GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–V (NEW) EXAMINATION – WINTER 2023

Subject Code:3151910   **Date:18-12-2023**
Subject Name: Operation Research
Time:10:30 AM TO 01:00 PM   **Total Marks:70**
Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

		Marks
Q.1	**(a)** What is Operation Research? Discuss the scope of operation research in brief.	**03**
	(b) Explain how and why operation research have been valuable in adding executive decision	**04**
	(c) A pen manufacturer has two models. A basic model (A) and a standard model (B). Each pen of type B takes twice as long as one of type A and the company would have time to make a maximum of 2000 pen per day if only the basic model A is produced. Supply of plastic is sufficient to produce 1500 pen per day both A and B combined. The standard version of pen B requires additional accessories of which there are 600 set per day available. If the company makes a profit of Rs 3 and Rs 5 per pen of type A and B respectively, how many pens of type A and B each will have to be produced to maximize the profit?	**07**

Q.2	**(a)** Explain the relationship between stages and states in dynamic programming	**03**
	(b) Define the following terms associated with customers waiting in queue. Balking, Reneging, Jockeying, Collusion	**04**
	(c) A manufacturing company produce two product A and B. Each product undergoes through operation on machine X and Y. The time required to perform these operations with the available capacity of machines X and Y in a given quarter are given below. The market survey has predicted that not more than 450 units of product A and not more than 250 of product B can be sold in the given quarter. The company wants to determine the product mix to maximize profit. The unit profits for product A and B are Rs 20 and Rs 40 respectively.	**07**

Machine	Product time required per unit		Available capacity (Hrs)
	A	B	
X	1.5 Hrs.	1 Hrs.	750
Y	1 Hrs.	3 Hrs.	900
Profit	Rs 20	Rs 40	

Formulate the problem and solve graphically.

OR

(c)	Minimize $z = 3x_1 + 5x_2$	**07**

Subject to $4x_1 + 2x_2 \leq 12$
$\qquad 2x_1 + 2x_2 = 10$
$\qquad 2x_1 + 5x_2 \geq 10$
Use Big – M method to solve the LPP.

Q.3 **(a)** What do you understand by a balanced and unbalanced transportation problem? How unbalanced problem is tackled? **03**

(b) Explain the steps in volved in Modified Distribution method **04**

(c) A captain of cricket team has to allot five middle order batting position to five batsmen. The average runs scored by each batsman at this position are given in table. **07**

Batting Position

	III	IV	V	VI	VII
A	40	40	35	25	50
B	42	30	16	25	27
C	50	48	40	60	50
D	20	19	20	18	25
E	58	60	59	55	53

(Batsman — row label for A, B, C, D, E)

Make the assignment so that the expected total average runs scored by these batsmen are maximum.

OR

Q.3 **(a)** Explain the difference between a transportation problem and an assignment problem. **03**

(b) Describe the mathematical formulation of an assignment problem. **04**

(c) Manufacturing firm has three plant A, B and C and three ware house P, Q and R. Their plants capacities and ware house demand and transportation cost per unit is shown in table. **07**

From \ To	P	Q	R	Capacity
A	11	9	6	40
B	12	14	11	50
C	10	8	10	40
Demand	55	45	30	130

Find the most economical shipment to minimize the total transportation costs. There is no condition any plant can transport the product to any ware house.

Q.4 **(a)** What is strategy? Explain the difference between pure and mixed strategy. **03**

(b) Customer arrives at barber's shop according to poisson process with a mean inter arrival time of 20 minutes. Customer spend an average time of 15 minutes in the barber's chair. **04**

1. What is the probability that a new arrival need not to wait for the barber to be free?
2. What is the expected number of customers in the barber's shop?
3. How much time can a customer expect to wait for his turn?
4. How much time can a customer expect to spend in the shop?

(c) A manufacturer, find from his past records that the costs per year associated with a machine with a purchase price of Rs 50,000 are as given below: **07**

Year	1	2	3	4	5	6	7	8
Running cost Rs (Maintenance Cost)	15000	16000	18000	21000	25000	29000	34000	40000
Scrap Value	35000	25000	17000	12000	10000	5000	4000	4000

Determine the optimum policy.

OR

Q.4 **(a)** What do you understand by zero sum with reference to game theory? Explain saddle point in brief. **03**

(b) Describe kendell's notation in respect of queuing theory   **04**

(c) Assume that present value of one rupee to be spent in a year's time is Rs 0.90   **07**
and capital cost of equipment is Rs 6000. Running costs are given in the table:

Year	1	2	3	4	5	6	7
Running Cost	1000	1200	1600	2000	2600	3200	4000

When should the machine be replaced?

Q.5 **(a)** Explain various steps involved in decision making.   **03**

(b) Differentiate between CPM and PERT   **04**

(c) A project schedule has the following characteristic: **07**

Activity	Duration	Activity	Duration
1-2	3	4-8	6
1-4	2	5-6	5
1-7	1	6-9	4
2-3	3	7-8	4
3-6	2	8-9	5
4-5	4		

Construct a network diagram and find critical path, total duration of the project, various time estimates.

OR

Q.5 **(a)** What is the difference between decision making under certainty, under   **03**
uncertainty and under risk

(b) Define: Activity, Event, Dummy activity, Float   **04**

(c) A small project is composed of 7 activities whose time estimates are listed in the   **07**
below table. Activities are identified by their beginning and ending nodes
members

Activity		1-2	1-3	1-4	2-5	3-5	4-6	5-6
Time	Optimistic	1	1	2	1	2	2	3
Estimates	Most Likely	1	4	2	1	5	5	6
Week	Pessimistic	7	7	8	1	14	8	15

1. Draw Project Network
2. Find the expected duration and variance for each activity
3. What is the expected project length and standard deviation?
4. What is the probability that the project will be completed 3 weeks later than the expected time?

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