

## COMP 333 Practice Exam

This is representative of the kinds of topics and kind of questions you may be asked on the midterm.

### Higher-Order Functions in JavaScript

1.) Write the output of the following JavaScript code:

```
function foo(fooParam) {
  return function (innerParam) {
    return fooParam - innerParam;
  }
}

let f1 = foo(7);
let f2 = foo(10);
console.log(f1(2));
console.log(f2(3));
console.log(f1(4));
console.log(f2(5));
```

2.) Consider the following JavaScript code:

```
function base() {
  return function (f) {};
}

function rec(n) {
  return function (f) {
    f();
    n(f);
  }
}

function empty() {}

let f1 = rec(rec(base));
let f2 = rec(rec(rec(base)));
f1(empty);
f2(empty);
```

How many times is `empty` called in total in the above code?

3.) Consider the following JavaScript code with corresponding output, which calls an unseen function called `mystery`:

```
function output() {  
    console.log("foo");  
}  
  
let f1 = mystery(output);  
f1();  
console.log();  
  
let f2 = mystery(f1);  
f2();  
console.log();  
  
let f3 = mystery(f2);  
f3();  
console.log();
```

**Output:**

foo  
foo

foo  
foo  
foo  
foo

foo  
foo  
foo  
foo  
foo  
foo  
foo  
foo

Define the `mystery` function below.

4.) Write the output of the following JavaScript code:

```
function cap(min, max, wrapped) {  
  return function (param) {  
    let temp = wrapped(param);  
    if (temp < min) {  
      return min;  
    } else if (temp > max) {  
      return max;  
    } else {  
      return temp;  
    }  
  };  
}
```

```
function addTen(param) {  
  return param + 10;  
}
```

```
function subTen(param) {  
  return param - 10;  
}
```

```
let f1 = cap(0, 10, addTen);  
let f2 = cap(0, 100, addTen);  
let f3 = cap(0, 10, subTen);  
let f4 = cap(0, 100, subTen);
```

```
console.log(f1(0));  
console.log(f1(5));  
console.log();
```

```
console.log(f2(0));  
console.log(f2(5));  
console.log();
```

```
console.log(f3(0));  
console.log(f3(5));  
console.log();
```

```
console.log(f4(0));  
console.log(f4(5));  
console.log();
```

5.) Consider the following JavaScript code and output:

```
console.log(
  ifNotNull(1 + 1,
    a => ifNotNull(2 + 2,
      b => a + b)));
console.log(
  ifNotNull(7,
    function (e) {
      console.log(e);
      return ifNotNull(null,
        function (f) {
          console.log(f);
          return 8;
        })
    })
  ));
```

Output:

```
6
7
null
```

`ifNotNull` takes two parameters:

1. Some arbitrary value, which might be `null`
2. A function. This function is called with the arbitrary value if the value is not `null`, and the result of the function is returned. If the value is `null`, this function isn't called, and `null` is returned instead.

Define the `ifNotNull` function below, so that the output above is produced.

6.) Consider the following array definition in JavaScript:

```
let arr = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
```

6.a) Use `filter` to get an array of all even elements in `arr`.

6.b) Use `map` to get an array of strings, where each string represents a number in `arr`. As a hint, you can call the `toString()` method on a number (e.g., `5.toString()`) in JavaScript to get its string representation.

6.c) Use `reduce` to get the last element in `arr`.

6.d) Use a combination of `filter` and `reduce` to get the sum of all elements in `arr` which are greater than 5.

## Prototype-Based Inheritance in JavaScript

7.a.) Define a constructor for Dog objects, where each Dog object has a name. An example code snippet is below, illustrating usage:

```
let d = new Dog("Rover"); // line 1
console.log(d.name);      // line 2; prints Rover
```

7.b.) Define a different constructor for Dog, which puts a bark method **directly** on the Dog objects. The bark method should print "Woof!" when called. Example usage is below:

```
let d = new Dog("Sparky");
d.bark(); // prints Woof!
```

7.c.) Define a method named growl for Dog objects, which prints "[dog name] growls" when called. Use Dog's **prototype**, instead of putting the method directly on Dog objects themselves. Example usage is below:

```
let d = new Dog("Rocky");
d.growl(); // prints Rocky growls
```

8.) Consider the JavaScript code below:

```
function Animal(name) { this.name = name; }
Animal.prototype.getName = function() { return this.name; }
function Bird(name) { Animal.call(this, name); }
Bird.prototype = Object.create(Animal.prototype);
Bird.prototype.fly = function() {
  console.log(this.getName() + " flies");
}
function Mouse(name) {
  this.name = name;
  this.squeak = function() {
    console.log(this.name + " squeaks");
  }
}
Mouse.prototype = Object.create(Animal.prototype);
Mouse.prototype.fly = Bird.prototype.fly;
let b1 = new Bird("Coco"); let b2 = new Bird("Sunny");
let m1 = new Mouse("Pip"); let m2 = new Mouse("Ruby");
```

Write a memory diagram which shows how memory looks after this program executes. Your diagram should include the objects and fields associated with `b1`, `b2`, `m1`, `m2`, `Mouse.prototype`, and `Bird.prototype`, `Animal.prototype`. As a hint, the `__proto__` field on objects refers to the corresponding object's prototype.

9.) Consider the test suite below, using `assertEquals` from the second assignment:

```
function test1() {
  let t1 = new Obj("foo");
  assertEquals("foo", t1.field);
}

function test2() {
  let t2 = new Obj("bar");
  assertEquals("barbar", t2.doubleField());
}

function test3() {
  let t3 = new Obj("baz");
  // hasOwnProperty returns true if the object itself has the field,
  // otherwise it returns false. If the field is on the object's
  // prototype instead (__proto__), it returns false.
  assertEquals(false, t3.hasOwnProperty("doubleField"));
}
```

Write JavaScript code which will make the above tests pass.