

A Whirlwind Tour of Go

Just the Cool Parts

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v1.1.1



The Point

- “What *is* Go?”
- “What is it actually good for?”
- “Why should I care?”

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 - ∴ Go’s syntax is very much like C’s
 - ... but cleaned up and streamlined a bit.
- Dreamed up while waiting on a 45-minute C++ compile
 - Fast compilation
 - Native binary compiler with low overhead
 - Strong static typing
 - Extraordinarily spartan

The Basics

This is the “whirlwind” part...

(Laying a foundation of the basics so the more interesting discussions are understandable.)

Intrinsic Data Types

- The usual suspects: `int`, `int8`, `int16`, `int32`, `int64`, `uint`, `uint8`, `uint16`, `uint32`, `uint64`, `bool`, `byte`, `float32`, `float64`, `string`.
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- Slices: `[]int`, `[]byte`, `[]string`.
- Maps: `map[string]int`.
- Channels: `chan int`.

Expressions and Operators

- Arithmetic: $+$, $-$, $*$, $/$, $\%$.
- Relational: $==$, $!=$, $>$, $<$, $>=$, $<=$.
- Logical: $\&\&$, $||$, $!$.
- Bitwise: $\&$, $|$, \wedge , $<<$, $>>$, $\&\wedge$.

// $x \&\wedge y == x \& (\wedge y)$

Expressions and Operators

- Arithmetic: `+`, `-`, `*`, `/`, `%`.
- Relational: `==`, `!=`, `>`, `<`, `>=`, `<=`.
- Logical: `&&`, `||`, `!`.
- Bitwise: `&`, `|`, `^`, `<<`, `>>`, `&^`.
`// x &^ y == x & (^y)`
- Assignment: `=`, `+=`, `-=`, `*=`, `/=`, `%=`, `&=`, `^=`, `|=`, `<<=`, `>>=`, `:=`.

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- Unary: `+`, `-`, `^`. `// ^x`
- Increment/Decrement: `++`, `--`. `// x++ or x--`

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- Increment/Decrement: `++`, `--`. `// x++ or x--`
- Channel I/O: `<-`. `// channel<-x or <-channel`
- Blank identifier: `_`.

Declarations

- Type declarations *follow* identifier names

```
var x int
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var UserName string
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func DivideNumbers(x, y int) (int, error) { ... }
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var x int
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```

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func AddNumbers(x, y int) int { ... }
```

```
func DivideNumbers(x, y int) (int, error) { ... }
```

```
type Shape struct {
```

```
    X      int
```

```
    Y      int
```

```
    Color  ColorCode
```

```
}
```


Program Structure

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- Import packages into the program using the `import` statement.
- Always prefix identifiers from imported packages with their package name.
- Identifiers can be *public* or *private* w/r/t package boundaries.
 - Identifier names starting with an uppercase letter are public.
 - All others are private.

Hello, World

```
https://go.dev/play/
```

```
/* Standard-issue "Hello, World" program in Go */
```

```
package main
```

```
import "fmt"
```

```
func main() {  
    fmt.Println("Hello, 世界")  
}
```

The Playground

- Interactive playground to immediately try something in Go.
- <https://go.dev/play/>

The screenshot shows the Go Playground web interface. At the top is a teal navigation bar with the Go logo and links for 'Why Go', 'Learn', 'Docs', 'Packages', and 'Community'. Below this is a dark grey header area with the title 'The Go Playground', a version selector set to 'Go 1.22', and buttons for 'Run', 'Format', and 'Share'. To the right of these buttons is a text input field containing 'Hello, World!'. The main area is a dark grey editor with a light blue border. It contains the following Go code:

```
1 // You can edit this code!
2 // Click here and start typing.
3 package main
4
5 import "fmt"
6
7 func main() {
8     fmt.Println("Hello, 世界")
9 }
10
11
```

Below the editor, the output of the program is displayed: 'Hello, 世界'. At the bottom of the output area, it says 'Program exited.'.

Importing Third-Party Packages

- Standard library package names are simple names:

```
import "fmt"  
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import "flag"  
import "math"
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- Getting packages from public repositories:

```
import "github.com/MadScienceZone/go-gma/v5/dice"
```

Automatic API Documentation

• `https://pkg.go.dev/repository-url`

The screenshot shows the Go Package Documentation page for the 'dice' package. The header includes the Go logo, a search bar, and navigation links like 'Why Go', 'Learn', 'Docs', 'Packages', and 'Community'. The main content area displays the package name 'dice' with a 'package' tag, its version 'v5.17.0' (marked as 'Latest'), and publication details. Below this, there are sections for 'Details' (with links to valid go.mod file, redistributable license, tagged version, and stable version), 'Repository' (github.com/MadScienceZone/go-gma), and 'Links' (Open Source Insights). The 'Documentation' section is expanded, showing a sidebar with 'Overview', 'Index', 'Constants', 'Variables', 'Functions', 'Types', and 'Source Files'. The 'Overview' section describes the package's purpose and provides a code example for rolling dice.

Discover Packages > github.com/MadScienceZone/go-gma/v5 > dice

dice package

Version: v5.17.0 **Latest** | Published: Feb 28, 2024 | License: BSD-3-Clause | Imports: 16 | Imported by: 0

Details [Valid go.mod file](#) [Redistributable license](#) [Tagged version](#) [Stable version](#) [Learn more about best practices](#)

Repository [github.com/MadScienceZone/go-gma](#)

Links [Open Source Insights](#)

Jump to ...

Documentation

- Overview
- Index
- Constants
- Variables
- Functions
- Types
- Source Files

Overview

Package dice provides a general facility for generating random numbers in fantasy role-playing games.

The preferred usage model is to use the higher-level abstraction provided by DieRoller, which rolls dice as described by strings. For example:

```
label, results, err := Roll("d20+16 | c")
label, result, err := RollOnce("15d6 + 15 fire + 1 acid")
```

If you need to keep the die roller itself around after the dice are rolled, to query its status, or to produce a repeatable string of die rolls given a custom seed or number generator, create a new DieRoller value and reuse that as needed:

```
dr, err := NewDieRoller()
```

“Factored” Notation

```
import "fmt"  
import "encoding/json"  
import "flag"  
import "math"
```

“Factored” Notation

```
import "fmt"
import "encoding/json"
import "flag"
import "math"

import (
    "fmt"
    "encoding/json"
    "flag"
    "math"
)
```

“Factored” Notation

```
var initialized bool
var usernames    []string
var Greeting     string    = "Hello"
var TheAnswer    = 42

var (
    initialized bool
    usernames    []string
    Greeting     string    = "Hello"
    TheAnswer    = 42
)
```

“Factored” Notation

```
const initialized      = false
const Greeting         = "Hello"
const TheAnswer byte = 42

const (
    initialized      = false
    Greeting         = "Hello"
    TheAnswer byte = 42
)
```

“Factored” Notation and iota

<https://go.dev/play/p/LSHu1VKUz20>

```
type MessageType byte
const (
    ServerCommand MessageType = 0
    ServerReply    MessageType = 1
    ServerError    MessageType = 2
    UrgentMessage  MessageType = 3
)
```


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)

const (
    ServerCommand MessageType = iota
    ServerReply    MessageType = iota
    ServerError    MessageType = iota
    UrgentMessage  MessageType = iota
)
```

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    ServerError
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)
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“Factored” Notation and iota Expressions

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https://go.dev/play/p/LSHu1VKUz20
```

```
type MessageType byte
const (
    ServerCommand MessageType = 0x01
    ServerReply    MessageType = 0x02
    ServerError    MessageType = 0x04
    UrgentMessage  MessageType = 0x08
)

const (
    ServerCommand MessageType = 1 << iota
    ServerReply
    ServerError
    UrgentMessage
)
```

Conditionals

```
var x int

if x > 10 {
    fmt.Println("X exceeds 10.")
} else {
    fmt.Println("X is tiny.")
}
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if x > 10 {  
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} else {  
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}
```

```
if x *= 2; x > 10 {  
    fmt.Println("Now X is big.")  
} else {  
    fmt.Println("X is still small.")  
}
```

Switches

```
var x int

switch x {
case 0:
    fmt.Println("X is nothing.")
case 1, 3, 5:
    fmt.Println("X is odd.")
case 2, 4, 6:
    fmt.Println("X is even.")
default:
    fmt.Println("X is bigger than I can count.")
}
```

Loops

```
// infinite loop
```

```
for {  
}
```

```
// while loop
```

```
for thing.IsReady() {  
}
```

```
// traditional 3-part for loop
```

```
for i := 0; i < 10; i++ {  
}
```

Loops

```
// loop over interval [0,10)
```

```
for i := range 10 {  
}
```

```
// loop over elements of a collection
```

```
for i, v := range []int{1, 4, -3, 153} {  
}
```

```
// loop over data received from channel
```

```
for item := range channel {  
}
```


Arrays

- The number of elements *is part of the type* (`[10] int` vs. `[15] int`).

Arrays

- The number of elements *is part of the type* ([10] `int` vs. [15] `int`).
- Variables declared are initialized empty but ready for use

```
var things [5]string
```

```
things[0] = "raindrops on roses"  
things[1] = "whiskers on kittens"  
things[2] = "copper kettles"  
things[3] = "woolen mittens"  
things[4] = "wild geese"
```

```
fmt.Println("I like", things[2])  
fmt.Println("I also like", things)  
fmt.Println("I know", len(things), "things.")
```

Arrays

<https://go.dev/play/p/rexZjp6SdKD>

- Or you can specify an array literal value to use in an expression or assign to a variable

```
things := [5]string{
    "raindrops on roses",
    "whiskers on kittens",
    "copper kettles",
    "woolen mittens",
    "wild geese",
}
```

```
fmt.Println("I like", things[2])
fmt.Println("I also like", things)
fmt.Println("I know", len(things), "things.")
```

Slices

<https://go.dev/play/p/rexZjp6SdKD>

- Specify a range $[n:m]$ as the index into an array to get a subset of the array values with indices from n to $m - 1$.
- The value is a *slice*, not an *array*. It's a different type.
 - For `[5]string`, the value is `[]string`.

```
fmt.Println("Some things:", things[1:3])  
fmt.Println("Some things:", things[:3])  
fmt.Println("Some things:", things[1:])  
fmt.Println("Some things:", things[:])
```

Slices

`https://go.dev/play/p/rexZjp6SdKD`

- Dimensionless “arrays”: `[]int`.
- Actually a “view” into an underlying array.
 - Go creates and manages the underlying array automatically for you.

```
var things []string
```

Slices

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```

- Dimensionless “arrays”: `[]int`.
- Actually a “view” into an underlying array.
 - Go creates and manages the underlying array automatically for you.

```
var things []string

things = append(things, "doorbells")
things = append(things, "sleighbells", "schnitzel")
fmt.Println(len(things), things)
// prints:  3 [doorbells sleighbells schnitzel]
```

Slices

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https://go.dev/play/p/rexZjp6SdKD
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- Can also specify a slice of values as a literal.

```
things := []string{  
    "doorbells",  
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things := []string{
    "doorbells",
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    "schnitzel",
}
```

```
primes := []int{2, 3, 5, 7, 11, 13}
lowPrimes := slices.Delete(primes, 3, len(primes))
fmt.Println(lowPrimes)
// prints: [2 3 5]
```


Maps

```
https://go.dev/play/p/Bfs6kEUKwve
```

```
var Ages map[string]int  
Ages = make(map[string]int)
```

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https://go.dev/play/p/Bfs6kEUKwve
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```
var Ages map[string]int
Ages = make(map[string]int)

Ages["Alice"] = 14
Ages["Bob"] = 22
Ages["Charlie"] = 27
Ages["Daria"] = 42
fmt.Println(Ages)
```

Maps

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https://go.dev/play/p/Bfs6kEUKwve
```

```
Ages := map[string]int{
    "Alice": 14,
    "Bob": 22,
    "Charlie": 27,
    "Daria": 42,
}

fmt.Println(Ages)

for name, age := range Ages {
    if age >= 18 {
        fmt.Printf("%s may vote.\n", name)
    } else {
        fmt.Printf("%s is not eligible.\n", name)
    }
}
```

Maps

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https://go.dev/play/p/Bfs6kEUKwve
```

```
aliceAge := Ages["Alice"] // 14  
eveAge  := Ages["Eve"]   // 0
```

Maps

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https://go.dev/play/p/Bfs6kEUKwve
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```
aliceAge := Ages["Alice"]           // 14
```

```
eveAge := Ages["Eve"]                // 0
```

```
aliceAge, exists := Ages["Alice"]    // 14, true
```

```
eveAge, exists := Ages["Eve"]        // 0, false
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```
Ages["Eve"] = 20
```

```
delete(Ages, "Bob")
```

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aliceAge, exists := Ages["Alice"] // 14, true
eveAge, exists  := Ages["Eve"]    // 0, false
```

```
Ages["Eve"] = 20
delete(Ages, "Bob")
```

```
if _, exists := Ages[name]; exists {
    fmt.Println("We do know about", name)
}
```

Maps

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aliceAge := Ages["Alice"] // 14
eveAge   := Ages["Eve"]   // 0
```

```
aliceAge, exists := Ages["Alice"] // 14, true
eveAge, exists   := Ages["Eve"]   // 0, false
```

```
Ages["Eve"] = 20
delete(Ages, "Bob")
```

```
if age, exists := Ages[name]; exists {
    fmt.Printf("We know %s's age is %d.\n", name, age)
} else {
    fmt.Println("We don't know", name)
}
```


Error Values

Error Handling

Error Values

```
func main() {  
    var intval int  
    var err      error  
  
    for i, arg := range os.Args[1:] {  
        intval, err = strconv.Atoi(arg)  
        if err != nil {  
            fmt.Printf("Arg #%d (\"%s\"): %v.\n",  
                        i, arg, err)  
        } else {  
            fmt.Printf("Arg #%d == %d\n", i, intval)  
        }  
    }  
}
```

Object Oriented Features

Wherewith Object Orientation?

(For a language without object classes...)

Structures

<https://go.dev/play/p/TC1HUvPovi0>

```
type Triangle struct {  
    Base    int  
    Height  int  
    X       int // Reference point  
    Y       int  
}
```

Structures

<https://go.dev/play/p/TC1HUvPovi0>

```
type Triangle struct {  
    Base    int  
    Height  int  
    X       int // Reference point  
    Y       int  
}
```

```
var t1 Triangle  
t1.Base = 37  
t1.Height = 15  
t1.X = 11  
t1.Y = 22
```

Structures

<https://go.dev/play/p/TC1HUvPovi0>

```
type Triangle struct {  
    Base    int  
    Height  int  
    X       int // Reference point  
    Y       int  
}  
  
var t2 Triangle = Triangle{Base: 3, Height: 1}  
  
fmt.Println("t2's base is", t2.Base)
```

Structures

```
https://go.dev/play/p/TC1HUvPovi0
```

```
type Triangle struct {  
    Base    int  
    Height  int  
    X       int // Reference point  
    Y       int  
}
```

```
t3 := Triangle{  
    Base:    100,  
    Height:  42,  
    X:       -3,  
    Y:       14,  
}
```

Method Functions

```
https://go.dev/play/p/TC1HUvPovi0
```

```
func Area(t Triangle) float64 {  
    return (float64(t.Base) *  
           float64(t.Height)) / 2.0  
}
```

```
func Translate(t Triangle, dx, dy int) Triangle {  
    t.X += dx  
    t.Y += dy  
    return t  
}
```

```
fmt.Println("t1 area =", Area(t1))  
t2 = Translate(t2, +3, -2)
```


Method Functions

```
https://go.dev/play/p/TC1HUvPovi0
```

```
func Area(t Triangle) float64 {  
    return (float64(t.Base) *  
           float64(t.Height)) / 2.0  
}  
  
func Translate(t *Triangle, dx, dy int) {  
    t.X += dx  
    t.Y += dy  
}  
  
fmt.Println("t1 area =", Area(t1))  
Translate(&t2, +3, -2)
```

Method Functions

```
https://go.dev/play/p/TC1HUvPovi0
```

```
func (t Triangle) Area() float64 {  
    return (float64(t.Base) *  
        float64(t.Height)) / 2.0  
}
```

```
func (t *Triangle) Translate(dx, dy int) {  
    t.X += dx  
    t.Y += dy  
}
```

```
fmt.Println("t1 area =", t1.Area())  
t2.Translate(+3, -2)
```

Composition

<https://go.dev/play/p/qp2nc6gywLr>

```
type BaseShape struct {  
    X int  
    Y int  
}
```

```
func (s BaseShape) ReferencePoint() (int, int) {  
    return s.X, s.Y  
}
```

```
// (We'll set aside the Translate method for now to  
// keep the in-class example simple.)
```

Composition

<https://go.dev/play/p/qp2nc6gywLr>

```
type Triangle struct {  
    BaseShape  
    Base    int  
    Height  int  
}  
  
func (t Triangle) Area() float64 {  
    return (float64(t.Base) *  
           float64(t.Height)) / 2.0  
}
```

Composition

<https://go.dev/play/p/qp2nc6gywLr>

```
type Rectangle struct {  
    BaseShape  
    Width  int  
    Height int  
}  
  
func (r Rectangle) Area() float64 {  
    return float64(r.Width * r.Height)  
}
```

Composition

```
https://go.dev/play/p/qp2nc6gywLr
```

```
// Regular Polygons
type Polygon struct {
    BaseShape
    Sides    int
    Length   float64 // Length of each side
    Radius   float64 // Radius of inscribed circle
}

func (p Polygon) Area() float64 {
    return (float64(p.Sides) / 2.0) *
        p.Length * p.Radius
}
```

Composition

<https://go.dev/play/p/qp2nc6gywLr>

```
type Circle struct {  
    BaseShape  
    Radius float64  
}  
  
func (c Circle) Area() float64 {  
    return math.Pi * math.Pow(c.Radius, 2)  
}
```

Composition

<https://go.dev/play/p/qp2nc6gywLr>

```
c := Circle{  
    BaseShape: BaseShape{  
        X: 1,  
        Y: 2,  
    },  
    Radius: 1.5,  
}
```


Composition

<https://go.dev/play/p/qp2nc6gywLr>

```
c := Circle{
    BaseShape: BaseShape{
        X: 1,
        Y: 2,
    },
    Radius: 1.5,
}

fmt.Println(c.BaseShape.X, c.BaseShape.Y,
            c.Radius, c.Area())
```

Composition

```
https://go.dev/play/p/qp2nc6gywLr
```

```
c := Circle{
    BaseShape: BaseShape{
        X: 1,
        Y: 2,
    },
    Radius: 1.5,
}

fmt.Println(c.BaseShape.X, c.BaseShape.Y,
            c.Radius, c.Area())

fmt.Println(c.X, c.Y, c.Radius, c.Area())
```

Polymorphism

<https://go.dev/play/p/qp2nc6gywLr>

```
shapes := []Shape{
    Triangle{
        BaseShape: BaseShape{
            X: 3,
            Y: 12,
        },
        Base: 3,
        Height: 2,
    },
    Circle{BaseShape:BaseShape{Y: 22}, Radius: 1.5},
    Rectangle{Height: 100, Width: 50},
}
```

Polymorphism

```
https://go.dev/play/p/qp2nc6gywLr
```

```
shapes := []Shape{
    Triangle{BaseShape: BaseShape{X: 3, Y: 12},
        Base: 3, Height: 2},
    Circle{BaseShape:BaseShape{Y: 22}, Radius: 1.5},
    Rectangle{Height: 100, Width: 50},
}

for i, shape := range shapes {
    x, y := shape.ReferencePoint()
    fmt.Printf("#%d at (%d,%d), area=%f\n",
        i, x, y, shape.Area())
}
```

Polymorphism via Interfaces

<https://go.dev/play/p/qp2nc6gywLr>

```
type Shape interface {  
    Area() float64  
    ReferencePoint() (int, int)  
}
```

Polymorphism via Interfaces

<https://go.dev/play/p/qp2nc6gywLr>

```
type Shape interface {  
    Area() float64  
    ReferencePoint() (int, int)  
}  
  
func reportArea(s Shape) {  
    fmt.Printf("The area is %f\n", s.Area())  
}
```

Type Assertions

Type Assertions

Type Assertions

<https://go.dev/play/p/dy952C3yZUX>

```
f(42)
```

```
f(-2)
```

```
func f(mystery any) {    // any == interface{}
    var v int

    // we know it's an int, just treat it as one
    v = mystery + 15

    fmt.Println("int mystery is", v)
}
```


Type Assertions

<https://go.dev/play/p/dy952C3yZUX>

```
f(42)
```

```
f(-2)
```

```
func f(mystery any) {    // any == interface{}
    var v int

    x := mystery.(int)
    v = x + 15

    fmt.Println("int mystery is", v)
}
```

Type Assertions

```
https://go.dev/play/p/dy952C3yZUX
```

```
f(42)
```

```
f("hello")
```

```
func f(mystery any) {    // any == interface{}
    var v int

    x := mystery.(int)
    v = x + 15

    fmt.Println("int mystery is", v)
}
```

Type Assertions

```
https://go.dev/play/p/dy952C3yZUX
```

```
f(42)
```

```
f("hello")
```

```
func f(mystery any) {    // any == interface{}
    var v int

    x, ok := mystery.(int)
    v = x + 15

    fmt.Println("int mystery is", v)
}
```

Type Switch

<https://go.dev/play/p/dy952C3yZUX>

```
f(42)
f("hello")
func f(mystery any) {    // any == interface{}
    var v int

    switch x := mystery.(type) {
    case int:
        v = x + 15
    case string:
        fmt.Println("string", x)
    default:
        // handle the unknown type
    }
}
```

Goroutines

Concurrency!

(Goroutines and Channels and some other things)

Goroutines—Calling a Function in the “Background”

<https://go.dev/play/p/FJNb0cNYI8->

```
func countdown() {  
    for i := 10; i >= 0; i-- {  
        fmt.Printf(">>> %d <<<\n", i)  
        time.Sleep(1 * time.Second)  
    }  
}
```

Goroutines—Calling a Function in the “Background”

<https://go.dev/play/p/FJNb0cNYI8->

```
func countdown() {  
    for i := 10; i >= 0; i-- {  
        fmt.Printf(">>> %d <<<\n", i)  
        time.Sleep(1 * time.Second)  
    }  
}  
  
func main() {  
    countdown()  
    fmt.Println("Starting a long-running task...")  
    time.Sleep(15 * time.Second)  
    fmt.Println("Done. Exiting.")  
}
```

Goroutines—Calling a Function in the “Background”

<https://go.dev/play/p/FJNb0cNYI8->

```
func countdown() {  
    for i := 10; i >= 0; i-- {  
        fmt.Printf(">>> %d <<<\n", i)  
        time.Sleep(1 * time.Second)  
    }  
}  
  
func main() {  
    go countdown()  
    fmt.Println("Starting a long-running task...")  
    time.Sleep(15 * time.Second)  
    fmt.Println("Done. Exiting.")  
}
```


Channels

```
https://go.dev/play/p/sFuhOuwVS6c
```

```
ch := make(chan byte)
```

Channels

```
https://go.dev/play/p/sFuhOuwVS6c
```

```
ch := make(chan byte)

fmt.Println("Writing to channel")

ch <- 42

fmt.Println("Reading from channel")

x := <-ch

fmt.Println("Read", x, "from channel")
```

Channels

```
https://go.dev/play/p/sFuhOuwVS6c
```

```
ch := make(chan byte)

fmt.Println("Writing to channel")

ch <- 42          // DEADLOCKED!

fmt.Println("Reading from channel")

x := <-ch

fmt.Println("Read", x, "from channel")
```

Channels

<https://go.dev/play/p/sFuhOuwVS6c>

```
ch := make(chan byte)
go func(c chan byte) {
    x := <-c
    fmt.Println("Read", x, "from channel")
}(ch)

fmt.Println("Writing to channel")
ch <- 42
```

Buffered Channels

```
https://go.dev/play/p/sFuhOuwVS6c
```

```
ch := make(chan byte, 1)
```

Buffered Channels

```
https://go.dev/play/p/sFuhOuwVS6c
```

```
ch := make(chan byte, 1)

fmt.Println("Writing to channel")
ch <- 42

fmt.Println("Reading from channel")
x := <-ch
fmt.Println("Read", x, "from channel")
```

Select

Select

Select (C)

```
#include <sys/select.h>
fd_set read_handles, write_handles, err_handles;
struct timeval t;
int sel = 0;

FD_ZERO(&read_handles);
FD_ZERO(&write_handles);
FD_ZERO(&err_handles);
/* set bits for handles you're interested in */
t.tv_sec = 1;
t.tv_usec = 0;
```


Select (C)

```
if ((sel = select(maxfd, &read_handles,
                  &write_handles,
                  &err_handles, &t)) == -1) {
    /* error... */
}
else if (sel > 0) {
    /* go back and check the bits in *_handles */
}
```

Select (Go)

```
select {  
case x := <- ichan:  
    // we could read from ichan, proceed  
    // with that...  
  
case ochan <- ovalue:  
    // we could write to ochan  
  
}
```

Select (Go)

```
select {  
case x := <- ichan:  
    // we could read from ichan, proceed  
    // with that...  
  
case ochan <- ovalue:  
    // we could write to ochan  
  
default:  
    // if we don't want the whole select to  
    // block, add a default case here.  
  
}
```

Global ID Generation Examples

Thread-Safe Memory Access

by example

Global ID Generation (Naïve)

```
https://go.dev/play/p/i0xsFX_TSaa
```

```
type GameState struct {  
    NextMessageID int  
}
```

Global ID Generation (Naïve)

```
https://go.dev/play/p/i0xsFX_TSaa
```

```
type GameState struct {  
    NextMessageID int  
}
```

```
var gameserver GameState
```

```
// In many concurrent goroutines...
```

```
gameServer.NextMessageID++
```

```
client.ID = gameServer.NextMessageID
```

Global ID Generation (Naïve)

```
https://go.dev/play/p/i0xsFX_TSaa
```

```
type GameState struct {  
    NextMessageID int  
}
```

```
var gameserver GameState
```

```
// In many concurrent goroutines...
```

```
gameServer.NextMessageID++           // UNSAFE!
```

```
client.ID = gameServer.NextMessageID // UNSAFE!
```

Global ID Generation (Mutex)

https://go.dev/play/p/i0xsFX_TSaa

```
type GameState struct {
    nextMessageID int
    lock          sync.Mutex
}

func (state *GameState) GetNextID() int {

}

// in many random goroutines...
client.ID = gameServer.GetNextID()
```


Global ID Generation (Mutex)

```
https://go.dev/play/p/i0xsFX_TSaa
```

```
type GameState struct {  
    nextMessageID int  
    lock          sync.Mutex  
}  
  
func (state *GameState) GetNextID() int {  
    state.lock.Lock()  
    state.nextMessageID++  
    nextID := state.MessageID  
    state.lock.Unlock()  
    return nextID  
}  
  
// in many random goroutines...  
client.ID = gameServer.GetNextID()
```

Global ID Generation (Mutex)

```
https://go.dev/play/p/i0xsFX_TSaa
```

```
type GameState struct {  
    nextMessageID int  
    lock          sync.Mutex  
}  
  
func (state *GameState) GetNextID() int {  
    state.lock.Lock()  
    defer state.lock.Unlock()  
  
    state.nextMessageID++  
    return state.nextMessageID  
}  
  
// in many random goroutines...  
client.ID = gameServer.GetNextID()
```

Global ID Generation (Mutex)

```
https://go.dev/play/p/i0xsFX_TSaa
```

```
func main() {  
    var gameServer GameState  
    var wg          sync.WaitGroup  
    for i := range 100 {  
        wg.Add(1)  
        id := i  
        go func() {  
            defer wg.Done()  
            fmt.Printf("Goroutine #%d, ID=%d\n", id,  
                      gameServer.GetNextID())  
        }()  
    }  
    wg.Wait()  
}
```

Global ID Generation (Channel)

But that's not very idiomatic for Go.

Here's a much better approach...

Global ID Generation (Channel)

<https://go.dev/play/p/mRfglxbH-kI>

```
func serveMessageIDs(c chan<- int) {  
    var id int  
    for {  
        c <- id  
        id++  
    }  
}
```

Global ID Generation (Channel)

```
https://go.dev/play/p/mRfglxbH-kI
```

```
func serveMessageIDs(c chan<- int) {  
    var id int  
    for {  
        c <- id  
        id++  
    }  
}  
  
// start up the service  
IDSource := make(chan int)  
go serveMessageIDs(IDSource)
```

Global ID Generation (Channel)

```
https://go.dev/play/p/mRfglxbH-kI
```

```
func serveMessageIDs(c chan<- int) {  
    var id int  
    for {  
        c <- id  
        id++  
    }  
}  
  
// start up the service  
IDSource := make(chan int)  
go serveMessageIDs(IDSource)  
  
// In many random goroutines...  
client.ID = <-IDSource
```

Bonus/Backup Material

Some more cool stuff if time
allows...

Contextx

Contexts

Contexts

```
https://go.dev/play/p/cPSNhVfS8r-
```

```
func collectData(stream <-chan string) error {
    for {
        data, ok := <-stream
        if !ok {
            return nil
        }
        if err := doSomething(data); err != nil {
            return err
        }
    }
}

// elsewhere
collectData(stream)
```

Contexts

```
https://go.dev/play/p/cPSNhVfS8r-
```

```
func collectData(ctx context.Context,
                 stream <-chan string) error {
    for {
        select {
        case <-ctx.Done():
            return nil
        case data, ok := <-stream:
            if !ok { return nil }
            if err := doSomething(data); err != nil {
                return err
            }
        }
    }
}
```

Contexts

```
https://go.dev/play/p/cPSNhVfS8r-
```

```
// caller
```

```
ctx, cancel := context.WithTimeout(  
    context.Background(), 5 * time.Second)  
defer cancel()  
  
if err := collectData(ctx, stream); err != nil {  
    panic(err)  
}
```

Contexts

```
https://go.dev/play/p/cPSNhVfS8r-
```

```
func collectData(ctx context.Context,
                 stream <-chan string) error {
    for {
        select {
        case <-ctx.Done():
            return nil
        case <-time.After(2 * time.Second):
            log.Print("collectData taking too long")
        case data, ok := <-stream:
            if !ok { return nil }
            if err := doSomething(data); err != nil {
                return err
            }
        }
    }
}
```

JSON

Encoding (JSON)

JSON

```
https://go.dev/play/p/_KcMkqhzhbZ
```

```
import "encoding/json"

type User struct {
    Name    string    `json:"name"`
    ID      int       `json:",omitempty"`
    Attrs   []string  `json:"attributes,omitempty"`
    Secret  []byte    `json:"- "`
}

data := User{
    Name: "steve",
    ID: 42,
    Attrs: []string{"foo", "bar"},
    Secret: sdata,
}
```

JSON

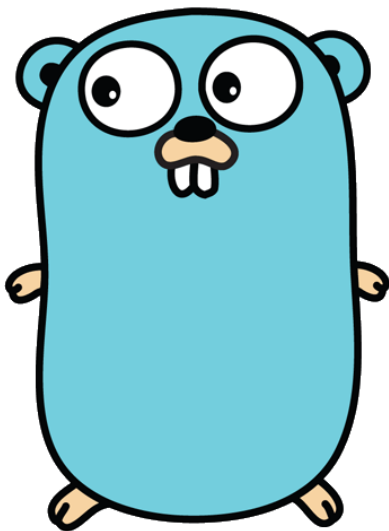
```
https://go.dev/play/p/_KcMkqhzhbZ
```

```
import "encoding/json"
```

```
type User struct {  
    Name    string    `json:"name"`  
    ID      int       `json:",omitempty"`  
    Attrs   []string  `json:"attributes,omitempty"`  
    Secret  []byte    `json:"- "`  
}
```

```
encoded, err := json.Marshal(data)  
// {"name":"steve","ID":42,"attributes":["foo","bar"]}
```

```
var inputData User  
err := json.Unmarshal(jsonBytes, &inputData)
```

github.com/MadScienceZone/go-tour