

The Go Programming Language

Basic

Anuchit Prasertsang
Developer

Basic

Topic

- Introduction
- Variables
- Constants
- Control Flow
- Loop
- Data Structures
- Array
- Slices
- Map
- Functions
- Defer
- Pointers

Installing

Download <https://golang.org/dl> (<https://golang.org/dl/>)

mac/linux

Download file.tar.gz

windows

Download file.zip

GOROOT

mac/linux

windows

GOROOT vs GOPATH

GOROOT is a root of your Go installation.

If you are a Java user, \$GOROOT is similar in effect to \$JAVA_HOME

GOPATH is an environment variable that specifies the location of your workspace.

It defaults to a directory named go inside your home directory

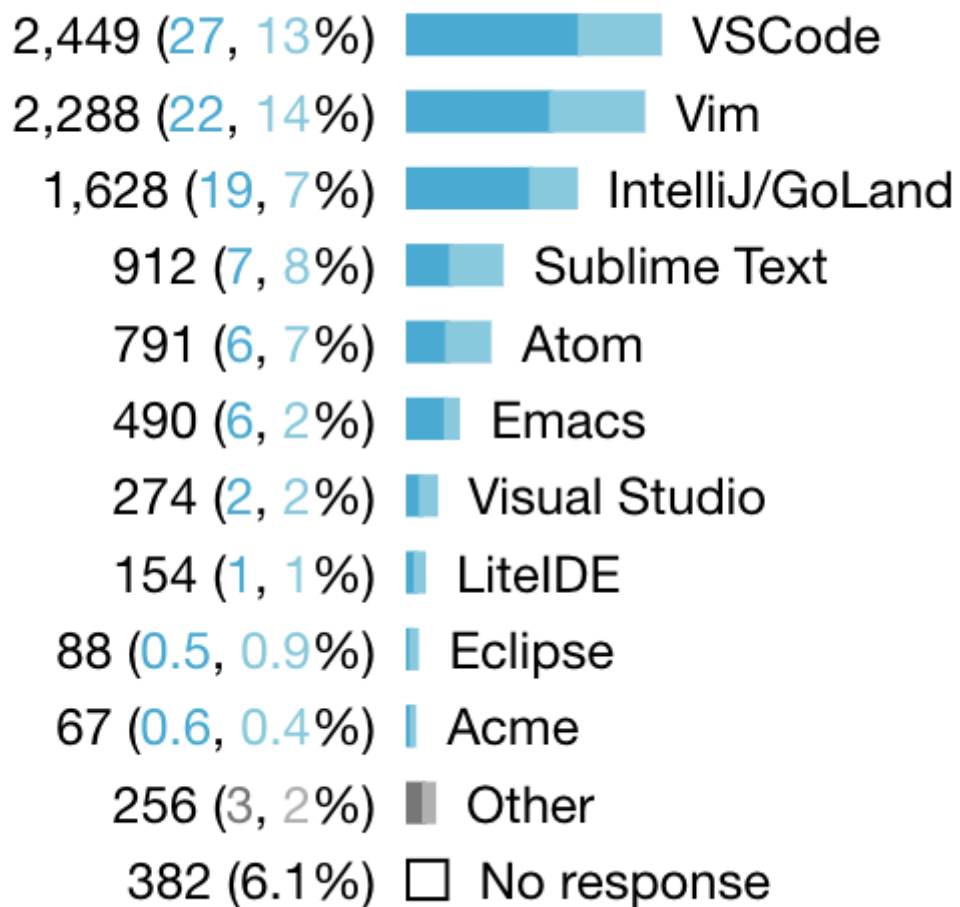
- Unix

- Windows

Project structure

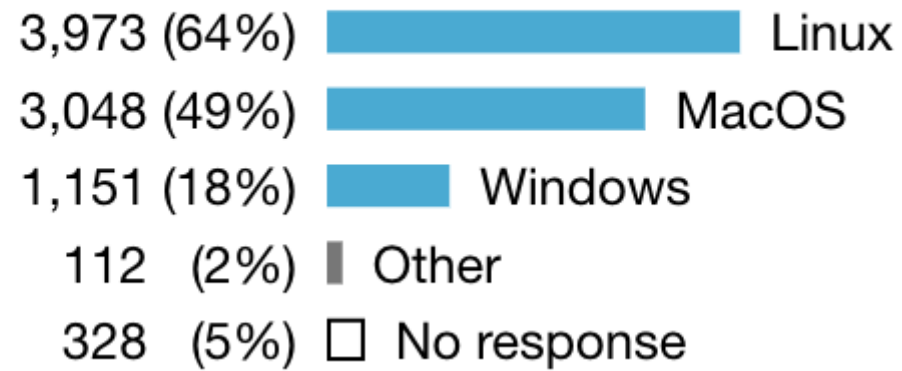
editor

My preferred code editor



OS

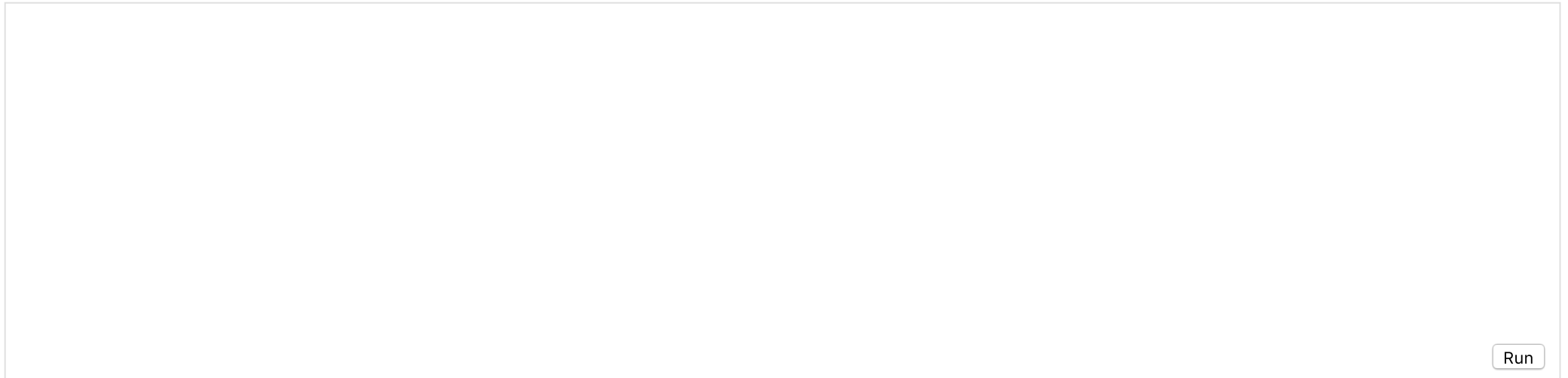
I primarily develop Go on: (multiple choice)



Keywords

Packages

- Every Go program is made up of packages.
- Programs start running in package main.



- By convention, the package name is the same as the last element of the import path. For instance, the "**math/rand**" package comprises files that begin with the statement `package rand`.

Imports

- This code groups the imports into a parenthesized, "factored" import statement.

- You can also write multiple import statements, like:

But it is good style to use the factored import statement.

Exported names

- In Go, a name is exported if it begins with a **capital letter**.

- When importing a package **math.Pi**
- Any "unexported" names are not accessible from outside the package.

Variables

- The **var** statement declares a list of variables; as in function argument lists, the type is last.
- A **var** statement can be at package or function level. We see both in this example.

Run

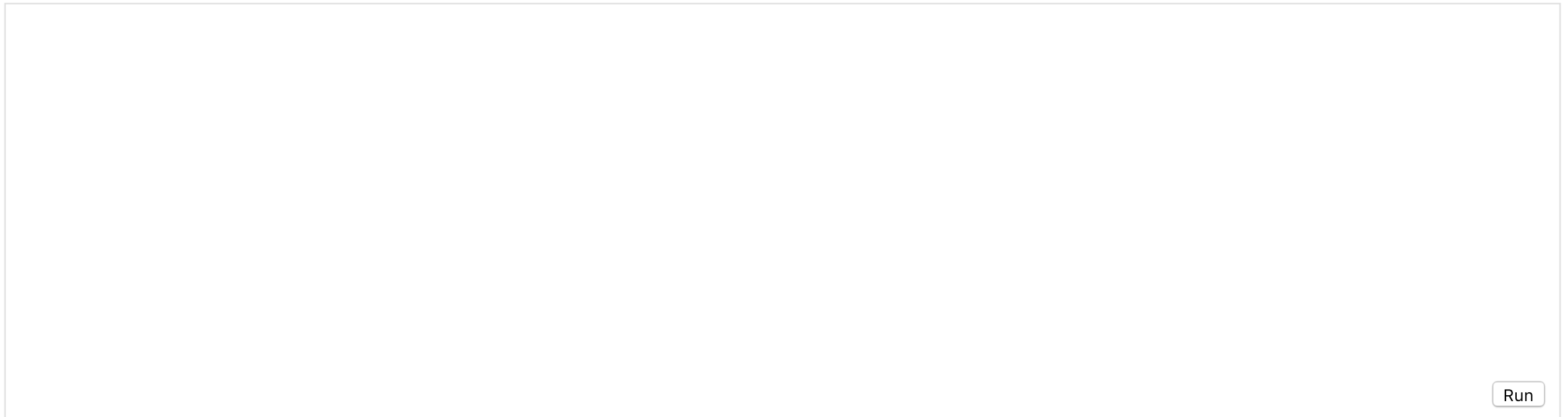
Variables with initializers

- If an initializer is present, the type can be omitted; the variable will take the type of the initializer.

Run

Short variable declarations

- Inside a function, the `:=` short assignment statement can be used in place of a **var** declaration with implicit type.



- Outside a function, every statement begins with a keyword (`if` , `while` , and so on) and so the `:=` construct is not available.

Basic types

Go's basic types are



The `int`, `int32`, and `int64` types are usually 32 bits wide on 32-bit systems and 64 bits wide on 64-bit systems.

When you need an integer value you should use `int` unless you have a specific reason to use a sized or unsigned integer type.

Zero values

Variables declared without an explicit initial value are given their zero value.

The zero value is:

0 for numeric types,

false for the boolean type

"" (the empty string) for strings.

Run

`%q` a double-quoted string safely escaped with Go syntax

Type conversions

The expression `T(v)` converts the value `v` to the type `T`.

Some numeric conversions:

Or, put more simply:

Unlike in C, in Go assignment between items of different type requires an explicit conversion¹⁰.

Type conversions - example

Try removing the or conversions in the example and see what happens.



Type inference

When declaring a variable without specifying an explicit type (either by using the `:=` syntax or `var = expression` syntax), the variable's type is inferred from the value on the right hand side.

When the right hand side of the declaration is typed, the new variable is of that same type:

But when the right hand side contains an untyped numeric constant, the new variable may be an `Int`, `Long`, or `Double` depending on the precision of the constant:

Type inference - example

Try changing the initial value of `z` in the example code and observe how its type is affected.



Constants

Constants are declared like variables, but with the `const` keyword.

Constants can be `int`, `float`, `double`, or `string` values.

Constants **cannot** be declared using the `:=` syntax.

Run

Constants - iota

iota expression is repeated by the other constants
until another assignment or type declaration shows up.

Functions

- A function can take zero or more arguments.
- In this example, **add** takes two parameters of type **int**.
- Notice that the comes the .

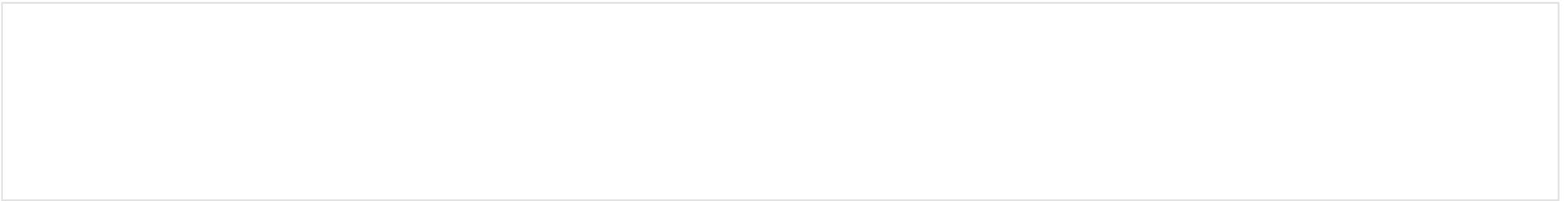
Multiple results

- a function can return any number of results
- the **swap** function returns two string.

Run

Named return values

- Go's return values may be named. If so, they are treated as variables defined at the top of the function.



- A return statement without arguments returns the named return values. This is known as a "**naked**" return.
- Naked return statements should be used only in short functions.

Function values

Functions are values too. They can be **passed around** just like other values. Function values may be used as function arguments and return values.

Function closures

Exercise: Fibonacci closure

Implement a function that returns a function (a closure) that returns successive fibonacci numbers

F0, the "0" is omitted (0, 1, 1, 2, 3, 5, ...)

Flow Control

For

Go has only one looping construct, the **for** loop.

Run

The basic **for** loop has three components separated by semicolons:

The init statement will often be a short variable declaration, and the variables declared there are visible only in the scope of the **for** statement. The loop will stop iterating once the boolean condition evaluates to **false**.

Note: there are no parentheses surrounding

For continued

The init and post statements are optional.

Run

For is Go's "while"

At that point you can drop the semicolons: C's while is spelled for in Go.

Run

Forever

If you omit the loop condition it loops forever, so an infinite loop is compactly expressed.

Run

If

Go's **if** statements are like its loops; the expression need not be surrounded by parentheses () but the braces { } are **required**.

Run

If with a short statement

Like `if`, the `if` statement can start with a short statement to execute before the condition. Variables declared by the statement are only in scope until the end of the `if`.

(Try using `if` in the last `if` statement.)

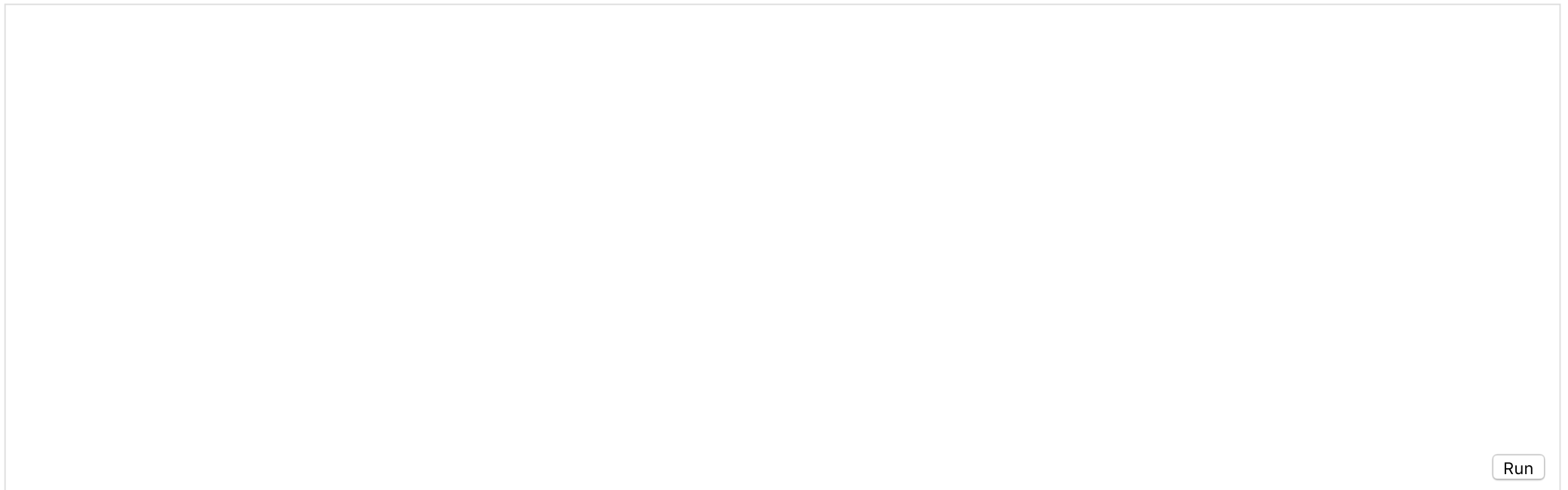
If and else

Variables declared inside an **if** short statement are also available inside any of the **else** blocks.

Exercise: Loops and Functions

Switch

A **switch** statement is a shorter way to write a sequence of statements. It runs the first case whose value is equal to the condition expression.



Go **only runs the selected case**, not all the cases that follow. the **break** statement is provided automatically in Go.

Switch evaluation order

Switch cases evaluate cases from top to bottom, stopping when a case succeeds.

(For example,

does not call `if i==0` .)

Run

Switch with no condition

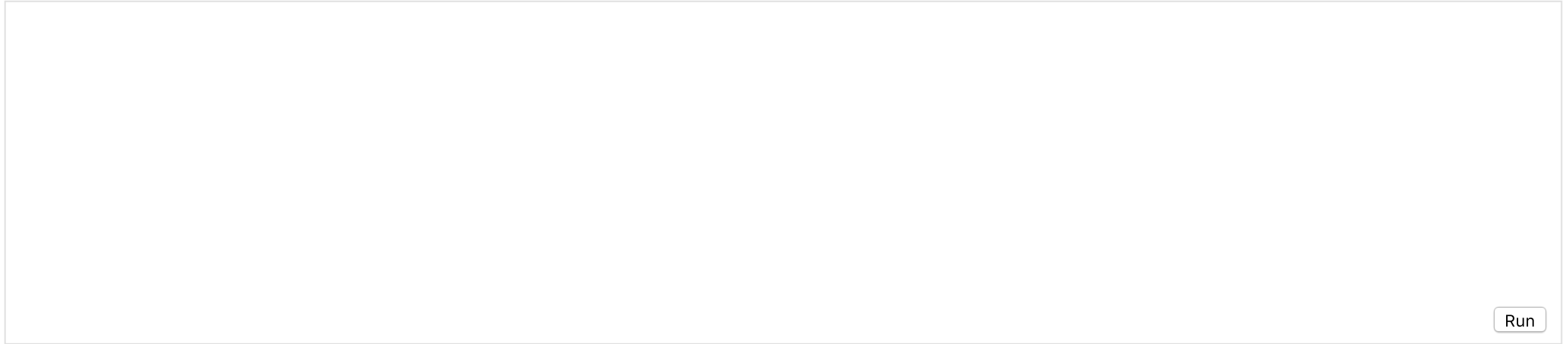
Switch without a condition is the same as **switch true**.



This construct can be a clean way to write long if-then-else chains.

Defer

A defer statement defers the execution of a function until the surrounding function returns.



The deferred call's arguments are evaluated immediately,
but the function call is not executed until the surrounding function returns.

Stacking defers

Deferred function calls are pushed onto a stack. When a function returns, its deferred calls are executed in last-in-first-out order.

Run

More types

Pointers

Go has pointers. A pointer holds the memory address of a value.

The type `*T` is a pointer to a `T` value. Its zero value is `nil`.

The `&` operator generates a pointer to its operand.

The `*` operator denotes the pointer's underlying value.

This is known as "dereferencing" or "indirecting".

Unlike C, Go has no pointer arithmetic.

Pointers - example

Structs

A is a collection of fields.

Run

Struct Fields

Struct fields are accessed using a dot.

Run

Pointers to structs

Struct fields can be accessed through a struct pointer.



To access the field **X** of a struct when we have the struct pointer **p** we could write **(* p).X**. However, that notation is cumbersome, so the language permits us instead to write just **p.X**, without the explicit dereference.

Struct Literals

A struct literal denotes a newly allocated struct value by listing the values of its fields.

You can list just a subset of fields by using the **Name:** syntax. (And the order of named fields is irrelevant.)

Run

The special prefix **&** returns a pointer to the struct value.

Arrays

The type `[n]T` is an array of `n` values of type `T`.

The expression

declares a variable `a` as an array of ten integers.

Run

An array's length is part of its type, so arrays `be` `.`

This seems limiting, but don't worry; Go provides a convenient way of working with arrays.⁵²

Slices

An array has a fixed size. A slice, on the other hand, is a dynamically-sized, flexible view into the elements of an array. In practice, slices are much more common than arrays.

The type `[]T` is a slice with elements of type `T`.

A slice is formed by specifying two indices, a low and high bound, separated by a colon:

This selects a **half-open range** which includes the element, but excludes the one.

The following expression creates a slice which includes elements 1 through 3 of `a`:

Slices - example, create slices from array

Run

Slices are like references to arrays

A slice does not store any data, it just describes a section of an underlying array.



Changing the elements of a slice modifies the corresponding elements of its underlying array.

Other slices that share the same underlying array will see those changes.

Slice literals

A slice literal is like an array literal without the length.

the array will be create, then builds a slice that references it:

Run

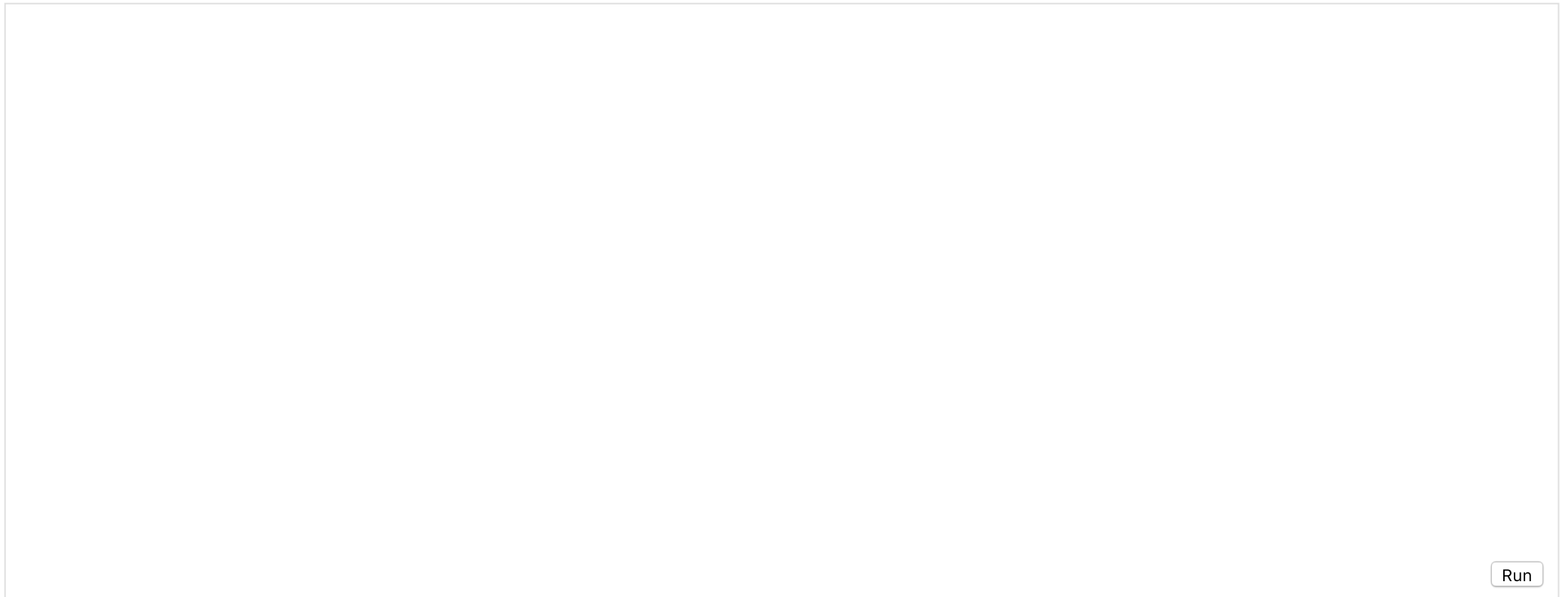
Slice bound defaults

When slicing, you may omit the high or low bounds to use their defaults instead.
For the array

these slice expressions are equivalent:

The default is for the low bound and the of the slice for the high bound.

Slice bound defaults - example



Slice length and capacity

A slice has both a `len` and a `cap`.

The length of a slice is the number of elements it contains.

The capacity of a slice is the number of elements in the underlying array, counting from the first element in the slice.

The length and capacity of a slice `s` can be obtained using the expressions `len(s)` and `cap(s)`.⁵⁹

Slice length and capacity - example

You can extend a slice's length by re-slicing it, provided it has sufficient capacity. Try changing one of the slice operations in the example program to extend it beyond its capacity and see what happens.

Nil slices

The zero value of a slice is **nil**.

A nil slice has a length and capacity of 0 and has no underlying array.

Run

Creating a slice with make

Slices can be created with the built-in **make** function; this is how you create dynamically-sized arrays.

The **make** function allocates a zeroed array and returns a slice that refers to that array:

To specify a capacity, pass a third argument to make:

Creating a slice with make - example



Run

Slices of slices

Slices can contain any type, including other slices.



Appending to a slice

It is common to **append** new elements to a slice, and so Go provides a built-in append function.

[append documents](https://golang.org/pkg/builtin/#append) (https://golang.org/pkg/builtin/#append)

The first parameter **s** of **append** is a slice of type **T**, and the rest are **T** values to append to the slice.

The resulting value of **append** is a slice containing all the elements of the original slice plus the provided values.

If the backing array of **s** is too small to fit all the given values a bigger array will be allocated. The returned slice will point to the newly allocated array.

[slices usages and internals](https://blog.golang.org/go-slices-usage-and-internals) (https://blog.golang.org/go-slices-usage-and-internals)

Appending to a slice - example

Run

Range

The range form of the for loop iterates over a slice or map.

When ranging over a slice, two values are returned for each iteration. The **first** is the **index**, and the **second** is a **copy of the element** at that index.

Run

Range continued

You can skip the index or value by assigning to `_`.

If you only want the index, drop the `, value` entirely.

Run

Exercise: Slices

Implement **Pic**. It should return a slice of length **dy**, each element of which is a slice of **dx** 8-bit unsigned integers. When you run the program, it will display your picture, interpreting the integers as grayscale (well, bluescale) values.

The choice of image is up to you. Interesting functions include `image`, `imageData`, and `imageSize`.

(You need to use a loop to allocate each `[]uint8` inside the `[][]uint8`.)

(Use `uint8(intValue)` to convert between types.)

Exercise: Slices - example answer

Run

Maps

A map maps keys to values.

The zero value of a map is **nil**. A **nil** map has no keys, nor can keys be added.

The `make` function returns a **map** of the given type, initialized and ready for use.

Run

Exercise: Maps I

- create map

Map literals

Map literals are like struct literals, but the keys are required.

Run

Map literals continued

If the top-level type is just a type name, you can omit it from the elements of the literal.

Run

Mutating Maps

Insert or update an element in map m:

Retrieve an element:


Delete an element:

Test that a key is present with a two-value assignment:

If key is in m, ok is true. If not, ok is false.

If key is not in the map, then elem is the zero value for the map's element type.

Mutating Maps - example



A large empty rectangular box, likely intended for code or output. In the bottom right corner of this box, there is a small button labeled "Run".

Exercise: Maps II

Implement **WordCount**. It should return a map of the counts of each “word” in the string **s**.

You might find **strings.Fields** helpful.

Thank you

Anuchit Prasertsang

Developer

anuchit.prasertsang@gmail.com (mailto:anuchit.prasertsang@gmail.com)

<https://github.com/AnuchitO> (https://github.com/AnuchitO)

[@twitter_AnuchitO](http://twitter.com/twitter_AnuchitO) (http://twitter.com/twitter_AnuchitO)

