Homework 6

Math 282 Computational Geometry
due 5:00pm on Tuesday, March 30

Solve the following problems from the textbook, and write your solutions clearly and neatly. Make sure to explain your reasoning and provide mathematical details that support your answers. For a few tips on writing solutions, see this helpful guide for mathematical writing.

If you are taking this course for elective credit towards the computer science major, then do the problem labeled **CS only** and not the problems labeled **math only**. Otherwise, do the problems labeled **math only** instead of the problem labeled **CS only**.

You may write or type your solutions electronically, or write them on paper and scan/photograph them. If you photograph your papers, please use a scanning app to produce a single PDF file containing your solutions. Upload your written solutions (and your code/output if you do the CS problem) to the Homework 6 assignment on Moodle.

1. **math only:** Exercise 3.20
2. **CS only:** Flipping an edge in a triangulation requires that the two triangles sharing that edge form a convex quadrilateral. Implement (in your favorite programming language) a function that takes in four points in counterclockwise order, a, b, c, d, and returns *true* if the quadrilateral is convex (and so either the edge ac or bd or flippable), and *false* if it is nonconvex.

   For this problem, hand in your code and also a demonstration showing that your code works correctly for both convex and nonconvex quadrilaterals. For example, this could be a screenshot or text copied from your terminal showing what happens when you run your program.
3. **all:** Exercise 3.21 (c)
4. **all:** Exercise 3.24
5. **all:** Exercise 3.26 — Only do point sets (a) and (c). We found the flip graph of (a) in class, and you found the flip graph of (c) in a previous exercise.
6. **all:** Exercise 3.55 — *Hint*: re-read the proof of Thales' Theorem on pages 83–84.
7. **all:** For any point set, and any triangulation of that point set, one may add up all edge lengths in the triangulation. Prove or disprove that this sum is always minimized by the Delaunay triangulation.