

Roll No.

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BCA-404(N)

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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

(B-53) P. T. O.

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

(B-53)

(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. http://csjmuonline.com

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 time 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.