Basics

Installation

Check go installation

```
go version
```

```
1@DESKTOP-8B6DSJ8 MINGW64 ~
$ go version
go version go1.18.2 windows/amd64
```

Setup environment variable

for linux

```
export GOPATH=$HOME/go
export PATH=$PATH:$GOPATH/bin
```

For windows

```
setx GOPATH %USERPROFILE%\go
setx path "%path%;%GOPATH%\bin"
```

First program

```
package main

import"fmt"

func main(){

 fmt.Println("Hello, world!")

}
```

- Save file as `hello.go`

Launch without a binary file

- Launch

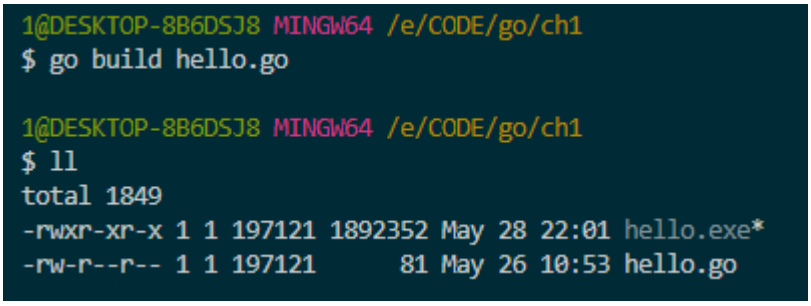
  ```
  go run hello.go
  ```

  ```
  1@DESKTOP-8B6DSJ8 MINGW64 /e/CODE/go/ch1
  $ go run hello.go
  Hello, world!
  ```

- While launching binary file was created in temporary directory and deleted after program was finished

Build a binary file

```
go build -o hello_world hello.go
```



Install additional tols

You can install additional tools via `go install`

For example install aggregate linter (include many popular linters)

```
go install github.com/golangci/golangci-lint/cmd/golangci-lint@v1.46.2
```

Example with linter usage

- create module for an application

```
go mod init ch1
```

- create makefile for build. It will apply linter and create binary file

```
.DEFAULT_GOAL:= build

fmt:
	go fmt ./...
.PHONY:fmt

lint:fmt
	golint ./...
.PHONY:lint

vet:fmt
	go vet ./...
.PHONY:vet

build:vet
	go build hello.go
.PHONY:build
```

After `:` defined previous `target`, link to previous task which has to been completed before current task

- launch build

```
make
```

```
1@DESKTOP-8B6DSJ8 MINGW64 /e/CODE/go/ch1
$ make
go fmt ./...
go vet ./...
go build hello.go
```

if you don't have `make` on Windows, you can install `choko` manager and then install `make`

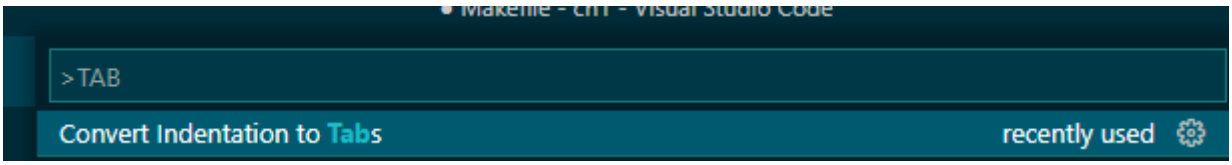
```
Set-ExecutionPolicy Bypass -Scope Process -Force;
[System.Net.ServicePointManager]::SecurityProtocol =
[System.Net.ServicePointManager]::SecurityProtocol -bor 3072; iex ((New-
Object
System.Net.WebClient).DownloadString('[https://community.chocolatey.org/ins
tall.ps1](https://www.google.com/url?
q=https://community.chocolatey.org/install.ps1&sa=D&source=editors&ust=1675
178682544290&usg=AOvVaw1Vvl_ZL3FJM_aIM1uyGrzj)'))

choco install make
```

Troubleshooting

Tabs and spaces

In the process writing VS code change tab to spaces. Then I find an option



You can check indentation with halp of `cat`

```
cat -e -t -v Makefile
```

```
1@DESKTOP-8B6DSJ8 MINGW64 /e/CODE/go/ch1
$ cat -e -t -v Makefile
.DEFAULT_GOAL := build$
$
fmt:$
^Igo fmt ./...$
.PHONY:fmt$
$
lint: fmt$
^Igolint ./...$
.PHONY:lint$
$
vet: fmt$
^Igo vet ./...$
.PHONY:vet$
$
build: vet$
^Igo build hello.go$
.PHONY:build
```

Before it was like this

```
1@DESKTOP-8B6DSJ8 MINGW64 /e/CODE/go/ch1
$ cat -e -t -v Makefile
.DEFAULT_GOAL := build$
$
fmt:$
        go fmt ./...$
.PHONY:fmt$
$
lint: fmt$
        golint ./...$
.PHONY:lint$
$
vet: fmt$
        go vet ./...$
.PHONY:vet$
$
build: vet$
        go build hello.go$
.PHONY:build
```

Variables

keyword var then name of variable then type of variable

```
var age int
```

```
package main

import "fmt"

func main() {
```

```
    var name string = "John"
    fmt.Println(name)
}
```

Data types

`int`, `int8`, `int16`, `int32`, `int64`

`float32`, `float64` - floating-point

`bool` - boolean data type

Literals

In integral literal you can write underscores `_`

Conditional

```
if condition {
} else {
}
```

comparison operators: ==, !=, <, >, <=, >=.

```
package main

import "fmt"

func main() {

    const age = 20

    if age >= 18 {
        fmt.Println("Этот человек совершеннолетний")
    } else {
        fmt.Println("Этот человек несовершеннолетний")
    }

}
```

Cycles

For

```
```

```
package main

import "fmt"

func main() {
    for i := 0; i < 5; i++ {
        fmt.Println(i)
    }
}
```

Range

```
package main

import "fmt"

func main() {
    names := []string{"Ivan", "Petr", "Johan"}

    for index, name := range names {
        fmt.Println(index, name)
    }
}
```

```
package main

import "fmt"

func main() {

    numbers := []int{0, 2, 3, 4}
    for index, value := range numbers {
        fmt.Println(index, value)
    }
}
```

ignoring index

```
for _, value := range slice {
    fmt.Println(value)
}
```

ignoring value

```
for index, _ := range slice {
    fmt.Println(index)
}
```

Slices

```
package main

import "fmt"

func main() {

    numbers := []int{1, 2, 3, 4, 5}
    numbers = append(numbers, 6)
    subset := numbers[2:4]
    fmt.Println("numbers:", numbers)
    fmt.Println("subset:", subset)
}
```

Functions

```
func add(x int, y int) int {
    return x + y
}
```

```
package main

import "fmt"

func main() {

    fmt.Println(isEven(0))
    fmt.Println(isEven(2))
    fmt.Println(isEven(145))
    fmt.Println(isEven(3))
    fmt.Println(isEven(10))
}

func isEven(number int) bool {
    return number%2 == 0
}
```

Structures

```
type Person struct {
    name string
    age  int
}
```

```
var p Person
p.name = "John"
p.age = 30
```

```
person := Person{name: "Alice", age: 30}
```

```
package main

import "fmt"

func main() {

    var field Rectangle
    field.height = 10
    field.width = 20
    fmt.Println(field.height, field.width)
}

type Rectangle struct {
    width  int
    height int
}
```

Method with structure

method is outside of structure. The first part after func is reciever. So called that connected to structure.

```
package main

import "fmt"

func main() {

    var field Rectangle
    field.height = 10
    field.width = 20
    fmt.Println(field.perimeter())
}
```

```
type Rectangle struct {
    width  int
    height int
}

func (rectangle Rectangle) perimeter() int {
    return rectangle.height + rectangle.width
}
```

Visibility

Visibility rules:

- Capitalization: If the name of a method, function, variable, or structure begins with a capital letter, then the identifier is exportable, meaning it can be accessed from other packages. This is similar to public in other programming languages.
- Lowercase Letter: If the name begins with a lowercase letter, then this identifier is non-exportable and can only be accessed within its package. This is similar to private in other programming languages.

```
package mypackage

type Car struct { // Exportable structure
    Make  string // public field
    model string // private field
}

func (c Car) Describe() string { // public method
    return fmt.Sprintf("%s %s", c.Make, c.model)
}

func secretFunction() { // private method
    fmt.Println("This is a secret")
}
```

Pointers

```
var ptr *int
```

```
var x int = 10
ptr := &x
fmt.Println(*ptr)
```

```go
package main

import "fmt"

func main() {

    var variable int = 10
    ptr := &variable

    *ptr = 20

    fmt.Println(variable)

}
```

```go
package main

import "fmt"

func increment(x *int) {
    *x += 1
}

func main() {
    var a int = 5
    increment(&a)
    fmt.Println(a) // Выведет 6
}
```

```go
package main

import "fmt"

func newInt() *int {
    var dummy int = 10
    return &dummy
}

func main() {
    numPtr := newInt()
    fmt.Println(*numPtr) // Выведет 10
}
```

if we will change to `fmt.Println(numPtr)` then we just print an address to memory as hex digit.
`0xc000014088`

go routines

it is lightweight threads.

```
package main

import (
    "fmt"
    "time"
)

func say(s string) {
    for i := 0; i < 5; i++ {
        time.Sleep(100 * time.Millisecond)
        fmt.Println(s)
    }
}

func main() {
    go say("world")
    say("hello")
}
```

channels

a way to exchange data between go routines without races. It can be described as a stream of data.

```
package main

import "fmt"

func sum(s []int, c chan int) {
    sum := 0
    for _, v := range s {
        sum += v
    }
    c <- sum // put int to the channel
}

func main() {
    s := []int{7, 2, 8, -9, 4, 0}

    c := make(chan int)
    go sum(s[:len(s)/2], c)
    go sum(s[len(s)/2:], c)
    x, y := <-c, <-c // blocking operation before results are ready

    fmt.Println(x, y, x+y)
}
```

buffer channel

```
resultChan := make(chan int, 2)
```

A buffered pipe has an internal buffer that allows it to store a certain number of elements without having to read them immediately. When you create a channel using `make(chan Type, size)`, you specify the maximum number of elements that can be stored in the channel buffe

Sending to a buffered channel:

- If a buffered channel has free buffer space, sending to the channel occurs without blocking—the sender does not wait for the receiver to start reading.
- If the channel's buffer is full, the sender blocks and waits until the buffer becomes free (when another goroutine reads from the channel).

Receiving from a buffered channel:

- If there is data in the channel, the reception occurs without blocking the recipient immediately receives the data.
- If the channel is empty, the receiver blocks and waits until data is sent to the channel.

```
package main

import (
    "fmt"
)

func calculateSum(values []int, resultChan chan int) {
    sum := 0
    for _, value := range values {
        sum += value
    }
    resultChan <- sum
}

func main() {
    numbers := []int{1, 2, 3, 4, 5, 6, 7, 8, 9, 10}
    resultChan := make(chan int, 2)

    mid := len(numbers) / 2
    go calculateSum(numbers[:mid], resultChan)
    go calculateSum(numbers[mid:], resultChan)

    sum1, sum2 := <-resultChan, <-resultChan

    fmt.Println("Total Sum:", sum1 + sum2)
}
```

Interfaces

```
type Describer interface {
    Describe() string
}
```

both of the next structures implemented interface

```
func (p Person) Describe() string {
    return fmt.Sprintf("%s is %d years old", p.Name, p.Age)
}

func (c Car) Describe() string {
    return fmt.Sprintf("%s %s, made in %d", c.Make, c.Model, c.Year)
}
```

```
func printDescription(d Describer) {
    fmt.Println(d.Describe())
}
```

Error handling

```
package main

import (
    "fmt"
    "errors"
)

func divide(a, b float64) (float64, error) {
    if b == 0 {
        return 0, errors.New("division by zero")
    }
    return a / b, nil
}

func main() {
    result, err := divide(10.0, 0)
    if err != nil {
        fmt.Println("Error:", err)
    } else {
        fmt.Println("Result:", result)
    }
}
```

```

```

```go
package main

import (
    "fmt"
    "io"
    "os"
)

func main() {

    result, err := readFile("/home/dmitrii/.bashrc")
    if err != nil {
        fmt.Println(err.Error())
    } else {
        fmt.Println(result)
    }
}

func readFile(path string) (string, error) {

    file, error := os.Open(path)

    if error != nil {
        return "", error
    }
    defer file.Close()

    result, error := io.ReadAll(file)
    if error != nil {
        return "", error
    }

    return string(result), nil
}
```

defer

for closing resources.

```go
func example() {
    fmt.Println("Начало функции")
    defer fmt.Println("Это выполнится в конце")
    fmt.Println("Это выполнится до defer")
}
```

```go
package main
```

```
import "fmt"

func main() {
    fmt.Println("Начало функции")

    defer fmt.Println("Первый defer")
    defer fmt.Println("Второй defer")
    defer fmt.Println("Третий defer")

    fmt.Println("Конец функции")
}
```

```
Начало функции
Конец функции
Третий defer
Второй defer
Первый defer
```

Modules

to create a module

```
go mod init <module-name>
```

an example file `go.mod`

```
module test

go 1.16
```

Testing

Naming

if file `math.go` then test should be in `math_test.go`

Example

```
// math.go
package main

func Add(a, b int) int {
```

```
    return a + b
}
```

```
// math_test.go
package main

import "testing"

func TestAdd(t *testing.T) {
    result := Add(2, 3)
    expected := 5
    if result != expected {
        t.Errorf("Add(2, 3) = %d; want %d", result, expected)
    }
}
```

```
package main

import "errors"

func Divide(a, b float64) (float64, error) {
    if b == 0 {
        return 0, errors.New("division by zero")
    }
    return a / b, nil
}
```

```
package main

import "testing"

func TestDivideByPositiveNumber(t *testing.T) {
    var expected float64 = 3

    result, error := Divide(6, 2)

    if result != expected {
        t.Errorf("Divide(6, 2) = %f; expected %f", result, expected)
    }
    if error != nil {
        t.Error("error should be nil")
    }
}

func TestDivideByZero(t *testing.T) {
```

```
    _, error := Divide(6, 0)

    if error == nil {
        t.Error("Divide(6, 0) should return error")
    }
}
```

How to run

```
go test
```

with verbose

```
go test -v
```

```
dmitrii@dmitrii-ThinkPad-T15-Gen-2i:~/CODE/go/test$ go test -v
=== RUN   TestDivideByPositiveNumber
--- PASS: TestDivideByPositiveNumber (0.00s)
=== RUN   TestDivideByZero
--- PASS: TestDivideByZero (0.00s)
PASS
ok      test    0.001s
```