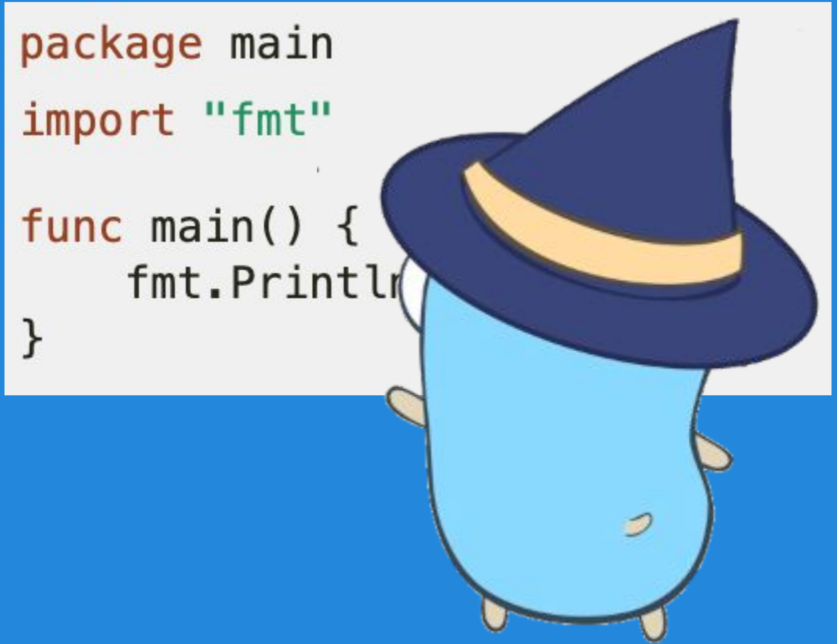
# Cognitive Code Complexity



```
package main

import "fmt"

func main() {
    fmt.Printl
}
```

making Go programs more easy

# Mini introduction

Marcel (nickname: Marcelloh)

Aalsmeerderbrug

59 years young

**Experience:**

- 41 years development
- 9 years Go experience
- 2 years Go Trainer

# What is Cognitive code complexity?

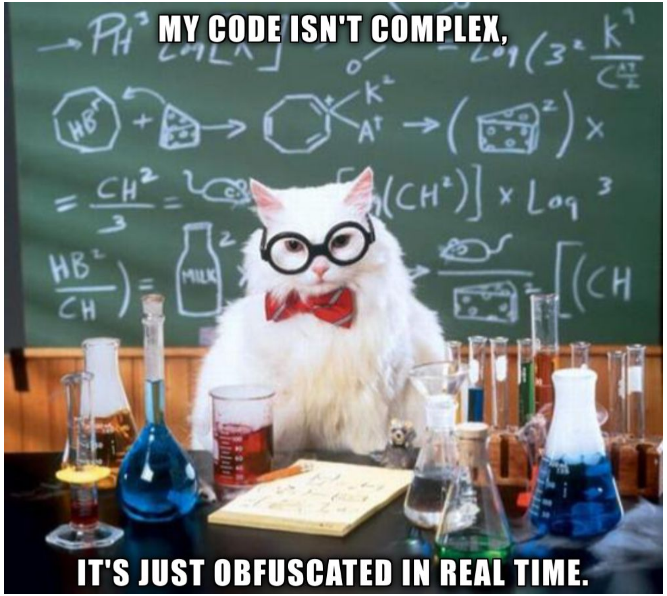
- A metric that is used to “predict” the understandability/maintainability of code as if a developer would rate “the” code
- A measure on how difficult a unit of code is to understand

WHEN YOU'RE SO EXCITED ABOUT CODING THAT YOU CAN'T
HELP BUT TALK ABOUT COGNITIVE CODE COMPLEXITY WITH EVERYONE

# In the beginning...

Software starts small and grows over time

# Problem



Sometimes you're just busy implementing the latest idea into a piece that software.

As long as everything works according to specifications, you're good, right?

# Nastyness Detection

If you're lucky, you have that critic of a co-worker, who can point you to some nasty stuff you did (during a code review).

But to have that colleague,or to become your own critic, can take time.

# Studies

In the past there have been several studies about Cognitive Code Complexity.

I followed those studies and created a linter based on those ideas.

WHEN YOU UNDERSTAND
COGNITIVE CODE COMPLEXITY
BUT NOBODY ELSE HAS ANY IDEA
WHAT YOU'RE TALKING ABOUT

# Recognisable parts of the linter

These will make the code more complex:

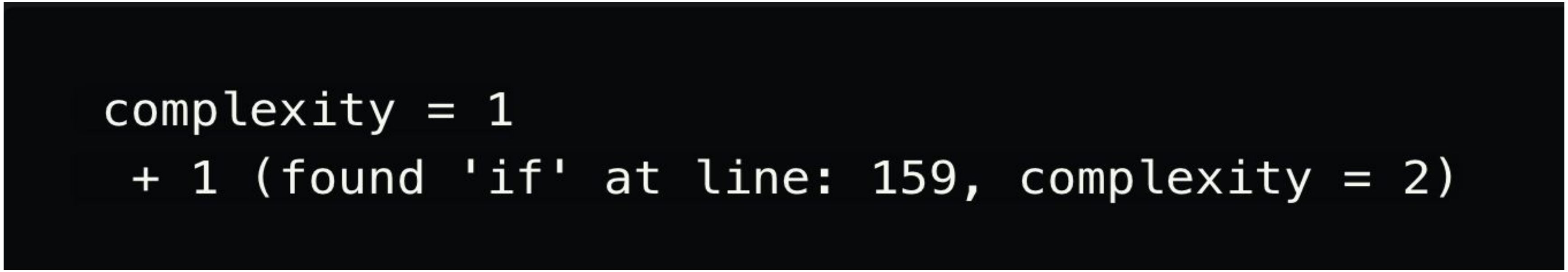
AssignStmt
BlockStmt
BranchStmt
CaseClause
DeferStmt
ForStmt
GoStmt
IfStmt
LabelStmt
RangeStmt
SwitchStmt
TypeSwitchStmt

also:

- wrong comment
- nr of params
- generics
- function length
- logical operators
- complex lines

# How does that linting works?

Imagine that each if-statement within a function adds up to the complexity of that function.

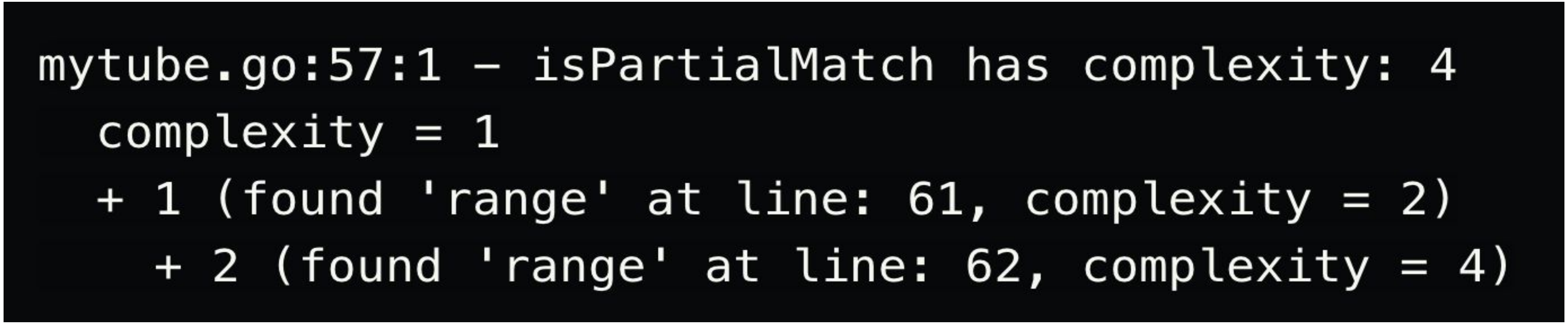


```
complexity = 1
 + 1 (found 'if' at line: 159, complexity = 2)
```

Of course, it is not that simple!

# Nested statements

It’s actually not that simple, because we can have nested statements.



```
mytube.go:57:1 - isPartialMatch has complexity: 4
  complexity = 1
  + 1 (found 'range' at line: 61, complexity = 2)
    + 2 (found 'range' at line: 62, complexity = 4)
```

Based on the level of nesting, it gets more complex. This is how the studies all go. 🤣

# Studies are wrong!

I showed the linter to my 18 year old son and he asked something like:

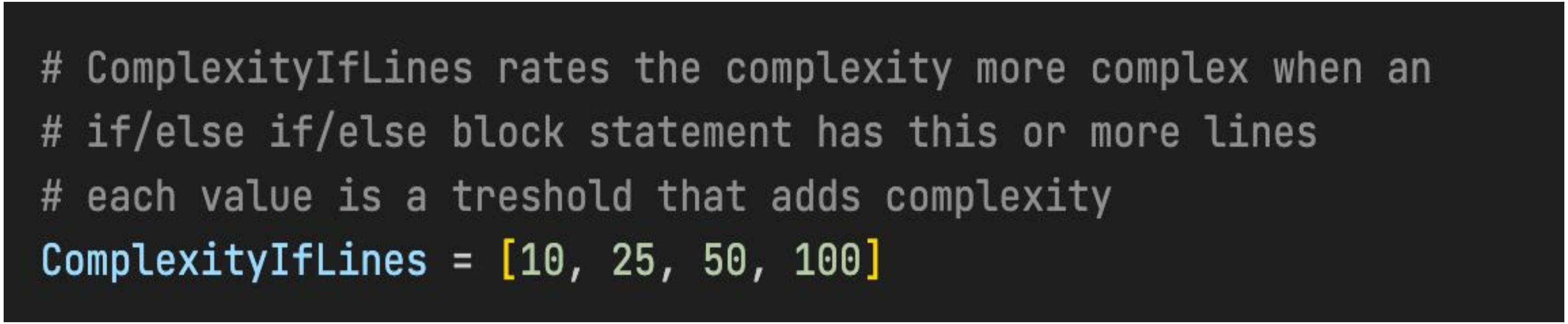
“*Would you agree that an if-statement with a little content is less difficult than an if-statement with more content?*"

and I totally agreed.

WHEN YOU REALIZE YOUR ENTIRE IDEA
WAS BASED ON FLAWED STUDIES

# Challenge accepted

I changed the linter to become more configurable.



```toml
# ComplexityIfLines rates the complexity more complex when an
# if/else if/else block statement has this or more lines
# each value is a treshold that adds complexity
ComplexityIfLines = [10, 25, 50, 100]
```

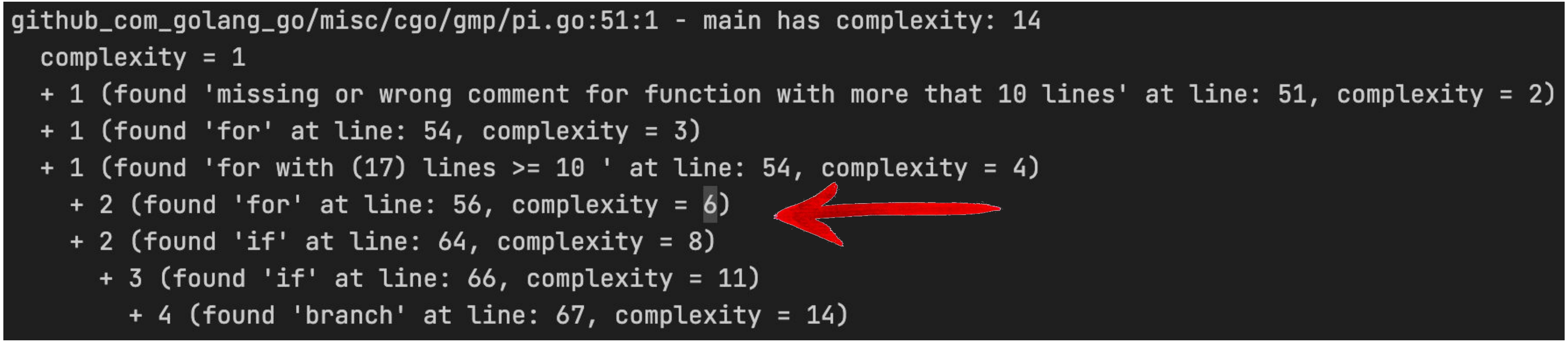
Just a part of my TOML configuration file.

# Sneak peak

Let me show you the configuration file.

# Linting result

with explanation



```
github_com_golang_go/misc/cgo/gmp/pi.go:51:1 - main has complexity: 14
  complexity = 1
  + 1 (found 'missing or wrong comment for function with more that 10 lines' at line: 51, complexity = 2)
  + 1 (found 'for' at line: 54, complexity = 3)
  + 1 (found 'for with (17) lines >= 10 ' at line: 54, complexity = 4)
    + 2 (found 'for' at line: 56, complexity = 6)
    + 2 (found 'if' at line: 64, complexity = 8)
      + 3 (found 'if' at line: 66, complexity = 11)
        + 4 (found 'branch' at line: 67, complexity = 14)
```

# How to solve complex code?

- Be aware of maintainability
- Make use of early returns
- Look at blocks of code which you can extract into a separate function
- Break things down into smaller, more mainainable/manageable tasks

# Numbers & Reactions

Sometimes I was asked, sometimes I just gave the report uninvited.
The reactions were 95% positive with an occasional “hey, it works, so why bother?”

# 80+ not so random projects

Popular ones

- go, docker, cockroach, cobra, …

Idiomatic ones

- pkgsite, ivy, mox, …

Starters

- fedha, cc-profile, instagram-insights, …

# Overall numbers

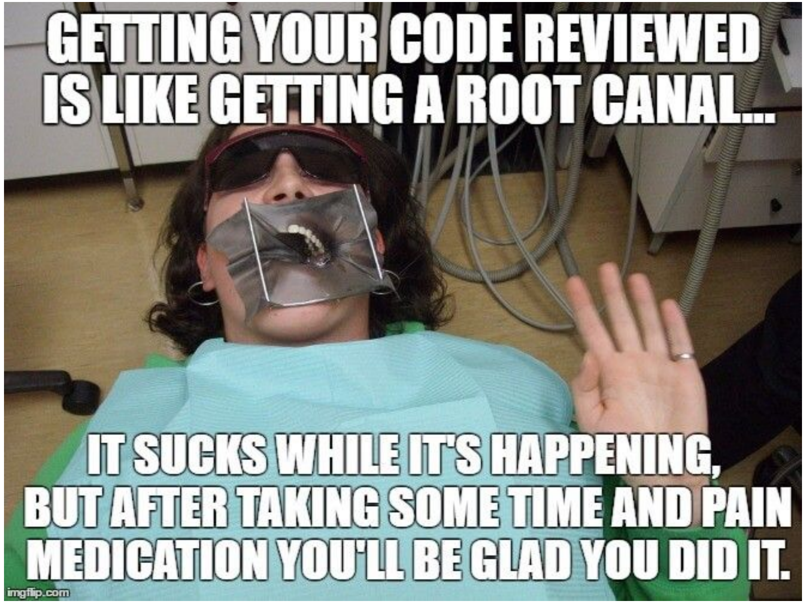
Date 20-11-2023

Analyzed 81 projects, 47.601 files, with 284.401 functions
That’s 5.427.312 lines of code inside functions

Findings:
31.029 complex functions with 2.164.305 lines of code
about 11 % of all functions are complex
about 40 % of lines belong to a complex function

# Podium 1

Top 3 of projects with the highest complexity


GETTING YOUR CODE REVIEWED IS LIKE GETTING A ROOT CANAL...
IT SUCKS WHILE IT'S HAPPENING, BUT AFTER TAKING SOME TIME AND PAIN MEDICATION YOU'LL BE GLAD YOU DID IT.
imgflip.com

# Podium 1 - number 3 : cockroach project

4.930 = files

48.028 = functions

932.120 = function lines

5.631 = complex functions

445.045 = complex function lines

11.72 % are complex functions

47.75 % of lines belong to complex functions

6.75 = overall average complexity per function

1.043 = highest complexity

# Sneak peak 2

Let me show you the linting of the cockroach project

# Podium 1 - number 2 : sqlc project

3.108 = files
1.287 = functions
31.210 = function lines
132 = complex functions
12.380 = complex function lines
10.26 % are complex functions
39.67 % of lines belong to complex functions
8.36 = overall average complexity per function
1.355 = highest complexity

# Sneak peak 3

Let me show you the linting of the sqlc project

# Podium 1 - number 1 :
# Go project

8.162 = files

36.901 = functions

645.497 = function lines

4.650 = complex functions

369.506 = complex function lines

12.60 % are complex functions

57.24 % of lines belong to complex functions

7.87 = overall average complexity per function

1.512 = highest complexity

# Sneak peak 4

Let me show you the linting of the Go project

# Podium 2

Top 3 of projects with the highest % of complex functions

SOFTWARE DEVELOPMENT IS NOT STRESSFUL
SAYS ROBERT, 22 YEARS OLD

# Podium 2 - number 3 :
# Mox project

196 = files

1.774 = functions

52.556 = function lines

351 = complex functions

36.096 = complex function lines

19.79 % are complex functions

68.68 % of lines belong to complex functions

13.98 = overall average complexity per function

925 = highest complexity

# Podium 2 - number 2 : Gorm project

64 = files

421 = functions

10247 = function lines

88 = complex functions

6645 = complex function lines

20.90 % are complex functions

64.85 % of lines belong to complex functions

18.48 = overall average complexity per function

662 = highest complexity

# Podium 2 - number 1 : Rime-ice project

9 = files

33 = functions

1.375 = function lines

20 = complex functions

1.245 = complex function lines

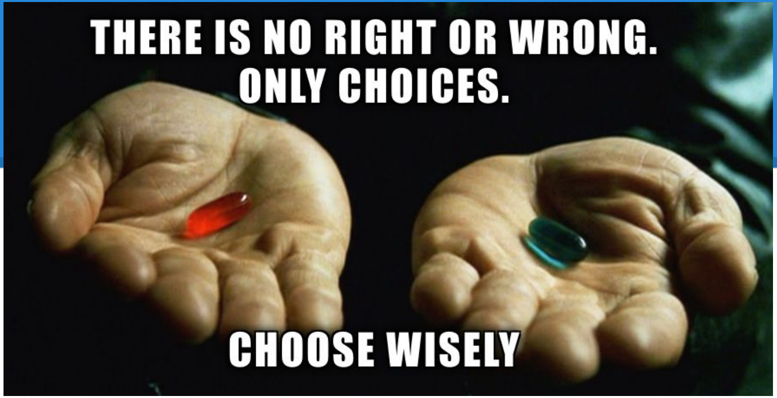
60.61 % are complex functions

90.55 % of lines belong to complex functions

158 = highest complexity

26.18 = overall average complexity per function

# Facts / wisdom



- K.I.S.S (Keep It Stupid Simple)
- Complex code can hide bugs easily
- Don’t be clever, be smart (or wise)
- Code tends to get more complex over time.
- To write code is easy, to write understandable, maintainable code is hard. (Marcelloh)
- Treat your code the way you want others’ code to treat you.
- Any intelligent fool can make things bigger, more complex, and more violent. It takes a touch of genius, and a lot of courage, to move in the opposite direction. (Albert Einstein)

# Sneak peak 5

Let me show you the linter running, scanning all those projects.

# Exchange

3-5 companies

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https://dev.to/marcello_h/solve-code-complexity-in-go-56hg