Exercise 8 – Simplex Method

In folder for this seminar you will find a script for generating two linear programming problems (`cv9.m`). Your job is to write the simplex method to solve both of these.

- Problem 1 is a randomly generated linear programming problem in inequality form, i.e., finding the optimal $x \in \mathbb{R}^n$ such that

$$\begin{aligned} \underset{x}{\text{minimize}} \ & c^T x \\ \text{subject to} \ & A_{\text{ineq}} x \leq b_{\text{ineq}}, \\ & x \geq 0, \end{aligned}$$

  where $A \in \mathbb{R}^{m \times n}$. Transform this problem into the standard form. Since is generated in such a way that $b \geq 0$, there is no need to ude the two phase method - the starting basis will correspond to the m variables that you need to add to transform it to the standard form. Find the biggest n, m ($m = 3n$), for which you can solve the problem in 1 second (on your machine).

- Problem 2 is real-world network problem (with data saved in `problem.mat`) with the same structure as Problem 1, i.e., find $x \in \mathbb{R}^n$ such that

$$\begin{aligned} \underset{x}{\text{minimize}} \ & c^T x \\ \text{subject to} \ & A_{\text{ineq}} x \leq b_{\text{ineq}}, \\ & x \geq 0, \end{aligned}$$

  For this problem, however, some of the components of the vector b are negative - use a two phase method to solve it (you should find that after the Phase I, none of the added s variables remain in the basis, so you can completely remove them when constructing the Phase II problem.) You can visualize the network problem being solved by calling `plot_problem(problem)`, and the solution by calling `plot_problem(problem,x)`, where x is the corresponding solution.