

GUJARAT TECHNOLOGICAL UNIVERSITY
MCA - SEMESTER-VI • EXAMINATION – SUMMER 2013

Subject Code: 640003**Date: 27-05-2013****Subject Name: Operations Research (OR)****Time: 10.30 am - 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.

- Q.1 (a)** What is Operation Research? Explain the application areas of the research. **05**
- (b)** What is Linear Programming? What are major assumptions and limitations? **05**
- (c)** Construct the dual of the problem **04**
- $\text{Max}_z = 6x_1 + 4x_2 + 6x_3 + x_4$
 subject to the constraints
 (i) $4x_1 + 4x_2 + 4x_3 + 8x_4 = 21$ (ii) $3x_1 + 17x_2 + 80x_3 + 2x_4 \leq 48$
 Where $x_1, x_2 \geq 0$ and x_3, x_4 are unrestricted.

- Q.2 (a)** Solve the following LP problem using simplex method. **07**
- $\text{Max}_z = 50x_1 + 70x_2$
 Subject to the constraints
 (i) $x_1 + x_2 \leq 70$ (ii) $x_1 + 2x_2 \leq 100$ and (iii) $2x_1 + x_2 \leq 120$
 Where $x_1, x_2 \geq 0$
- (b)** A manufacturer has two machines A and B. He manufactures two products P and Q on these machines. For manufacturing product P he has to use machine A for three hours and machine B for six hours, and for manufacturing product Q he has to use machine A for six hours and machine B for five hours. On each unit of P he earns Rs. 4 and on each unit of Q he earns Rs. 5. How many units of P and Q should be manufactured to get maximum profit? Each machine cannot be used for more than 2100 hours. Solve the LPP by Graphical method. **07**

OR

- (b)** Solve the following LP problem using Big-M method. **07**
- $\text{Max}_z = 3x_1 - x_2$
 Subject to the constraints
 (i) $2x_1 + x_2 \leq 2$, (ii) $x_1 + 3x_2 \geq 3$, (iii) $x_2 \leq 4$
 Where $x_1, x_2 \geq 0$
- Q.3 (a)** What is Duality? What are the rules to form a dual problem from the primal problem? What are the advantages of Duality? **07**
- (b)** Find the initial basic feasible solution to the transportation problem in which the cells contain transportation cost in rupees by using. **07**
- (i) NWCM (ii) VAM

	W ₁	W ₂	W ₃	W ₄	W ₅	Available
F ₁	7	6	4	5	9	40
F ₂	8	5	6	7	8	30
F ₃	6	8	9	6	5	20
F ₄	5	7	7	8	6	10

Required

30	30	15	20	5
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 100

OR

- Q.3 (a)** What is the unbalanced assignment problem? How is it solved by the Hungarian method? **07**
- (b)** Four different jobs are to be done on four different machines. The set up and the production times are prohibitively high for changeover. The following below table indicates the cost of producing job *i* on machine *j* in rupees. **07**

		Machines			
		A	B	C	D
Jobs	I	5	7	11	6
	ii	8	5	9	6
	iii	4	7	10	7
	iv	10	4	8	3

Assign jobs to different machines so that the total cost is minimized.

- Q.4 (a)** The number of days for completing different jobs of a project are given below. Prepare a network of the project and determine critical path. Also find total float, free float and independent float. **07**

Job	1-2	2-3	2-4	3-5	3-6	4-6	4-7	5-8	6-8	7-8
Time	2	3	5	4	1	6	2	8	7	4

- (b)** Explain Inventory. What are the advantages and disadvantages of having inventories? **07**

OR

- Q.4 (a)** Explain the two-person zero-sum game, giving suitable example. Consider the game *G* with the following payoff. **07**

		Player B	
		B1	B2
Player A	A1	2	6
	A2	-2	λ

- (i)** Show that *G* is strictly determinable whatever λ maybe.
(ii) Determine the value of *G*.
- (b)** What is simulation? Explain Monte-Carlo simulation along with all the necessary steps. **07**

- Q.5 (a)** Explain Errors and Dummies in PERT/CPM Network and also define the following terms in PERT **07**

(i) Three time estimates **(ii)** Expected time

- (b)** Find the cost per period of individual replacement policy of an installation of 300 light bulbs, given the following: **07**

(i) Cost of replacing an individual bulb is Rs 2

(ii) Conditional probability of failure is given below

Week no	0	1	2	3	4
Conditional probability of failure	0	0.1	0.3	0.7	1.0

Also calculate the number of light bulbs that would fail during each of the four weeks

OR

- Q.5 (a)** There are 7 jobs, each of which has to go through the machine A and machine B in the order AB. The processing times in hours is given below: **07**

Job	1	2	3	4	5	6	7
Machine A	3	12	15	6	10	11	9
Machine B	8	10	10	6	12	1	3

Determine a sequence of these jobs that will minimize the total elapsed time T. Also find T and idle time for machines A and B.

- (b)** A self service store employs one cashier at its counter. Nine customers arrive on an average every five minutes but the cashier can serve 10 customers in 5 minutes. Assuming Poisson distribution for arrival rate and exponential distribution for service time, find **07**
- 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.
