Homework 5

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For C and Go, go to the links provided to see the function in action. Codepad for C and play.golang.org for Go.

Python

```python
def list_min(list):
  def min_finder(l, m):
    if not l:
      print m
    else:
      min_finder(l[1:], m if m < l[0] else l[0])
  min_finder(list, float("inf"))
```

C

```c
// Function in action at http://codepad.org/D4reNoZ5

int arrayMin(int *a, int size, int min, int index) {
  if (index == size - 1) {
    return min;
  } else {
    min = min < a[index] ? min : a[index];
    index++;
  }
  return arrayMin(a, size, min, index);
}
```

Javascript

```javascript
var arrayMin = function (array) {
  var minFinder = function (a, m) {
    return a.length === 0 ? m : minFinder(a.slice(1), m < a[0] ? m : a[0]);
  }
  return minFinder(array, Infinity);
}
```

Go

```
// Function in action at http://play.golang.org/p/KU4Jn1Qkcx

func ArrayMin(a []int, min int) int {
  if (len(a) == 0) {
    return min
  } else {
    if (a[0] < min) {
      min = a[0]
    }
  }
  return ArrayMin(a[1:], min)
}
```

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There is a possibility of getting stuck in an infinite loop. The user would potentially need to stop the program on their own if this were to happen.

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Javascript

```
var left = function () {alert("left");};
var right = function () {alert("right");};
var both = function (a, b) {};

both(left(), right());
```

We can see after running this code in a shell or jsFiddle that JavaScript evaluate subroutines in the order that they are passed into a function (left-to-right).

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If the program outputs $0, 1, 2, 3, 4, 5, 6, 7, 8, 9$ this is how the program runs: It first pushes the return address of i on the stack (which is 0). Print i out. The increment it by 1. When foo is called a second time, it looks up the variable i again and simply increments it. Basically, the i overlayed the j in memory. If the program ran in this way, it is likely that the stack was cleared when the program was run.

There is also a possibility that one can see all zeroes. This is because when the program allocated a stack frame for the i, it allocated it in such a place where it just so happened to be 0. This could mean that the stack was not initialized on that particular system.

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The old version of Fortran printed 3 because it passed by reference. The modern version of Fortran prints 2 because it passes pointers to copies of rvalues. This is due to the fact that the compiler put the value of 2 (literal) in memory when foo was first called. Whenever there is 2 in the program, the compiler told it to look in that memory address. The value was changed when foo was called thus explaining why it printed 3.

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Call by value: $1, [2, 3, 4]$ **is printed.**

Call by value-result: $2, [2, 2, 4]$ **is printed.**

Call by reference: $2, [2, 3, 4]$ **is printed.**

Call by name: $2, [2, 3, 4]$ **is printed.**

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```
// queue.js

function Queue() {
    var data = [];

    return {
        add: function (x) {data.push(x);},
        remove: function () {return data.shift();}
    };
}

module.exports = Queue;

// In the Node.js REPL...

> var queue = require('./queue.js')
undefined
> var q = queue()
undefined
> q
{ add: [Function], remove: [Function] }
> q.add(7)
undefined
> q.data
undefined
> q.remove()
7
```

12 - XC

This is a bad idea because an object should not (cannot) have more than one class. As opposed to inheritance (*i.e. IS-A*), this society of classes should be built by aggregation (*i.e. HAS-A*). Aggregation should not be confused with composition. In other words, each *Person* HAS-A *Job*. The class *Job* can live it on its own without a *Person* having that particular *Job*. Each *Job* will have its own class to store properties specific to that *Job*. The person class should be the only class denoting a person. This person class can have its set of jobs or roles as a property.

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Java

```java
public class OddGenerator {

  private int x = -1;
  public int nextOdd() {
    return x += 2;
  }

  public static void main (String[] args) {
    OddGenerator odds = new OddGenerator();
    System.out.println(odds.nextOdd());
    System.out.println(odds.nextOdd());
    System.out.println(odds.nextOdd());
    System.out.println(odds.nextOdd());
  }
}
```

Python

```python
def odd_generator():
  odd = {'current' : -1}
  def next_odd(): odd['current'] += 2; print odd['current']
  return next_odd

a = odd_generator()

a()
a()
a()
a()
```

Javascript

```
var nextOdd = function () {
  var x = -1;
  return function () {return x += 2;};
}();

nextOdd();
nextOdd();
nextOdd();
nextOdd();
```

C++

```
#include <iostream>
using namespace std;

class OddGenerator {
  private:
    int x = -1;
  public:
    int nextOdd();
};

int OddGenerator::nextOdd() {
  return x += 2;
}

int main () {
  OddGenerator odds;
  cout << odds.nextOdd() << endl;
  cout << odds.nextOdd() << endl;
  cout << odds.nextOdd() << endl;
  cout << odds.nextOdd() << endl;
}
```