Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA - SEMESTER–IV • EXAMINATION – SUMMER • 2014

Subject Code: 640003 **Date: 29-05-2014**

Subject Name: Operations Research

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)** Comment on the following statement **05**

i) OR is the art of winning war without actually actually fighting it.

ii) OR is the art of finding bad answers where worse exists.

(b) Define the following concepts in the context of linear programming: **06**

i) Basic feasible solution

ii) Unbounded solution

iii) Slack and surplus variables

(c) Explain two-person zero-sum game, giving suitable example. **03**

Q.2 **(a)** Solve the following LP problem graphically **07**

$\text{Min}_z = 20x_1 + 10x_2$

Subject to

$$x_1 + 2x_2 \le 40,$$
$$3x_1 + x_2 \ge 30,$$
$$4x_1 + 3x_2 \ge 60,$$
$$x_1, x_2 \ge 0.$$

(b) Use the Simplex Method to solve the following LP problem. **07**

$\text{Max}_z = 3x_1 + 5x_2 + 4x_3$

Subject to

$$2x_1 + 3x_2 \le 8,$$
$$2x_2 + 5x_3 \le 10,$$
$$3x_1 + 2x_2 + 4x_3 \le 15,$$

and $x_1, x_2, x_3 \ge 0.$

OR

(b) Solve the following LP Problem using Big-M method **07**

$\text{Min}_z = 12x_1 + 20x_2$

Subject to

$$6x_1 + 8x_2 \ge 100,$$
$$7x_1 + 12x_2 \ge 120,$$

and $x_1, x_2 \ge 0.$

Q.3 **(a)** (i) Construct the dual of the problem **04**

$\text{Min}_z = 3x_1 - 2x_2 + 4x_3$

Subject to

$3x_1 + 5x_2 + 4x_3 \geq 7,$
$6x_1 + x_2 + 3x_3 \geq 4,$
$7x_1 - 2x_2 - x_3 \leq 10,$
$x_1 - 2x_2 + 5x_3 \geq 3,$
$4x_1 + 7x_2 - 2x_3 \geq 2,$

and $x_1, x_2, x_3 \geq 0.$

(ii) In a certain game player P has three possible choices, A, B and C. Player Q has two choices, D and E. Payments have to be made as per the choices made. The payments are as shown in the table: **03**

Payment data for various options:

Choices	Payments
A,D	P pays Q Re 1
A,E	Q pays P Re 5
B,D	No payments
B,E	Q pays P Re 6
C,D	Q pays P Re 4
C,E	Q pays P Re 5

What is the the best strategy for players P and Q in this game?

(b) Find the optimal solution of the following transportation problem: **07**

Plants	Ware houses				
	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	

OR

Q.3 **(a)** Describe the transportation problem with its general mathematical formulation. **07**

(b) A construction company has requested bids for subcontracts on five different projects. Five companies have responded their bids and are represented below: **07**

		Bid amounts ('000$_s$ Rs)				
		A	B	C	D	E
Bidders	1	41	72	39	52	25
	2	22	29	49	65	81
	3	27	39	60	51	40
	4	45	50	48	52	37
	5	29	40	45	26	30

Determine the minimum cost assignment of subcontracts to bidders, assuming that each bidder can receive only one contract.

Q.4 **(a)** What do you understand by **07**

i) queue discipline ii) queuing process iii) service process

(b) A television repair man finds that the time spent on his jobs has an exponential distribution with a mean of 30 minutes. If he repairs the sets in the order in which they came in and if the arrival of sets follows a Poisson distribution with an approximate average rate of 10 per 8-hours day, what is the repairman's expected idle time each day? How many jobs are ahead of the average set just brought in? **07**

OR

Q.4 **(a)** Define Simulation? Explain applications, advantages and disadvantages of Simulation. **07**

Q.4 **(b)** The production department of a company requires 3,600 kg of raw material for manufacturing a particular item per year. It has been estimated that the cost of placing an order is Rs 36 and the cost of carrying inventory is 25% of the investment in the inventories. The price is Rs 10 per kg. Help the purchase manager to determine an ordering policy for raw material. **07**

Q.5 **(a)** Machine A costs Rs 45,000 and its operating costs are estimated to be Rs 1000 for the first year increasing by Rs 10,000 per year in the second and subsequent years. Machine B costs Rs 50,000 and operating costs are Rs 2,000 for the first year, increasing by Rs 4,000 in the second and subsequent years. If at present we have a machine of type A, should we replace it with B? If so when? Assume that both machines have no resale value and their future costs are not discounted. **07**

(b) Ten jobs are to be processed on two machines M1 and M2. Determine the optimal sequence and evaluate the total elapsed time, besides the job and machine idle time. The job processing times (in hours) are given below in table. **07**

	Job processing times in hours									
Machines	J_1	J_2	J_3	J_4	J_5	J_6	J_7	J_8	J_9	J_{10}
M_1	8	9	10	4	8	5	6	9	6	7
M_2	5	3	7	7	6	8	3	7	8	7

OR

Q.5 **(a)** Determine the optimal sequence of performing 4 jobs on 5 machines. The matching of each machine is required in the order ABCDE and the process timings as as follows. **07**

Jobs	Machines				
	A	B	C	D	E
I	7	5	2	3	9
II	6	6	4	5	10
III	5	4	5	6	8
IV	8	3	3	2	6

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

(b) A project schedule has the following characteristics **07**

Activity	Time (Weeks)
1-2	4
1-3	1
2-4	1
3-4	1
3-5	6
4-9	5
5-6	4
5-7	8
6-8	1
7-8	2
8-10	5
9-10	7

(i) Construct the network
(ii) Compute E and L for each event
(iii) Find Critical path and Total Float.

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