Homework 5

MATH 261 Computational Geometry
due 5:00pm on Friday, January 17

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.

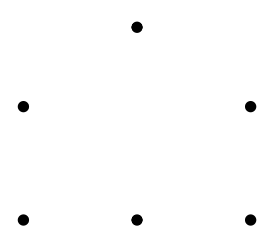
If you are taking this course for elective credit towards the computer science major, then do the problem labeled **CS** and not the problem labeled **math**. Otherwise, you may choose whether to do the **math** problem or the **CS** problem.

You may write or type your solutions electronically, or write them on paper and scan/photograph them. 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 only problem) to the Homework 5 assignment on Moodle.

1. all: Exercises 3.14 — Recall that the *degree* of a vertex v is the number of edges incident to v.

2. all: Exercise 3.18

3. all: Construct the flip graph of the following set of points. (Note that the bottom three points are collinear.) Then find the diameter of this flip graph.



4. all: Exercise 3.19

5. math: Exercise 3.24

6. CS: 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. Provide sample input and output that clearly demonstrates that your algorithm works for both convex and nonconvex quadrilaterals.

7. all: Exercise 3.29

8. all: Exercise 3.55 — *Hint*: re-read the proof of Thales' Theorem on pages 83–84.