More Loops, Overflow, Debugging

02-201

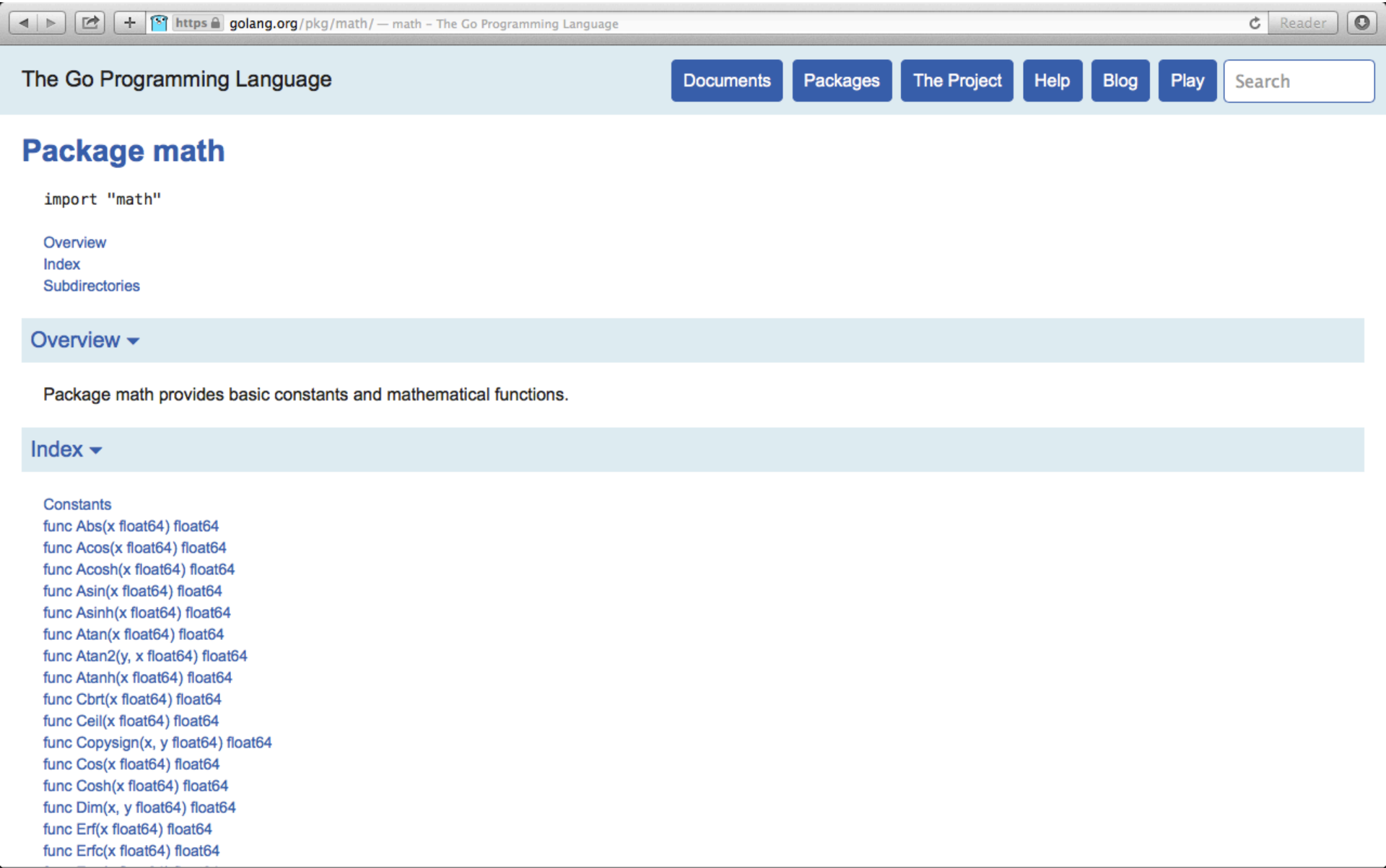
For KthDigit() on HW1

Check out

```
math.Abs()
math.Pow10()
```

in the math package (import “math”)

Reading Package Documentation



Warm-Up (Review of Loops)

Exercise: Write a Go function that takes integers k and n and prints k^n for every number between 0 and n.

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Exercise: Write a Go function that takes integers *k* and *n* and prints k^n for every number between 0 and *n*.

```
import "math"

func PrintPowers(k, n int) int {
   for i:=0; i<=n; i++ {
      fmt.Println(math.Pow(k, i))
   }
}
```

Error! math.Pow() can only take float64 variable types.

Converting Between Types

Use *type(expression)* to convert *expression* to *type:*

```
var a float64 = 3.2      // ok!
var c int = int(a)       // ok: 3.2 converted to 3.0
var g int = int(3.2)     // ERROR! can't convert 3.2 to int
var f uint = uint(c)     // ok: c is converted to uint
var ok bool = bool(0)    // ERROR! can't covert int to bool
```

Conversion Challenges

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```
var i uint = 10
for ; i>=0; i = i-1 {
   fmt.Println(i)
}
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Exercise: How many times does this loop run?

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var i uint = 10
for ; i>=0; i = i-1 {
   fmt.Println(i)
}
```

Exercise: How many times does this loop run?

Answer: It never stops!

Variables Have Ranges

Type	Min	Max
`int`	- 9223372036854775808	9223372036854775807
`uint`	0	18446744073709551615
`float64`	-1.797693134862315708145274237317043567981e+308	1.797693134862315708145274237317043567981e+308

If a uint gets too large, it “wraps around” to 0; if it is negative, it “wraps around” to the largest possible uint.

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var i int = 9223372036854775807
fmt.Println(i+1)
```

Exercise: What is printed?

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Answer: -9223372036854775808

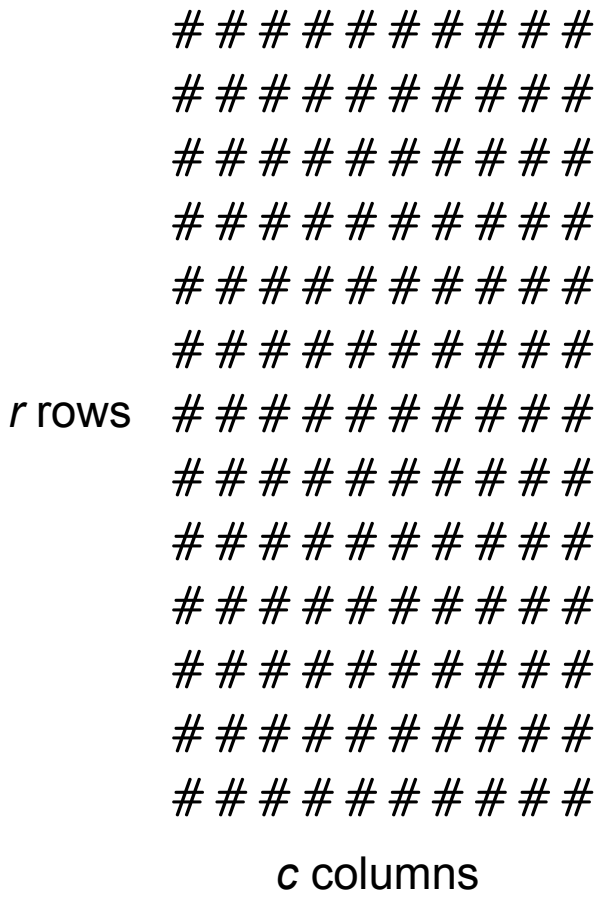
Lesson: if you have very big or very small numbers, you have to do something special to prevent this “overflow”.

Printing a “Rectangle”

Print Rectangle Problem: *Draw a rectangle of symbols.*

- **Input:** Integers *r* and *c*.
- **Output:** A rectangle of “#” symbols with *r* rows and *c* columns.

Think: How do we do this?



Nested Loops: Printing a "Rectangle"

```
// PrintRect(r, c) prints r x c
// rectangle of # symbols
func PrintRect(r, c int) {
    for i:=1; i<=r; i++ {
        for j:=1; j<=c; j++ {
            fmt.Print("#")
        }
        fmt.Println("")
    }
}
```

r rows

```
##########
##########
##########
##########
##########
##########
##########
##########
##########
##########
##########
##########
```

c columns

Note that nothing is returned by this function.

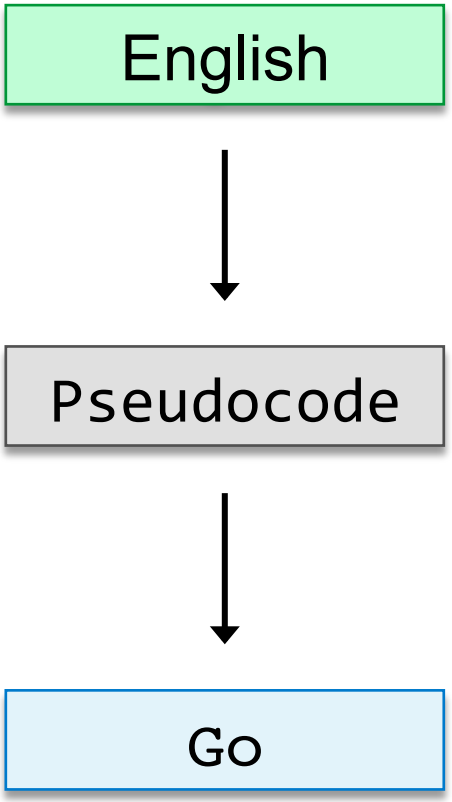
Print a Diamond

Print Diamond Problem: *Draw a diamond of "#" symbols.*

- **Input:** An odd integer *n*.
- **Output:** A diamond of the form below having height *n*.

```
        #
      # # #
    # # # # #
  # # # # # # #
# # # # # # # # #
  # # # # # # #
    # # # # #
      # # #
        #
```

(*n* = 9)



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Print Diamond Problem: *Draw a diamond of "#" symbols.*

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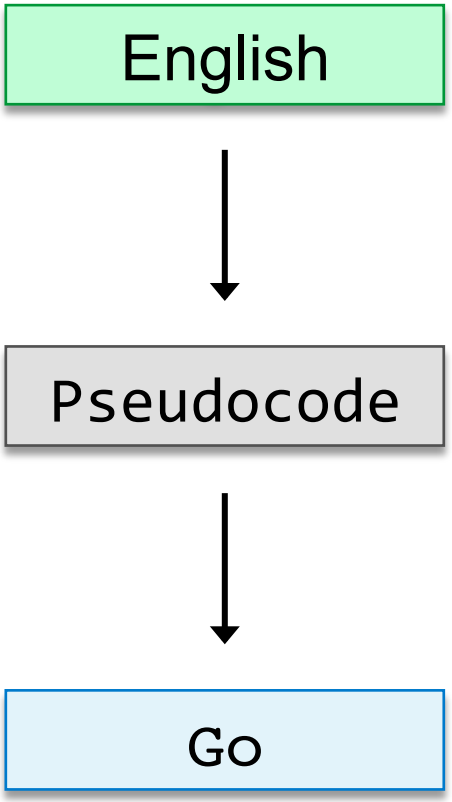
- **Output:** A diamond of the form below having height *n*.

```
    #
   ###
  #####
 #######
#########
 #######
  #####
   ###
    #
```

(*n* = 9)

Think: How can we solve this problem? (Think top-down...)



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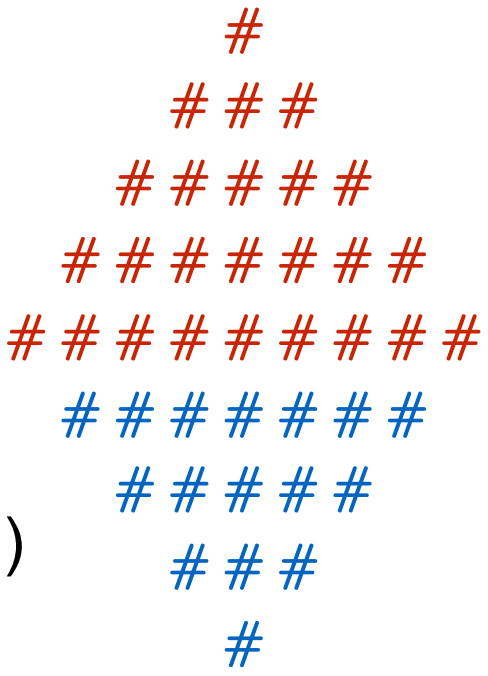

(*n* = 9)

```
PrintDiamond(n)
   PrintTriangle(n/2 + 1)
   PrintInvertedTriangle(n/2)
```

Print a Diamond

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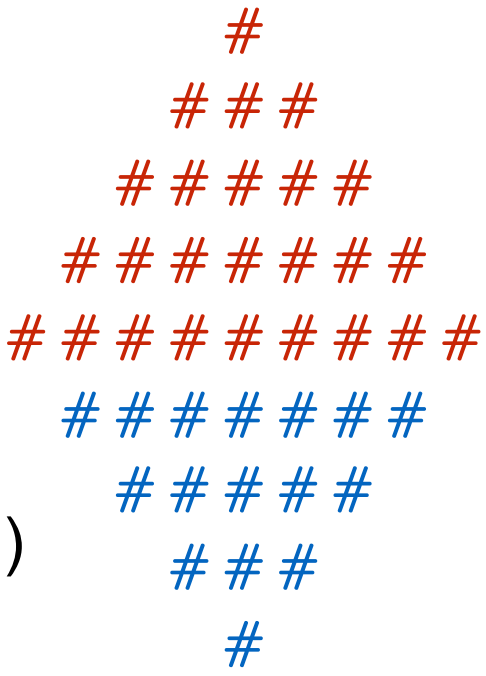

(*n* = 9)

Note: We have greatly simplified the problem already.

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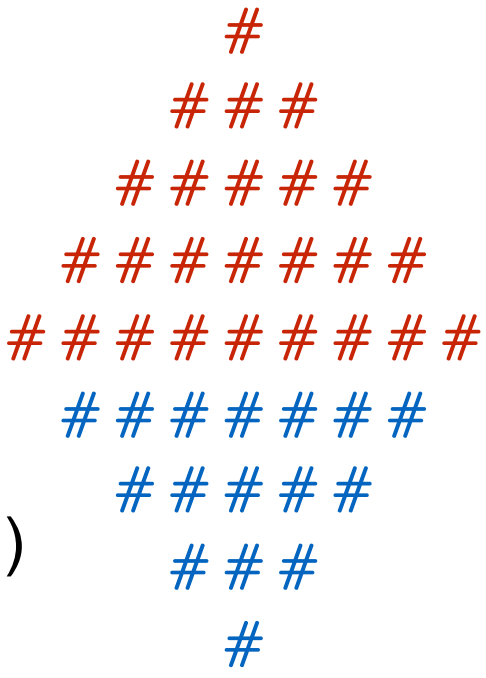

(*n* = 9)

Note: We have greatly simplified the problem already.

```
PrintDiamond(n)
   PrintTriangle(n/2 + 1)
   PrintInvertedTriangle(n/2)
```

Exercise: Write pseudocode for PrintTriangle().

Implementing PrintTriangle()

```
func PrintTriangle(k int) {
    var size int = 1 // num of symbols to print
    for row := 0; row < k; row++ {
        // print space to indent row
        for i := 0; i <= k – row; i++ {
            fmt.Print(" ")
        }
        // print correct number of symbols in a row
        for i := 1; i <= size; i++ {
            fmt.Print("#")
        }
        size = size + 2 // next row prints two more
        fmt.Println(”“) // start new line
    }
}
```

Implementing PrintTriangle()

```
func PrintTriangle(k int) {
    var size int = 1 // num of symbols to print
    for row := 0; row < k; row++ {
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        }
        size = size + 2 // next row prints two more
        fmt.Println(””) // start new line
    }
}
```

Think: Are there any ways in which this code could be improved?

Think Style: A Better PrintTriangle()

```
func BetterPrintTriangle(k int) {
   for row := 0; row < k; row++ {
        // print space to indent row
        for i := 0; i <= k – row; i++ {
            fmt.Print(" ")
        }
        // print correct number of symbols in a row
        for i := 1; i <= 2*row-1; i++ {
            fmt.Print("#")
        }
        fmt.Println(””) // start new line
    }
}
```

Shorter is not necessarily better, but this avoids an unnecessary additional variable.

Best: Reusable PrintRow() Function

```
func BestPrintTriangle(k int) {
   for row := 0; row < k; row++ {
      PrintRow(k-row, 2*row+1)
   }
}

func PrintRow(numOfSpaces, numOfSymbols int) {
   for i:=numOfSpaces; i>=1; i-- {
      fmt.Print(" ")
   }
   for i:=1; i<=numOfSymbols; i++ {
      fmt.Print("#")
   }
   fmt.Println()
}
```

A little longer, but more modular and easier to read.