Homework 2

Math 282 Computational Geometry
due 5:00pm on Monday, January 9

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.

There are no CS only problems on this homework, so everyone should do all 9 problems.

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 only problem) to the Homework 2 assignment on Moodle.

1. Exercise 1.23

2. Exercise 1.29 — Prove this directly using the definition of what it means for a guard to cover a polygon, without using Theorem 1.32.

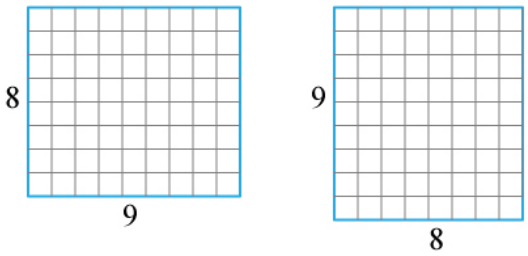
3. Exercise 1.41 — State your conjecture, and explain why you think your conjecture might be true.

4. Exercise 1.45 — *Hint*: If all edges of the Greek cross have length 1, then the resulting square must have edge length $\sqrt{5}$. Find a diagonal of the Greek cross with length $\sqrt{5}$.

5. Exercise 1.46 — *Hint*: What must be the edge length of the resulting square?

6. Exercise 1.52

7. A *translation dissection* is a dissection such that the pieces may only be translated, not rotated or flipped. Find a two-piece translation dissection of an 8×9 rectangle to a 9×8 rectangle. For this, each piece will be an orthogonal polygon. Your cuts may consist of many straight segments that meet at right angles.



8. Draw a single plot that shows the following functions $f(n)$ for $n > 1$:

(a) $f(n) = 1$
(b) $f(n) = n$

(c) $f(n) = n^2$

(d) $f(n) = \log(n)$

(e) $f(n) = n \log(n)$

Your plot should show the relative growth rates of these functions for large n. (This will help us compare the runtime complexities of algorithms that we will soon encounter.)

9. In Chapter 1, the authors of our text state nine unsolved problems. Which of these problems do you find most interesting? Explain *why* this problem is interesting to you, and *how* you could begin to work toward solving the problem.