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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: IV - THEORY EXAMINATION (2021 - 2022)

Subject: Operations Research

Time: 3 Hours

Max. Marks: 50

General Instructions:

1. The question paper comprises three sections, A, B, and C. You are expected to answer them as directed.
2. Section A - Question No- 1 is 1 mark each & Question No- 2 carries 2 mark each.
3. Section B - Question No-3 is based on external choice carrying 5 marks each.
4. Section C - Questions No. 4-8 are within unit choice questions carrying 4 marks each.
5. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION A

15

1. Attempt all parts:-

- 1-a. A model is (CO1) 1
- (a) Selective representation of reality
 - (b) An abstraction
 - (c) An approximation
 - (d) All of the above
- 1-c. Slack variable (CO2) 1
- (a) Is the difference between the left and right sides of a constraint?
 - (b) Is the amount by which the left side of a \leq constraint is smaller than the right side.
 - (c) Is the amount by which the left side of a \leq constraint is larger than the right side.
 - (d) Exists for each variable in a linear programming problem.
- 1-e. The purpose of a dummy source or dummy destination in a transportation problem is to (CO3) 1
- (a) prevent the solution from becoming degenerate
 - (b) obtain a balance between total supply and total demand
 - (c) make certain that the total cost does not exceed some specified figure
 - (d) provide a means of representing a dummy problem
- 1-g. One of the important basic objective of Inventory management is (CO4) 1
- (a) To calculate EOQ for all materials in the organization
 - (b) To go in person to the market and purchase the materials
 - (c) To employ the available capital efficiently so as to yield maximum results
 - (d) Once materials are issued to the departments, personally check how they are used
- 1-i. The unit of traffic intensity is (CO5) 1
- (a) Poisson
 - (b) Markow
 - (c) Erlang
 - (d) Kendall

2. Attempt all parts:-

- 2.a. Discuss the importance of operations research in decision making process. (CO1) 2
- 2.b. Solve the following LPP by graphical method 2

Maximize $Z = X + 2Y$
 subject to $2X + 3Y \leq 40$
 $2X + Y \leq 10$
 $X \geq 0, Y \geq 0$. (CO2)

- 2.c. Write the mathematical form of transportation Problem. (CO3) 2
 2.d. What are three types of floats? (CO4) 2
 2.e. What is service discipline? (CO5) 2

SECTION B 15

3. Answer any three of the following:-

- 3-a. Write a short note on the following: 5
 a) Area of applications of OR
 b) Role of constraints and objectives in the construction of mathematical models
 c) Statistician's role as member of OR team (CO1)

- 3-c. **Solve the LPP** $Max\ z = 3x_1 + 2x_2$ 5
Subject to $2x_1 + x_2 \leq 5, x_1 + x_2 \leq 3$
 $x_1, x_2 \geq 0$ (CO2)

- 3.e. Five men are available to do five different jobs. From past records, the time (in hours) that each man takes to do each job is known and given in the following table: 5

		Job				
		I	II	III	IV	V
Man	A	2	9	2	7	1
	B	6	8	7	6	1
	C	4	6	5	3	1
	D	4	2	7	3	1
	E	5	3	9	5	1

Find the assignment of men to jobs that will minimize the total time taken. (CO3)

- 3.f. A manufacturer has to supply his customer with 24000 units of his product per year. This demand is fixed and known. Since the customer in an assembly line operation uses the unit and the customer has no storage space for the unit, the manufacturer must supply a day's requirement each day. If the manufacturer fails to supply the required units, he will lose the amount and probably his business. Hence, the cost of a shortage is assumed to be infinite, and consequently, none will be tolerated. The inventory holding cost amounts to 0.10 per unit per month, and the set up cost per unit is Rs. 350/-. Find the optimum lot size, the length of optimum production run. (CO4) 5
- 3.g. Given an arrival rate of 20 per hour, is it better for a customer to get service at a single channel with mean service rare of 22 customers or at one of two channels in parallel, with mean service rate of 11 customers for each of the two channels? Assume that both queues are of M/M/S type. (CO5) 5

SECTION C 30

4. Answer any one of the following:-

- 4-a. Discuss the various steps used in solving Operations Research problems. (CO1) 4
 4-b. What are the pre-requisites of a computer based MIS? (CO1) 4

5. Answer any one of the following:-

- 5-a. Solve by Big M Method 4
 Maximize $Z = 4x + 3y$
 s.t. $2x + 3y \leq 6,$
 $3x + y \geq 3,$
 Both x and y all ≥ 0 . (CO2)
- 5-b. Solve the following LP problem by Simplex Method 4
 Maximize $Z = 3x_1 + 2x_2$

$$\text{Subject to } 4x_1 + 3x_2 \leq 12$$

$$4x_1 + x_2 \leq 8$$

$$4x_1 - x_2 \leq 8$$

$$\text{and } x_1, x_2 \geq 0 \text{ (CO2)}$$

6. Answer any one of the following:-

- 6-a. Obtain an initial basic feasible solution to the following transportation problem by using least-cost method. (CO3) 4

	D ₁	D ₂	D ₃	Supply
O ₁	9	8	5	25
O ₂	6	8	4	35
O ₃	7	6	9	40
Demand	30	25	45	

- 6-b. Find initial basic feasible solution by using Vogel's approximation method of the following transportation problem. (CO3) 4

	D ₁	D ₂	D ₃	Supply
O ₁	6	8	4	14
O ₂	4	0	8	12
O ₃	1	2	6	5
Demand	6	10	15	

7. Answer any one of the following:-

- 7-a. Explain in brief: PERT, CPM, crashing dummy activities and lead time with reference to project management. (CO4) 4

- 7-b. Draw the network and determine the critical path for the given data. Also calculate all the floats involved in CPM. (CO4) 4

Jobs	1-2	1-3	2-4	3-4	3-5	4-5	4-6	5-6
Duration	6	5	10	3	4	6	2	9

8. Answer any one of the following:-

- 8-a. What is meant by Monte-Carlo method of simulation? Discuss its scope. (CO5) 4

- 8-b. Prove that if arrivals occur at random in time, then the number of arrivals with parameters λ occurring in a fixed time interval $(0, t)$ follows a poisson distribution. (CO5) 4