COS418 Precept 1

9/14/18

Resources:

https://tour.golang.org/list

https://play.golang.org

https://gobyexample.com/

Basic syntax code in playground:

https://tinyurl.com/y7rdgqj3

```go
// All files start with a package declaration
package main

// Import statements, one package on each line
import (
	"errors"
	"fmt"
)

// Main method will be called when the Go executable is run
func main() {
	fmt.Println("Hello world!")
	basic()
	add(1, 2)
	divide(3, 4)
	loops()
	slices()
	maps()
	sharks()
}
```

```
// Function declaration
func basic() {
    // Declare x as a variable, initialized to 0
    var x int
    // Declare y as a variable, initialized to 2
    var y int = 2
    // Declare z as a variable, initialized to 4
    // This syntax can only be used in a function
    z := 4

    // Assign values to variables
    x = 1
    y = 2
    z = x + 2 * y + 3

    // Print the variables; just use %v for most types
    fmt.Printf("x = %v, y = %v, z = %v\n", x, y, z)
}
```

```go
// Function declaration; takes in 2 ints and outputs an int
func add(x, y int) int {
    return x + y
}

// Function that returns two things; error is nil if successful
func divide(x, y int) (float64, error) {
    if y == 0 {
        return 0.0, errors.New("Divide by zero")
    }
    // Cast x and y to float64 before dividing
    return float64(x) / float64(y), nil
}
```

```
func loops() {
	// For loop
	for i := 0; i < 10; i++ {
		fmt.Print(".")
	}
	// While loop
	sum := 1
	for sum < 1000 {
		sum *= 2
	}
	fmt.Printf("The sum is %v\n", sum)
}
```

```go
func slices() {
	slice := []int{1, 2, 3, 4, 5, 6, 7, 8}
	fmt.Println(slice)
	fmt.Println(slice[2:5]) // 3, 4, 5
	fmt.Println(slice[5:]) // 6, 7, 8
	fmt.Println(slice[:3]) // 1, 2, 3
	slice2 := make([]string, 3)
	slice2[0] = "tic"
	slice2[1] = "tac"
	slice2[2] = "toe"
	fmt.Println(slice2)
	slice2 = append(slice2, "tom")
	slice2 = append(slice2, "radar")
	fmt.Println(slice2)
	for index, value := range slice2 {
		fmt.Printf("%v: %v\n", index, value)
	}
	fmt.Printf("Slice length = %v\n", len(slice2))
}
```

```
func maps() {
    myMap := make(map[string]int)
    myMap["yellow"] = 1
    myMap["magic"] = 2
    myMap["amsterdam"] = 3
    fmt.Println(myMap)
    myMap["magic"] = 100
    delete(myMap, "amsterdam")
    fmt.Println(myMap)
    fmt.Printf("Map size = %v\n", len(myMap))
}
```

Exercises (easy)

You can use the playground for this (https://play.golang.org) if you don't have go installed locally.

1. Print the first 10 squared numbers.
2. Print the first 10 fibonacci numbers.
3. Fizzbuzz: Replace multiples of 3 with *fizz* and multiples of 5 with *buzz*; replace multiples of both with *fizzbuzz*. Print the first 100 numbers in this sequence.
4. Write a function that reverses a slice.
5. Write a function that returns the number of unique items in a slice.

```go
// Object oriented programming
// Convention: capitalize first letter of public fields
type Shark struct {
    Name string
    Age int
}

// Declare a public method
// This is called a receiver method
func (s *Shark) Bite() {
    fmt.Printf("%v says CHOMP!\n", s.Name)
}

// Because functions in Go are pass by value
// (as opposed to pass by reference), receiver
// methods generally take in pointers to the
// object instead of the object itself.
func (s *Shark) ChangeName(newName string) {
    s.Name = newName
}
```

```go
// Receiver methods can take in other objects as well
func (s *Shark) Greet(s2 *Shark) {
	if (s.Age < s2.Age) {
		fmt.Printf("%v says your majesty\n", s.Name)
	} else {
		fmt.Printf("%v says yo what's up %v\n",
			s.Name, s2.Name)
	}
}

func sharks() {
	shark1 := Shark{"Bruce", 32}
	shark2 := Shark{"Sharkira", 40}
	shark1.Bite()
	shark1.ChangeName("Lee")
	shark1.Greet(&shark2) // pass in pointer
	shark2.Greet(&shark1)
}
```

```go
// Launch n goroutines, each printing a number
// Note how the numbers are not printed in order
func goroutines() {
	for i := 0; i < 10; i++ {
		// Print the number asynchronously
		go fmt.Printf("Printing %v in a goroutine\n", i)
	}
	// At this point the numbers may not have been printed yet
	fmt.Println("Launched the goroutines")
}
```

```go
// Channels are a way to pass messages across goroutines
func channels() {
	ch := make(chan int)
	// Launch a goroutine using an anonymous function
	go func() {
		i := 1
		for {
			// This line blocks until someone
			// consumes from the channel
			ch <- i * i
			i++
		}
	}()
	// Extract first 10 squared numbers from the channel
	for i := 0; i < 10; i++ {
		// This line blocks until someone sends into the channel
		fmt.Printf("The next squared number is %v\n", <-ch)
	}
}
```

```go
// Buffered channels are like channels except:
//   1. Sending only blocks when the channel is full
//   2. Receiving only blocks when the channel is empty
func bufferedChannels() {
	ch := make(chan int, 3)
	ch <- 1
	ch <- 2
	ch <- 3
	// Buffer is now full; sending any new messages will block
	// Instead let's just consume from the channel
	for i := 0; i < 3; i++ {
		fmt.Printf("Consuming %v from channel\n", <-ch)
	}
	// Buffer is now empty; consuming from channel will block
}
```

Exercises (medium+)

Link to the playground: https://play.golang.org

1. Implement a binary tree in which each node contains a number. Then write a function that sums all the numbers in the tree.
2. Write a function that launches *n* goroutines to square all entries in a slice in parallel, where *n* is provided by the caller. Your function should block until all goroutines terminate.
3. Given an *n* by *n* matrix, print all entries in spiral order. Now do it in both directions (clockwise and anti-clockwise).
4. Implement mergesort using goroutines. If the size of the input slice is *n*, how many goroutines are launched in total?