APMA1210 Midterm 1 Practice Exam

Problem 1

Consider the following LP

$$\begin{aligned} \max \quad & z = 3x_1 - 4x_2 + x_3 \\ \text{s.t.} \quad & 2x_1 - x_2 + x_3 \leq 0 \\ & x_1 + 5x_2 - 2x_3 \geq 0 \\ & x_1, x_2, x_3 \geq 0 \end{aligned}$$

Put the LP to the standard form.

Problem 2

The Joy-full Scoop ice cream company has decided to start manufacturing its trademark flavor Cookie Crash close to the stores that sell it, to minimize the cost of shipping for the delicious frozen treat. The company has built m factories, and needs to ship ice cream to n stores. Each store requires d_j containers of Cookie Crash per week, $j = 1, \ldots, n$, and each factory can produce at most p_i containers of Cookie Crash per week, $i = 1, \ldots, m$. It costs c_{ij} dollars to ship 1 container of Cookie Crash from factory i to store j. Construct a linear program that the Joy-full Scoop company could use to minimize its shipping costs while meeting demand and not exceeding production limits.

Problem 3

Consider the following LP

$$\begin{aligned} \max \quad & z = 5x_1 + 2x_2 \\ \text{s.t.} \quad & 2x_1 - x_2 \geq 2 \\ & x_1 - 3x_2 \leq 4 \\ & x_1 + x_2 \leq 7 \\ & x_1, x_2 \geq 0 \end{aligned}$$

Solve the LP by Simplex method.

Problem 4

Consider the LP in problem 3, find the dual LP. Change the direction of one of the constraints in problem 3. Will the corresponding dual LP be feasible?