Design and Analysis of Algorithms : Assignment 4

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Problem

The given problem is to implement the revised simplex algorithm from the simplex algorithm present in the class and tutorial. Also using the reference from the Wikipedia.

The problem is taken from the tutorial class which is present below.

$$\text{Objective function to maximize : } Z = 4x1 + 3x2$$
$$\text{Given linear constraints are}$$
$$2x1 + 3x2 \leq 6$$
$$-3x1 + 2x2 \leq 3$$
$$2x2 \leq 5$$
$$2x1 + x2 \leq 4$$
$$x1, x2, x3, x4 \geq 0$$

Solution

Revised simplex algorithm is differs from simplex algorithm, and had many improvements. I have not directly used the Wikipedia reference but a slightly different version of it. I gathered resources from different sources and came up with this solution. I am not explaining my algorithm in detail, and the code is self explanatory, which is heavily commented.

Overview of algorithm

1. Convert the problem to standard form
2. Find the initial basis
3. Form the matrices from the linear equations given.
4. Compute $(C_B B^{-1}, 1)$; if all elements are positive or zeros then optimal solution found
5. Compute $X_k = B^{-1} * a_k$; if all elements ≤ 0 then its an unbounded solution
6. Compute $X_B = B^{-1} * b$;
7. Form the revised simplex table find the entering basis and leaving basis.
8. B^{-1} row transformations
9. Repeat from step 4 until an optimal solution or stopping condition is reached.

Code can also be found here : Assignment4

Final Output

For the given problem the optimal solution found the revised simplex algorithm is

$$Z = 4x1 + 3x2$$
optimal values for x1 = 1.5 and x2 =1
$$Z = 4 * 1.5 + 3 * 1 = 9$$

The maximum value for the given objective function subject to given linear constraints is Z = 9.