MA 421 Fall 2025 (Aaron N. K. Yip)
Homework 2, due on Thursday, Sept 11th, in class

1. [V] (*Linear Programming, Foundations and Extensions*, **5th edition**)

   p.22: 2.1, 2.2, 2.5, 2.6, 2.10; p.40: 3.4.

2. [C] (*Linear Programming*, by Chvatal, uploaded in Brightspace/Content/Course Materials)

   p.9: 1.2; p.26: 2.2

3. Consider the example of cycling in [C], p.31. Apply Bland Rule to break cycling and hence find the optimal solution.

4. Consider the non-uniqueness example in [C], p.23. The description of all the optimal solutions in terms of the variables x_2 and x_5 (together with $x_3 = 0$) is not quite "satisfactory" because x_5 seems not to be one of the original variables. (The problem has three variables and three constraints. So it seems x_1, x_2, x_3 are the original variables and x_4, x_5, x_6 are the slack variables.)

   (a) Write down the original problem formulation using the variables, x_1, x_2 and x_3.

   (b) Express all the optimal solutions in terms of x_1, x_2 and x_3. (We already know that $x_3 = 0$.) Better still, plot, in the x_1x_2-plane the region corresponding to the optimal solution.

Remarks.

1. For all the problems, you need to show the intermediate steps, in terms of dictionary. Even if for two-dimensional problems which can be done much easily by graphical method, you are still required to do them using simplex method. You can do them by hand, or if you choose any software (such as the one provided by the textbook [V]), please provide appropriate screen shots.

2. Note the the similarity between problem [V] 2.10 and [C] 1.2. Do both of them using simplex method. Can you also think of another (simpler) method to solve them?