# B.Sc.- III (CBCS Pattern) Sem-VI 021B - Mathematics-III - DSE-VII : Linear Programming and Transportation Problems

P. Pages : 4 Time : Three Hours			<b>GUG/W/22/13364</b> Max. Marks : 60	
	Not	tes : 1. Solve <b>all the five</b> questions. 2. All questions carry equal marks.		
		UNIT – I		
1.	a)	Obtain an initial feasible solution of the following: $2x_1 + x_3 \ge 5$ $5x_1 - 2x_3 \ge -3$ $3x_1 + x_2 - 7x_3 = 16$	6	
	b)	Express the following L.P. problem in the matrix standard form. Minimize : $Z = x_1 + 2x_2 + 3x_3$ Subject to : $3x_1 + 4x_3 \le 5$ $5x_1 + x_2 + 6x_3 = 7$ $8x_1 + 9x_3 \ge 2$ With : $x_1, x_2, x_3 \ge 0$	6	
		OR		
	c)	Put the following Linear program in its standard form with non-negative variables: Minimize : $Z = 25x_1 + 30x_2$ Subject to : $4x_1 + 7x_2 \ge 1$ $8x_1 + 5x_2 \ge 3$ $6x_1 + 9x_2 \ge 2$ With : $x_1, x_2$ unrestricted in sign.	6	
	d)	Prove that Intersection of any two convex set is also a convex set.	6	
		UNIT – II		
2.	a)	Solve the following LP problem by simply method Maximize : $Z = 3x_1 + 4x_2$ Subject to : $2x_1 + x_2 \le 6$	6	

With

 $2x_1 + 3x_2 \leq 9$ 

:  $x_1, x_2 \ge 0$ 

b) Use two phase method to solve the LPP.

Minimize :  $Z = x_1 + 2x_2$ Subject to :  $x_1 + 3x_2 \ge 11$  $2x_1 + x_2 \ge 9$ With :  $x_1, x_2 \ge 0$ 

#### OR

c) Solve the linear program by Big-M method.  
Maximize : 
$$Z = 4x_1 + 5x_2 - 3x_3$$
  
Subject to :  $x_1 + x_2 + x_3 = 10$   
 $x_1 - x_2 \ge 1$   
 $2x_1 + 3x_2 + x_3 \le 30$   
With :  $x_1, x_2, x_3 \ge 0$ 

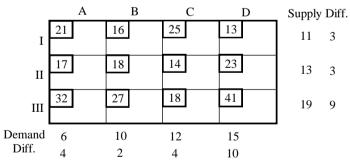
d) Determine the symmetric dual of the L.P. problem

Maximize : 
$$Z = 5x_1 + 2x_2$$
  
Subject to :  $6x_1 + x_2 \ge 6$   
 $4x_1 + 3x_2 \ge 12$   
 $x_1 + 2x_2 \ge 4$   
With :  $x_1, x_2 \ge 0$ 

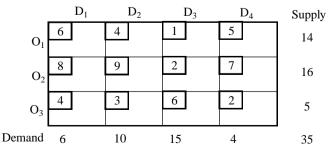
Also solve the dual directly and hence verify that if a dual problem has no feasible solution, then its primal have a feasible solution but not optimal.

#### UNIT – III

**3.** a) Determine an initial basic feasible solution to the following transportation problem using **6** Vogel's method.



b) Determine an initial basic feasible solution to the following transportation problem using 6 north – west corner rule.



2

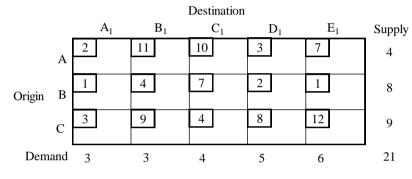
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6

Warehouse Factory	<b>W</b> <sub>1</sub>	<b>W</b> <sub>2</sub>	<b>W</b> <sub>3</sub>	$W_4$	Factory Capacity
$\mathbf{F}_1$	19	30	50	10	7
$F_2$	70	30	40	60	9
F <sub>3</sub>	40	8	70	20	18
Warehouse requirement	5	8	7	14	34

c) Find the initial basic feasible solution of the transportation problem by least cost method.

d) Determine an initial basic feasible solution to the following transportation problem. Using 6
 Vogel's approximation method.





4. a) Maximize  $Z = x(5\pi - x)$  on [0, 20].

b) Find all local and global optima for 
$$f(x) = x + \frac{1}{x}$$
 on  $(0, \infty)$ .

#### OR

- c) Define concave function Show that  $f(x) = x^3 - 6x^2 + 9x + 6$  is strictly concave on  $(-\infty, 2)$  and strictly convex on  $(2, \infty)$
- d) HMT Ltd. decide to make four subassemblies through four contractors. Each contractor is to receive only one subassembly. The cost of each subassembly is determined by the bids submitted by each contractor and is shown in the following table in hundreds of rupees. Assign the different subassemblies to contractors to minimize the total cost.

	Contractors				
	1	2	3	4	
1	15	13	14	17	
Subassembly <sup>2</sup>	11	12	15	13	
3 3 3 Subasseniibiy	13	12	10	11	
4	15	17	14	16	

3

6

6

6

## Attempt any six.

Write general form of LPP.		
Define surplus variable.	2	
Obtain the symmetric dual of LPP.         Maximize : $Z = 12x_1 + 26x_2 + 80x_3$ Subject to : $2x_1 + 6x_2 + 5x_3 \ge 4$ $4x_1 + 2x_2 + x_3 \ge 10$ $x_1 + x_2 + 2x_3 \ge 6$ With       : $x_1, x_2, x_3 \ge 0$	2	
What is the condition for optimality in simplex table?	2	
Define feasible solution to Transportation problem.	2	
State the mathematical formulation of transportation problem.	2	
Define global maximum.	2	
What is an assignment problem?	2	
	Define surplus variable. Obtain the symmetric dual of LPP. Maximize : $Z = 12x_1 + 26x_2 + 80x_3$ Subject to : $2x_1 + 6x_2 + 5x_3 \ge 4$ $4x_1 + 2x_2 + x_3 \ge 10$ $x_1 + x_2 + 2x_3 \ge 6$ With : $x_1, x_2, x_3 \ge 0$ What is the condition for optimality in simplex table? Define feasible solution to Transportation problem. State the mathematical formulation of transportation problem. Define global maximum.	

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