Part I: Introduction to Functions

Function Parameters

- Function parameters are essentially variables available to the function
- Can (but shouldn’t) redefine them
- Can be used in an expression
- Must follow same identifier rules
- Multiple parameters separated by a comma

Defining Functions

- Define functions by using the `function` keyword
- Function needs:
  - A name (identifier)
  - A list of parameters (inputs)
  - A body

```
function milesToKm(miles) {
  var km = miles * 1.60934;
  return km;
}

function format(firstName, lastName) {
  return lastName + ', ' + firstName;
}
```

Functions

- Functions are units of code with inputs that produce an output
- Provide code organization
- Functions provide a way to reuse code
- Easier to test, maintain, etc.
- Also provides for procedural abstraction
  - Logic/process is encapsulated inside a function
  - We don’t need to worry about the details of how a computation is executed
  - We just use it
  - Example: `Math.sqrt()`
Return Values

- Functions compute some result and need to communicate it back to the code that called it
- Use the keyword `return`
- A function may return any type
- A function doesn’t have to return anything (if it doesn’t, it’s called a “void” function)
- Forgetting (or omitting) a return value will end up returning an `undefined` value

Using Functions

- You call a function as we’ve been doing: providing values (or variables) as arguments, storing the return value

```javascript
var x = 2;
var y;
y = Math.sqrt(x);
var m = 252.4;
var k;
k = milesToKm(m);
k = milesToKm(100.2);
var name = format("Chris", "Bourke");
```

Passing By Value I

- Values stored in variables are copied and passed to the function for processing
- The function knows nothing about the original variable
- Changes to the function parameters have no effect on the original variable
- Demonstration

```javascript
function test(a, b) {
  a = 10;
  console.log("a = " + a);
  var c = a + b;
  return c;
}

var x = 5;
var y = 15;
var m;
m = test(x, y); // 25
m = test(x); // undefined
m = test(); // undefined
```

Optional Parameters I

- When calling a function, passing argument(s) is optional
- If an argument is not passed to a function, the parameter’s value becomes `undefined`
- Example
- This can be used as a feature: we can define functions with optional parameters either:
  - Provide sensible default values
  - Change the behavior/meaning of the function based on the parameters
- Example: jQuery’s `css()` function: one parameter gets the value, two parameters sets the parameter
- Check if a parameter is provided by using `x === undefined`

Optional Parameters II

```javascript
function min(a, b) {
  if(a < b) {
    return a;
  } else {
    return b;
  }
}

var x = 10;
var y = 20;
var m;
m = min(x, y); // 10
m = min(x); // undefined
m = min(); // undefined
```
Functions as Object Members I

- Declaring a function makes it globally scoped
- Every piece of code can “see” it and use it
- This has potential to “pollute the namespace”
- If two libraries both defined a function `showPopup()`, they would be in conflict
- Solution: organize functions into objects as members
- Just like `Math` library

Part II: Callbacks

Functions Calling Functions I

- Functions can call other functions
- When a function is called, control flow is handed over to the function until it completes
- After it completes, control is handed back to the calling function
- Such function calls are synchronous

Functions Calling Functions II

```javascript
function bar(a) {
  console.log(`bar = \${a}`);
}

function foo() {
  bar(10);
  console.log(`foo`);
  bar(20);
}

foo();
```

Functions as Object Members II

```javascript
var MyFunctions = {
  min: function(a, b) {
    if(a < b) {
      return a;
    } else {
      return b;
    }
  },
  milesToKm: function(miles) {
    var km = miles * 1.60934;
    return km;
  }
};
```

Topic Overview

- Functions calling functions
- Functions as variables & parameters
- Anonymous Functions
- Asynchronous Computing
Functions as Parameters I

- Variables can hold numbers, strings, objects, arrays, etc.
- Variables can also hold functions!
- A function’s “value” is its name
- This allows you to pass a function to another function!

Functions as Parameters II

```javascript
function foo() {
    ...
}

function bar(x, someFunction) {
    ...
}

var myFunc = foo;
bar(10, myFunc);
//or
bar(10, foo);
```

Functions as Parameters III

- The passed function is called a callback
- This allows us to write more generic, general code
- Example: `forEach()` or jQuery’s `.each()` function
- Example: Sorting
- Callbacks are used extensively in jQuery: you can call a function and provide another callback that you want called after the completion of the function

Functions as Parameters IV

```javascript
function foo(x) {
    console.log("x = " + x);
}

function bar(x, someFunction) {
    console.log("bar: " + x);
    //call the passed function "back"
    someFunction(x);
}

bar(10, foo);
```

Anonymous Functions I

- If the only purpose to a function is to pass it off to another function as a callback, there is no need to “pollute the namespace” by declaring the function with a name
- Alternative: define the function “inline” without a name and immediately pass it to another function
- Called an anonymous function

Anonymous Functions II

```javascript
function bar(x, someFunction) {
    console.log("bar: " + x);
    //call the passed function "back"
    someFunction(x);
}

//there is no function foo, just an anonymous
//one that does the same thing
bar(10, function(x) {
    console.log("x = " + x);
});
```
Asynchronous Computing

- Some function may execute “long”-running procedures such as making a network connection to get data
- Don’t want these processes to freeze (to “block”) the rest of the application
- Freezing while waiting would give a bad User Experience (UX)
- Solution: make some functions asynchronous
- Execution doesn’t block the rest of the application
- We won’t go into detail and in fact even with ES6 our ability to do asynchronous computing is limited
- Pitfall: care needs to be taken to chain callbacks appropriately
- Example demonstration

Part III: Exercises

Exercise

- Develop a function to round a number to the nearest cent (nearest 100th)
- Generalize this function so that it supports rounding to any decimal place
- Rewrite the first function to utilize this function
- Organize your functions into a utility class