

TME-601

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Paper Code & Roll No. to be filled in your Answer Book

Roll No.

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B. Tech.

UTU (EVEN SEM.-VI) Examination-2015

OPERATION RESEARCH*Time : 3 Hrs.]**[Max. Marks :100*

Note: Attempt All Questions. All Questions Carry Equal Marks.

1. Attempt any four questions. (5×4=20)
- "Operation Research" is 'Science as well as an art'. Elaborate.
 - Write an algorithm for solution of LPP by simplex method.
 - Explain steps involved in Vogel's approximation method.
 - Discuss the similarities and differences of CPM and PERT.
 - Discuss in detail a deterministic queuing model.
 - Use the graphical method to solve the following LP problem.

$$\text{Maximize } Z = 80x_1 + 120x_2$$

$$\text{Subject to constraints } x_1 + x_2 \leq 9$$

$$20x_1 + 50x_2 \leq 360$$

$$x_1 \geq 2; x_2 \geq 3$$

$$x_1, x_2 \geq 0$$

2. Attempt any four questions. (5×4=20)

a) Write the Dual of the following primal LP problem.

$$\text{Maximize } Z_x = 2x_1 + 5x_2 + 6x_3$$

$$\text{Subject to constraints } 5x_1 + 6x_2 - x_3 \leq 3$$

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

$$x_1 - 5x_2 + 3x_3 \leq 1$$

$$-3x_1 - 3x_2 + 7x_3 \leq 6$$

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

b) A person wants to decide the constituents of a diet which will fulfill his daily requirement of proteins, fats and carbohydrates at the minimum cost. The choice is to be made from four different types of foods. The yields per unit of these foods are given.

Food Type	Proteins	Fats	Carbohydrates	Cost/Units (Rs)
1	3	2	6	45
2	4	2	4	40
3	8	7	7	85
4	6	5	4	65
Min req.	800	200	700	

Formulate linear programming model for the problem.

- c) Find the initial basic feasible solution to the following transportation problem by North West Corner Rule.

From	To			Supply
	2	7	4	
	3	3	1	8
	5	4	7	7
	1	6	2	14
demand	7	9	18	

- d) Assign the operators to different machines so that total cost is minimized.

Operators → Machines ↓	I	II	III	IV	V
A	10	5	13	15	16
B	3	9	18	3	6
C	10	7	2	2	2
D	5	11	9	7	12
E	7	9	10	4	12

- e) For what value of μ , the game with the following pay off matrix is strictly determinable?

		Player B		
		B1	B2	B3
Player A	A1	μ	6	2
	A2	-1	μ	-7
	A3	-2	4	μ

- f) In a bank operation, the arrival rate is 2 customers/minute. Determine the following :
- (i) The average numbers of arrivals during 5 minutes.
 - (ii) The probability that no arrivals will occur during the next 30 seconds.
 - (iii) The probability that at least one arrival will occur during the next 30 seconds.
 - (iv) The probability that the time between two successive arrivals is at least 3 minutes.

3. Attempt any two questions : (10×2=20)

- a) A television company has three major departments for manufacturing two of its models A & B. The monthly capacities of the departments are given as follows :

Department	Per unit time requirement (Hrs)		Hours available this month
	Model A	Model B	
1	4.0	2.0	1600
2	2.5	1.0	1200
3	4.5	1.5	1600

The marginal profit per unit from model A is Rs 400 and model B is Rs 100. Assuming that the company can sell any quantity of either product due to favorable market conditions, determine the optimum output for the models, the highest possible profit for this month.

b) Use two phase method to solve the following problem.

$$\text{Maximize } Z = 5x - 2y + 3z$$

$$\text{Subject to } 2x + 2y - z \geq 2$$

$$3x - 4y \leq 3$$

$$y + 3z \leq 5$$

$$x, y, z \geq 0$$

c) Find the optimal solution of the following transportation problem.

Warehouse → Factory ↓	W1	W2	W3	W4	Capacity
F1	19	30	50	10	7
F2	70	30	40	60	9
F3	40	8	70	20	18
Requirement	5	8	7	14	

4. Attempt any two questions : (2×10=20)

a) A self service store employs 1 cashier at its counter, 9 customers arrive on an average every 5 mins while the cashier can serve 10 customers in 5 mins. Assuming poisson's distribution for arrival rate and exponential distribution for service time find.

1. Avg. number of customer in the system

Average number of customer in the queue or average queue length.

Average time a customer spends in the system.

Average time a customer waits before being served.

A salesman travels from one place to another, he cannot, however, travel from one place and back. The distance (in km) between pairs of cities are given below :

		To City			
		P	Q	R	S
City	P	-	15	25	0
	Q	22	-	45	0
	R	40	30	-	0
	S	20	26	38	-

The problem is to chalk out a route which enables him to reach each of the cities only once, so that the total distance covered by him is minimum.

In a game of matching coins player A wins Rs 2 if there are 2 heads, wins nothing if are 2 tails and losses Rs 1 when there are 1 head and 1 tail. Determine the payoff matrix, best strategies for each player and the value of game to A.

5. Attempt any two questions : (10×2=20)

a) Six jobs A, B, C, D, E and F have arrive at one time to be processed on a single machine assuming that no new jobs arrive thereafter, determine.

Job	A	B	C	D	E	F
Processing time (min)	7	6	8	4	3	5

1. Optimal sequence as per SPT rule
2. Completion time of the jobs
3. Mean flow time
4. Average in-process inventory

b) The time estimates (in weeks) for the activities of a pert network are given below :

Activity	T_o	T_m	T_p
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

