

1. Solve the following problem manually by simplex method.

$$\text{Max } 3x_1 + 5x_2 + 4x_3 \text{ s.to } 2x_1 + 3x_2 \leq 8, 2x_2 + 5x_3 \leq 10, 3x_1 + 2x_2 + 4x_3 \leq 15, x_1, x_2, x_3 \geq 0$$

$$\text{Ans: } (x_1 = 89/41, x_2 = 50/41, x_3 = 62/41), \text{ max} = 765/41$$

2. Write C program for simplex method to solve a general linear programming problem:

$$\text{Maximize } c_1x_1 + c_2x_2 + \dots + c_nx_n$$

subject to

$$a_{11}x_1 + a_{12}x_2 + \dots + a_{1n}x_n \leq b_1$$

$$a_{21}x_1 + a_{22}x_2 + \dots + a_{2n}x_n \leq b_2$$

.....

$$a_{m1}x_1 + a_{m2}x_2 + \dots + a_{mn}x_n \leq b_m$$

$$\text{where } b_i \geq 0, i = 1, 2, \dots, m, x_j \geq 0, j = 1, 2, \dots, n, m \leq n$$

Out put:

(I) Optimal Solution, Optimal value

(II) Solution is Unbounded (If $z_j - c_j < 0$ corresponding to some non basic column and corresponding column element $x_{ij} \leq 0$ for all $i = 1, 2, \dots, m$.)

(III) Optimal Solution, Alternate solution exists: ((i) If there is an optimal basic feasible solution to a LPP and for some non basic column $z_j - c_j = 0$ and corresponding $x_{ij} < 0 \forall i$ then nonbasic alternate optimum solution will exist. (ii) If there is an optimal basic feasible solution to a LPP and for some non basic column $z_j - c_j = 0$ and corresponding $x_{ij} > 0$ for at least one $i = 1, 2, \dots, m$ then basic alternate optimum solution will exist.)

3. Using this C program find the solution of the following problems.

$$(i) \text{ max } 2x_1 + 4x_2 + x_3 + x_4 \text{ s.to } x_1 + 3x_2 + x_4 \leq 4, 2x_1 + x_2 \leq 3, x_2 + 4x_3 + x_4 \leq 3, x_j \geq 0$$

$$(ii) \text{ min } -3x_1 - 4x_2 \text{ s.to } x_1 - x_2 \leq 1, -x_1 + x_2 \leq 2, x_1, x_2 \geq 0$$