

Roll No.

BCA-404(N)

B. C. A. (Fourth Semester) EXAMINATION, May, 2017

(New Course)

Paper Fourth

OPTIMIZATION TECHNIQUES

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt questions from all Sections as directed.

Inst. : The candidates are required to answer only in serial order. If there are many parts of a question, answer them in continuation.

Section—A

(Short Answer Type Questions)

Note : All questions are compulsory. Each question carries 3 marks.

1. (A) Convert the following LPP into the standard form :

Minimize :

$$z = 12x_1 + 5x_2$$

Subject to the constraints

$$5x_1 + 3x_2 \geq 15$$

$$7x_1 + 2x_2 \leq 14$$

and $x_1, x_2 \geq 0$.

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- (B) Define slack and surplus variable giving examples of each.
- (C) Explain degeneracy in transportation problem and how to resolve it.
- (D) What is an unbalanced assignment problem ?
- (E) What is a replacement problem ? Describe the some important replacement situations.
- (F) Determine the dual of the problem :

Minimize :

$$z = 5x_1 + 2x_2 + x_3$$

Subject to :

$$2x_1 + 3x_2 + x_3 \geq 20$$

$$6x_1 + 8x_2 + 5x_3 \geq 30$$

$$7x_1 + x_2 + 3x_3 \geq 40$$

$$x_1 + 2x_2 + 4x_3 \geq 50$$

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

- (G) The assignment cost of assigning any operator to any one machine is given in the following table :

		Operators			
		I	II	III	IV
Machines	A	10	5	13	15
	B	3	9	18	3
	C	10	7	3	2
	D	5	11	9	7

Find the optimal assignment.

- (H) A stockist purchases an item at the rate of ₹ 40 per piece from a manufacturing 2000 units of the item are required per year. What should be the order quantity per order if the cost per order is ₹ 15 and the inventory charges per year are 20 paise ?
- (I) Explain the following term in context of queuing problem :-
- Traffic intensity
 - Jockeying

Section—B

(Long Answer Type Questions)

Note : Attempt any two questions.

2. Find the optimum solution to the following transportation problem in which the cells contain the transportation cost in rupees : 12

	W_1	W_2	W_3	W_4	W_5	Available
F_1	7	6	4	5	9	40
F_2	8	5	6	7	8	30
F_3	6	8	9	6	5	20
F_4	5	7	7	8	6	10
Required	30	30	15	20	5	100 (Total)

3. Solve the following LPP by Simplex method : 12
- Minimize :

$$z = x_1 - 3x_2 + 2x_3$$

Subject to :

$$3x_1 - x_2 + 2x_3 \leq 7$$

$$-2x_1 + 4x_2 \leq 12$$

$$-4x_1 + 3x_2 + 8x_3 \leq 10$$

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

4. (a) A manufacturer of a line of patent medicine is preparing a production plan on medicine A and B. There are sufficient ingredients available to make 20000 bottles of medicine A and 40000 bottles of medicine B, but there are only 45000 bottles into which either of the medicine can be put. Furthermore, it takes 3 hours to prepare enough material to fill 1000 bottles of A and 1 hour to prepare enough material to fill 1000 bottles of B and there are 66 hours available for this operation. The profit is ₹ 8 per bottle of medicine A and ₹ 7 per bottle of medicine B. Formulate the problem as a LPP. 7

- (b) Solve the following LPP by graphical method : 5
Max. :

$$z = 5x_1 + 7x_2$$

Subject to :

$$x_1 + x_2 \leq 4$$

$$3x_1 + 8x_2 \leq 24$$

$$10x_1 + 7x_2 \leq 35$$

and non-negative conditions $x_1 \geq 0, x_2 \geq 0$.

5. A company has one surplus truck in each of the cities A, B, C, D and E and one deficit truck in each of the cities 1, 2, 3, 4, 5 and 6. The distance between the cities in kilometre is shown in the matrix. Find the assignment of trucks from cities in surplus to cities in deficit so that the total distance covered by vehicles is minimum : 12

	1	2	3	4	5	6
A	12	10	15	22	18	8
B	10	18	25	15	16	12
C	11	10	3	8	5	9
D	6	14	10	13	13	12
E	8	12	11	7	13	10

Section—C

(Long Answer Type Questions)

Note : Attempt any two questions.

6. (a) Give Johnson's procedure for determining and optimal sequence for processing n jobs as two machines. 5
- (b) There are seven jobs, each of which has to go through the machines A and B in the order AB. Processing time in hours are given as : 7

Job	Machine A	Machine B
1	3	8
2	12	10
3	15	10
4	6	6
5	10	12
6	11	1
7	9	13

Determine a sequence of these jobs that will minimize the total elapsed time T.

7. In a store with one server, 9 customers arrive on an average of 5 minutes. Service is done for 10 customers in 5 minutes. Find : 12

- (i) Average number of customer in the system.
- (ii) The average queue length.
- (iii) Average time a customer spends in the store.
- (iv) The average time a customer waits before being served.

8. (a) Why is replacement of items required ?
Distinguish between individual replacement and group replacement policies. 5

- (b) The maintenance cost and resale value per year of a machine whose purchase price is ₹ 7,000 give below : 7

Year	Maintenance Cost (in ₹)	Resale Value (in ₹)
1	900	4,000
2	1,200	2,000
3	1,600	1,200
4	2,100	600
5	2,800	500
6	3,700	400
7	4,700	400
8	5,900	400

When should the machine be replaced ?

9. A manufacturer has to supply 12000 units of a product per year to his customer. The demand is fixed and known and shortage cost is assumed to be infinite. The inventory holding cost is ₹ .20 per unit per month and set up cost is ₹ 350. Determine :

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- (i) Optimum run size q_0 .
- (ii) Optimum scheduling period t_0 .
- (iii) Minimum total variable yearly cost.