

Roll No. 0802502

**BCA-404(N)**

**B. C. A. (Fourth Semester)  
EXAMINATION, May, 2018**

**(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) What is the role of OR in decision-making ?
- (B) Explain the following terms in context of queuing problem :
  - (i) Service Discipline
  - (ii) Service Channel
- (C) Explain briefly the following :
  - (i) Carrying cost
  - (ii) Set-up cost

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(D) Solve graphically the following LPP :

Max. :

$$z = 5x_1 + 7x_2$$

Subject to the constraints :

$$x_1 + x_2 \leq 4$$

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

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

and non-negative conditions are  $x_1, x_2 \geq 0$ .(E) Convert the LPP into standard form :  
Maximize :

$$z = 3x_1 + 2x_2$$

Subject to the constraints :

$$3x_1 + 2x_2 \leq 6$$

$$x_1 - x_2 \geq -1$$

$$x_1 + 2x_2 \geq 1$$

and  $x_1, x_2 \geq 0$ .

(F) Explain the following terms :

(i) Incoming and outgoing vector

(ii) Slack and surplus variable

(G) Write the dual of the following LPP :  
Maximize :

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

Subject to the constraints :

$$3x_1 + x_2 + x_3 \leq 12$$

$$x_1 + 2x_2 + 4x_3 \leq 20$$

$$2x_1 + 5x_2 - x_3 \leq 18$$

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

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| 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         | 3         |

Determine a sequence of these jobs that will minimize the total elapsed time T. Also find T and idle time for machines A and B.

9. A company has two grades of inspector I and II who are to be assigned for a quality control inspection. It is required that at least 2000 pieces be inspected per 8-hours day. Grade I inspector can check pieces at the rate of 50/hour with an accuracy of 97%. Grade II inspector can check pieces at the rate of 40/hour with an accuracy of 95%. The wage rate of grade I inspector is ₹ 4.50/hour and that of grade II is ₹ 2.50/hour. Each time an error is made by an inspector, the cost to the company is one rupee. The company has available for the inspection job 10 grade I and 5 grade II inspector. Formulate the problem to minimize total cost of inspection.

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Subject to :

$$2x_1 + 3x_2 \leq 8$$

$$2x_2 + 5x_3 \leq 10$$

$$3x_1 + 2x_2 + 4x_3 \leq 15$$

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

3. A branch of Punjab National Bank has only one typist. Since the typing work varies in length (number of pages to be typed), the typing rate is randomly distributed approximating a Poisson distribution with mean service rate of 8 letters per hour. The letters arrive at a rate of 5 per hour during the entire 8-hour work day. If the typewriter is valued at ₹ 1.50 per hour, determine :

- (i) Equipment utilization
- (ii) The per cent time that an arriving letter has to wait.
- (iii) Average system time.
- (iv) Average cost due to waiting on the part of typewriter i.e. it remaining idle.

4. The following table gives the cost of transporting material from supply point A, B, C and D to demand points E, F, G, H and I :

|      |   | To |    |    |    |    |
|------|---|----|----|----|----|----|
|      |   | E  | F  | G  | H  | I  |
| From | A | 8  | 10 | 12 | 17 | 15 |
|      | B | 15 | 13 | 18 | 11 | 9  |
|      | C | 14 | 20 | 6  | 10 | 3  |
|      | D | 13 | 19 | 7  | 6  | 12 |

40 10 50 210 120  
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The present allocation is as follows :

A to E 90, A to F 10, B to F 150, C to F 10, C to G 50, C to I 120, D to H 210, D to I 70.

Find if this allocation is optimum. If not find and optimum schedule.

5. A car hire company has one car at each of five depots  $a, b, c, d$  and  $e$ . A customer requires a car in each town, namely A, B, C, D and E. Distance (in kms) between depots (origins) and towns (destinations) are given in the following distance matrix :

|   | $a$ | $b$ | $c$ | $d$ | $e$ |
|---|-----|-----|-----|-----|-----|
| A | 160 | 130 | 175 | 190 | 200 |
| B | 135 | 120 | 130 | 160 | 175 |
| C | 140 | 110 | 155 | 170 | 185 |
| D | 50  | 50  | 80  | 80  | 110 |
| E | 55  | 35  | 70  | 80  | 105 |

How should cars be assigned to customers so as to minimize the distance travelled ?

Section—C

(Long Answer Type Questions)

Note : Attempt any two questions. Each question carries 12 marks.

6. A particular item has a demand of 9000 units/year. The cost of one procurement is ₹ 100 and holding cost per unit is ₹ 2.40 per year. The replacement is instantaneous and no shortage allowed. Determine :

- (i) The economic lot size

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- (ii) The number of orders per year  
 (iii) The time between orders  
 (iv) The total cost per year if the cost of one unit is ₹ 1.
7. The purchase price of a machine is ₹ 52,000. The installation charges amount to ₹ 14,400 and its scrap value in any only ₹ 6,400. The maintenance cost in various years is given below :

| Year | Maintenance cost (₹) |
|------|----------------------|
| 1    | 1,000                |
| 2    | 3,000                |
| 3    | 4,000                |
| 4    | 6,000                |
| 5    | 8,400                |
| 6    | 11,600               |
| 7    | 16,000               |
| 8    | 19,200               |

After how many years the machine be replaced ?  
 Assume that the machine replacement can be done only at the year ends.

8. (a) Give Johnson's procedure for determining an optimal sequence for processing jobs on 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 : 10

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- (H) Solve the following minimal assignment problem :

|     | Job | Man |    |    |    |
|-----|-----|-----|----|----|----|
|     |     | I   | 2  | 3  | 4  |
| I   |     | 12  | 30 | 21 | 15 |
| II  |     | 18  | 33 | 9  | 31 |
| III |     | 44  | 25 | 24 | 21 |
| IV  |     | 23  | 30 | 28 | 14 |

- (I) Find an initial BFS of the following transportation problem by lowest cost entry method :

|                       | Factory | Warehouse      |                |                |                | Factory Capacity |
|-----------------------|---------|----------------|----------------|----------------|----------------|------------------|
|                       |         | W <sub>1</sub> | W <sub>2</sub> | W <sub>3</sub> | W <sub>4</sub> |                  |
| F <sub>1</sub>        |         | 19             | 30             | 50             | 10             | 7                |
| F <sub>2</sub>        |         | 70             | 30             | 40             | 60             | 9                |
| F <sub>3</sub>        |         | 40             | 8              | 70             | 20             | 18               |
| Warehouse Requirement |         | 5              | 8              | 7              | 14             | 34               |

## Section—B

## (Long Answer Type Questions)

Note : Attempt any two questions. Each question carries 12 marks.

2. Solve the following LPP by Simplex method :

Maximize :

$$z = 3x_1 + 5x_2 + 4x_3$$

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