Seat No.: ________ Enrolment No.______________

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. - SEMESTER – VI • EXAMINATION – WINTER 2012

Subject code: 161601 **Date: 05/01/2013**

Subject Name: Modeling, Simulation and Operation Research

Time: 02.30 pm - 05.00 pm **Total Marks: 70**

Instructions:

1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** A chemical mixture consists of three raw materials A, B and C costing Rs. 20, Rs. 30 and Rs. 40 per kg. The specifications of the mixture are as follows: **07**

i) The mix must contain at least 20% of B

ii) The mix should not contain more than 40% of A

iii) The mix must contain at least 10% of C

Determine the LP model only, to find the least cost mix for a batch of 1000 kg of the chemical mixture.

(b) Solve the following LPP using BIG – M method. Show your calculation up to three iterations only. **07**

Minimize $Z = 40x_1 + 20x_2$

Subject to

$$2x_1 + 5x_2 \geq 48$$
$$8x_1 + 5x_2 \geq 72$$

x_1, and x_2, are non – negative

Q.2 **(a)** For the following problem formulate its dual and solve the dual problem graphically. Interpret the values of the dual variable with respect to the primal problem. **07**

Primal *Maximize* $Z = 3x_1 + x_2$

Subject to $x_1 + x_2 \leq 6$

$x_1 + 2x_2 \leq 8$

x_1, and x_2 are all non – negative.

(b) Solve the following problem using graphical method. **07**

Maximize $Z = 40x_1 + 80x_2$

Subject to

$$3x_1 + 2x_2 \leq 300$$
$$x_1 + x_2 \leq 80$$
$$2x_1 + x_2 \leq 200$$
$$3x_1 + 4x_2 \leq 300$$
$$x_1 \leq 60$$
$$x_2 \leq 60$$

x_1, and x_2 are all non – negative

OR

(b) Solve the following LPP using Two phase method **07**

Maximize $Z = 60x_1 + 48x_2$

Subject to

$$4x_1 + 2x_2 \geq 8$$
$$2x_1 - 4x_2 \geq 6$$

x_1 and x_2 are non – negative

Q.3 **(a)** Four software programs A, B, C and D are to be assigned to programmers W, X, Y, and Z. All the programmers are capable in their programming skills, except that **07**

programmer W could not program software B; programmer X could not program software D; programmer Y could not program software A. the cost of assigning the software to programmers are given in the cost matrix. Determine he optimum assignment.

	W	X	Y	Z
A	5	4	∞	5
B	∞	9	7	3
C	2	4	3	5
D	9	∞	7	8

(b) The following indicates the allocation values, shown in the boxes during and iteration of the transportation problem. **07**

i) Test for its optimality.

ii) Determine the optimum total transportation cost.

	D	E	F
A	4 $\boxed{35}$	4	3
B	5 $\boxed{5}$	1	6 $\boxed{20}$
C	8	3 $\boxed{40}$	2

OR

Q.3 **(a)** There are three warehouses X, Y, and Z having capacities 40, 30 and80 units of a product. Supply have to be effected from these warehouses to three regions A, B, and C with demand of 50 units each and where it could be sold at the unit prices Rs. 100, Rs. 140 and Rs. 120 respectively. The costs of transportation per unit are given in the following matrix. Determine the optimum distribution to maximize the total profit, if the production cost per unit is Rs. 50 **07**

	A	B	C
X	10	20	10
Y	20	30	20
Z	30	20	10

(b) There are four salesmen A, B, C and D and four areas W, X, Y, and Z where any one could be assigned. The expected profit that the company could get by assigning the salesman to area is given in the profit matrix. Determine the optimum assignment to maximize the total profit. **07**

	W	X	Y	Z
A	10	5	13	15
B	3	9	18	3
C	10	7	2	2
D	5	11	9	7

Q.4 **(a)** What is Monte-Carlo Simulation? Explain any two method for random number generation. **07**

(b) A typist at an office of a company receives on the average 20 letters per day for typing. The typist work 8 hours a day and it takes on the average 20 minutes to type a letter. The cost of the letter waiting to be mailed is Rs. 0.80 per hour and the cost of the equipment plus salary of the typist is Rs. 45 per day. What is the average numbers of letters to be typed and to be mailed? **07**

In order to improve the typing service, the company has the choice to take lease of one of the two models of an automated typewriter. The daily cost and the resulting increase in efficiency of the typist are given below. What action should the company take to minimize the total daily cost of waiting letters to be mailed?

Model	Additional cost/day	Increase in typist's efficiency
I	Rs. 20	50%
II	Rs. 25	75%

OR

Q.4 (a) Explain Characteristics of the queuing system. Explain the queuing models indicated by the following notations. **07**

i) $(M/D/1)$: $(FCFS/\infty/\infty)$

ii) $(M/M/1)$: $(FCFS/N/N)$

iii) $(D/D/1)$: $(FCFS/\infty/\infty)$

Q.4 (b) Software made by a company XYZ is to be tested at two testing centre: Centre A Centre B. Software will go for testing at A first and then B. The probability distribution for the testing time for software, in each centre is given below. Using simulation, determine the number of software could be tested in the testing centre. The random numbers are: 49, 83, 11, 19, 97, 74, 27, 61, 50, and 8. **07**

Testing Centre A		**Testing Centre B**	
Testing Time (min.)	Probability	Testing Time (min.)	Probability
10	0.2	8	0.3
11	0.3	9	0.4
12	0.4	10	0.3
13	0.1	-	-

Q.5 (a) Determine the critical path for the following network. What is the total time required for the project. Also find the free float and independent float for each activity. **07**

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

(b) Explain Individual replacement versus group replacement. **07**

OR

Q.5 (a) Udipis is building a new restaurant. In order to complete the following activities, along with their time estimates, are given below. **07**

Activity	**Immediate Predecessor**	**Optimistic Time**	**Pessimistic Time**	**Most Likely Time**
A	-	2	8	5
B	A	1	9	5
C	A	4	9	6
D	B, C	2	2	2
E	B	1	9	2
F	C, D	2	5	4
G	E	3	10	8
H	F, E	1	3	2
I	G, H			

Draw AOA network. Find the critical path/ paths and expected project duration. Also find the variance for the project duration.

(b) Explain the procedure for determining Minimal Spanning tree. **07**

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