A Whirlwind Tour of Go

Just the Cool Parts

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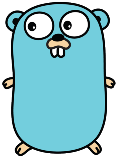
10-Apr-2024

v0.0.1



The Point

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

30 Seconds of History

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  - ... but cleaned up and streamlined a bit.

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- “If we were to design C today, knowing what we know now, on today’s technology...”
    - ∴ 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

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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- Special things: `complex64`, `complex128`.
- Structures: `struct{...}`.
- What about `char`? Nope. Instead, we have `rune`.
- Arrays: `[10]int`, `[100]rune`.
- Slices: `[]int`, `[]byte`, `[]string`.
- Maps: `map[string]int`.

Expressions and Operators

- Arithmetic: +, −, *, /, %.
- Relational: ==, !=, >, <, >=, <=.
- Logical: &&, ||, !.
- Bitwise: &, |, ^, <<, >>, &^.

```
// x &^ y == x & (^y)
```

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- Reference/Dereference: &, *.
- 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: _.

Go Syntax

- Type declarations *follow* identifier names

```
var x int
var UserName string

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

type Shape struct {
   X     int
   Y     int
   Color ColorCode
}
```

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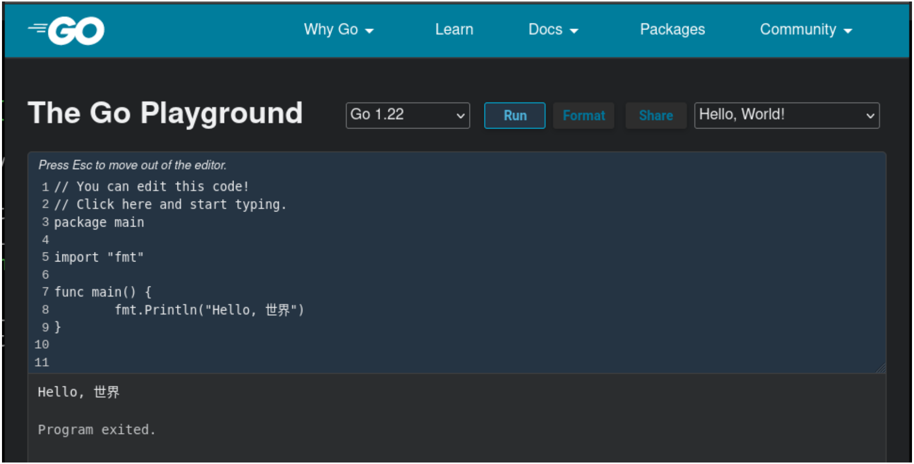
- The `main` package has a `main` function.
- Import packages into the program using the `import` statement.
- Always prefix identifiers from imported packages with their package name.
- Identifiers can be *public* or *private* w/r/t package boundaries.
  - Identifier names starting with an uppercase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

Hello, World

```go
/* 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 Go Playground

Press Esc to move out of the editor.

```
// You can edit this code!
// Click here and start typing.
package main

import "fmt"

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


```

```
Hello, 世界

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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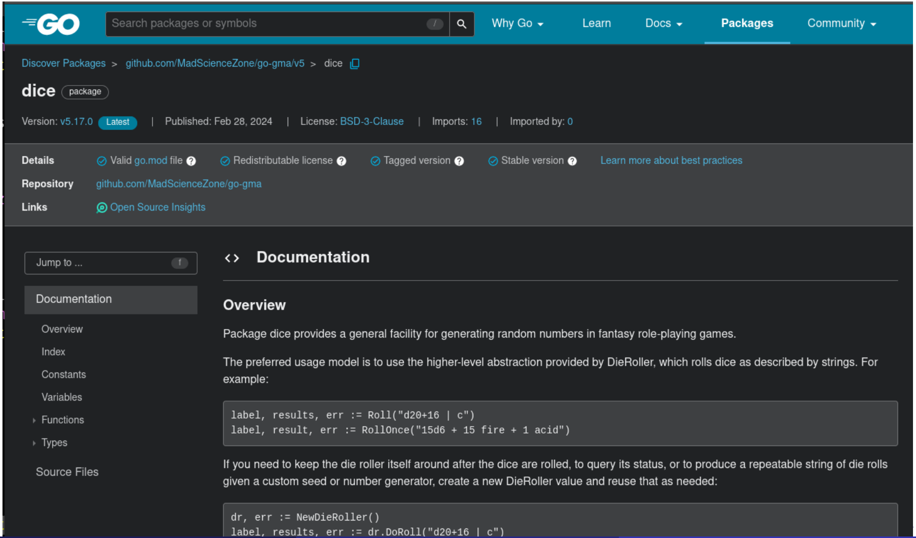
- Getting packages from public repositories:

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

Automatic API Documentation

- `https://pkg.go.dev/`*repository-url*



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

Documentation

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()
label, results, err := dr.DoRoll("d20+16 | c")
```

"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

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

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

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

“Factored” Notation and iota

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

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

“Factored” Notation and iota Expressions

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

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

Arrays

- No, never mind. Let's talk about slices instead.

Slices

```
var Ages map[string]int
Ages = make(map[string]int, 10)

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

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

Maps

Conditionals

Loops

Structures

Method Functions

Composition

Polymorphism

Goroutines—Calling a Function in the “Background”

```
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”

```
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”

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

func main() {
    go countdown()
    fmt.Println("Starting a long-running task...")
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Global ID Generation (Naïve)

```
type GameState struct {
    NextMessageID int
}
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Global ID Generation (Naïve)

```
type GameState struct {
    NextMessageID int
}

var gameServer GameState

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

Global ID Generation (Mutex)

```
type GameState struct {
    NextMessageID int
    Lock          sync.Mutex
}
```

Global ID Generation (Mutex)

```
type GameState struct {
    NextMessageID int
    Lock          sync.RWMutex
}
```

Global ID Generation (Mutex)

```
type GameState struct {
    NextMessageID int
    Lock          sync.RWMutex
}

func (state *GameState) GetNextID() int {
    state.Lock.Lock()
    state.NextMessageID++
    nextID := state.MessageID
    state.Lock.Unlock()
    return nextID
}
```

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client.ID = gameServer.GetNextID()
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func (state *GameState) GetNextID() int {
    state.Lock.Lock()
    defer state.Lock.Unlock()

    state.NextMessageID++
    return state.NextMessageID
}

client.ID = gameServer.GetNextID()
```

Global ID Generation (Channel)

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

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func serveMessageIDs(c chan int) int {
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}

IDSource := make(chan int)
go serveMessageIDs(IDSource)
```

Global ID Generation (Channel)

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

IDSource := make(chan int)
go serveMessageIDs(IDSource)

client.ID = <-IDSource
```

Channels

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

fmt.Println("Writing to channel")
ch <- 42
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fmt.Println("Reading from channel")
x := <-ch
fmt.Println("Read", x, "from channel")
```

Channels

```
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

```
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

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

Buffered Channels

ch := make(chan byte, 1)

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

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