Roll No. .....

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

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

(H) Solve the following minimal assignment problem :

		Man			
		1	2	3	4
Job	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 :

		Warehouse				Factory Capacity
		W_1	W_2	W_3	W_4	
Factory	F_1	19	30	50	10	7
	F_2	70	30	40	60	9
	F_3	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 :

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

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

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

(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 times in hours are given as : 10

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.

