PAPER ID-410979

Roll No:

B.TECH
(SEM VII) THEORY EXAMINATION 2021-22
OPERATIONS RESEARCH

Time: 3 Hours   *Total Marks: 100*

Note: **1.** Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. **Attempt *all* questions in brief.**   **2 x 10 = 20**
   a.   What are slack and surplus variables?
   b.   Explain basic feasible solution of LPP.
   c.   Define unbalanced assignment problem.
   d.   Discuss the objective of transportation problems.
   e.   What is PERT?
   f.   What are the rules for drawing the network diagram?
   g.   Define saddle point and optimal strategy.
   h.   What are various customer's behaviors?
   i.   Write down different types of costs on which EOQ depends.
   j.   Distinguish between deterministic and stochastic inventory models.

SECTION B

2. **Attempt any *three* of the following:**   **10 x 3 = 30**
   a.   Classify and explain different models used in OR.
        Solve the following problem by using graphical method:
        Minimize $Z = 2X_1 + 3X_2$
        Subjected to $X_1 + 2X_2 \geq 40$, $2X_1 + X_2 \geq 50$, $X_1, X_2 \geq 0$
   b.   Show that transportation is a special type of LPP. Use least cost method to find initial basic feasible solution of the given problem.

	D1	D2	D3	D4	Supply
S1	19	30	50	10	7
S2	70	30	40	60	9
S3	40	8	70	20	18
Demand	5	8	7	14	

   c.   What do you mean by network analysis? What is its significance? Also distinguish between the following:
        i. CPM and PERT
        ii. Critical and Dummy activities
   d.   For what type of business problem game theory is useful? Explain. Solve the following game graphically and find out the optimal strategies for both of the players.

		Player B			
		1	2	3	4
	1	4	-2	3	-1
Player A	2	-1	2	0	1
	3	-2	1	-2	0

   e.   What are the types of inventory? Why they are maintained. Explain the various costs related to inventory. What are the economic parameters of inventory?

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SECTION C

3. **Attempt any *one* part of the following:**   **10 x 1 = 10**

   (a)   Solve using Simplex method the following problem:

   Maximize $Z = 3x + 2y$

   subject to: $2x + y \leq 18$; $2x + 3y \leq 42$; $3x + y \leq 24$; $x \geq 0$, $y \geq 0$

   (b)   Explain the phenomenon of infeasibility in an LP problem. What are the indicators of such a phenomenon? Write the dual of the given primal problem:
   Maximize: $Z = a + 2b + 3c$
   s.t. $4a + 2b + c \leq 25$; $2a + 3b - c \geq 20$; $a + 2b + 3c \leq 15$; $b + 2c = 10$ and $a, b, c \geq 0$

4. **Attempt any *one* part of the following:**   **10 x 1 = 10**

   (a)   Applying MODI method, determine the optimal solution of the following transportation problem.

	1	2	3	4	Capacity
1	100	120	90	60	700
2	70	30	70	70	600
3	60	60	90	110	900
Demand	600	400	600	200	

   (b)   A company has four branches, one each at city A, B, C and D. A brance manager is to be appointed one at each city, out of four candidates P, Q, R and S. The monthly business depends upon the city and the effectiveness of the branch manager in that city. Which manager should be appointed at which city so as to get maximum total monthly business?

Branch Manager	City			
	A	B	C	D
	Monthly business(Lakhs)			
P	11	11	9	9
Q	13	16	11	10
R	12	17	13	8
S	16	14	16	12

5. **Attempt any *one* part of the following:**   **10 x 1 = 10**

   (a)   Determine Total Float, Free Float, Independent Float and Critical Path for the activity data given below. All durations are in days.
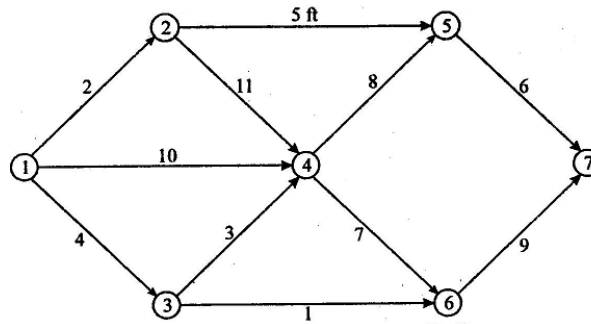
Initial Node	Final Node	Duration (days)
1	2	5
1	3	6
2	3	3
2	4	8
3	5	2
3	6	11
4	5	0
4	6	1
5	6	12

   (b)   Write the algorithm for finding minimum spanning tree for a network. In the given network, find the shortest path.

6. **Attempt any *one* part of the following:** 10 x 1 = 10

(a) Solve the following game using graphical method whose payoff matrix is:

		Player B			
		I	II	III	IV
Player A	I	4	-2	3	-1
	II	-1	2	0	1

(b) A self-service store employs one cashier at its counter. Nine customers arrive on an average every 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming Poisson distribution for arrival rate and exponential distribution for the service time, evaluate:
  (i) Average number of customers in the system.
  (ii) Average number of customers in the queue or average queue length.
  (iii) Average time a customer spends in the system.
  (iv) Average time a customer waits before being served.

7. **Attempt any *one* part of the following:** 10 x 1 = 10

(a) The purchase price of a machine is Rs. 52,000. The installation charges amount to Rs. 14400 and its scrap value is only Rs. 6400. The maintenance cost in various years is given below:
Year : 1 2 3 4 5 6 7 8
Maintenance cost :1000 3000 4000 6000 8400 11600 16000 19200
After how many years should the machine be replaced? Assume that the machine replacement can be done only at the year ends.

(b) A shop keeper has a uniform demand of an item at the rate of 50 items per month. He buys from a supplier at a cost of Rs. 6 per item and the cost of ordering is Rs. 10 for each order. If the stock holding costs are 20% per year of the stock value, how frequently should he replenish his stocks? Now suppose the supplier offers a 5% discount on orders between 200 and 999 items and a 10% discount on the orders exceeding or equal to 1000 items. Can the shop keeper reduce his costs by taking advantage of either of these discounts?