MATH 354: Homework 10

Due: April 7, 2022 at 11:00 am

1. Upcoming office hours are Tuesday April 5 9-10 am (note unusual time!) and Thursday April 7 9-10 am.

2. Reading is Sections 3.4 and 3.6 in Kolman and Beck.

3. Recall that Midterm 2 is Monday April 11 in class. It will cover from the start of the simplex method through the end of our discussion of sensitivity. (This means the materials for it will wrap up in the first half of lecture on Monday April 4.) The sample midterm will be posted sometime early next week.

4. Solve the following linear programming problem without the simplex method, as follows: Set up and solve the dual problem (this is easy). Then use the principle of complementary slackness to determine what the optimal solution and optimal value of the original problem must be.

   A store has three kinds of nuts to make trail mix. Walnuts cost twelve cents per ounce and contain 6 units of protein and 3 units of iron per ounce. Pecans cost seven cents per ounce and contain 1 unit of protein and 3 units of iron. Almonds cost six cents per ounce and contain 2 units of protein and 1 unit of iron. The store wants to make the cheapest trail mix it can which contains 24 units of protein and 22 units of iron. What combination of nuts should it use?

5. Consider the chips problem from the sample midterm, which you solved using the simplex method on Homework 7 Problem 4. Use your final tableau to answer the following questions.

   a) Suppose that the profit on a kilo of chili-flavored chips falls to 8 cents per kilo (but the profit on a kilo of pizza-flavored chips remains the same). What should the manufacturer do in this case, and what is the maximal profit? What if it instead rises to 12 cents per kilo?

   b) Conversely, suppose that the profit on a kilo of pizza-flavored chips changes (but the profit on a kilo of chili-flavored chips remains fixed). What is the range of possible values this profit could take which would not change what distribution of types of chips the manufacturer should make?

   c) Suppose the availability of the packer rises to three and a half hours per day. What should the manufacturer do in this case, and what is the resulting maximal profit?

   d) Suppose the availability of the flavorer falls to two hours per day. What should the manufacturer do in this case, and what is the resulting maximal profit?

6. Consider Problem 3 from Homework 8. What is the range of values the coefficient c_1 on x_1 could take without changing the optimal solution to the problem that you found? What about the coefficient c_3 on x_3?