Simplex Algorithm Implementation

This README document explains the implementation of the simplex algorithm to solve linear programming problems by maximization of the objective function. The program takes a CSV file (testcases) as input and outputs the sequence of vertices visited and the corresponding value of the objective function at that vertex.

Problem Statement :

Implement the simplex algorithm to maximize the objective function with respect to the constraints mentioned for each assignment. The input and output formats are as follows:

Input :

A CSV file with (m+1) rows and (n+1) columns:

- The first row (excluding the last element) represents the cost vector (c) of length (n).
- The last column (excluding the top element) represents the constraint vector (b) of length (m).
- Rows 2 to (m + 1) and columns 1 to (n) form the matrix (A) of size (m x n).

Output :

- The sequence of vertices visited during the simplex process.
- The value of the objective function at each vertex.

Assignments and Assumptions

Assignment 1

Assumptions:

- The polytope is non-degenerate.
- The polytope is bounded.
- The rank of matrix (A) is (n).

Test Cases and Observations:

- **Input**: `Test file 1` Initial feasible point, Non-degenerate, Bounded
- **Results**: Test Case 1: SUCCESS

Assignment 2

Assumptions:

- The polytope is non-degenerate.
- The rank of matrix (A) is (n).

Test Cases and Observations:

- **Input**:
  - `Test file 1` Initial feasible point, Non-degenerate, Bounded
  - `Test file 2` Initial feasible point, Non-degenerate, Unbounded
- **Results**:
  - Test Case 1: SUCCESS
  - Test Case 2: SUCCESS

Assignment 3

Assumptions:

- The rank of matrix (A) is (n).

Test Cases and Observations:

- **Input**:
  - `Test file 1` Initial feasible point, Non-degenerate, Bounded
  - `Test file 2` Initial feasible point, Non-degenerate, Unbounded
  - `Test file 3` Initial feasible point, Degenerate, Bounded
  - `Test file 4` Initial feasible point, Degenerate, Unbounded
- **Results**:
  - Test Case 1: SUCCESS
  - Test Case 2: SUCCESS
  - Test Case 3: SUCCESS
  - Test Case 4: SUCCESS

Assignment 4

Assumptions:

- The rank of matrix (A) is (n).

Test Cases and Observations:

- **Input**:
  - `Test file 5`: No initial feasible point, Non-degenerate, Bounded (all positive bounds).
  - `Test file 6`: No initial feasible point, Non-degenerate, Bounded (at least one negative bound).
  - `Test file 7`: No initial feasible point, Non-degenerate, Unbounded (all positive bounds).
  - `Test file 8`: No initial feasible point, Non-degenerate, Unbounded (at least one negative bound).
  - `Test file 9`: No initial feasible point, Degenerate, Bounded (all positive bounds).

Results:

- Test Case 5: SUCCESS
- Test Case 6: SUCCESS
- Test Case 7: SUCCESS
- Test Case 8: SUCCESS
- Test Case 9: SUCCESS

How to Use the Programs :

1. First generate some test cases for the input in CSV file according to the described format.
2. Run the program file for each assignment i (1 to 4) with the test case csv inputs by changing the name in the function.
3. The program will display the sequence of vertices visited and the objective function's values at those vertices.