Project — Part 1

0. **Project Rules and Advice**:

- You may work alone or in a group of at most three.
- The project is due in class on Monday, March 28.
- There should be only one submission from each group. Make sure that the names of every member of the group appear on it.
- Your finished product will be a lightly commented copy of your workspace. For a model, see **lpSolve with R.pdf** in Canvas/Files/R. You should of course include all commands, matrices, vectors etc., along with optimal solutions x^* and corresponding values of Z^*.
- The actual work of computing solutions and preparing your workspace for uploading shouldn't take more than a couple of hours. But as we all know from bitter experience, computer work often entails unexpected delays. Be sure to set aside enough time.

1. This is an introduction to linear optimization with R. You may use any package, but for this course, I think that R is a good choice. Anyone interested in probability, statistics, data management and data science should learn a bit about R.

2. If you haven't used R before, it might help to read the short introduction **R Introduction.pdf** in the folder Canvas/Files/R.

3. In the same folder you will find a sample workspace **lpSolve with R.pdf**. You may use it as a guide in solving the problems P_0 and P_1 given below. There is a lot of information about the package **lpSolve** on the internet. This is one good source among many.

4. Consider the linear program

$$(P_0)\begin{cases} \text{Maximize } Z = cx, \\ \text{Subject to: } Ax \le b, \\ x \ge 0, \end{cases}$$

where

$$A = \begin{bmatrix} 1.0 & 1.5 & 3.0 & -1.0 & 0.0 & 2.0 \\ 2.0 & 0.0 & 4.0 & 3.0 & 5.3 & 1.0 \\ 2.9 & 2.0 & -2.0 & 4.0 & 1.0 & 0.0 \\ 0.0 & 3.0 & 2.6 & 4.0 & 3.1 & 0.0 \\ 1.5 & -0.5 & 0.0 & 2.0 & 1.0 & 0.0 \end{bmatrix}, \quad b = \begin{bmatrix} 20.3 \\ 14.0 \\ 11.8 \\ 12.0 \\ 14.6 \end{bmatrix},$$

and

$$c = \begin{bmatrix} 3.0 & 2.0 & 1.4 & 2.2 & 5.0 & 2.8 \end{bmatrix}.$$

a. Give an optimal solution x^* and the corresponding value Z^* of the objective function.

b. Let P_1 be the same as P_0 with the direction of the first functional constraint changed to "$\ge$". Give an optimal solution x^* to the P_1 along with the corresponding value Z^* of the objective function.

c. The workspace should be lightly commented to help me follow your R commands. Save the workspace as a text file and then edit out errors, typos, etc., and insert any additional comments you feel are necessary. There should only be one submission per team, but each team member's name should appear on it.