COMP1511 PROGRAMMING FUNDAMENTALS

LECTURE 5

FuncTIONS!

Classically stylish

LAST LECTURE...

LAST WEEK, WE TALKED:

- Played with making some decisions and using IF statements with conditionals
- Looped the loop (WHILE)
- Talked about scanf() and how eccentric it is
- Started to learn about structs and enums

THIS LECTURE...

TODAY...

- Functions
- Style

WHERE IS THE CODE?

Live lecture code can be found here:

HTTPS://CGI.CSE.UNSW.EDU.AU/~CS1511/22T3/LIVE/WEEK03/

FUNCTIONS

FINALLY!

- So far, you have heard me refer to printf(), scanf() and the main() as a function… but what does this actually mean?
- You have heard me rattle on about procedures
- Let’s take a quick step to now talk about what these actually are :)

FUNCTIONS

FINALLY!

- A function is a way to break down our codes into smaller functional bits
    - Each function performs some sort of operation
    - Each function has inputs and an output (you may still have an empty input or output, depending on what the role of that function is)
    - We can call our function from anywhere in our code to perform its job and then return something to the spot it was called from

FUNCTIONS

WHAT DO WE NEED TO KNOW?

return type: What type does this function return?

name of function: What will I name my function?

input/ arguments: What am I giving my function?

A function, which adds two numbers together and returns the result

```
int add (int number_one, int number_two) {
    int sum;
    sum = number_one + number_two;
    return sum;
}
```

To finish I return an int (sum), which is what I said I would return when I wrote my function

FUNCTIONS

LET'S WRITE SOME CODE AND DECOMPOSE IT INTO FUNCTIONS

dice_roll_functions.c

- Demonstrating the use of functions with a program that takes in two die rolls and checks whether the sum of the dice is equal to the target number - you win if that is the case!
- Extending the problem: Otherwise you can roll again...
- How can we break this problem down?
    - Ask the user for the result of rolls (printf)
    - Scan in the two dice (scanf)
    - Add the numbers together (+)
    - Check the sum against the target number (#define)
    - Output the result against target number (printf)

FUNCTIONS

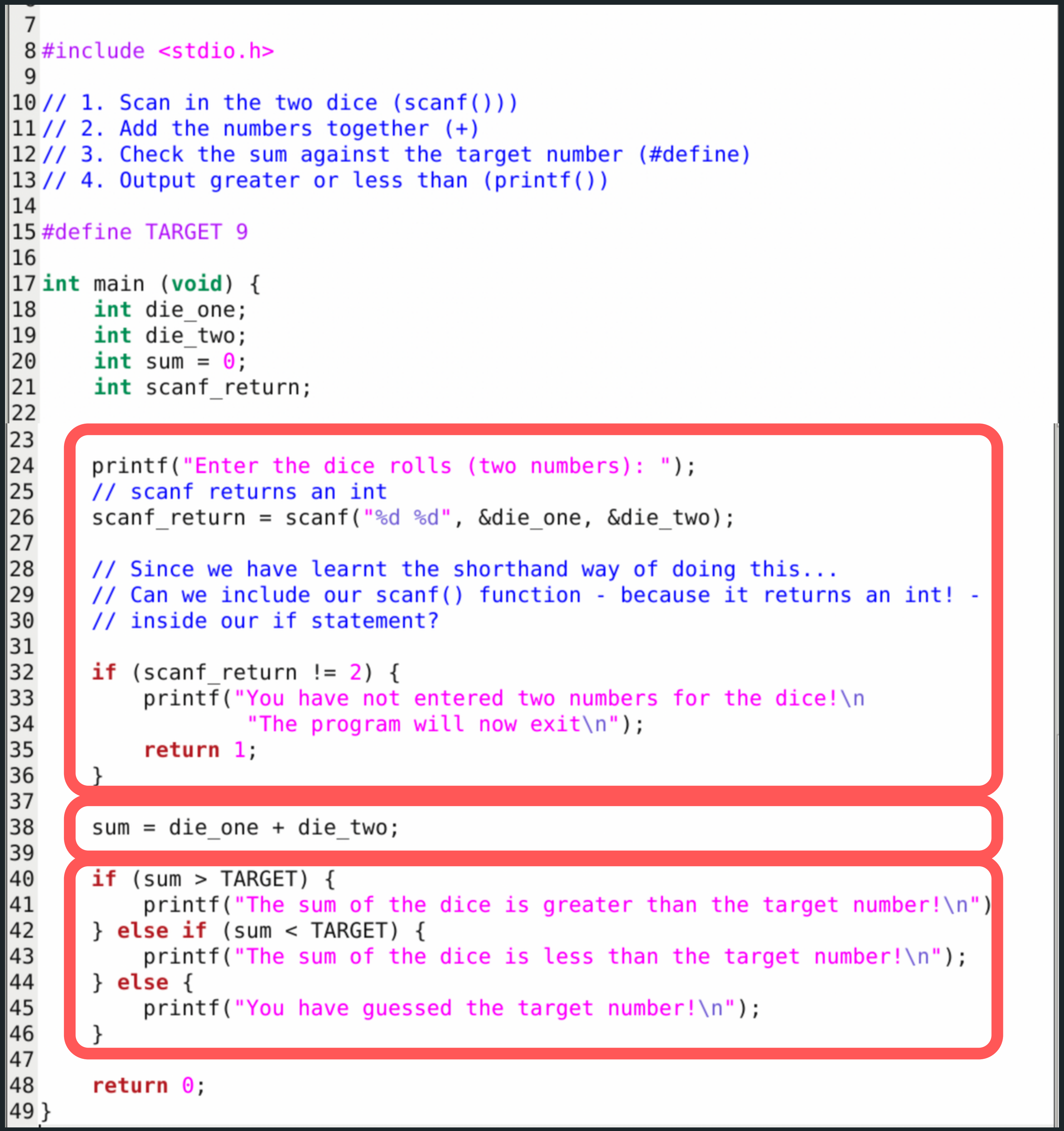
LET'S WRITE SOME CODE AND DECOMPOSE IT INTO FUNCTIONS

dice_roll_functions.c

- I will show the next five slides at the lecture/during the lecture (so that we can discuss the code that we are writing.
    - Lecture slides will be updated to include the code that we wrote in the lecture towards the end of the week

FUNCTIONS

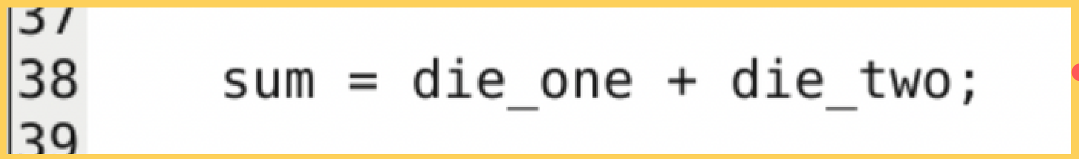
WHAT DOES IT LOOK LIKE VISUALLY?



```c

#include <stdio.h>

// 1. Scan in the two dice (scanf())
// 2. Add the numbers together (+)
// 3. Check the sum against the target number (#define)
// 4. Output greater or less than (printf())

#define TARGET 9

int main (void) {
    int die_one;
    int die_two;
    int sum = 0;
    int scanf_return;


    printf("Enter the dice rolls (two numbers): ");
    // scanf returns an int
    scanf_return = scanf("%d %d", &die_one, &die_two);

    // Since we have learnt the shorthand way of doing this...
    // Can we include our scanf() function - because it returns an int! -
    // inside our if statement?

    if (scanf_return != 2) {
        printf("You have not entered two numbers for the dice!\n
                "The program will now exit\n");
        return 1;
    }

    sum = die_one + die_two;

    if (sum > TARGET) {
        printf("The sum of the dice is greater than the target number!\n")
    } else if (sum < TARGET) {
        printf("The sum of the dice is less than the target number!\n");
    } else {
        printf("You have guessed the target number!\n");
    }

    return 0;
}
```

FUNCTIONS

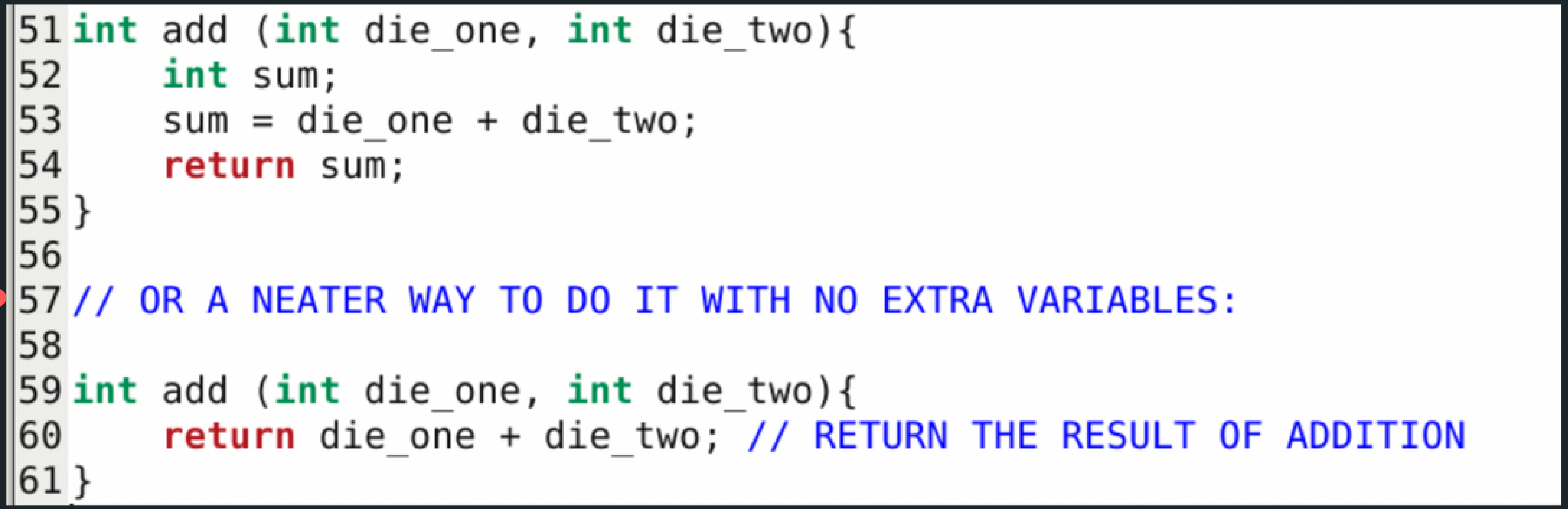
TAKING THE ADDITION OUT AS A SEPARATE STEP



```
    sum = die_one + die_two;
```

If I take the addition step out of the main function and move to its own step (function):

1. What do I have to give this function for it to work?
2. What should I name my function so that I know what to call it each time I need it?
3. What does this function have to return, so I can keep working?



```
int add (int die_one, int die_two){
    int sum;
    sum = die_one + die_two;
    return sum;
}

// OR A NEATER WAY TO DO IT WITH NO EXTRA VARIABLES:

int add (int die_one, int die_two){
    return die_one + die_two; // RETURN THE RESULT OF ADDITION
}
```

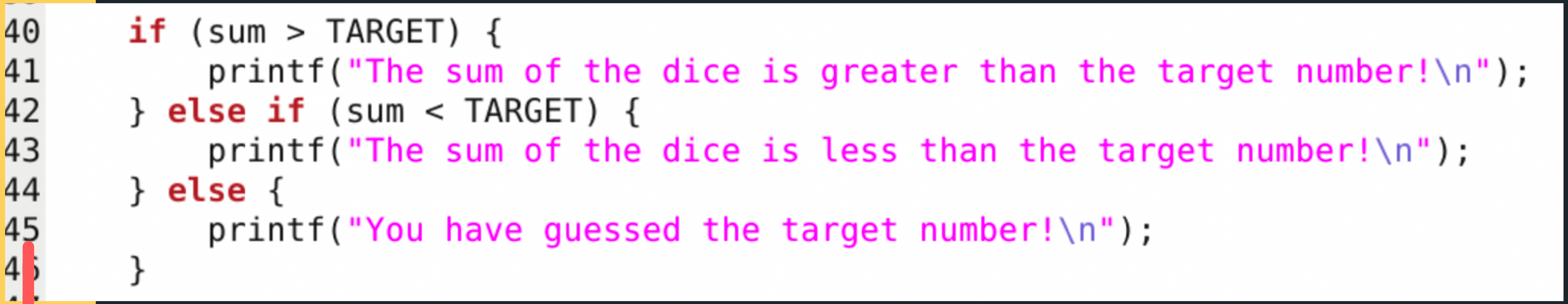
Can always call this from the main by referring to the function by name and saying what inputs I am giving this function, i.e. call by: add(die_one, die_two);

FUNCTIONS

TAKING THE COMPARISON OUT AS A SEPARATE STEP

If I take the comparison step out of the main function and move to its own step (function):

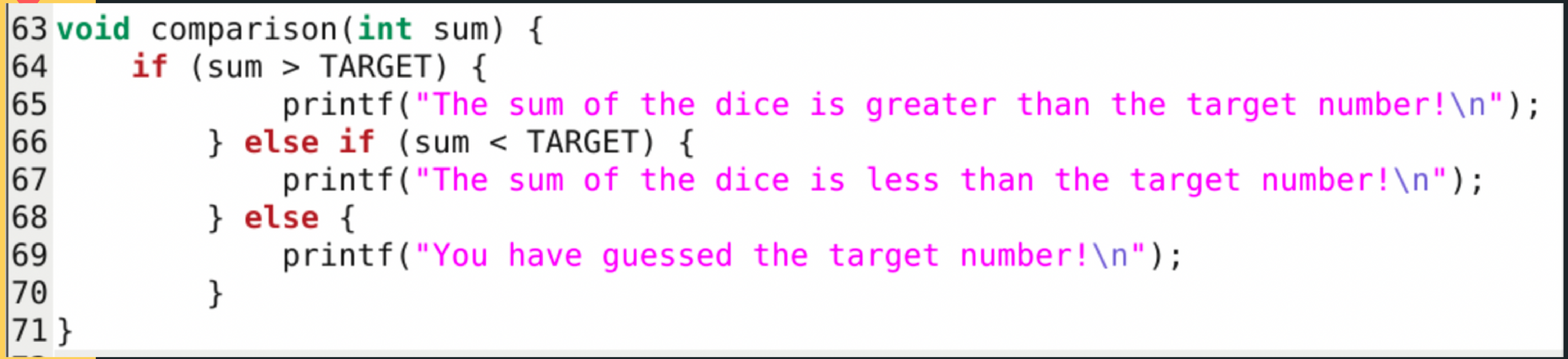
1. What do I have to give this function for it to work?
2. What should I name my function so that I know what to call it each time I need it?
3. What does this function have to return, so I can keep working?



```c
    if (sum > TARGET) {
        printf("The sum of the dice is greater than the target number!\n");
    } else if (sum < TARGET) {
        printf("The sum of the dice is less than the target number!\n");
    } else {
        printf("You have guessed the target number!\n");
    }
```

Call function when I need it by name:

comparison(sum)



```c
void comparison(int sum) {
    if (sum > TARGET) {
            printf("The sum of the dice is greater than the target number!\n");
        } else if (sum < TARGET) {
            printf("The sum of the dice is less than the target number!\n");
        } else {
            printf("You have guessed the target number!\n");
        }
}
```

FUNCTIONS

TELLING C I HAVE SOME FUNCTIONS THAT I WANT TO USE: PROTOTYPES

So now we have moved two steps out to be ther own functions. We now have a function to add two numbers together:

```
int add (int die_one, int die_two)
```

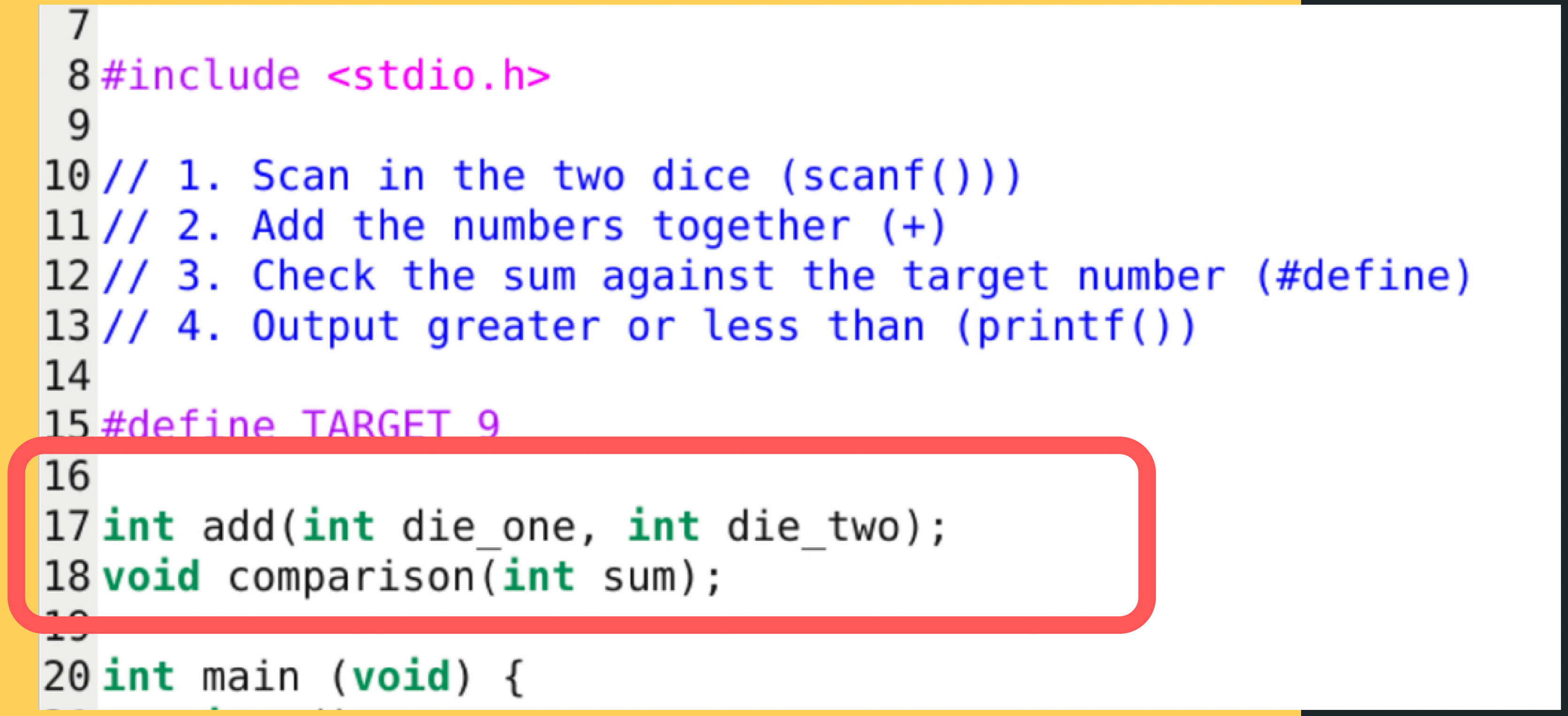
And a function to compare:

```
void comparison (int sum)
```

Just to remind you that C reads things in order from top to bottom, so it will not know these functions exist when we call to them! What can we do to fix that?

FUNCTIONS

PROTOTYPES



```
#include <stdio.h>

// 1. Scan in the two dice (scanf()))
// 2. Add the numbers together (+)
// 3. Check the sum against the target number (#define)
// 4. Output greater or less than (printf())

#define TARGET 9

int add(int die_one, int die_two);
void comparison(int sum);

int main (void) {
```

We let C know in the very beginning before main about each function that we will use, by creating a function prototype:

- This is a very basic definition of the function to let C know those functions are included somewhere in this file! It is like declaring a variable, but I am declaring a function - note the semi colon at the end of each statement! So for our add and compare functions:

```
int add (int die_one, int die_two);

void comparison (int sum);
```

BREAK TIME

52
40
34
26
22
20
17
16
13
11
10
8
5
4
2
1

TIME TO STRETCH

Pick a positive number (any number). If the number is even, cut it in half; if it's odd, triple it and add 1. Can you pick a number that will not land you in a loop?

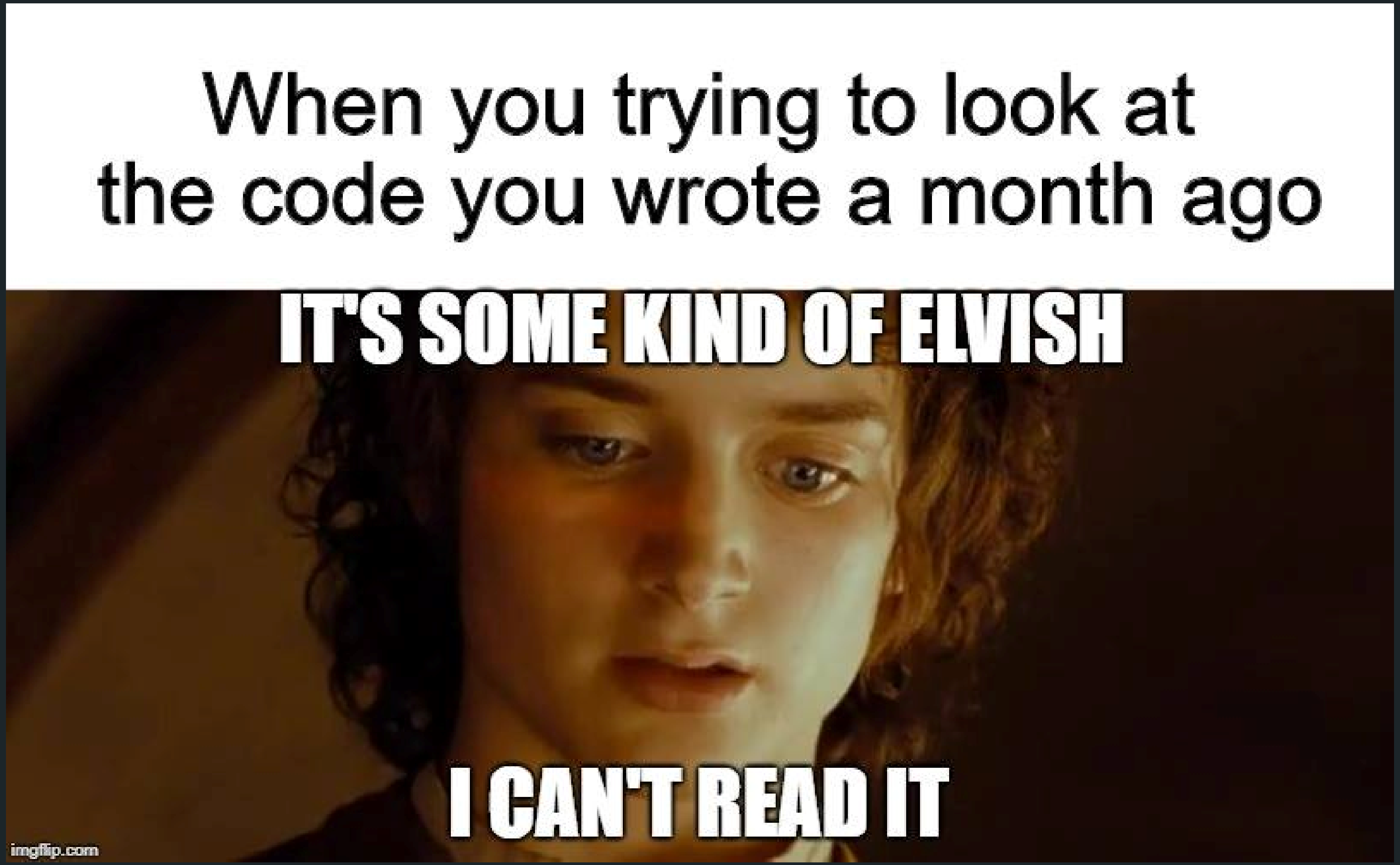
https://www.quantamagazine.org/why-mathematicians-still-cant-solve-the-collatz-conjecture-20200922/

BACK TO IT!

KAHOOT TIME!

Let's Kahoot….

WHAT IS STYLE? WHY STYLE?



WHAT IS STYLE? WHY STYLE? IS IT WORTH IT?

- The code we write is for human eyes
- We want to make our code:
  - easier to read
  - easier to understand
  - neat code ensures less possibility for mistakes
  - neat code ensures faster development time
- Coding should always be done in style - it is worth it...

WHAT IS GOOD STYLE?

- Indentation and Bracketing
- Names of variables and functions
- Structuring your code
  - Nesting
  - Repetition
- Comments where comments need to be
- Consistency

When I read your code, I should be able to understand what that code does just from your structure and variable names

BAD STYLE

:(

`bad_style.c`

- Let’s have a look at some bad style…
- How are you guys feeling? Have you fainted in shock and in horror?
- Let’s work with this code to tidy it up before I develop a permanent eye twitch…
  - Start from the smallest things that are easy to do straight away
  - What can you attack next?

KEEP IT CLEAN AS YOU GO

MUCH EASIER THAN MAKING YOUR WAY THROUGH A DUMPSTER FIRE OF MESS

- Write comments where they are needed
- Name your variables based on what that variable is there to do
- In your block of code surrounded by {}:
    - Indent 4 spaces
    - line up closing bracket with the statement that opened them vertically
- One expression per line
- Consistency in spacing
- Watch the nesting of IFs - can it be done more efficiently?

1511 STYLE GUIDE

- Often different organisations you work for, will have their own style guides, however, the basics remain the same across
- Your assignment will have style marks attached to it
- We have a style guide in 1511 that we encourage you to use to establish good coding practices early:

https://cgi.cse.unsw.edu.au/~cs1511/22T3/resources/style_guide.html

SOME NEAT SHORTHAND

INCREMENTING AND REPEATING OPERATIONS

- Increment count by 1

```
count = count + 1;
count++;
```

- Decrement count by 1

```
count = count - 1;
count--;
```

SOME NEAT SHORTHAND

INCREMENTING AND REPEATING OPERATIONS

- Increment count by 5

```
count = count + 5;
count += 5;
```

- Decrement count by 5

```
count = count - 5;
count -= 5;
```

- Multiply count by 5

```
count = count * 5;
count *= 5;
```

OTHER NEAT SHORTHAND

ASKING QUESTIONS INSIDE OUR CONDITION OR RETURNING AN OPERATION

- Remember when we checked that scanf() returned something by doing this:

```
int scanf_return;
scanf_return = scanf("%d", &number);
if(scanf_return != 1) {...
```

- You can actually call functions inside your if statements or your while loops, as long as that function returns something that can be checked

```
if (scanf("%d", &size) != 1)
```

WHAT ABOUT FOR LOOPS?

- You have so far learnt about looping with the keyword: while
- Some of you have asked about looping with a for loop
- They are very similar! Some people have preference for which one they like to use more, my rule of thumb is
    - while loops when I do not know the number of iterations ahead of time
    - for loops when I do know the number of iterations ahead of time

WHAT ABOUT FOR LOOPS?

For example:

- FOR loop to iterate over an array because I know how big my array is (on Wednesday!)
- FOR loop when you know the loop should execute n times
- WHILE loop for reading a file into a variable - we will not do this in 1511!
- WHILE loop when asking for user input.
- WHILE loop when the increment value is not a standard increment

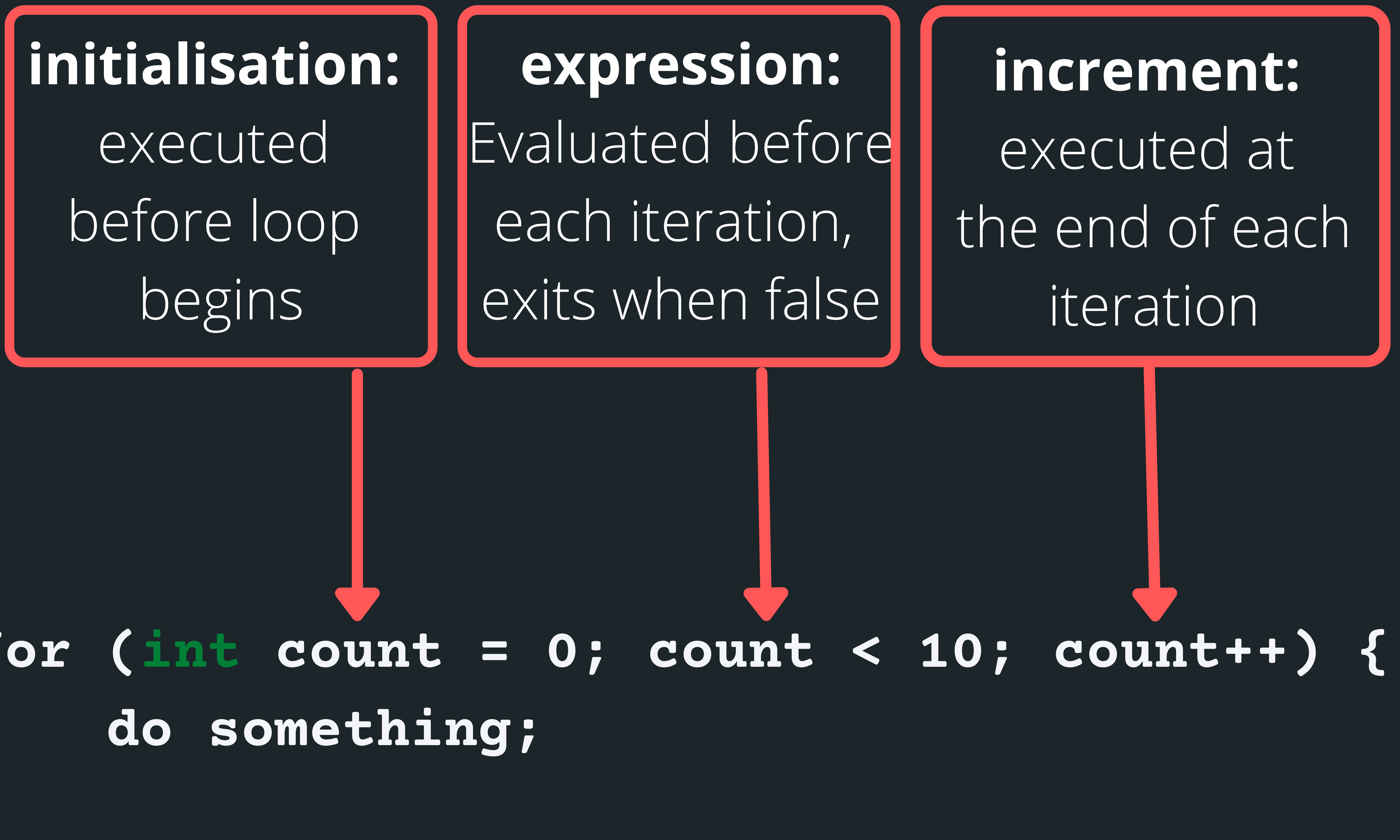
In the end it is your choice, so don’t get stressed about which one is right!

AT THIS POINT IN WEEK 3, THIS IS WHERE THINGS START TO GET HARDER

- If you do not understand something, do not panic! It is perfectly normal to not understand a concept the first time it is explained to you - try and read over the information again, ask questions in the tutorial and the lab - we are here to help you and to make sure that you are comfortable with the content.
- If you can't solve a problem, break down the problem into smaller and smaller steps until there is something that you can do and ask us lots of questions!
- Remember learning is hard and takes time
- Solving problems is hard and needs practice

FOR LOOP

STRUCTURE



initialisation: executed before loop begins

expression: Evaluated before each iteration, exits when false

increment: executed at the end of each iteration

```
for (int count = 0; count < 10; count++) {
    do something;
}
```

WHILE VERSUS FOR LOOP

STRUCTURE

```
// FOR LOOP
for (int i = 0; count < 10; count++) {
    // do something
}

// VERSUS

// WHILE LOOP (doing the same thing!)
int count = 0;
while (count < 10) {
    // do something
    count++;
}
```

Feedback please!

I value your feedback and use to pace the lectures and improve your overall learning experience. If you have any feedback from today's lecture, please follow the link below. Please remember to keep your feedback constructive, so I can action it and improve the learning experience.

https://www.menti.com/aljnu4qwjge7

WHAT DID WE LEARN TODAY?

FUNCTIONS

breaking down the problem into actionable steps

function_demo.c

STYLIN’

bad_style.c

REACH OUT

CONTENT RELATED QUESTIONS

Check out the forum

ADMIN QUESTIONS

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