Tutorial 3

- Loops
- Side Effects

Loops: for loops & while loops

- Using a loop to solve a problem is called ***iteration***.
- `while` is similar to `if statements` but `while` **repeatedly** *"loops back"* and executes the `statement` **until the `expression` is false**.
- General format of a `while` loop:

```
setup statement(s)
while (expression) {
  body statement(s)
  update statement(s)
}
```

- `for` loops are a "condensed" version of a `while` loop.

Global Variables

- C is an imperative programming language
- Code is divided into functions that serve specific purposes
- Functions may require access to the same information/variables
- Declare shared variables in the top level of the program (global scope)

Side Effects and Mutation

- C is a compiled language
- Compiler can optimize code for us in translation process
- Pure functions: only rely on parameters and local variables
  1. Cache repeated calls to same function
  2. Remove calls to function with unused return value

Side Effects and Mutation

- Sometimes compiler cannot make these optimizations because the function has side effects:
  1. Not using a pure function: function relies on global variables, so output of function can change even when called with the same parameters (compiler cannot know what output would be without running the program)
  2. Functions that read input (result depends on user input)
  3. Functions that produce output (compiler might remove calls to function with no effects except printing)

Side Effects and Mutation

- It is important to document your code and to indicate when a function has side effects
- This is so you (and other programmers) know when a function might have less predictable impacts on the execution of a program

Exercise: Managing a bank account Implement a simple banking interface where we can:

- `deposit`: adds money (positive) to your bank balance
- `withdraw`: withdraws money (positive) from your bank account if this will not make it more negative than the overdraft limit, and returns `true` on success
- `get_balance`: gets the current bank balance
- `set_overdraft_limit`: sets a non-negative overdraft limit

Checkerboard - Exercise

Write the following C program: (use iteration)

```
// This program reads in two integers (height, width)
// and prints a checkerboard with those dimensions
```

- There are some I/O tests on Seashell

Example: 4×4 checkerboard

```
// IN
4 4

// OUT
#.#.
.#.#
#.#.
.#.#
```