

D  
(20525)  
BCA-IV Sem.

Roll No.

**18019**

**B.C.A. Examination, May-2025**

**Optimization Techniques**

**(BCA-404)**

*Time : Three Hours ] [Maximum Marks : 75*

**Note :** Attempt **all** the sections as per instructions.

**Section-A**

**(Very Short Answer Type Questions)**

**Note :** Attempt **all** the **five** questions. Each question carries **3** marks. Very short answer is required not exceeding **75** words.  $3 \times 5 = 15$

1. Explain holding and shortage costs in an inventory model.
2. In the classical queue system  $(M|M|1) : (GD|\infty|\infty)$ , let  $\lambda$  is arrival rate and  $\mu$  is departure rate. Find out the expected queue length.

**P.T.O.**

3. Write down a mathematical model for transportation problem in optimization theory. Why this model can not be solved by using Simplex method?
4. Explain the principal assumption made while dealing with job sequencing problems.
5. Explain replacement problem with an example.

**Section-B**

**(Short Answer Type Questions)**

**Note :** Attempt any **two** questions out of the following **three** questions. Each question carries **7.5** marks. Short answer is required not exceeding **200** words.  $7.5 \times 2 = 15$

6. In the classical queue system  $(M|M|1) : (GD|\infty|\infty)$ , derive the following expressions for different parameters.
  - (a) Expected number of customers in the system.
  - (b) Expected number of customers in the queue.
  - (c) The probability that at least k customers are in the system.

**18019/2**

7. Solve the following linear programming problem by graphical method.

$$\text{Maximize } z = -x_1 + 2x_2$$

subject to

$$-x_1 + x_2 \leq 1,$$

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

$$x_1, x_2 \geq 0.$$

8. A company wants to replace an existing machine whose cost price is Rs. 17,500 and the scrap value is Rs. 500. The maintenance costs (in Rs.) are as follows:

Years	Maintenance cost (Rs.)
1	200
2	300
3	3500
4	1200
5	1800
6	2400
7	3300
8	4500

What should the machine be replaced?

### Section-C

#### (Long Answer Type Questions)

**Note :** Attempt any **three** questions out of the following **five** questions. Each question carries **15** marks. Answer is required in detail.  $15 \times 3 = 45$

9. In a barber's shop with a single barber, there are three chairs. Out of these one chair is for hair cutting and the other two for waiting inside the shop. If there are more than three customers in the shop at any time then three will occupy the chairs and rest wait outside. The customers come according to Poisson distribution with average two customers per hours. The service time  $T$  (per customer) is exponentially distributed with mean 20 minutes.
- (a) Find the probability that an arriving customer has to wait outside the shop.
- (b) Find the probability that an arriving customer gets a chair to sit.

18019/3

P.T.O.

18019/4

- (c) How long is an arriving customer expected to wait before start of service?
- (d) How many chairs should be provided so that arriving customer can wait on the chair at least 25 percent of the time?

10. Following failure rates have been observed for a certain type of light.

Week :	1	2	3	4	5
Percent failing by the end of week :	10	25	50	80	100

There are 1000 bulbs in use, and it costs Rs. 10 to replace an individual bulb which has burn out. If all bulbs were replaced simultaneously it would cost Rs. 4 per bulb. It is proposed to replace all bulbs at fixed intervals of time, whether or not they have burnt out, and to continue replacing burnt out bulbs as and when they fail. At what group replacement price per bulb would a policy of strictly individual replacement become preferable to the adopted policy?

18019/5

P.T.O.

11. Using Vogel's approximation method, find the initial basic feasible solution of the following transportation problem given in the standard notation:

		D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	Available
	s <sub>1</sub>	5	2	4	3	60
Sources	s <sub>2</sub>	6	4	9	5	60
	s <sub>3</sub>	2	3	8	1	90
	Requirement	50	65	65	30	210

Further, use the stepping tone method to find the optimal solution if the basic feasible solution obtained is not optimal.

12. We have five jobs, each of which must go through the two machines A and B in order AB. Processing times in hours are given in the table below:

Job	1	2	3	4	5
Machine-A	5	1	9	3	10
Machine-B	2	6	7	8	4

Determine sequence for the five jobs that will minimize the elapsed time T.

18019/6

13. The arrival rate of an item is 80 items per day and the demand occurs at a rate of 50 items per day. The ordering cost is Rs. 200 per order. The holding costs are Rs. 2 per unit per day and the shortage costs are Rs. 1 per unit per day. Find the economic lot size. Find also optimal maximum shortage level allowed and reorder point if the lead time is 6 days.