Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA - SEMESTER–IV • EXAMINATION – WINTER • 2014

Subject Code: 640003 Date: 02-12-2014

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)** Define Operation Research. Give the application area of operation research **07**

(b) An electronic company is engaged in the production of two components C_1 and C_2 that are used in radio sets. Each unit of C_1 costs the company Rs 5 in wages and Rs 5 in material, while each of C_2 costs the company Rs 25 in wages and Rs 15 in material. The company sells both products on one-period credit terms, but the company's labor and material expenses must be paid in cash. The selling price of C_1 is Rs 30 per unit and of C_2 it is Rs 70 per unit. Because of the company's strong monopoly in these components, it is assumed that the company can sell, at the prevailing prices, as many units as it produces. The company's production capacity is, however, limited by two considerations. First, at the beginning of period 1, the company has an initial balance of Rs 4,000(cash plus bank credit plus collections from past credit sales). Second, the company has, in each period, 2,000 hours of machine time and 1,400 hours of assembly time. The production of each C_1 required 3 hours of machine time and 2 hours of assembly time, whereas the production of each C_2 requires 2 hours of machine time and 3 hours of assembly time. Formulate this problem as an LP model so as to maximize the total profit to the company.(DO NOT SOLVE) **07**

Q.2 **(a)** Use graphical method to solve the following LP problem. **07**

Maximize $Z=15x_1 +10x_2$

Subject to the constraints

(i) $4x_1 + 6x_2 <= 360$,

(ii) $3x_1 + 0x_2 <= 180$,

(iii) $0x_1 + 5x_2 <= 200$

and $x_1, x_2 >= 0$

(b) Use the simplex method to solve the following LP problem. **07**

Maximize $Z = 3x_1 + 5x_2 + 4x_3$

subject to the constraints

(i) $2x_1 + 3x_2 <= 8$,

(ii) $2x_2 + 5x_3 <= 10$,

(iii) $3x_1 + 2x_2 + 4x_3 <= 15$

and $x_1, x_2, x_3 >= 0$

OR

(b) Use penalty (Big-M) method to solve the following LP problem. **07**

Maximize $Z = x_1 + 2x_2 + 3x_3 – x_4$

subject to constraints

(i) $x_1 + 2x_2 + 3x_3 = 15$,

(ii) $2x_1 + x_2 + 5x_3 = 20$,

(iii) $x_1 + 2x_2 + x_3 + x_4 = 10$

and $x_1, x_2, x_3, x_4 >= 0$

Q.3 **(a)** Write the dual of the following LP problem. **07**

Minimize $Z_x = 3x_1 - 2x_2 + 4x_3$

Subject to constraints

(i) $3x_1 + 5x_2 + 4x_3 >= 7$,

(ii) $6x_1 + x_2 + 3x_3 >= 4$,

(iii) $7x_1 - 2x_2 - x_3 <= 10$,

(iv) $x_1 - 2x_2 + 5x_3 >= 3$,

(v) $4x_1 + 7x_2 - 2x_3 >= 2$

And $x_1, x_2, x_3 >= 0$

(b) Determine an initial feasible solution to the following transportation problem by using (i) NWCM, (ii) LCM, and (iii) VAM. **07**

		Destination				
		D1	D2	D3	D4	Supply
Source	A	11	13	17	14	250
	B	16	18	14	10	300
	C	21	24	13	10	400
	Demand	200	225	275	250	

OR

Q.3 **(a)** Five men are available to do five different jobs. From past records, the time (in hours) that each man takes to do each job is known and is given in the following table: **07**

		Jobs				
		I	II	III	IV	V
Men	A	2	9	2	7	1
	B	6	8	7	6	1
	C	4	6	5	3	1
	D	4	2	7	3	1
	E	5	3	9	5	1

Find out how men should be assigned the jobs in way that will minimize the total time taken.

(b) For what value of λ, the game with following pay-off matrix is strictly determinable? **07**

		Player B		
		B_1	B_2	B_3
Player A	A_1	λ	6	2
	A_2	-1	λ	-7
	A_3	-2	4	λ

Q.4 **(a)** Given the following information: **07**

Activity	Predecessors	Dutation(days)
A	-	6
B	A	4
C	B	7
D	A	2
E	D	4
F	E	10
G	-	2
H	G	10
I	J,H	6
J	-	13
K	A	9
L	C, K	3
M	I, L	5

(a) Draw an arrow diagram for this project.
(b) Indicate the critical path.
(c) For each non-critical activity, find the total and free float.

(b) A book binder has one printing press, one binding machine and manuscripts of 7 different books. The times required for performing printing and binding operations for different books are shown below: **07**

Book:	1	2	3	4	5	6	7
Printing Time (hours):	20	90	80	20	120	15	65
Binding Time (hours):	25	60	75	30	90	35	50

Find the total minimum elapsed time and idle time of each machine.

OR

Q.4 **(a)** Explain difference between PERT and CPM. **07**

(b) Find an optimal sequence and idle time of each machine for following sequencing problem of four jobs and five machines, when passing is not allowed. Its processing time (in hours) is given below: **07**

		Machine				
		M_1	M_2	M_3	M_4	M_5
Job	A	7	5	2	3	9
	B	6	6	4	5	10
	C	5	4	5	6	8
	D	8	3	3	2	6

Q.5 **(a)** A firm is considering the replacement of a machine, whose cost price is Rs 12,200, and its scrap value is Rs 200. From experience the running (maintenance and operating) costs are found to be as follows: **07**

Year:	1	2	3	4	5	6	7	8
Running Cost(Rs):	200	500	800	1,200	1,800	2,500	3,200	4,000

What should the machine be replaced?

(b) Define the following terms: Payoff-matrix, Value of game, Optimal Strategy **07**

OR

Q.5 **(a)** Let the value of the money be assumed to be 10 percent year and suppose that machine is replaced after every three years, whereas machine B is replaced every six years. The yearly costs (in Rs) of both the machines are given below: **07**

Year:	1	2	3	4	5	6
Machine A:	1,000	200	400	1,000	200	400
Machine B:	1,700	100	200	300	400	500

Determine which machine should be purchased.

(b) 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	Time
1-2	2
2-3	3
2-4	5
3-5	4
3-6	1
4-6	6
4-7	2
5-8	8
6-8	7
7-8	4

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