Concurrency in GO

CS240

23/8/2017

What is concurrency?

- Concurrency is
  - Programming the composition of independently executing functions
  - It’s not parallelism: simultaneous execution of different functions
  - Nice talk by Rob Pike: https://vimeo.com/49718712
- Examples:
  - I/O
  - Processes
  - Servers communications
- What could go wrong?
  - Order violations - races
  - Deadlocks

Achieving concurrency

- Concurrency can be achieved using two ways:
  - Communicating sequential processes (CSP). Using communication for synchronization.
  - Shared memory using locks
- We are going to focus on CSP today

GO’s philosophy:

Do not communicate by sharing memory;

instead, share memory by communicating.

goroutines

- Think of them like threads.
  - They have smaller stacks
  - Allows for easy scalability
  - Managed by the process itself
- The goroutines terminate when main exits

Demo: goroutines

Channels

Channels are used to send and receive values from goroutines

Send to a channel: `ch <- x`

Receive from a channel: `x = <- ch`

There are two types of channels, buffered and unbuffered channels.

Channels

Unbuffered channels:

- Unbuffered channels blocks sending until some routine receives
- Receivers are blocked until a goroutine sends
- This would result in channels having a synchronizes behavior

Buffered channels:

- Allows the channel to accept more elements before releasing it to the receiver

Demo: Channels

Demo: Channels with fan-in

Demo: Redundancy using channels

Concurrency with shared memory?

- GO still supports the usual shared memory primitives
- Key functions include:
  - `sync.Mutex`: mutual exclusion (lock/unlock)
  - `sync.Once`: do an action exactly once
  - `sync.RWMutex`: more control on read/write locking
- More in documentation and tour

To do before next class

Finish the Go tour (concurrency) – do the Web Crawler exercise

Read the MapReduce paper

Suggested:

Go Concurrency Patterns: https://youtu.be/f6kdp27TYZs

Advanced Go Concurrency Patterns: https://youtu.be/QDDwwePbDtw