BCA–404(N)

B. C. A. (Fourth Semester)
EXAMINATION, May, 2013

(New Course)

Paper Fourth

OPTIMIZATION TECHNIQUES

Time : Three Hours]   [Maximum Marks : 75

Note : Section A is compulsory. Attempt *seven* questions out of ten questions from Section B and *one* question from Section C.

Section – A

1. Discuss linear programming in detail. Enumerate the basic theorems and their properties with a suitable example wherever needed. 　　　　9

2. Define assignment problem with a suitable example. 　　9

Section – B 　　　　　　42

3. Maximize :

$$-x_1 + 3x_2 - 3x_3$$

Subject to :

$$3x_1 - x_2 - 2x_3 \leq 7$$
$$- 2x_1 - 4x_2 + 4x_3 \leq 3$$
$$x_1 - 2x_3 \leq 4$$
$$- 2x_1 + 2x_2 + x_3 \leq 8$$
$$3x_1 \leq 5$$

$x_1, x_2, x_3 \geq 0.$

4. An office has four workers and four tasks have to be performed. Workers differ in efficiency and tasks differ in their intrinsic difficulty. Time each worker would take to complete each task is given in the effectiveness matrix. How should the tasks be allocated to each worker so as to minimize the total man hour ?

		Workers			
		I	II	III	IV
	A	5	23	14	8
Task	B	10	25	1	23
	C	35	16	15	12
	D	16	23	21	7

5. A garden shop wishes to prepare a supply of special fertilizer at a minimal cost by mixing two fertilizers, A and B. The mixture is to contain :

at least 45 units of phosphate

at least 36 units of nitrate

at least 40 units of ammonia

Fertilizer A costs the shop ₹ 0·97 per pound

Fertilizer B costs the shop ₹ 1·89 per pound

Fertilizer A contains 5 units of phosphate and 2 units of nitrate and 2 units of ammonia.

Fertilizer B contains 3 units of phosphate and 3 units of nitrate and 5 units of ammonia.

How many pounds of each fertilizer should the shop use in order to minimise their cost ?

6. Discuss various costs associated with queuing problem.

7. Discuss the Johnson's Algorithm for scheduling of one machine and two jobs; one machine and n jobs; all two machine cases.

8. Discuss differences between individual replacemnt and group replacement policies.

9. The demand of a product is 600 units per week and the items are withdrawn at a constant rate. The setup cost each time a production run is undertaken to replenish inventory is $ 25. The unit cost of each item is $ 3 and inventory holding cost is $ 0·05 per item per week :

   (a) Assuming shortages are not allowed, determine how often to orders and what size the order should be.

   (b) If shortage are allowed but cost $ 2 per item per week, determine how often to order and what size the order should be.

10. Discuss the main phases of O. R. study.

11. How can the tic-tac-toe game be converted to a linear programming problem ? Discuss.

12. A certain printer in the stat lab gets jobs with a rate of 3 per hour. On the average, the printer needs 15 mins. to finish a job. Find out all properties of interest for this printer system according to the M/M/1 queuing model.

Section – C

13. Traffic to a message switching center for one of the outgoing communication lines arrive in a random pattern at an average rate of 240 messages per minute. The line has a transmission rate of 800 characters/second. The message length distribution is approximately exponential with an average length of 176 characters. Calculate the following principal statistical measures of system performance assuming that a very large number of message buffers are provided : $2\frac{1}{2}$ each

   (a) Average number of messages in the system.

   (b) Average number of messages in the queue waiting to be transmitted.

   (c) Average time a message spends in a system.

   (d) Average time a message waits for transmission.

   (e) Probability that 10 or more messages are waiting to be transmitted.

   (f) 90th percentile waiting time in queue.

14. (a) A farmer can plant upto 8 acres of land with wheat or barley. He can earn ₹ 5,000 for every acre he plants with wheat and ₹ 3,000 for every acre of barley he plants. His use of a necessary pesticide for every 8 acres is 10 gallons. Wheat needs 2 gallons of pesticide for each acre planted and barley needs 1 gallon of pesticide per acre. What is the maximum profit that he can make ? 8

   (b) What is degeneracy ? Discuss the methods to resolve it in L. P. problem. 7