Introduction to Programming

Week – *3*, Lecture – *3*

Introduction to Iterative Programming

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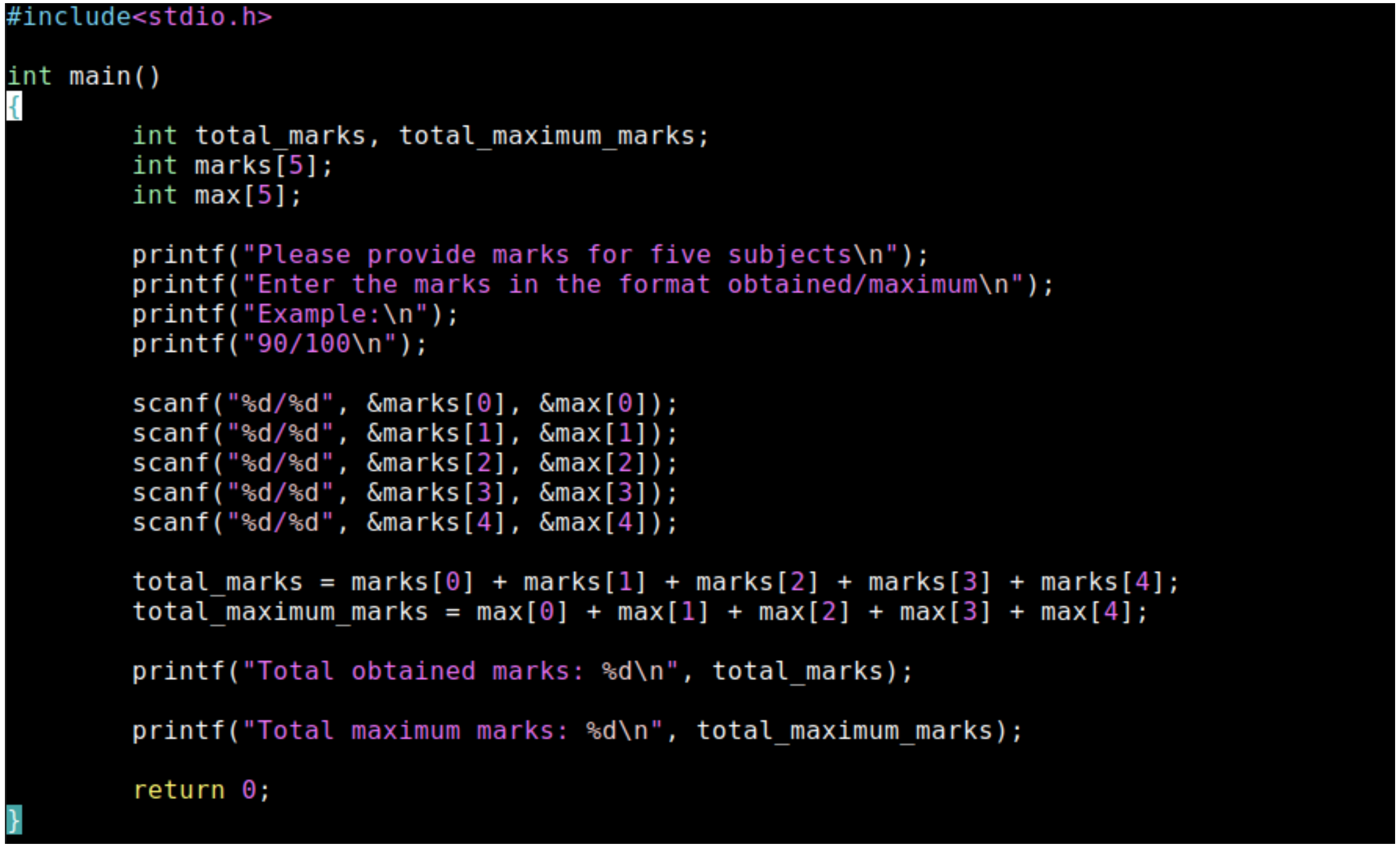
Revisiting the Marks Summer



```c
#include<stdio.h>

int main()
{
        int total_marks, total_maximum_marks;
        int marks[5];
        int max[5];

        printf("Please provide marks for five subjects\n");
        printf("Enter the marks in the format obtained/maximum\n");
        printf("Example:\n");
        printf("90/100\n");

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        printf("Total obtained marks: %d\n", total_marks);

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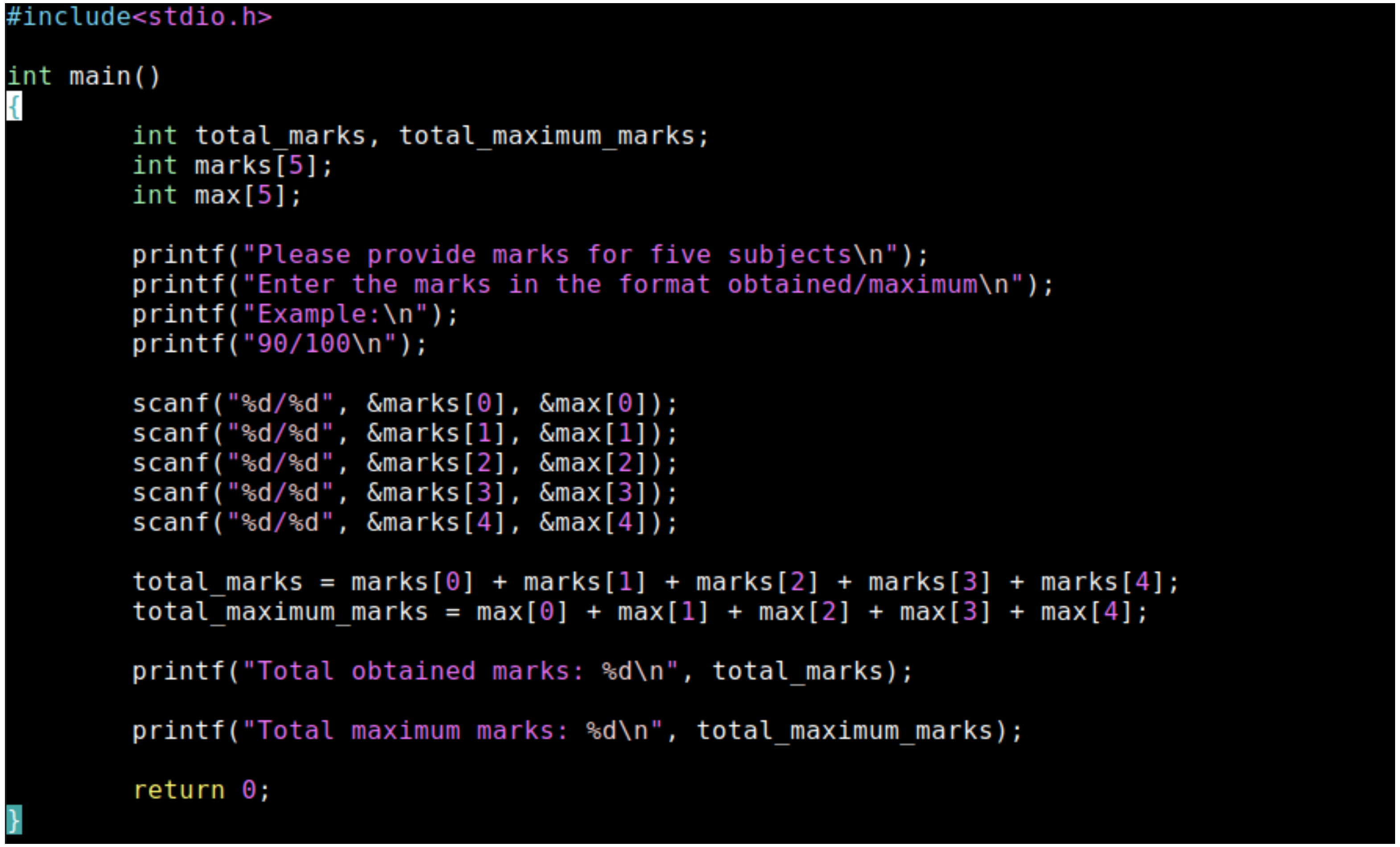
Revisiting the Marks Summer



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While we reduced the effort required to create variables by using arrays

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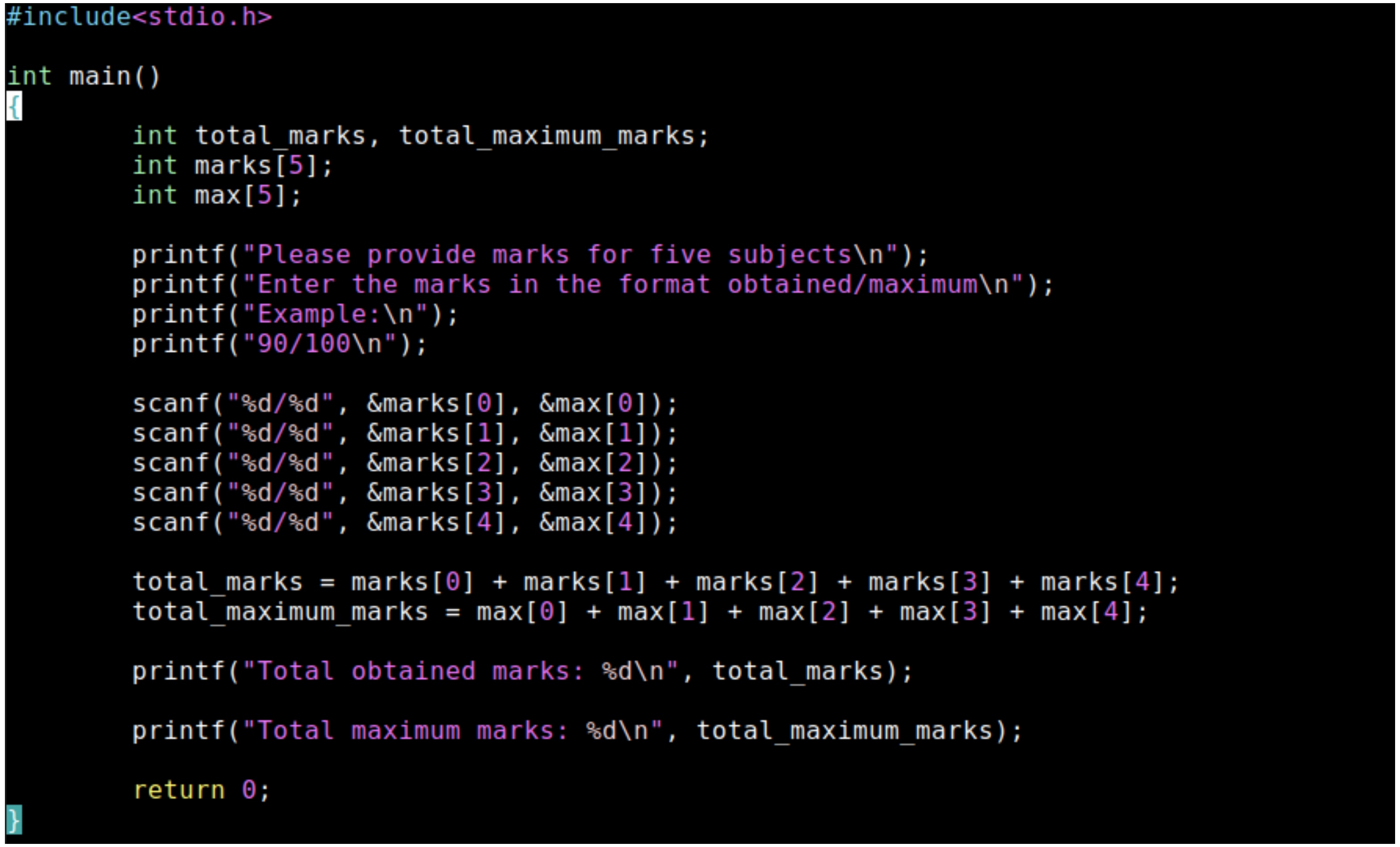

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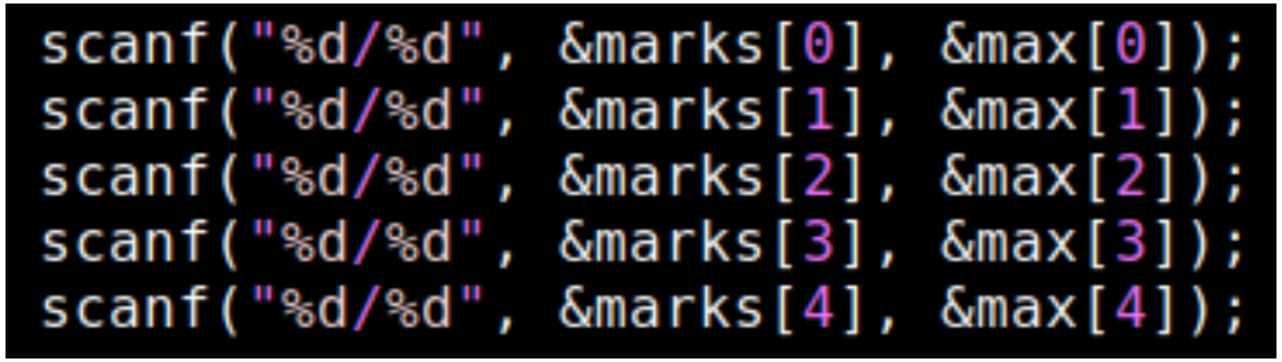
While we reduced the effort required to create variables by using arrays

We have not really reduced the total number of lines in the code !!

Running "similar" code repeatedly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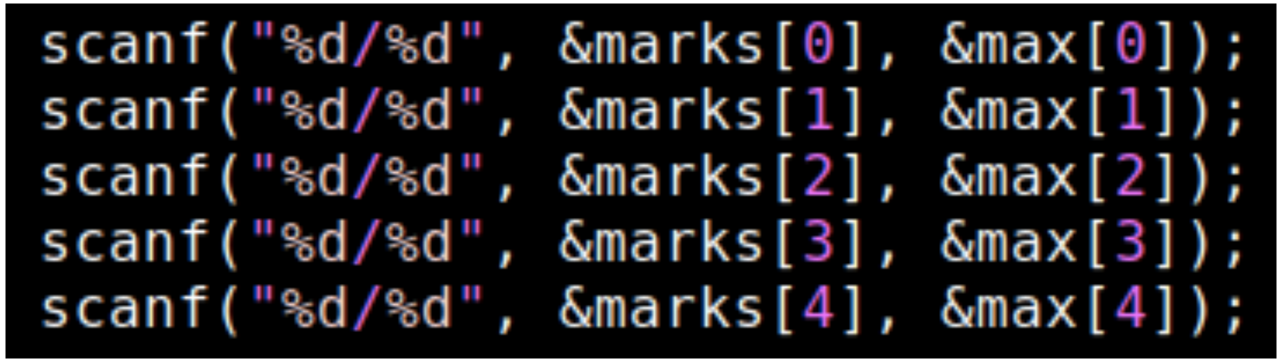

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Focus on this part of the code

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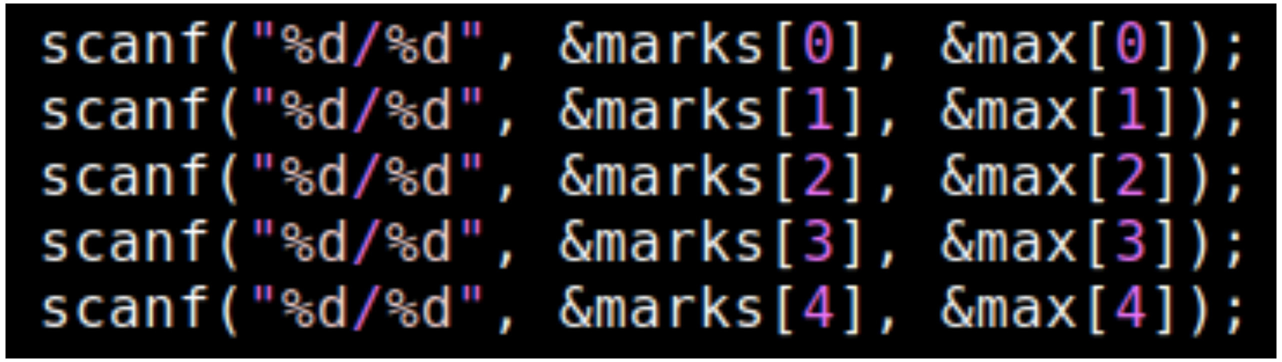

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What exactly is changing in these lines?

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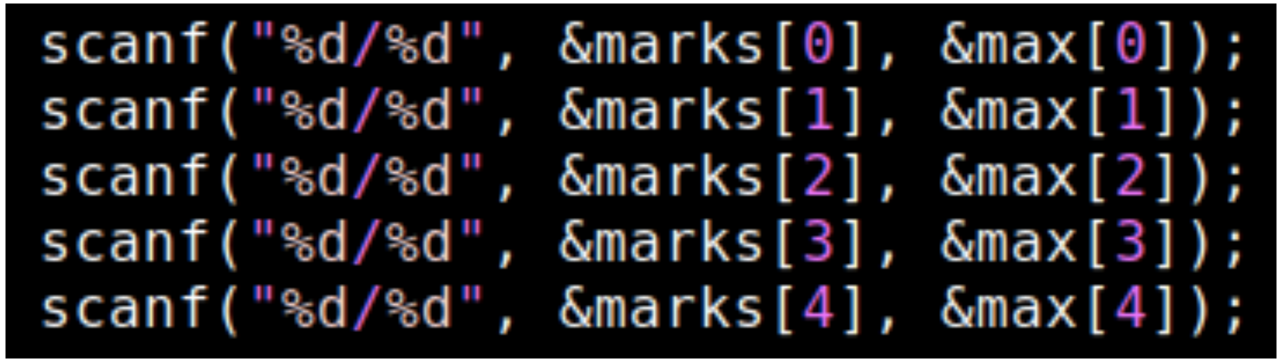

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What exactly is changing in these lines?

Just the index of the array elements !!

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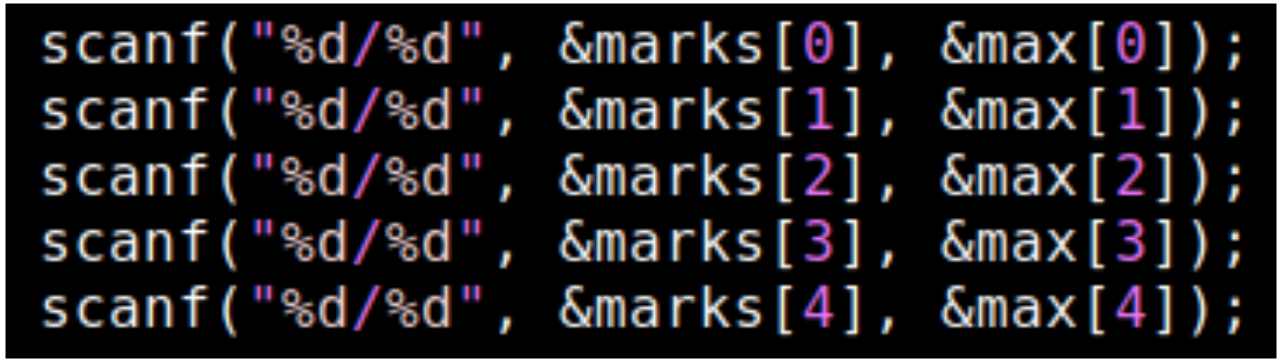

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What if we use a variable here for representing the index of array elements, and increase the value of that variable by 1 every time?

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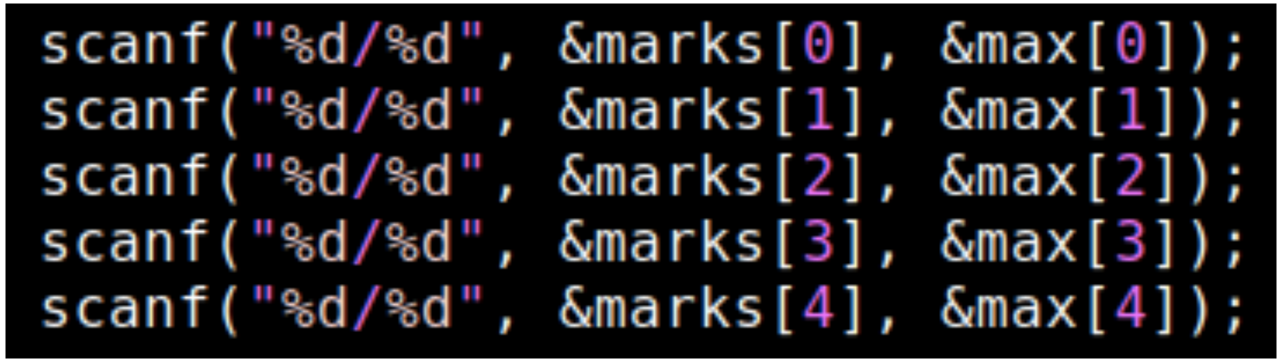

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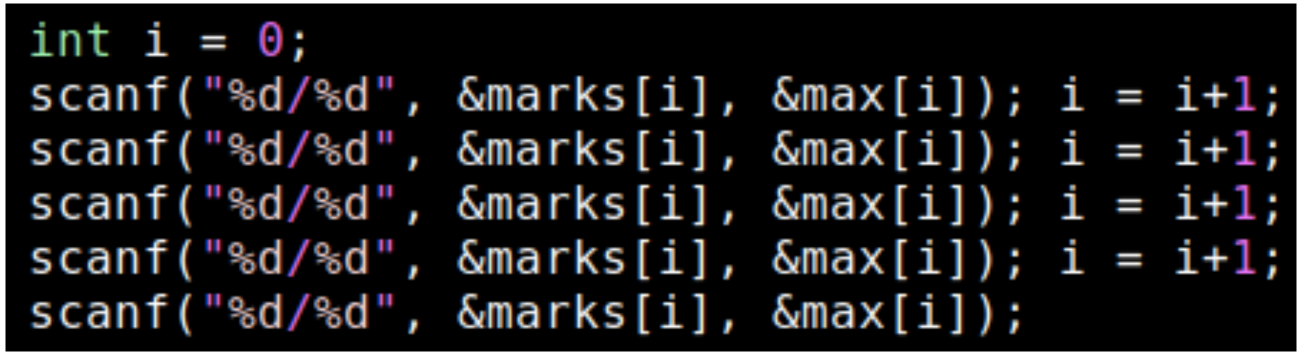

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Something like this !!

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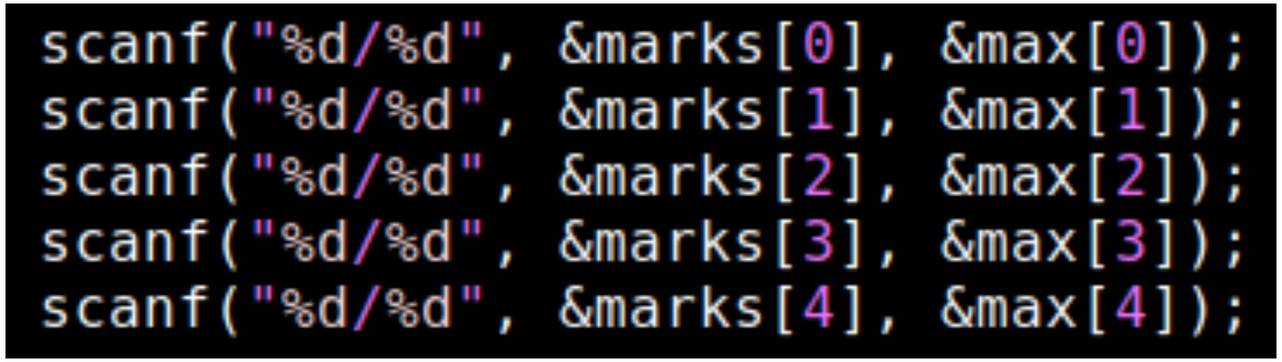

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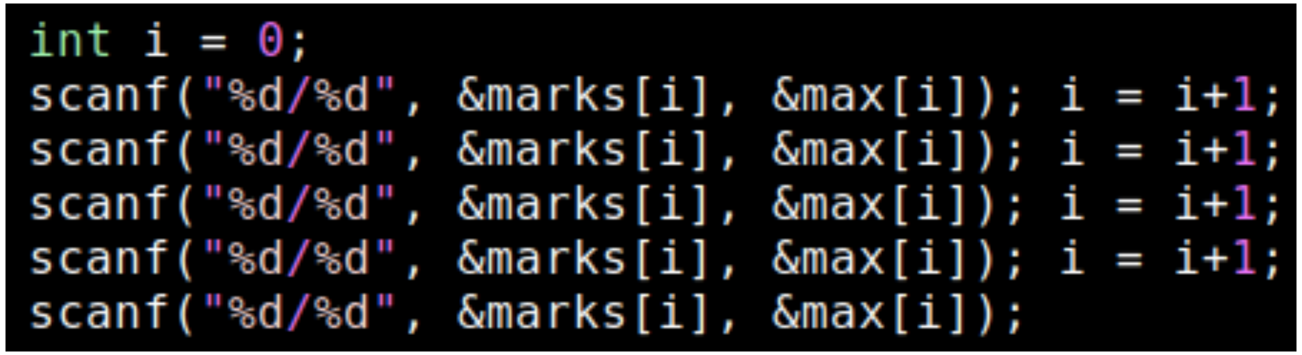

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What if we use a variable here for representing the index of array elements, and increase the value of that variable by 1 every time?

Something like this !!

By the way, this is a common statement in programming:

`i = i + 1;`

It means, "take the value of `i`, add `1` to it, and store it back in `i`"

In terms of algorithm, what we want is…

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X:
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The "go to" instruction is a *branching* instruction here

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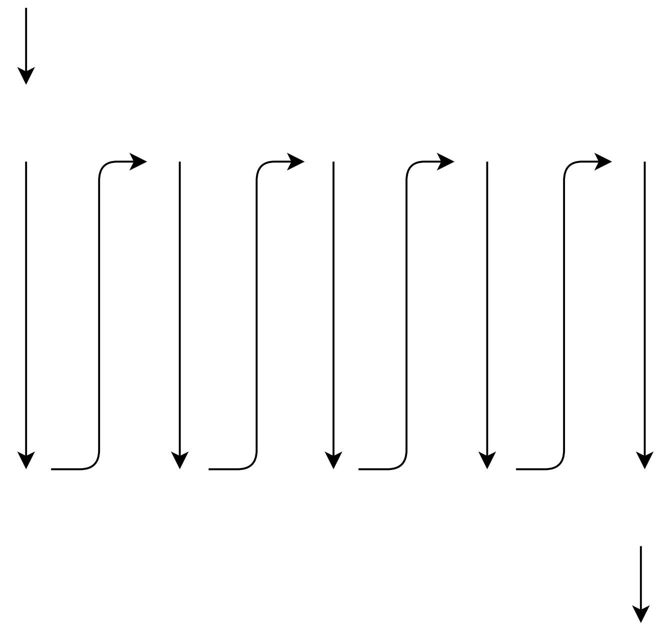

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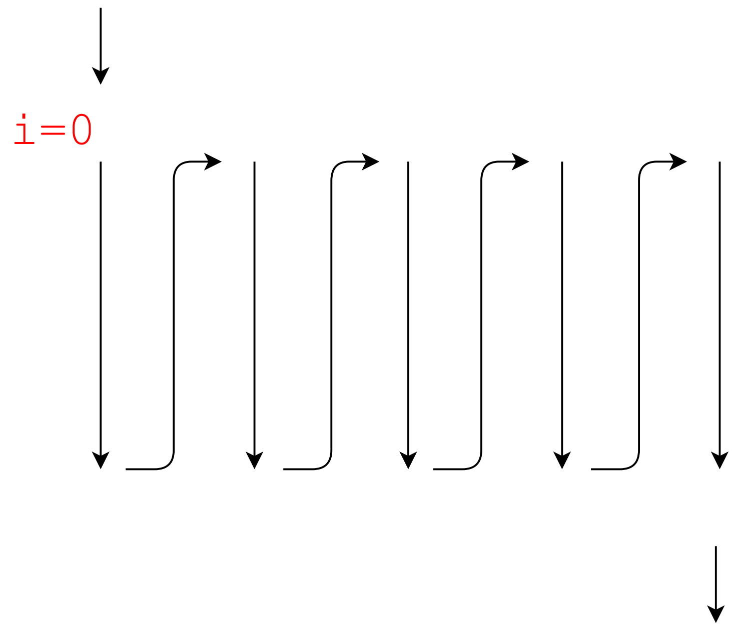

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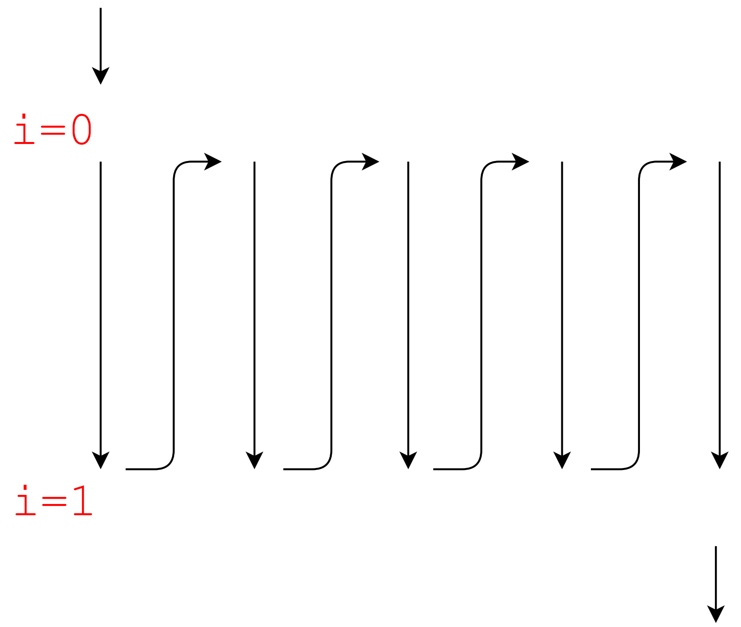

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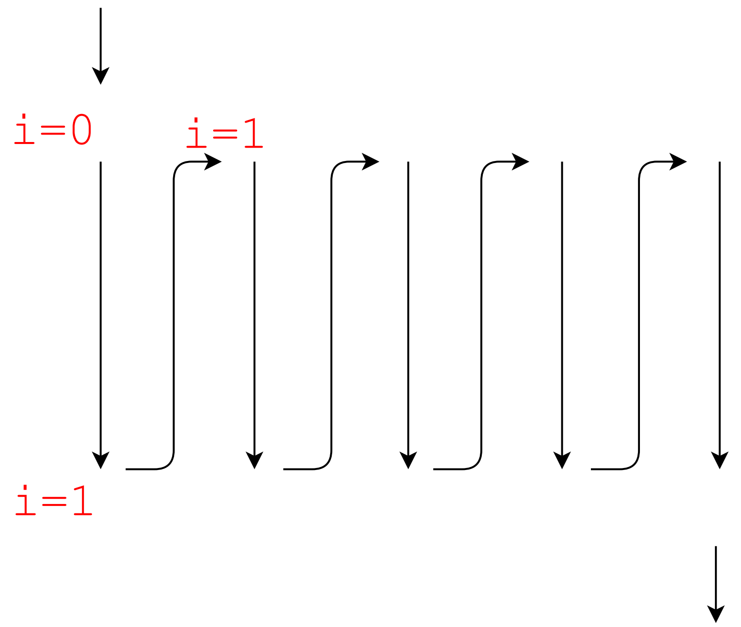

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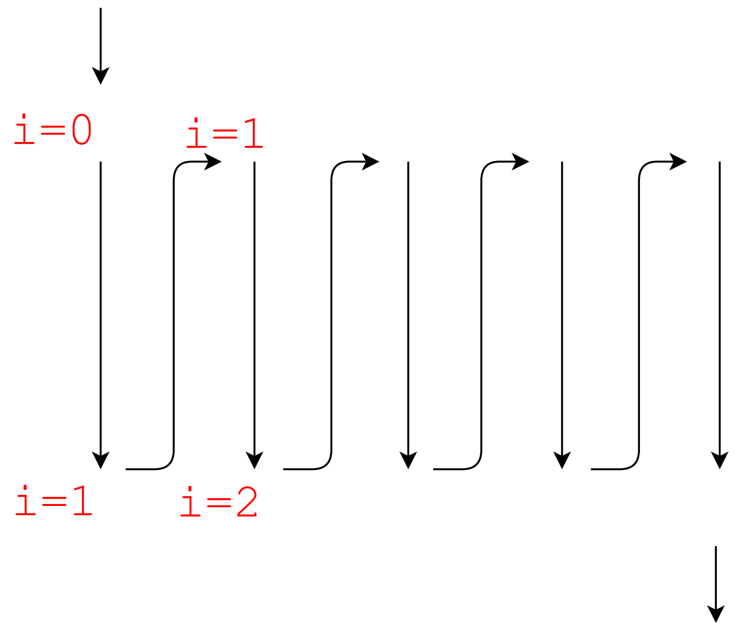

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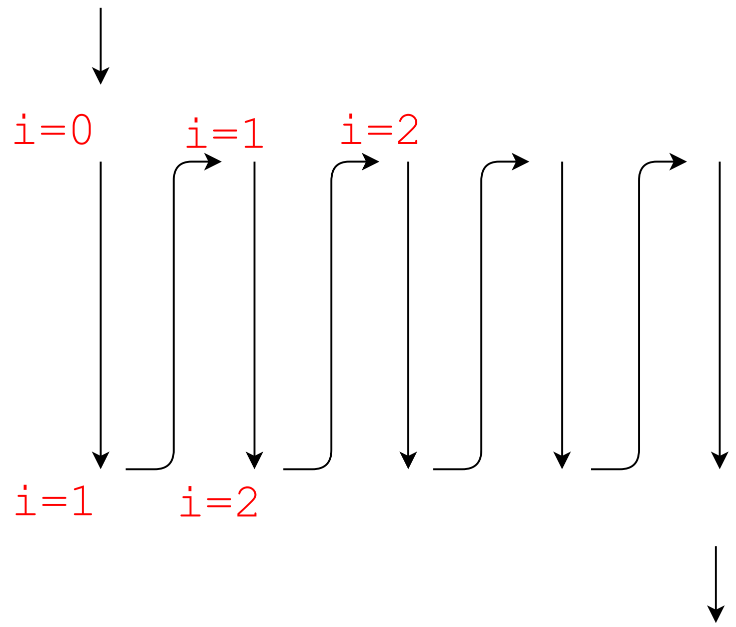

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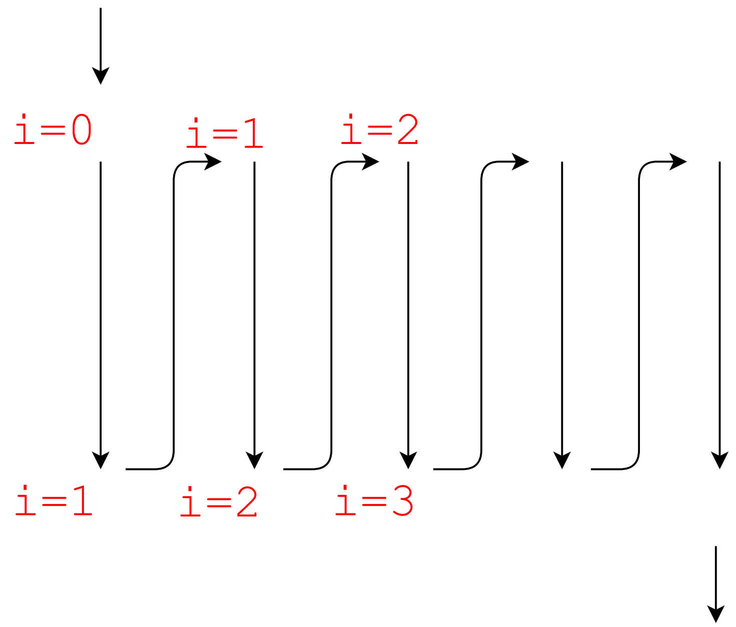

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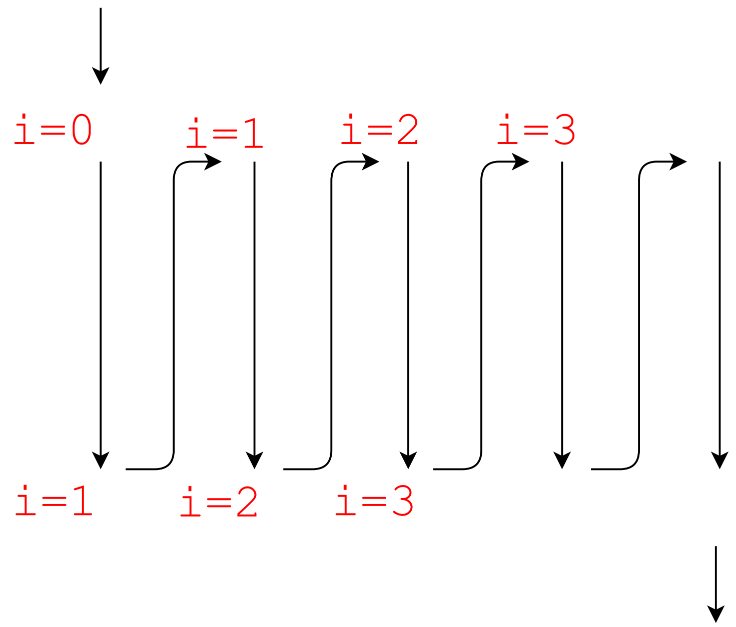

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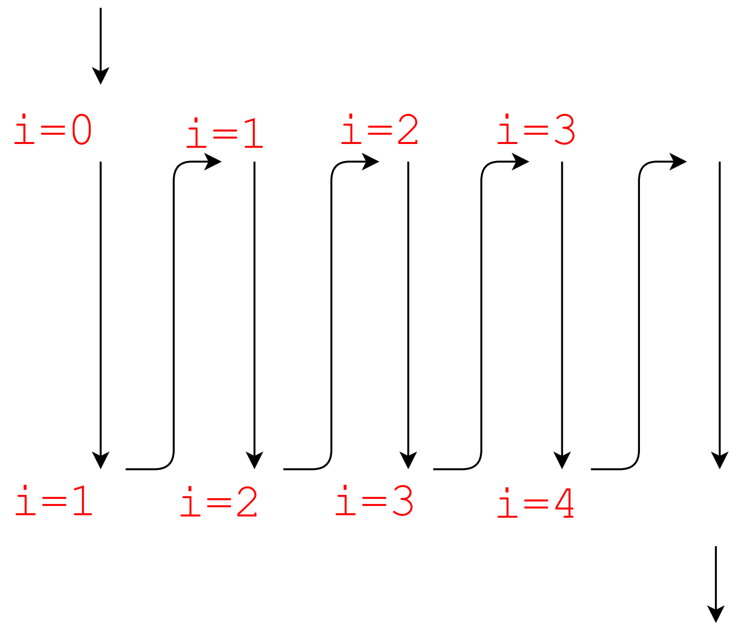

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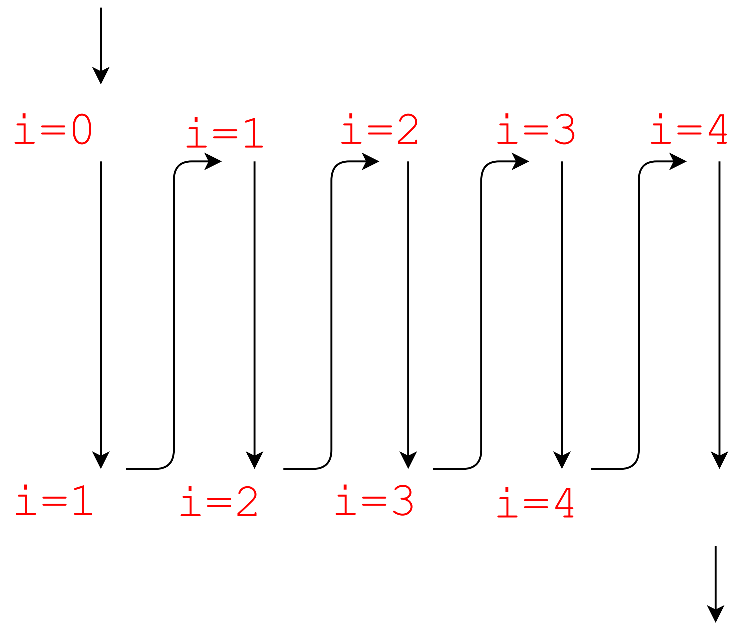

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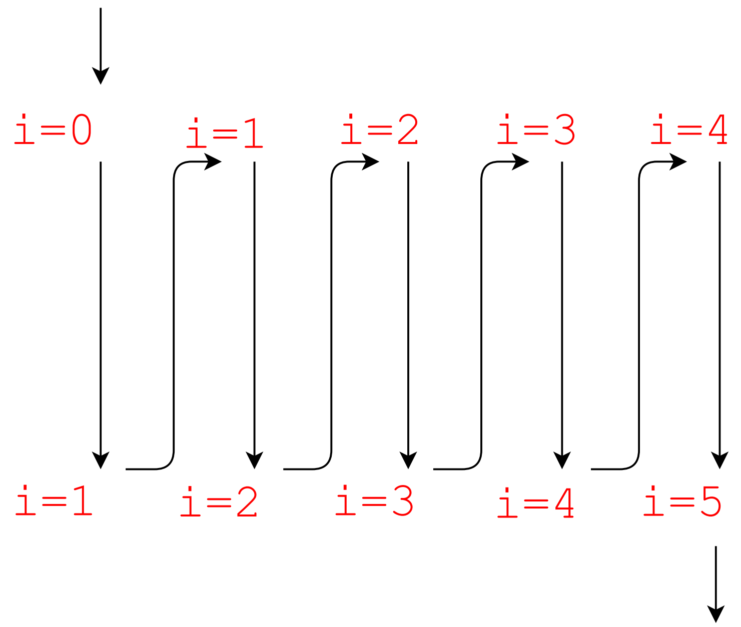

At this point the instruction right after the last statement above, is executed

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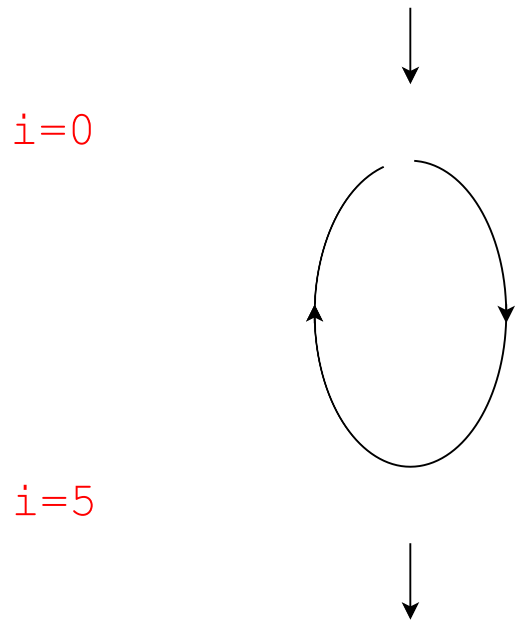

Another way to think about this flow is as shown

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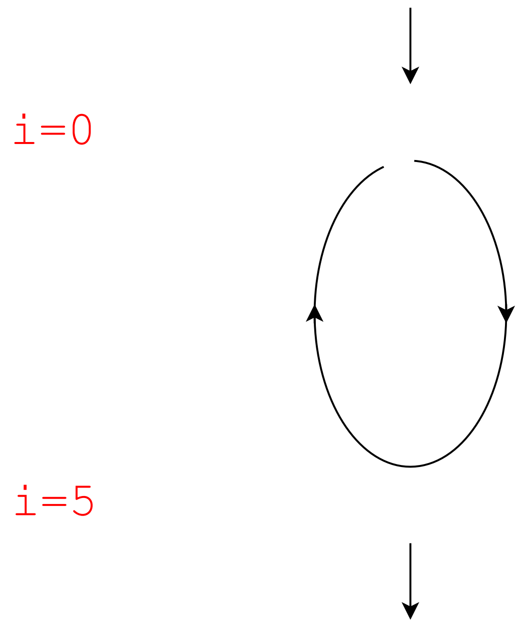

Another way to think about this flow is as shown

This type of flow in a program is called a *loop*

Why do we use loops?

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You’ll soon realise that the power of a program lies in its ability to do repeated tasks efficiently

- For example, it can do a task repeatedly, millions or billions of time !!

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You can solve a number of real-world problems by writing one or more loops

- Actually, this repeated processing is far more common than you may expect !!

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You can solve a number of real-world problems by writing one or more loops

- Actually, this repeated processing is far more common than you may expect !!

What you have to think about, is what changes in each *iteration* of the loop

- One iteration means the *body* of the loop being executed once
- The body, in turn, is the set of statements that are repeated multiple times

Using loops to solve problems

```
Statements before the loop
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Statements before the loop

Initialisation – setting values for important variables

Using loops to solve problems

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Statements before the loop

Initialisation – setting values for important variables

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    Statements, using different values of one or more variables



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    Update to the values of one or more variables


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    condition over one or more variables (to go out of the loop)
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Statements after the loop
```

Lets calculate Factorial !!

Procedure FactorialCalculater

```
    Inputs: num

    result = 1;

    if(num == 0)
    {
        return as Output : 1
    }

    do:
        result = result * num;
        num = num - 1;
        if(num > 1)
        {
            go to do;
        }

    return as Output : result
```

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            go to do;
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    return as Output : result
```

Convince yourself that you understand this pseudocode !!

Homework !!

Consider the example from the file `Stringify.c` in Lecture *3.2*

- If you don't know which example is it, please see the `Example Programs` folder on Course's Drive Folder
- Write pseudocode for the `puts()` function, using a loop

Rewrite the Procedure `FactorialCalculator` in such a way that

- there is another variable, `i`, which is initialised to 0, and
- the statement
  ```
  num = num - 1;
  ```
- … is replaced by the statement
  ```
  i = i + 1;
  ```
- … keeping the output exactly the same