CS41 Homework 1

This homework is due at 11:59PM on Sunday, September 9. Write your solution using \LaTeX. Submit this homework using github. This is an individual homework. It’s ok to discuss approaches at a high level. In fact, we encourage you to discuss general strategies. However, you should not reveal specific details of a solution, nor should you show your written solution to anyone else. The only exception to this rule is work you’ve done with a lab partner while in lab. In this case, note who you’ve worked with and what parts were solved during lab.

The main learning goals of this lab are to familiarize you with \LaTeX, review git and make sure you know how to grab/handin homeworks using git, and to begin to formalize and analyze algorithms.

1. **Algorithm Analysis.** Consider the following algorithm for the Hiking Problem.

   ```
   HIKING()
   1   \( k = 1 \).
   2   while you haven’t arrived at your friend:
   3       hike \( k \) miles north
   4       return to start
   5       hike \( k \) miles south
   6       return to start
   7   \( k = 10k \).
   ```

   Describe the distance traveled in HIKING as a function of the initial distance from your friend in the worst case. Express your answer in big-Oh notation. How does this algorithm compare to the algorithms we saw in class?

2. Pick an algorithm you already know (e.g., gradeschool addition or multiplication, or merge-Sort). Describe at a high-level how the algorithm works, and use mathematical \LaTeX notation to describe the runtime of the algorithm.

3. Choose a problem you encounter in everyday life (e.g. how to get from your dorm room to Clothier 016 by 8:50AM, or how to get into college) and describe an algorithm for solving that problem.

   Be as specific and descriptive as you can.

4. **(extra challenge problem)** We discussed in class a reason why \( m \) is a lower bound for the Hiking Problem. Show that \( 3m \) is a lower bound for the Hiking Problem.