

Roll No.

MAY 2008

Total No. of Questions : 09]

[Total No. of Pages : 03

Paper ID [PE301]

(Please fill this Paper ID in OMR Sheet)

B.Tech. (Sem. - 5th)

OPERATIONS RESEARCH (PE - 301)

Time : 03 Hours

Maximum Marks : 60

Instruction to Candidates:

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Four** questions from Section - B.
- 3) Attempt any **Two** questions from Section - C.

Section - A

Q1)

(10 × 2 = 20)

- a) Define a basic solution.
- b) What do you mean by standard form of a linear programming problem?
- c) Define dual of LPP.
- d) What do you understand by transportation problem?
- e) Explain how degeneracy in a transportation problem may be resolved.
- f) Why can the transportation technique or the simplex method not be used to solve the assignment problem?
- g) Define a Queue.
- h) List the advantages of simulation technique.
- i) Differentiate between PERT and CPM.
- j) Define critical path.

Section - B

(4 × 5 = 20)

- Q2)** Consider a cargo loading problem, where five items are to be loaded on a vessel. The weight (w_i) and volume (v_i) of each unit of the different items as well as their corresponding returns per unit (r_i) are tabulated below:

Item - i	w_i	v_i	r_i
1	5	1	4
2	8	8	7
3	3	6	6
4	2	5	5
5	7	4	4

The maximum cargo weight (w) and the volume (v) are given as 112 and 109, respectively. It is required to determine the optimal cargo load in discrete units of each item such that the total return is maximized. Formulate the problem as an integer programming model.

Q3) Solve the following LP problem graphically.

$$\text{Maximize } Z = 5 X_1 - 2 X_2$$

$$\text{Subject to } X_1 \leq 2, -X_1 + 2X_2 \geq 4, X_1 \text{ and } X_2 \geq 0.$$

Q4) Solve the following LP problem using simplex method:

$$\text{Maximize } Z = 6 X_1 + 4 X_2$$

$$\text{Subject to } 2 X_1 + 3 X_2 \leq 30$$

$$3 X_1 + 2 X_2 \leq 24$$

$$X_1 + X_2 \geq 3 \text{ and } X_1, X_2 \geq 0.$$

Is the solution unique? If not, give the alternate optimum solutions.

Q5) Solve the following LP problem using dual simplex method:

$$\text{Minimize } Z = X_1 + 2 X_2 + 3 X_3$$

$$\text{Subject to } 2 X_1 - X_2 + X_3 \geq 4$$

$$X_1 + X_2 + 2 X_3 \leq 8$$

$$X_2 - X_3 \geq 2 \text{ and } X_1, X_2 \text{ and } X_3 \geq 0.$$

Q6) Determine an initial basic feasible solution to the following transportation problem using Vogel's approximation method:

Origin	Destination					Supply
	D	E	F	G	H	
A	2	11	10	3	7	4
B	1	4	7	2	1	8
C	3	9	4	8	12	9
Demand	3	3	4	5	6	

Section - C

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(2 × 10 = 20)

Q7) Generate 10 observations from a uniform distribution between -20 and 30.

Q8) A project schedule has the following characteristics:

<u>Activity</u>	<u>Time</u>	<u>Activity</u>	<u>Time</u>
1-2	4	5-6	4
1-3	1	5-7	8
2-4	1	6-8	1
3-4	1	7-8	2
3-5	6	8-10	5
4-9	5	9-10	7

(a) construct the network, (b) calculate the earliest and latest occurrence for each event and, (c) find critical path.

Q9) The arrival rate of customers at a banking counter follows Poisson distribution with a mean of 45 per hour. The service rate of the counter clerk also follows Poisson distribution with a mean of 60 per hour.

- (a) What is the probability of having 0, 5 and 10 customers in the system?
- (b) Find the average number of customers waiting in the queue and in the system.
- (c) Average waiting time of the customer in the queue and in the system.