

**BACHELOR OF TECHNOLOGY (CBCS) (2020 COURSE)**  
**B.Tech.Sem - VII COMPUTER SCIENCE & ENGINEERING : SUMMER : 2024**  
**SUBJECT: OPTIMIZATION TECHNIQUES**

Day : Thursday  
Date : 09/05/2024

S-24343-2024

Time : 02:30 PM-05:30 PM  
Max. Marks : 60

**N.B.**

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Assume suitable data if necessary.
- 4) Use of non-programmable calculator is allowed.

**Q.1** Suppose in a hospital, it is decided that each patient should be given at least 3, 4, 5 units of nutrients say A, B, C respectively. Suppose there are 4 foods say  $f_1, f_2, f_3$  and  $f_4$  available, let the following table shows the nutrients A, B, C present per unit in the foods  $f_1, f_2, f_3$  and  $f_4$ . (10)

Nutrients	Foods				Stage capacity min/day
	$f_1$	$f_2$	$f_3$	$f_4$	
A	0.5	1	3	1.5	3
B	1	2	0	2.5	4
C	2	1.5	0.5	0	5

Suppose the cost per unit of foods  $f_1, f_2, f_3$  and  $f_4$  is ₹ 1, ₹ 2, ₹ 3, ₹ 0.5 respectively. The problem is to find the best diet that can be supplied at minimum cost, satisfying the daily, requirements of the patient. Formulate this into mathematical model.

OR

Explain advantages of linear programming techniques.

**Q.2** Solve the following by graphical method (10)

Maximize  $Z = 3000x + 2000y$

Subject to  $x + 2y \leq 6$

$2x + y \leq 8$

$y \leq 2$

$x - y \geq -1$

$x \geq 0, y \geq 0$

OR

Solve the following L.P.P. by simplex method

Minimize  $Z = x_1 - 3x_2 + 2x_3$

Subject to  $3x_1 - x_2 + 3x_3 \leq 7$

$-2x_1 + 4x_2 \leq 12$

$-4x_1 + 3x_2 + 8x_3 \leq 10$

$x_1, x_2, x_3 \geq 0$

P.T.O.

- Q.3 Carry out maximum five iterations of the following problem using method of steepest descent method. (10)  
 Assume  $X^0 = 0$   
 Minimize  $f(x_1, x_2) = x_1 - x_2 + x_1^2 - x_1 x_2$ .

OR

Solve graphically the following non-linear programming problem  
 Maximize  $Z = 2x_1 + 3x_2$   
 Subject to constraints,  
 i)  $x_1^2 + x_2^2 \leq 20$       ii)  $x_1 \cdot x_2 \leq 8$   
 and  $x_1, x_2 \geq 0$

- Q.4 Use dynamic programming to solve the following problem: (10)  
 Maximize  $Z = 3x_1 + 5x_2$   
 Subject to constraint  
 i)  $x_1 \leq 4$     ii)  $x_2 \leq 6$     iii)  $3x_1 + 2x_2 \leq 18$  and  $x_1, x_2 \geq 0$ .

OR

Determine the values of  $U_1, U_2$  and  $U_3$  so as to  
 Maximize  $Z = U_1 \cdot U_2 \cdot U_3$   
 Subject to constraints,  
 $U_1 + U_2 + U_3 = 10$  and  $U_1, U_2, U_3 \geq 0$

- Q.5 Solve the following integer linear programming problem to get optimal solution of the problem, by using the cutting plane algorithm, (10)  
 Maximize  $Z = 2x_1 + 20x_2 - 10x_3$   
 Subject to constraint  
 i)  $2x_1 + 20x_2 + 4x_3 \leq 15$   
 ii)  $6x_1 + 20x_2 + 4x_3 = 20$   
 $x_1, x_2, x_3 \geq 0$  and are integers.

OR

Describe the following terms in Gomory's all integer programming algorithm:

- i) Initialization      ii) Test of optimality  
 iii) Generation of cutting plane    iv) Obtaining new situation
- Q.6 Define the union and intersection of two fuzzy sets, A and B. Explain complement of fuzzy set with Venn diagram. (10)

OR

Convert the following problem into separable form  
 Minimize  
 $f(x_1, x_2) = 5e^{4x_1 + x_2} + 10x_2^2$   
 Subject to  $10x_1 x_2 + 15x_2^2 = 100$   
 $x_1 \geq 0, x_2 > 0$

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