CIS 122 Summer 2019
Challenge Problems – Set 4

Challenge problems will not be guaranteed to follow our material exactly – meaning that solutions to these problems may involve concepts or techniques that we haven't seen yet, or may not formally cover at all. Additionally, these problems are neither required nor testable material.

1) one more recursion problem: Fibonacci numbers

The Fibonacci sequence is defined as the following: The 0^{th} and 1^{st} Fibonacci numbers are defined to be 0 and 1, respectively. From here, each successive Fibonacci number is defined to be the sum of the previous two numbers. Therefore, there is an inherently recursive relationship in the Fibonacci sequence – each Fibonacci number is defined in terms of two other Fibonacci numbers!

The first few terms of the sequence are: 0, 1, 1, 2, 3, 5, 8, 13, 21, …

Write a function fib(n), which calculates the nth Fibonacci number in a recursive fashion.

2) Bubble Sort

Our first list assignment (Assignment 8) has us writing a sorting algorithm called "selection sort". There are a variety of sorting algorithms in computing, each of which has its own name. For example, selection sort finds the correct "next" item in order, and puts it in place. "Insertion sort" just grabs whatever it finds, and then inserts it into the correct place in a growing sorted section of the list. "Bubble sort" grabs each next element, and "bubbles" it up into the correct place by successively swapping it with its neighbor until it is in the correct place. This Wiki page has a nice animation of the process:
https://en.wikipedia.org/wiki/Bubble_sort

Write a function bubblesort(li) that sorts a list (li) in-place using the bubble sort technique. Your implementation should use a while loop to perform the swapping.

3) Bar codes using Turtle

https://classes.cs.uoregon.edu/15F/cis210/assignments/W3-ZipBarcode.php

Follow this link to one of Professor Sventek's introductory programming projects. There is starter code and a description available from the page.