



School of Computer Science
Faculty of Science
National University of Engineering

Test 3

Topics: linear programming; the Simplex method algorithm

Subject: Computational Mathematics

Period: 2020-2

1. (3 pts.) Implement a function in Python that receives a ‘tableau’, a basic \mathbf{b} and a non-basic element \mathbf{n} , and returns the resulting ‘tableau’ of conducting the process of pivoting \mathbf{b} and \mathbf{n} .
2. (3 pts.) Create a function in Python that receives a ‘tableau’ with $\tilde{b} \geq 0$, and returns the resulting ‘tableau’ of conducting the iteration process of the Simplex method. (Suppose that the underlying problem does have a solution.)
3. Considering the following linear optimization problem:

$$\begin{aligned} \max_{x_1, x_2} \quad & z = x_1 + 3 \cdot x_2 \\ \text{s.t.} \quad & -x_1 + x_2 \leq -1 \\ & x_1 + 2 \cdot x_2 \leq 4 \\ & x_1, x_2 \geq 0, \end{aligned}$$

- (a) (3 pts.) Conduct a geometric analysis: sketch the feasible region, sketch the level sets of the objective function and find the optimal solution.
- (b) (3 pts.) Conduct the Simplex method in Python, implement the instructions of the algorithm we have seen in class.

- (c) (1 pt.) Compare the last two items above with the result of calling a function of some library that solves LPP's.

4. Considering the following linear optimization problem:

$$\begin{aligned} \max_{x_1, x_2} \quad & z = 3 \cdot x_1 + 2 \cdot x_2 \\ \text{s.t.} \quad & -x_1 + 3 \cdot x_2 \leq 12 \\ & x_1 + x_2 \leq 8 \\ & 2 \cdot x_1 - x_2 \leq 10 \\ & x_1, x_2 \geq 0, \end{aligned}$$

- (a) (3 pts.) Conduct a geometric analysis: sketch the feasible region, sketch the level sets of the objective function and find the optimal solution.
- (b) (3 pts.) Conduct the Simplex method in Python, implement the instructions of the algorithm we have seen in class.
- (c) (1 pt.) Compare the last two items above with the result of calling a function of some library that solves LPP's.

January 13, 2021