

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA - SEMESTER- IV • EXAMINATION – SUMMER • 2014

Subject Code: 2640003

Date: 29-05-2014

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 Linear Programming? What are major assumptions and limitations? **07**
- (b) The ABC Company has been a producer of picture tubes for television sets and certain printed circuits for radios. The company has just expanded in to full scale production and marketing of AM and AM-FM radios. It has built a new plant that can operate 48 hours per week. production of an AM radio in the new plant will require 2 hours and production of an AM-FM radio will require 3 hours. each AM radio will contribute Rs. 40 to profits while an AM-FM radio will contribute Rs. 80 to profits. The marketing department ,after extensive research has determined that a maximum of 15 AM radios and 10 AM-FM radios can be sold each week.
- Formulate a linear programming model to determine the optimum production mix of AM and FM radios that will maximize profits. Solve the above LPP using graphical Method. **07**
- Q.2** (a) Solve the following LPP using Simplex Method. **07**
- Max $Z = x_1 + 4x_2 + 5x_3$
- Subject to the Constraint $3x_1 + 3x_2 \leq 22$
- $x_1 + 2x_2 + 3x_3 \leq 14$
- $3x_1 + 2x_2 \leq 15$
- and $x_1, x_2, x_3 \geq 0$.
- (b) Use Penalty (BIG-M) method to solve the following LP Problem. **07**
- Max $Z = 2x_1 + 3x_2 + 4x_3$
- Subject to the Constraint $3x_1 + x_2 + 4x_3 \leq 600$
- $2x_1 + 4x_2 + 2x_3 \geq 480$
- $2x_1 + 3x_2 + 3x_3 = 540$
- and $x_1, x_2, x_3 \geq 0$.
- OR**
- (b) Discuss, in detail, the various types of inventories. **07**

- Q.3 (a)** A company four warehouse A, B, C and D. It is required to deliver a product from these warehouses to three customers A, B and C. The warehouses have the following amounts in a stock: **07**

Warehouse: A B C D

No of Units 15 16 12 13

and the customers requirement are

Customers: A B C

No of Units 18 20 18

The table below shows the costs of transporting one unit from warehouse to the customer.

		warehouse			
		A	B	C	D
Customer	A	8	9	6	3
	B	6	11	5	10
	C	3	8	7	9

Find the initial Basic Transportation routes using (i) LCM (ii) Vogel Approximation.

- (b)** The following maintenance job has to be performed periodically on the heat exchangers in a refinery: **07**

Task	Description	Immediate Predecessors	Time (Day)
A	Dismantle pipe connections	-	14
B	Dismantle header, closure and floating head front	A	22
C	Remove tube bundle	B	10
D	Clean bolts	B	16
E	Clean header and floating head front	B	12
F	Clean tube bundle	C	10
G	Clean shell	C	6
H	Replace tube bundle	F,G	8
I	Prepare shell pressure test	D,E,H	24
J	Prepare tube pressure test and make the final reassembly	I	16

(a) Draw a network diagram of activities for the project.

(b) Identify the critical path. What is its length?

(c) Find the total float and free float for each task.

OR

- Q.3 (a)** In a railway marshalling yard, good trains arrive at a rate of 30 trains per day. Assuming that the interarrival time follows an exponential distribution and the service time(time taken to hump a train) distribution is also exponential with an average of 36 minutes. Calculate: **07**

(I) Expected queue size(Line length)

(II) Probability that the queue size exceeds 10

- (b) A national truck rental service has a surplus of one truck in each of the cities, A, B, C, D and E; and a deficit of one truck in each of the cities P, Q, R, S and T. The distances (in km) between the cities with a surplus and cities with deficit are displayed in the below: 07

FROM	TO					
		P	Q	R	S	T
	A	85	75	65	125	75
	B	90	78	66	132	78
	C	75	66	57	114	69
	D	80	72	60	120	72
	E	76	64	56	112	68

How should the trucks be displayed so as to minimize the total distance travelled?

- Q.4 (a)** (I) Solve the following game by maximin (minimax) principle, whose payoff matrix are given below: Include in your answer: (1) strategy selection for each player (2) the value of the game to each player. Does the game has a saddle point? 03

Player A	Player B				
	B1	B2	B3	B4	B5
A1	3	-1	4	6	7
A2	-1	8	2	4	12
A3	16	8	6	14	12
A4	1	11	-4	2	1

- (II) Obtain the dual of the following primal LP problem: 04

$$\text{Maximize } z = x_1 - 2x_2 + 3x_3$$

$$\text{subject to the constraints } -2x_1 + x_2 + 3x_3 = 2$$

$$2x_1 + 3x_2 + 4x_3 = 1$$

$$\text{and } x_1, x_2, x_3 \geq 0$$

- (b) (I) What do you understand by queue? differentiate each Balking, Reneging and jockeying with illustration. 07
 (II) Define following terms :
 (i) Feasible solution (ii) Redundancy constraints (iii) Pay-off matrix.

OR

- Q.4 (a)** (I) Machine A costs Rs. 9,000. Its annual operating costs are Rs. 200 for the first year, and then increase by Rs. 2,000 every year. Determine the best age at which the machine should be replaced. If the optimum replacement policy is followed, what will be the average yearly cost of owning and operating the machine? 07
 (II) Machine B costs Rs. 10,000. Its annual operating costs are Rs. 400 for the first year and then increase by Rs. 800 every year. You now have a machine of type A that is one year old. Should you replace it with machine B, if so, when?

- (b) A project has following activities and other characteristics:

07

Activity	Time Estimates (weeks)			Preceding activity
	Optimistic	Most likely	Pessimistic	
A	4	7	16	-
B	1	5	15	-
C	6	12	30	A
D	2	5	8	A
E	5	11	17	C
F	3	6	15	D
G	3	9	27	B
H	1	4	7	E,F
I	4	19	28	G

(a) Draw the network diagram.

(b) Find expected time and variance for each activity also find critical path.

(c) Find expected project completion time.

- Q.5 (a) What is Simulation? What are the advantages and disadvantages of Simulation?

07

- (b) The production department of the company requires 3,600 kg of raw material for manufacturing a particular item per year. It has been estimated that a costs of placing an order is Rs. 36. The cost of carrying inventory is 25% of investment in the inventories. The price is Rs. 10 per kg. Help the purchase manager to determine an ordering policy for raw material.

07

OR

- Q.5 (a) A machine operator has to perform three operations, turning threading and knurling on a number of different jobs. The time required to perform these operations (in minutes) for each job is known and is given below:

07

Jobs	Time of turning (min)	Time of Threading (min)	Time of Knurling (min)
1	3	8	13
2	12	6	14
3	5	4	9
4	2	6	12
5	9	3	8
6	11	1	13

Determine the order in which the jobs should be processed in order to minimize the total time required to turn out all the jobs.

- (b) The management of a large hotel is considering the periodic replacement of light bulbs fitted in its rooms. There are 500 rooms in the hotel and each room has 6 bulbs. The management is now following the policy of replacing the bulbs as they fail at a total cost of Rs. 3 per bulb. The management feels that this cost can be reduced to Rs. 1 by adopting the periodic replacement method. On the basis of information given below, evaluate the alternative and make recommendation to the management.

07

Month of use	1	2	3	4	5
Per cent of bulbs failing by that month	10	25	50	80	100
