CS3000: Algorithms & Data — Summer 2023 — Laney Strange

Recitation 1
Due May 9th @ 9pm eastern via Gradescope

Name:
Collaborators:

- One recitation problem each week is graded; the rest are there for practice. That problem will be graded on completeness – full credit for making an honest effort. It is also closely linked to the upcoming Long Homework, so be sure you read the feedback from your grader!
- Recitations can usually be written by hand, but this recitation includes a LaTeXand pseudocode warm-up, so we require you to typeset your solution. We recommend using the source file for this assignment to get started.
- Put your name on the first page. If you are using the LaTeX template we provided, then you can make sure it appears by filling in the `yourname` command.
- This recitation is due May 9th @ 9pm eastern via Gradescope. If you miss the in-person recitation, or need to submit your solution later than the end of your section, please fill out this form: https://forms.gle/CLrhrkVauXYzC7U57
- Collaboration is strongly encouraged during recitation! Please list all your collaborators in your solution for each problem by filling in the `yourcollaborators` command.

Problem 1. *Pseudocode Warm-Up (for practice; not graded)*

Read through the CS3000 LaTeX Pseudocode Guide

Complete the pseudocode below for linear search. It should return the position in the array where the key is found, or -1 if it's not there.

SEARCH(A, key)

1 **for** $i = 1$ **to** $A.length$

Solution:

Problem 2. *Mystery Algorithm One (graded)*

You encounter the following pseudocode, and you can assume it calls the procedure LINEARSEARCH implemented as in Problem 1.

```
MYSTERY(A, key)
1  for i = 1 to A.length
2        if SEARCH(A, i) == −1
3              return i
4  return NIL
```

What would this algorithm return in the follow examples?

- MYSTERY($[1, 2, 4]$)?

  Solution:

- MYSTERY($[2, 3, 1]$)?

  Solution:

- MYSTERY($[5, 3, 1]$)?

  Solution:

- MYSTERY($[18, 19, 20, 21]$)?

  Solution:

- MYSTERY($[2, 3, 4]$)?

  Solution:

Problem 3. *LaTeX/Math Warm-Up (for practice; not graded)*

Read through the CS3000 LaTeX Overview
Remember proof by induction from cs1800? Of course you do, it's the best! For this problem, we'll get warmed-up with LaTeXand also remind ourselves of the steps in an inductive proof.

Prove that the sum of the first n positive integers is $\frac{(n)(n+1)}{2}$

Statement $S(n)$ states that $\sum_{i=1}^{n} i = \frac{(n)(n+1)}{2}$.

Claim $\forall n \in \mathbb{Z}^+, S(n)$

In your solution below, make sure you include the base case, inductive hypothesis (assume true for $S(k)$ for an arbitrary k), and inductive step (show $S(k) \implies S(k+1)$).

Solution: