MCA 3rd Semester Examination, 2010

COMPUTER BASED OPTIMIZATION TECHNIQUE

PAPER—2304

Full Marks : 100

Time : 3 hours

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

GROUP—A

[*Marks* : 50]

Answer **Q.No.1** and any **two** questions from the rest

1. Solve any *one* : 7

(*a*) Using revised simplex method solve the following LPP :

$$\text{Maximize} \quad z = 4x_1 + 7x_2$$

$$\text{subject to} \quad 2x_1 + 5x_2 \leq 40$$
$$x_1 + x_2 \leq 11$$
$$x_1, x_2 \geq 0$$

(*b*) Solve by dual simplex method :

$$\text{Minimize} \quad z = x_1 + x_2$$

$$\text{subject to} \quad 2x_1 + x_2 \geq 1$$
$$x_1 + 4x_2 \geq 1$$
$$3x_1 + 2x_2 \geq 1$$
$$x_1, \ x_2 \geq 0$$

2. (*a*) Solve the following LPP by simplex method :

$$\text{Maximize} \quad z = x_1 + 2x_2$$

$$\text{subject to} \quad x_1 + x_2 \leq 2$$
$$x_1 + 6x_2 \leq 6$$
$$x_1, x_2 \geq 0.$$

Use the optimal table of this LPP to get the ranges of values of $[b_1, b_2]^T$ so that the same table remains optimal table after necessary correction. Also find the corresponding optimal solution. 7

(*b*) Solve the following transportation problem using matrix minima method to find the initial BFS : 7

	D_1	D_2	D_3	D_4	
O_1	3	4	7	5	32
O_2	5	3	6	2	17
O_3	4	7	9	1	35
	15	17	29	23	

3. Solve the following LPP by simplex method : 14

Maximize $z = 2x_1 + x_2$

subject to $x_1 + 2x_2 \leq 4$

$3x_1 + 2x_2 \leq 6$

$x_1, x_2 \geq 0.$

Make the necessary correction in the optimal table and solve the resulting problem for each of the parameter change listed below.

(*i*) c_1 is changed from 2 to 3

(*ii*) c_2 is changed from 1 to 4

(*iii*) $[c_1, c_2]$ is changed from [2, 1] to [5, 8]

(*iv*) b_1 is changed from 4 to 6

(*v*) b_2 is changed from 6 to 4

(*vi*) $[b_1, b_2]^T$ is changed from $[4, 6]^T$ to $[6, 4]^T$.

4. (*a*) Solve the following assignment problem : 7

	I	II	III	IV	V
A	6	8	6	7	9
B	9	8	7	4	6
C	9	6	5	10	4
D	7	8	7	9	6
E	10	9	8	7	5

(*b*) Use Branch and Bound Method to solve the following Integer Programming Problem : 7

Maximize $z = -x_1 + x_2$

subject to $8x_1 + 5x_2 \leq 20$

$5x_1 + 6x_2 \leq 15$

x_1, x_2 are integers.

[*Internal Assessment* — 15 Marks]

GROUP—B

[*Marks* : 50]

Answer **Q.No.5** and any **two** from the rest

5. Find the optimal sequence for the following sequencing problem of 05 jobs and 04 machines of which processing times (in hours) is given below. Find also the total elapsed time. 5

Jobs / Machines	*A*	*B*	*C*	*D*	*E*
M_1	10	12	8	15	16
M_2	3	2	4	1	5
M_3	5	6	4	7	3
M_4	14	7	12	8	10

6. (*a*) Find the optimal order quantity for an inventory model with finite replenishment, uniform demand, lead time zero and shortages are not allowed. 5

(*b*) A company has a demand of 12000 units/year for an item and it can produce 2000 such item per month. The cost of one set-up is Rs. 400 and the holding cost/unit/month is Rs. 0·15. Find the optimum lot size and the total cost per year, assuming the cost of one unit as Rs. 4. Also find the maximum inventory, manufacturing time and total time period. 5

(*c*) A project has the following time schedule.

Activity	1 - 2	2 - 3	2 - 4	3 - 5	4 - 6	5 - 6	5 - 7	6 - 7
Pessimistic time (week)	3	9	6	8	8	0	5	8
Most likely time (week)	3	6	4	6	6	0	4	5
Optimistic time (week)	3	3	2	4	4	0	3	2

(*i*) Draw the network diagram.

(*ii*) Calculate the critical path.

(*iii*) Find the probability that the project will be completed in 23 weeks.

[Given that 97·26% corresponds the 1·92 standard normal deviate] 1 + 2 + 2

7. (*a*) Derive the difference equations for the queueing system (M/M/1 : ∞ / FCFS/∞) in steady state. Find the average number of customers in the queue. 8

(*b*) A drive in bank window has a mean service time of 2 minutes, while the customers arrive at a rate of 20 per hour. Assuming that these represent rates with a Poisson distribution, determine

(*i*) the approximate time that the teller will remain idle (assuming 8 hours a day)

(*ii*) how long a customer will have to wait before reaching the server.

(*iii*) the probability that a customers, on arrival, will have to wait.

(*iv*) the probability that there will be no customer waiting for service in the system.

(*v*) the average number of customers in the system. 5

(*c*) Construct a network for each of the activit and their precedence relationships are gi below :

Activity	Predecessor
A	—
B	—
C	*A*
D	*A*
E	*I, J, K*
F	*B, D*
G	*B, D*
H	*F*
I	*A*
J	*G, H*
K	*F*

8. (*a*) At time zero, all items in a system are new. E item has a probability p of failing immediat before the end of the first month of life an probability $q\,(=1-p)$ of failing immediat before the end of the second month. If all items are replaced as they fail, then show t the expected number of failures $f(x)$ at the e of month x is given by

$$f(x) = \frac{N}{1+q}\,[1-(-q)^{x+1}]$$

where N is the number of items in the syste

(*b*) The following mortality rates have been observed for a certain type of light bulb.

End of week	1	2	3	4	5	6
Probability of failure to-date	·09	·25	·49	·85	·97	1·0

There are 1000 bulbs in the system at the beginning. What is the best interval between two group replacements ? Given that if a bulb fails, it costs Rs. 3 to replace but it all the bulbs are replaced in the same operation, it costs Rs. 0·7 per bulb. Compare it with the cost of replacement due to individual replacement policy. 7

(*c*) (*i*) Number the events of the following network.