mean arrival rate = 6 units per hour. Simulate five hours of arrival at the station.
5. A machine owner finds from his past records that the costs per year of maintaining a machine whose purchase price is Rs. 6000 are as given below:

Year	1	2	3	4	5	6	7	8
Maintenance Cost (Rs):	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.

6. The demand per month for a product is distributed normally with mean of 100 and standard deviation 25. The lead time distribution is given below. What service level will be afforded by a recorder level of 500 units?

Lead time (Months):	1	2	3	4	5
Probability:	0.10	0.20	0.40	0.20	0.10

**Section-C**

7. On completing the construction of house a person discovers that 100 square feet of plywood scrap and 80 square feet of white pine scrap are in usable form for the construction of tables and book cases. It takes 16 square feet of plywood and 8 square feet of white pine to make a table; 12 square feet of plywood and 16 square feet of white pine are required to construct a book case. By selling the finished product to a local furniture store the person can realize a profit of Rs 25 on each table and Rs 290 on each book case. How may the man most profitably use the left-over wood? Use graphical method to solve the problem.
8. Customers arrive at one window drive according to a Poisson distribution with mean of 10 minutes and service time per customer is exponential with mean of 6 minutes. the space in front of the window can accommodate only three vehicle including the serviced one. Other vehicles have to wait outside this space:  
 (a) Probability that an arriving customer can drive directly to the space in front of the window.  
 (b) Probability that an arriving customer will have to wait outside the directed space.
9. The activities of a project are tabulated below with immediate predecessors and normal & crash time cost.

Activity	Immediate Predecessor	Normal		Crash	
		Cost (Rs)	Time (days)	Cost (Rs)	Time (days)
A	-	200	3	400	2
B	-	250	8	700	5
C	-	320	5	380	4
D	A	410	0	800	4
E	C	600	2	670	1
F	B, E	400	6	950	1
H	B, E	550	12	1000	6
G	D	300	11	400	9

- (a) Draw the network corresponding to Normal time.  
 (b) Determine the critical path and the normal duration and cost of the project.