Assignment 16 (2/21)

Subhadip Chowdhury

- *This homework is due at the beginning of class on **Friday** 3/2. You may cite results from class as appropriate. Unless otherwise stated, you must provide a complete explanation for your solutions, not simply an answer. You are encouraged to work together on these problems, but you must write up your solutions independently.*

- *Hand in the exercises only, not the reading material item. You are encouraged to think about the exercises marked with a (⋆) or (†) if you have time, but you don't need to hand them in. If you correctly solve a (†)-marked problem, you will get a candy!*

- *Remember that you can always use the result of the previous assignment problems without proof to solve the new assignment problems.*

- *We are currently covering the Simplex Method for solving LPP*

Important Points and Reading Materials

- THE SIMPLEX METHOD

  First Read up on the algorithm from the following link:

  https://people.richland.edu/james/ictcm/2006/simplex.html

  Ignore the stuff about Table Method in there. Make sure you can answer the following conceptual questions.

  - Understand why "find all the corners and plug them into the function" isn't a very good way to solve linear programming problems, except for very simple ones.

  - Understand the intuition behind the simplex method. Namely, "start at one corner, and keep moving along edges to increase the value of the function." Why does this actually give you an absolute maximum, and not just a local maximum?

  - Understand how to turn inequalities into equalities by introducing slack variables. Why is this useful?

  - Understand how to preform the simplex method mathematically. How do the steps you are taking correspond to the intuitive description of the simplex method. When in the process are you moving along an edge?

  - How do you decide on the Pivot Column? There's not always going to be one right choice, but the thing that matters most is that you're always increasing the value of the function. How can you tell which variables you're allowed to increase, just by looking at the table?

  - Once you've picked a variable to increase, how do you tell how far you can increase it? How do you figure out the Pivot Row?

  - How do you perform a pivot using row-reductions?

  - How do you know when you've finished the simplex method, i.e. how do you tell when you can't move along another edge to increase the function further?

  Then read Vanderbei Chapter 2, section 1 and 2 for a more theoretical explanation. Note that the notations in Vanderbei differ a little bit, namely in signs; but they are the same method in theory. I would prefer if you worked with the table as we discussed in class today (matches the notes from the link above) rather than those in Vanderbei. However, I will give marks to any convention as long as it is mathematically correct.

  I am going to work out more examples in class on Friday, and we will also talk about 'infeasible' and 'unbounded' LPP.

Problems

Exercise 1

Solve problem 2.(3, 9, 10) from Vanderbei using Simplex Method.

Exercise 2†

Write a computer program in your favourite language that implements the Simplex Method for $n = 2$ variables. Note that you will need to define a subroutine for row-reductions.