2024
SRMUJ
3rd Semester Examination
M. Sc.
Mathematics
MTM-305(B)
Special Paper-OR: Advanced Optimization-I

Full Marks: 40 **Time: 2 Hours**

The figures in the margin indicate full marks. Candidates are required to give their answers as far as practicable. Notations used here have their usual meaning.

1. Answer any four of the following questions: **2 × 4**

(a) What are the basic differences between the Fibonacci and Golden section search methods.

(b) State whether the following function is a polynomial, posynomial or both $f = 4 + 2x_1^2 x_2^{-1} + 3x_2^{-4} + 5x_1^{-1}x_2^3$.

(c) Find the conjugate directions for the matrix $\begin{bmatrix} 4 & 5 \\ 5 & 4 \end{bmatrix}$.

(d) What is the general mathematical form of geometric programming problem? Write its necessary and sufficient conditions for optimality.

(e) What are the sufficient conditions of quadratic programming problem?

(f) What's are the differences of feasible solutions between Linear programming problems and Goal programming problems?

2. Answer any four of the following questions: **8 × 4**

(a) Following is the optimal solution of an LPP

		c_j	4	6	2	0	0
c_B	x_B	b	y_1	y_2	y_3	y_4	y_5
4	x_1	1	1	0	-1	$\frac{4}{3}$	$-\frac{1}{3}$
6	x_2	2	0	1	2	$-\frac{1}{3}$	$\frac{1}{3}$
$z_j - c_j$		16	0	0	6	$\frac{10}{3}$	$\frac{2}{3}$

(i) If the cost coefficient c_1 changes to 8, then find the optimal basic feasible solution of the modified problem.

(ii) Find the optimal basic feasible solution after adding a new constraint $2x_1 + x_2 \leq 3$ in the above optimal table. 3 + 5

(b) Solve the LPP by revised simplex method

$$\text{Maximize } Z = 5x_1 + 3x_2$$
$$\text{subject to } 3x_1 + 5x_2 \leq 15$$
$$5x_1 + 2x_2 \leq 10$$
$$x_1, x_2 \geq 0 .$$ 8

(c) Solve the following integer programming problem using branch and bound method.

$$\text{Maximize } Z = 2x_1 + 3x_2$$
$$\text{subject to } 6x_1 + 5x_2 \leq 25$$
$$x_1 + 3x_2 \leq 10$$
and x_1, x_2 are non-negative integers. 8

(d) Apply Wolf's method to solve the quadratic programming problem:

$$\text{Maximize } Z = 4x_1 + 6x_2 - 2x_1^2 - 2x_1x_2 - 2x_2^2$$
$$\text{subject to } x_1 + 2x_2 \leq 2$$
$$x_1, x_2 \geq 0.$$ 8

(e) Solve the following IPP using Gomory's cutting plane method

$$\text{Maximize } z = 5x_1 + 7x_2$$
$$\text{subject to } -2x_1 + 3x_2 \leq 6$$
$$6x_1 + x_2 \leq 30$$
$$x_1, x_2 \geq 0 \text{ and integers.}$$ 8

(f) The optimal solution of the LPP

$$\text{Maximize } Z = 6x_1 - 2x_2 + 3x_3$$
$$\text{subject to } 2x_1 - x_2 + 2x_3 \leq 2$$
$$x_1 + 4x_3 \leq 4$$
$$x_1, x_2, x_3 \geq 0.$$

Contained in the following table

C_B	y_B	x_B	y_1	y_2	y_3	y_4	y_5
6	y_1	4	1	0	4	0	1
-2	y_2	6	0	1	6	-1	2
	$z_j - c_j$	Z=12	0	0	9	2	2

Find the ranges of the cost components when (i) changed one at a time (ii) changed two at a time (iii) changed all three at a time to keep the optimal solution same. 8