

**A 1393**

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2007.

Eighth Semester

Mechanical Engineering

ME 436 — OPERATIONS RESEARCH

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define operations research.
2. Define artificial variable.
3. What do you mean by minimal spanning tree?
4. Distinguish between CPM and PERT.
5. Define EOQ.
6. What is reorder level?
7. Define Simulation.
8. What is balking?
9. Define saddle point.
10. What is economic life?

PART B — (5 × 16 = 80 marks)

11. (a) Solve the following linear programming problem using Dual Simplex method.

$$\text{Minimize } z = x_1 + 2x_2 + 3x_3$$

Subject to

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

$$x_1 + x_2 + 2x_3 \leq 8$$

$$x_2 - x_3 \geq 2$$

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

Or

- (b) A college is having a degree programme for which the effective semester time available is very less and the degree course requires field work. Hence, the savings in the total number of class hours handled can be utilized for such field work. Based on past experience, the college has established the number of hours required to teach each subject by each faculty. The course in its present semester has 5 subjects and the college has considered 6 existing faculty members to teach these courses. The objective is to assign the best 5 teachers out of these 6 faculty to teach 5 different subjects such that the total number of class hours required is minimized. The data of this problem is summarized in Fig. 5.10. Solve this assignment problem optimally.

		Subject				
		1	2	3	4	5
Faculty	1	30	39	31	38	40
	2	43	37	32	35	38
	3	34	41	33	41	34
	4	39	36	43	32	36
	5	32	49	35	40	37
	6	36	42	35	44	42

12. (a) Consider the details of a distance network as shown below.

Arc	Distance	Arc	Distance
1 - 2	8	3 - 6	6
1 - 3	5	4 - 5	8
1 - 4	7	4 - 6	12
1 - 5	16	5 - 8	7
2 - 3	15	6 - 8	9
2 - 6	3	6 - 9	15
2 - 7	4	7 - 9	12
3 - 4	5	8 - 9	6

- (i) Construct the distance network  
(ii) Find the shortest path from the node 1 to the node 9 using the systematic method

Or

- (b) Consider the following two machines and 6 jobs flow shop problem.

Job	Machine - 1	Machine - 2
1	5	7
2	10	8
3	8	13
4	9	7
5	6	11
6	12	10

Obtain the optimal schedule and the corresponding makespan for the above problem.

13. (a) Annual demand for an item is 5400 units. Ordering cost is Rs.600 per order. Inventory carrying cost is 30% of the purchase price per unit per year. The price breaks are as shown below.

Quantity	Price (Rs.)
$0 \leq Q_1 < 2400$	12
$2400 \leq Q_2 < 3000$	10
$3000 \leq Q_3$	8

Find the optimal order size.

Or

- (b) The daily demand of sandwich bread at a kiosk follows a discrete distribution as given in the following table.

Discrete Distribution of Sweet Bread

Serial No.	1	2	3	4	5	6	7	8	9	10	11
Demand $D_i$	35	36	37	38	39	40	41	42	43	44	45
Probability $p_i$	0.10	.11	0.20	0.07	0.10	0.14	0.12	0.04	0.05	0.05	0.02

The purchase price of the bread is Rs.10 per packet. The selling price is Rs. 14 per packet. If the bread packets are not sold within the day of purchase, they are sold at Rs. 7 per packet to hotels for secondary use. Find the optimal order size of the sweet bread.

14. (a) The arrival rate of breakdown machines at a maintenance shop follows poisson distribution with a mean of 6 per hour. The service rate of machines by a maintenance mechanic also follows poisson distribution with a mean of 4 per hour. The down time cost per hour of a breakdown machine is Rs. 300. The labour hour rate is Rs.60. Determine the optimal number of maintenance mechanics to be employed to repair the machines such that the total cost is minimized.

Or

- (b) Cars arrive at a drive – in restaurant with a mean arrival rate of 30 cars per hour and the service rate of the cars is 22 cars per hour. The arrival rate and the service rate follow poisson distribution. The number of parking space for cars is only 5. Find the standard results of this system.
15. (a) The following table represents the payoff matrix with respect to the player A. Solve it optimally using linear programming method.

		Player B		
		1	2	3
Player A	1	1	-1	-1
	2	-1	-1	3
	3	-1	2	-1

Or

- (b) A company is planning to replace an equipment whose first cost is Rs. 1,00,000. The operating and maintenance cost of the equipment during its first year of operation is Rs.10,000 and it increases by Rs. 2,000 every year thereafter . The resale value of the equipment at the end of the first year of its operation is Rs. 65,000 and it decreases by Rs. 10,000 every year thereafter. Find the economic life of the equipment by assuming the interest rate as 12%.