Programming Methodology

Lab 11: Program Correctness

Wednesday, November 15th, 2023

Weekly Lab Agenda

- Go over reminders/goals
- Review past material
- Work in groups of 2-3 to solve a few exercises
    - Lab leaders will assign new groups this week
- Discussion leaders will walk around and answer questions
- Solutions to exercises will be reviewed as a class
- Attendance taken at the end

Reminders

- You should be working on your group project.
- Have a planned timeline to avoid last minute rush!
- Reach out to us if there is any issues in your team.
  - Private post on campuswire or
  - Email to mkuechen@umass.edu

Today's Goals

- Practice working on program correctness.

Binary Search Invariant

- Recall the case study on binary search we saw in class.
- What will be the invariants in this case:
  - a[lo-1] < x && x < a[hi+1] // x is not outside searched interval (we don't miss it)
  - (lo === 0 || a[lo-1] < x) && (hi + 1 === a.length || x < a[hi+1]) // ensure indices are valid:

Question 1

The code is for binary search checking middle first.

This code has a bug, which can be identified by observing the invariant.

Use the rules to check if the invariant is maintained, or if there is some path through the code that fails to re-establish it.

```
function bsearchmid (a, target) {
        let lo = 0; let hi = a.length - 1;
        (lo === 0 || a[lo-1] < target) && (hi + 1 === a.length || target < a[hi+1])
        while (lo <= hi) {
                let mid = lo + Math.floor((hi-lo)/2);
                if (a[mid] == target) {
                        return mid;
                }
                else if (a[mid] < target) {
                        lo = mid;
                } else {
                        hi = mid;
                }
        }
        return -1
}
```

Question 2

Please write your solution to question 2 on paper. You will submit your work to gradescope before we review the solution, and we'll grade your work to give you feedback.

Question 2

What is the largest value A for which the loop below terminates with n=20?

Use an invariant to justify your answer.

#Fall 2020 Q7

```
let n: number = 0;

let s: number = A;

while (s <= 100) {

        if (n % 2 > 0) {

                s += n; }

        n = n + 1;

}
```