

**E 6163**



Reg. No.....

Name.....

**B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, SEPTEMBER 2024**

**Sixth Semester**

Choice Based Course—OPERATIONS RESEARCH

(For B.Sc. Mathematics Model I)

[Prior to 2013 Admissions]

Time : Three Hours

Maximum Weight : 25

**Part A**

*Answer all questions.*

*A bunch of **four** questions carries a weight 1.*

- I. 1 Define a convex set.
- 2 What is the standard basis for  $\mathbb{R}^n$ .
- 3 What is a polytope ?
- 4 Is intersection of convex sets again a Convex set.
- II. 5 Define the term objective function.
- 6 Define the term feasible solution of a L.P.P.
- 7 What are artificial variables ?
- 8 What is a degenerate solution ?
- III. 9 Define the term loop in a transportation table.
- 10 What is a balanced transportation problem ?
- 11 Write a necessary and sufficient condition for the existence of a feasible solution to the transportation problem.
- 12 What is a degenerate transportation problem ?





- IV. 13 What is Queue discipline ?
- 14 What is traffic intensity ?
- 15 Define the term transient state.
- 16 Explain the term service time.

(4 × 1 = 4)

**Part B**

*Answer any five questions.  
Each question carries a weight of 1.*

- 17 Given the hyperplane  $3x_1 + 2x_2 + 4x_3 + 6x_4 = 7$ . Find in which half space is the point  $x = (6, 1, 7, 2)$ .
- 18 Is the set  $A = \{(x_1, x_2) / x_1, x_2 \leq 1, x_1 \geq 0, x_2 \geq 0\}$  a convex set. Justify.
- 19 How many basic feasible solutions are there to a given system of 3 simultaneous linear equations in 4 unknowns.
- 20 How do you resolve the problem of equalities in constraints in a L.P.P ?
- 21 Discuss the duality in linear programming.
- 22 State a transportation problem. When does it have a unique solution ?
- 23 What assumptions are made while formulating an assignment model.
- 24 Explain the terms input and holding time associated with a queueing model.

(5 × 1 = 5)

**Part C**

*Answer any four questions.  
Each question carries a weight 2.*

- 25 Solve graphically the problem :

$$\text{Maximize } z = 3x_1 + 2x_2$$

subject to the constraints :

$$x_1 - x_2 \leq 1$$

$$x_1 + x_2 \geq 3, \quad x_1, x_2 \geq 0.$$





26 What are the essential characteristics of a linear programming model ?

27 Use simplex method to solve the following linear programming problem.

Maximize  $z = 2x_1 + x_2$

subject to the constraints :

$x_1 - 2x_2 \leq 10$

$x_1 + x_2 \leq 6$

$x_1 - x_2 \leq 2$

$x_1 - 2x_2 \leq 1$

$x_1, x_2 \geq 0.$

28 Show that dual of the dual is the primal.

29 Determine an initial basic feasible solution to the following transportation problem using north-west corner rule.

		<i>To</i>						
		3	4	6	8	9	20	
<i>From</i>	2	10	1	5	8	30	<i>Available</i>	
	7	11	20	40	3	15		
	2	1	9	14	16	13		
	40	6	8	18	6			
		<i>Demand</i>						

30 Explain the concept of (a) Bulk Queues ; and (b) Regeneration points.

(4 × 2 = 8)





**Part D**

*Answer any two questions.  
Each question carries a weight 4.*

31 Use dual simplex method to solve the L.P.P.

Maximize  $z = 2x_1 + x_2 + x_3$

subject to the constraints :

$$4x_1 + 6x_2 + 3x_3 \leq 8$$

$$x_1 - 9x_2 + x_3 \leq -3$$

$$-2x_1 - 3x_2 + 5x_3 \leq -4$$

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

32 Solve the following assignment problem and find the minimum assignment cost :

	<i>Jobs</i>			
<i>Persons</i>	1	2	3	4
A	10	12	19	11
B	5	10	7	8
C	12	14	13	11
D	8	15	11	9

- 33 (a) Write a note on Birth-Death process in Queueing theory.  
(b) Describe the applications of Queueing theory to industry.

(2 × 4 = 8)

