Code No:**R164205C**　　　**R16**　　　Set No. 1

IV B.Tech II Semester Regular Examinations, September - 2020
OPERATION RESEARCH
(Computer Science and Engineering)

Time: 3 hours　　　　　　　　　　　　　　　　　　　**Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B
*****

PART–A*(14 Marks)*

1. a) What are the limitations of an OR model? [3]
   b) What do you mean by an unbalanced transportation problem? [2]
   c) What is no passing rule in a sequencing algorithm? [2]
   d) What is a payoff matrix in game theory? [2]
   e) Explain the terms: (i) present worth factor (ii) discount rate. [3]
   f) What are the functions of inventory control? [2]

PART–B*(4x14 = 56 Marks)*

2. Solve the following LPP by using Big M method:
   Maximize $Z = -2X_1 - X_2$
   　　　Subject to 　　$3X_1 + X_2 = 3$
   　　　　　　　　　$4X_1 + 3X_2 \geq 6$
   　　　　　　　　　$X_1 + 2X_2 \leq 4$
   　　　　　　　　　$X_1, X_2 \geq 0$ [14]

3. Solve the following transportation problem

Destination					
Origin		A	B	C	D	Supply
	P	4	6	8	13	50
	Q	13	11	10	8	70
	R	14	4	10	13	30
	S	9	11	13	8	50
	Demand	25	35	105	20	

Determine the Shipping scheme by the Northwest corner Rule and Test the above solution for Optimality using MODI method [14]

4. a) A as salesman has visits of Five cities A,B,C,D and E the distance between the five cities is as Follows. If the salesman starts from city A and has to come back to his starting point, which route is should be select so that the total distance travelled in minimum.

	A	B	C	D	E
A	--	7	6	8	4
B	7	--	8	5	6
C	6	8	--	9	7
D	8	5	9	--	8
E	4	6	7	8	--

[10]

   b) What are the general assumptions of a sequencing model? [4]

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5. a) What are the essential characteristics of dynamic programming? [6]
    b) Solve the following GAME, using the Dominance Principle

	Firm B				
Firm A	4	6	5	10	6
	7	8	5	9	10
	8	9	11	10	9
	6	4	10	6	4

[8]

6. a) What is replacement? Describe some important replacement situations. [6]
    b) A firm is considering replacement of a machine whose cost is Rs. 12,200 and its scrap value is Rs. 200. The maintenance costs are found to be as under on the basis of experience:

Year	1	2	3	4	5	6	7	8
maintenance cost (Rs.)	200	500	800	1,200	1,800	2,500	3,200	4,000

When should the machine be replaced? [8]

7. a) Discuss the assumptions underlying basic EOQ formula and derive EOQ formula. [7]
    b) Discuss various costs involved in an inventory model. [7]

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Set No. 2

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OPERATION RESEARCH
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Time: 3 hours   **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B
*****

PART–A*(14 Marks)*

1. a) What is operations research?   [2]
    b) List the optimality methods in transportation problem.   [2]
    c) What is an unbalanced assignment problem?   [2]
    d) State the usefulness of dynamic programming.   [3]
    e) What are the types of replacement problem?   [2]
    f) What are the objectives of inventory control?   [3]

PART–B*(4x14 = 56 Marks)*

2. a) Solve the following Problem by Graphical method
    $$\text{Maximize } Z = 6X_1 + 10X_2$$
    Subjected to
    $$X_1 + X_2 \le 70,$$
    $$X_1 \le 40,$$
    $$X_2 \ge 20,$$
    $$2X_1 + 3X_2 \le 300 \qquad [8]$$
    b) Write a note on slack, surplus and artificial variables in linear programming.   [6]

3. a) The following table shown all the necessary information on the available supply to each warehouse, the requirement of each market and the unit transportation cost form each warehouse to each market.

Market						
Warehouse		I	II	III	IV	**Supply**
	A	5	2	4	3	22
	B	4	8	1	6	15
	C	4	6	7	5	8
	Requirement	7	12	17	9	

The shipping clerk has worked out the following schedule from experience. 12 units from A to II, 1 unit from A to III, 9 units from A to IV, 15 units from B to III, 7 units from C to I and I unit from C to III.
(i) Check and see if the clerk has the optimal schedule.
(ii) Find the optimal schedule and minimum total shipping cost.
(iii) If the clerk is approached by a carrier of route C to II, who offers to reduce his rate in the hope of getting some business, by how much the rate be reduced before the clerk should consider giving him an order.   [10]
    b) Discuss the steps involved in VOGEL's Approximation method.   [4]

4. a) Solve the following assignment problem. Given time matrix (hrs) as shown in the table:

Persons	Machines			
	I	II	III	IV
A	8	26	17	11
B	13	28	4	26
C	38	19	18	15
D	19	26	24	10

[9]

b) Write short notes on the sequencing decision problem for 'n' jobs on 'm' machines. [5]

5. a) Obtain the optimal strategies for both persons and the value of the game, for two person zero sum game whose payoff matrix is as follows:

Player A		Player B						
		B1	B2	B3	B4	B5	B6	B7
	A1	-1	3	-1	4	2	2	5
	A2	-3	5	6	1	2	2	0

[8]

b) What sort of problems can be solved using dynamic programming? Illustrate with a case study. [6]

6. A factory has a large number bulbs, all of which must be working condition. The mortality of bulbs is given in the following table.

Week	1	2	3	4	5	6
Proportion ofbulbs failing	0.10	0.15	0.25	0.35	0.12	0.03

If a bulb fails in service, it costs Rs. 3.50 to be replaced. But if all the bulbs are replaced at a time it costs Rs. 1.20 each, find the optimum group replacement policy. [14]

7. a) With the help of neat diagram explain the following terms:
(i) Order Quantity (ii) Lead Time (iii) Safety Stock (iv) Re-Order Point [8]

b) A company requires 16000 units of raw material costing Rs. 2 per unit. The cost of placing an order is Rs. 45 and the carrying costs are 10% per year per unit of the average inventory. Determine: (i) the EOQ (ii) Cycle Time and (iii) Total variable cost of managing the inventory [6]

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Set No. 3

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Time: 3 hours   **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B
*****

PART–A*(14 Marks)*

1. a) What is the purpose of a mathematical model? [2]
   b) List some methods to find initial basic feasible solution in transportation problem. [2]
   c) What is travelling salesman problem? [2]
   d) Define Pure and mixed strategies. [3]
   e) What is group replacement? [2]
   f) Explain the significance of lead time and safety stock in inventory control. [3]

PART–B*(4x14 = 56 Marks)*

2. a) A person requires at least 10 and 12 units of chemicals A and B respectively, for his garden. A liquid product contains 5 and 2 units of A and B respectively per bottle. A dry product contains 1 and 4 units of A and B respectively per box. If the liquid product sales for Rs. 30 per bottle, dry product sales for Rs. 40 per box. How many of each should be purchased in order to minimize the cost and meet the requirements? Formulate and solve the L.P.P. [10]
   b) Discuss the importance of model in the solution of OR problems. [4]

3. a) Following is the unit cost matrix of a transportation problem. Use stepping stone method to obtain the optimum basic feasible solution.

	D1	D2	D3	**Available**
S1	5	2	4	1
S2	4	8	1	3
S3	4	6	7	4
Requirement	4	2	2	

[10]
   b) Describe the matrix form of the transportation problem. Illustrate with 2 origins and 3 destinations. [4]

4. a) We have 5 jobs, each of which must be processed on the two machines A and B in the order AB. Processing time in hours are given as follows:

Job	1	2	3	4	5
Machine A	5	1	9	3	10
Machine B	2	6	7	8	4

[8]
   Determine a sequence for the 5 jobs and find the total elapsed time T.
   b) What is an assignment problem? Give two areas of its applications. [6]

5. Find the shortest path from vertex A to B along arcs joining various vertices lying between A and B. Length of each path is given below.
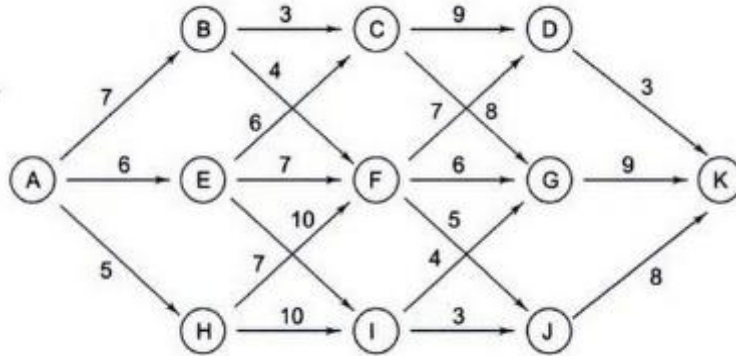
[14]

6. The following mortality rates have been observed for certain type of light bulbs.

Week	1	2	3	4	5
Probability of failure	0.3	0.1	0.1	0.2	0.3

There are 500 bulbs in use and it costs Rs. 1 to replace an individual bulb, which has burnt out. If all the were replaced simultaneously, it would cost Rs. 0.30 per bulb. It is proposed to replace all the bulbs at fixed intervals, whether or not they have burnt out and to continue replacing burnt out bulbs as they fail. At what intervals should all the bulbs be replaced. At what group replacement price per bulb would a policy of strictly individual replacement become preferable to the adopted poicy. [14]

7. a) Describe the different inventory models. [8]
   b) A company requires 15,000 units of raw material costing Rs.3 per unit. The cost of placing an order is Rs. 50 and the carrying cost are 10% per year unit of the average inventory. Determine:
   (i) The economic order quantity.
   (ii) No. orders.
   (iii) Total cost of managing inventory. [6]

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Set No. 4

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Time: 3 hours   Max. Marks: 70

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B
*****

PART–A*(14 Marks)*

1. a) What is an artificial variable?   [2]
    b) What are the differences between transportation and assignment problems?   [3]
    c) What are the assumptions in n-job – 2 machine sequencing?   [3]
    d) Explain minimax criterion.   [2]
    e) What is replacement?   [2]
    f) What are costs associated with inventory?   [2]

PART–B*(4x14 = 56 Marks)*

2. a) Solve the following Degeneracy in simplex method
        Maximize $Z= 3X_1 + 9X_2$
    Subjected to
                $X_1 + 4X_2 \le 8$
                $X_1 + 2X_2 \le 4$
                $X_1, X_2 \ge 0$ [8]
    b) What are the advantages and limitations of linear programming technique   [6]

3. a) Determine the basic Feasible solution to the following Transportation problem
        using Northwest corner rule, least cost method and Vogel's approximation
        method .

	A	B	C	D	E	**Supply**
P	2	11	10	3	7	4
Q	1	4	7	2	1	8
R	3	9	4	8	12	9
Demand	3	3	4	5	6	

                                                                                    [9]
    b) What do you mean by an unbalanced transportation problem and explain how to
        convert the unbalanced transportation problem into a balanced one.   [5]

4. a) Find the sequence that minimizes the total elapsed time required to complete the
        following tasks on the machines in the order $1 – 2 – 3$. Find also the minimum
        total elapsed time and the ideal times on the machines.

Jobs	A	B	C	D	E	F	G
Time on Machine 1	3	8	7	4	9	8	7
Time on Machine 2	4	3	2	5	1	4	3
Time on Machine 3	6	7	5	11	5	6	12

                                                                                    [10]
    b) Describe the mathematical formulation of an assignment problem.   [4]

5. Suppose that a company is planning its capital improvement projects for the next years. The company has budgeted Rs. 100 lakh and is reviewing four possible projects for funding. the following table shows the projects, together with their costs and net present value of return.

Project	1	2	3	4
Cost (Lakh)	50	70	30	30
Return	50	100	60	30

A project will be funded entirely or not at all. Maximize the return on the projects. [14]

6. a) A machine costs Rs.10000. Its operating cost and resale values are tabulated below: Determine at what time it should be replaced.

Year	1	2	3	4	5	6	7	8
Operating cost	1000	1200	1400	1700	2000	2500	3000	3500
Resale value	6000	4000	3200	2600	2500	2400	2000	1600

[7]

   b) Discuss the process of dealing with replacement of items that fail completely and suddenly. [7]

7. Derive the EOQ formula for the demand rate uniform and production rate finite model. [14]