

Homework 2

Due Tuesday, October 27 at 8pm

Instructions. Of the following problems, choose any two (or more) to do. Alternatively, if you do the optional midterm, that midterm can count as this homework assignment — you don't even need to turn in anything for this homework. Alternatively, do zero of these problems, and instead do something else that is beneficial to you! That “something else” might be:

- Do a cooler problem of your choosing.
- Relate the class to your research.
- Learn a side-topic related to linear programming or optimization.
- Code something up.
- Make a blog post.
- Make a YouTube video.
- etc.

Please submit this homework by emailing it to henry.adams@colostate.edu with the email subject line “Math 510: Homework 2”.

I may take one or two of your answers and use them as “solutions” that I share with the class. I will only share your answer in a positive light, not in a negative light. But if you'd rather I not use any of your answers for this purpose, simply let me know!

Problems.

1. Do the optional midterm (that suffices for this entire homework), or any problem or two from the optional midterm.
2. Do any problem you haven't yet done from Homework 1.
3. Solve a linear programming problem of your choosing in a software package of your choosing (perhaps python, Matlab, etc). There should be built-in commands for doing this.
4. Find and briefly describe a cool example application of linear programming.
5. Show that if the pivot rule is chosen to be Dantzig's rule (largest coefficient), then the linear program from page 77 of our book by Matoušek and Gärtner visits all 8 of the possible vertices on this Klee–Minty cube.
6. Read about the counterexample to the Hirsch conjecture, and briefly explain it from a high level.
7. Skim parts of Spielman and Teng's article *Smoothed Analysis of Algorithms: Why the Simplex Algorithm Usually Takes Polynomial Time*, available at <https://www.di.ens.fr/~vergnaud/algo0910/Simplex.pdf>, and briefly explain what you learned.
8. Any other problem of your choosing!