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# Introduction

- Go is a script-like, object-like, typed language.
  - It is compiled and runs efficiently.
  - It has a garbage collector.
  - It supports concurrency.

# Hello World

- Define & import packages.
- Functions defined with ‘func’ keyword.
- Source file in UTF-8.
- No semi-colon.

```
package main
import fmt "fmt"

func main() {
    fmt.Printf("Hello world\n")
}
```

# How to compile

- 32-bit:
  - 8g helloworld.go
    8l helloworld.8
    8.out
- 64-bit:
  - 6g helloworld.go
    6l helloworld.6
    6.out

# Variables

- Constants: **const name = value**.
  - Integers constants may be big, e.g., const big = (1 << 100) >> 97 They overflow only when assigned to variables.
- Variables: **var name = initValue**.

- var omitNewLine = flag.Bool(“n”,false,”no new line”)
  - make a Bool defined in package flag,
  - has type *Bool (pointer to a Bool).

# Using Packages

- fmt.Printf
  - package fmt, function Printf.
- os.Stdout.WriteString(s)
  - package os, variable Stdout, method WriteString.

# Common types

- int float
- int8, int32, float64...
- string (immutable)
- Arrays:
  - *var name [size]type;*
    var arrayOfInt[10]int;
  - Slice expressions *a[low:high]* represent sub-arrays.
  - Multiple slices can share data, multiple arrays cannot.

# Slice - Example

```
func sum(a []int) int { // returns an int
  s := 0
  for i := 0; i < len(a); i++ {
    s += a[i]
  }
  return s
}

s := sum(&[3]int{1,2,3}) // &->address of instance
                         // implicitly promoted to a slice
s := sum(&[...]int{1,2,3}) // let the compiler count
s := sum([]int{1,2,3})     // also works
```

# cont.

- Maps can be initialized in a similar manner:
  m := map[string]int{"one":1, "two":2}
- Ranges are supported:
  - for i:=0; i<len(a); i++ {...}
    →
    for i, v := range a {...}
    assigns i to the indices and v to values of a.

# Allocation

- type T struct { a,b int }
  var t *T = new(T)
  or
  t = new(T)
  - new() allocates and constructs a new instance.
- To construct without getting a pointer use make:
  - m := make(map[string]int)

# Assignments

- Some functions return pairs, typically value and error status.
  - nr,er := f.Read(&buf)

# Switch

- General switch statements:

```
switch init; value {
case expr :
    ...
case expr :
    ...
}
```

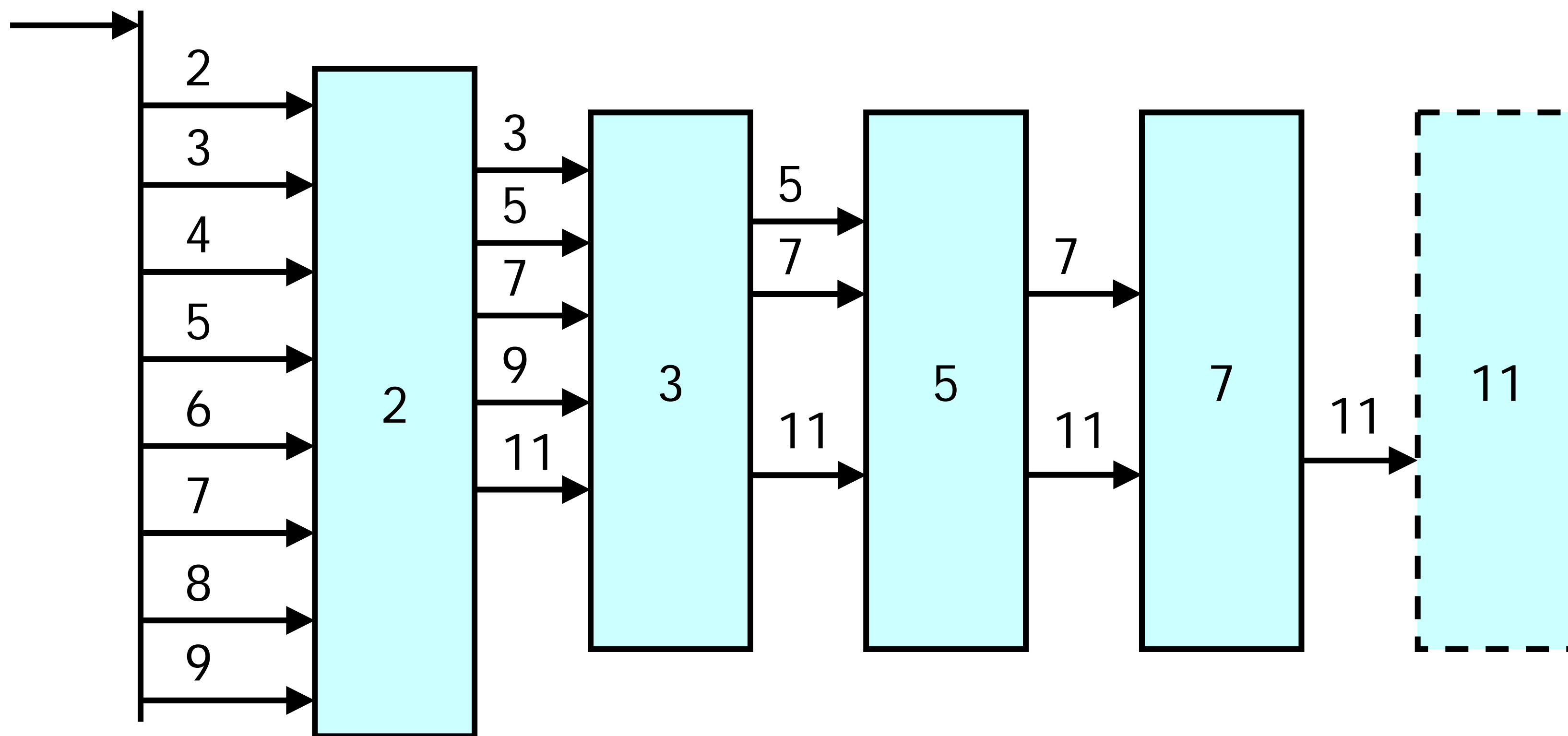
  - Matches from top to bottom expr to value.
  - Has an init statement.

# Interfaces

- type reader interface {
  Read(b []byte) (ret int, err os.Error)
  String() string
  }
- Any type having these methods implements the interface.
- Separate implementation from API.

# Concurrency – Prime Numbers

- Based on Sieve of Eratosthenes.
- Put filters to filter streams of numbers.



# Channels

- Use Go channels to have processes communicate with each other.
  - ```
    func generate(ch chan int) {
      for i:=2; ; i++ {
        ch <- i // Send 'i' to channel 'ch'
      }
    }
    ```
  - Channels are blocking.
  - Operator <- sends values to channels.
  - Simple form of typed message passing.
  - Can be sent as part of messages.
    ```

# Filters

- Copy values from ‘in’ to ‘out’, discarding multiples of ‘prime’.
  - ```
    func filter(in,out chan int, prime int) {
        for {
            i := <-in              // Receives value from 'in'
            if i % prime != 0 {
                out <- i              // Send value to 'out'
            }
        }
    }
    ```
  - Concurrent computations are called *goroutines*.
  - The filters and generators are goroutines.
    ```

# All together

- func main() {

```
func main() {
    ch := make(chan int)  // create channel
    go generate(ch)        // start goroutine
    for {
        prime := <- ch
        fmt.Println(prime)
        ch1 := make(chan int)
        go filter(ch,ch1,prime)
        ch = ch1
    }
}
```

- Create and start filters on-the-fly & connect them.

# Lambda Expressions

- Inlined functions.
  - ```
    func filter(in chan int, prime int) chan int {
      out := make(chan int)
      go func() {
        for {
          if i := <-in; i%prime != 0 {
            out <- i
          }
        }
      }()
      return out
    }
    ```
    ```

# Conclusion

- Light weight language.
- Object like.
- Support for concurrency
  - goroutines
  - message passing via (blocking) channels