

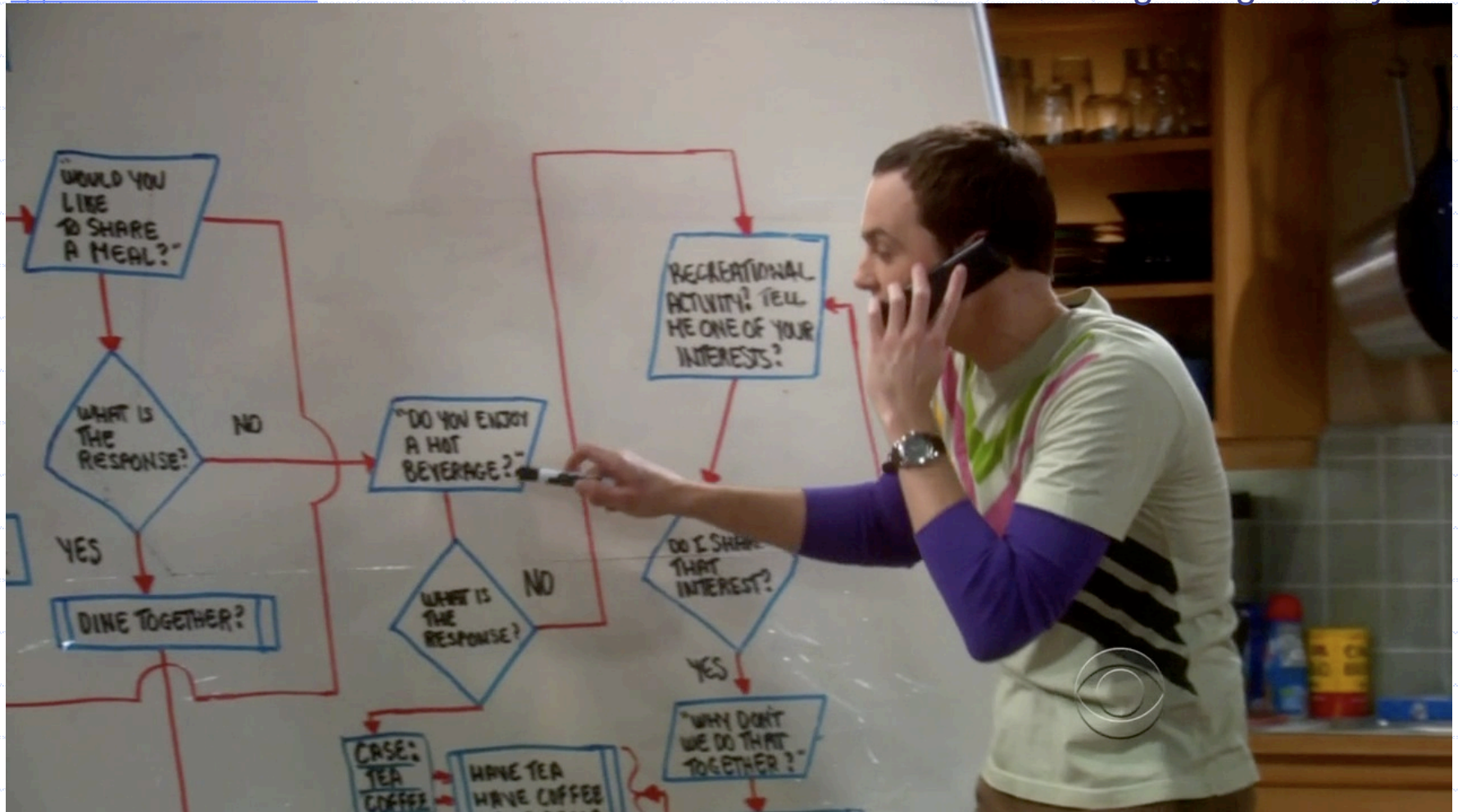
# Process of Programming:

## Step 2

- Obtain a logical solution to your problem.
- A logical solution is a finite and clear step-by-step procedure to solve your problem.
- Also called an Algorithm (or *recipe*).
  - We can visualize this using a Flowchart.
  - Very important step in the programming process.

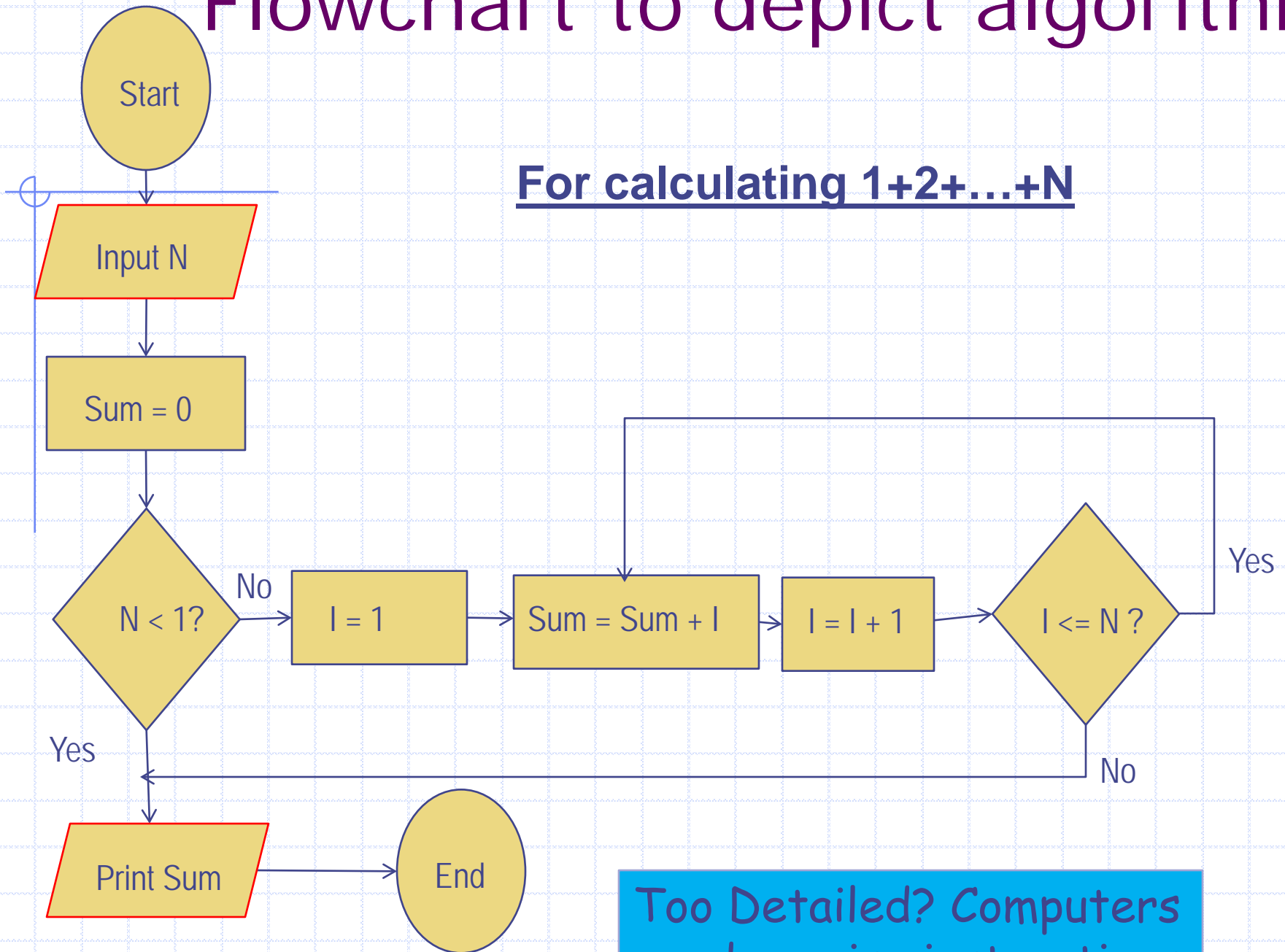
# Friendship Algorithm/Flowchart

Source: The Big Bang Theory



# Flowchart to depict algorithm

For calculating  $1+2+\dots+N$



Too Detailed? Computers need precise instructions

# Algorithms in real-life

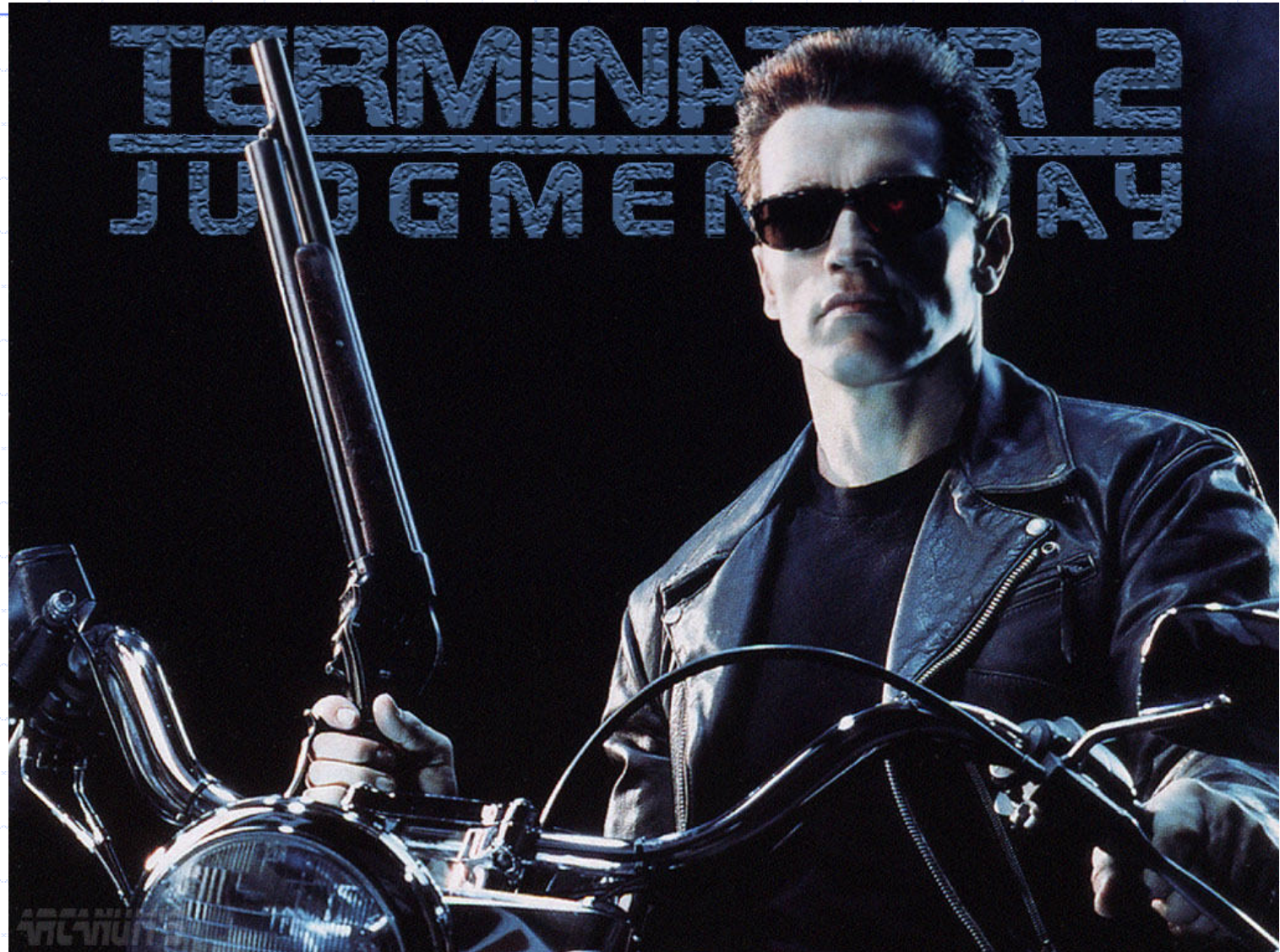
- ◆ Any step-by-step guide. e.g. Assembly instructions for a make-it-yourself kit.



<http://www.gocomics.com/calvinandhobbes/2009/06/02>

# What is "NOT" a computer

At least for this course...

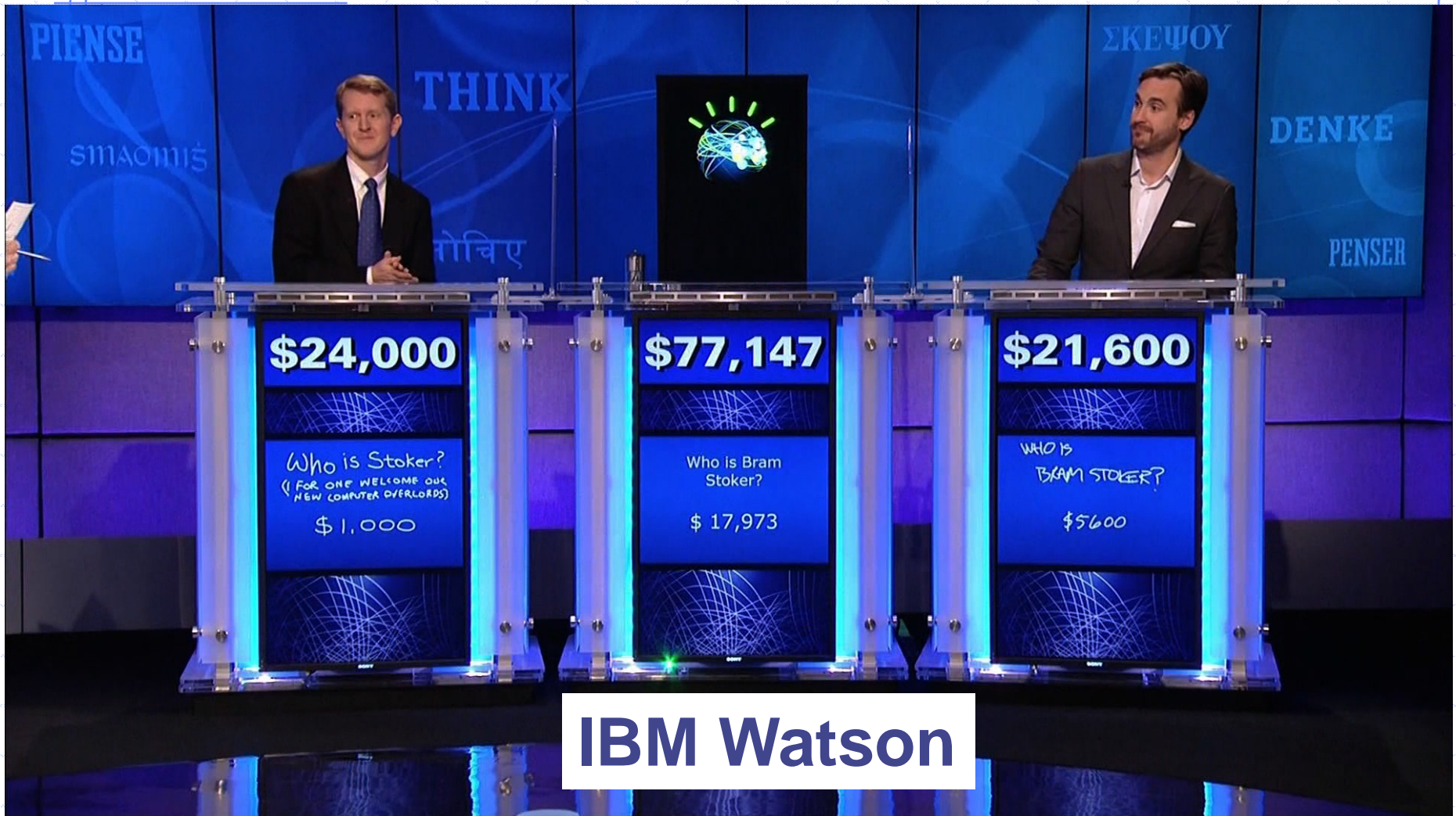


# Some famous Computers

## IBM Deep Blue

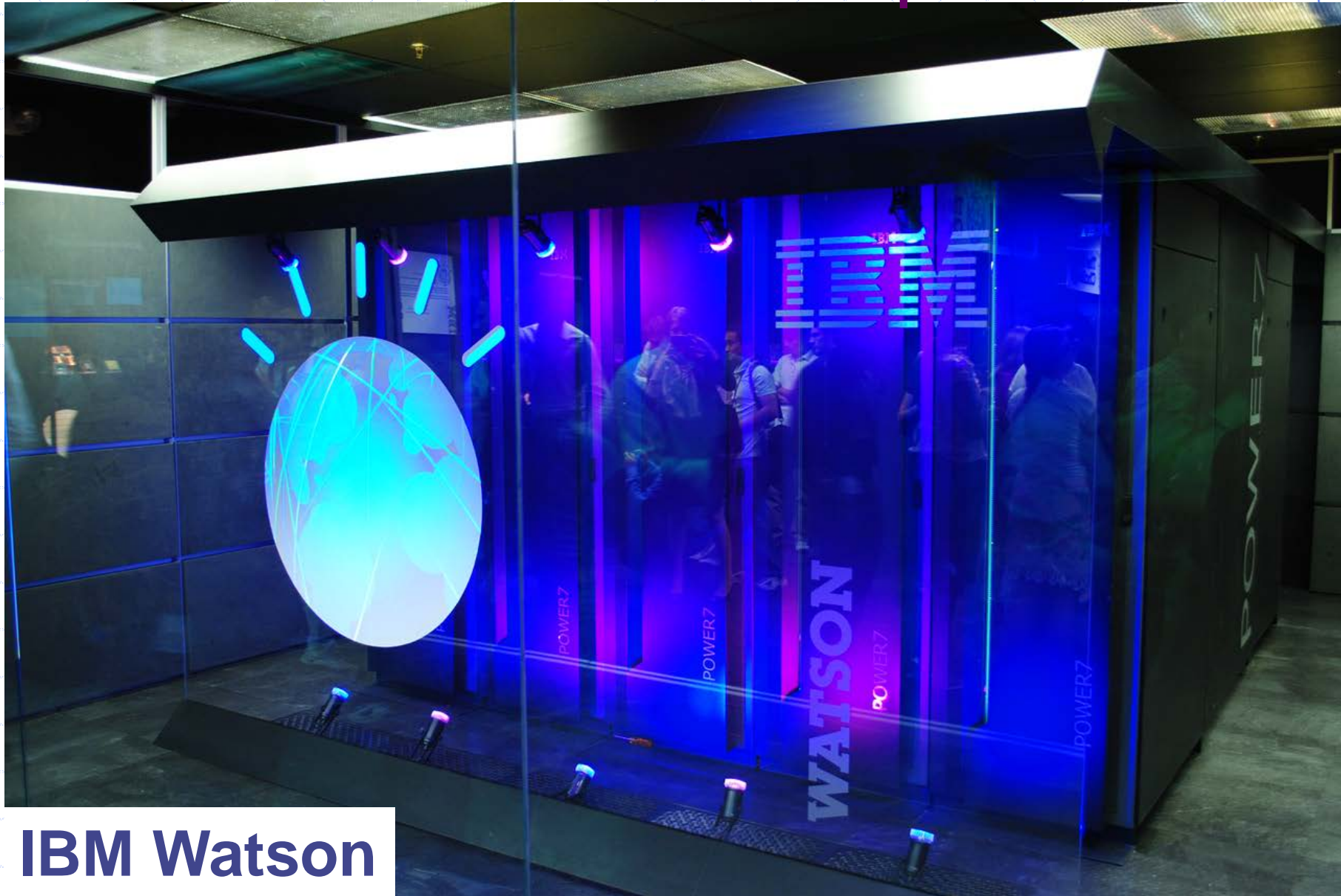


# Some famous Computers



**IBM Watson**

# Some famous Computers



**IBM Watson**





# ESC101: Introduction to Computing

## Overview of Programming

# GCD

- ◆ An algorithm to find the greatest common divisor of two positive integers  $m$  and  $n$ ,  $m \geq n$ .
- ◆ A naïve solution – Described *informally* as follows.
  1. Take the smaller number  $n$ .
  2. For each number  $k$ ,  $n \geq k \geq 1$ , in descending order, do the following.
    - a) If  $k$  divides  $m$  and  $n$ , then  $k$  is the gcd of  $m$  and  $n$

# GCD

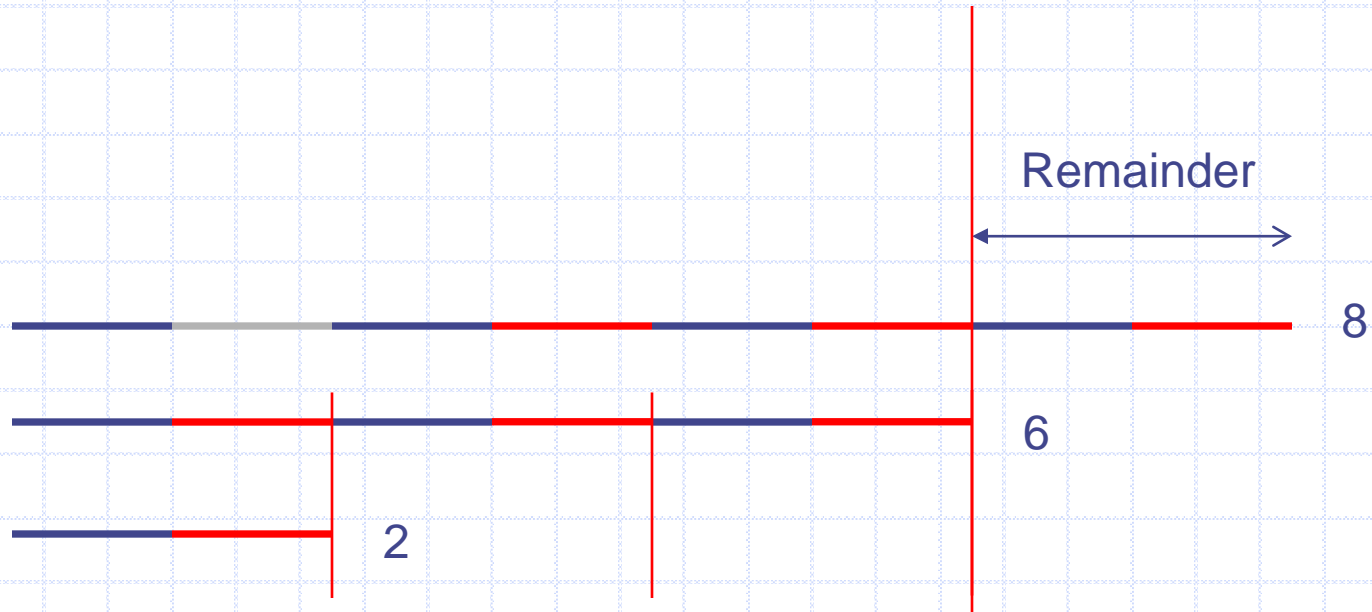
- ◆ This will compute gcd correctly, but is VERY slow (think about large numbers  $m$  and  $n=m-1$ ).
- ◆ There is a faster way...

# GCD Algorithm - Intuition

To find gcd of 8 and 6.

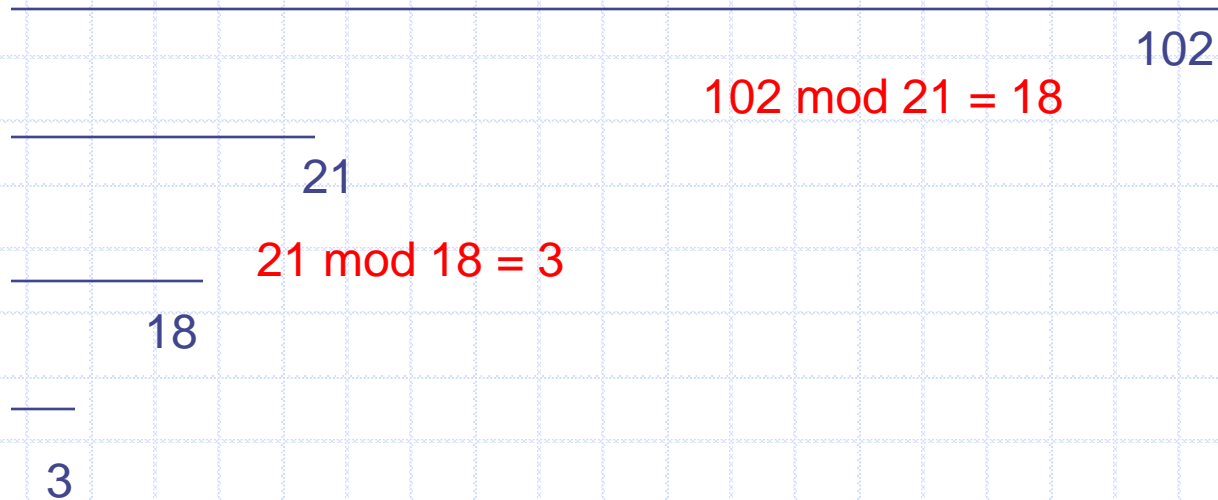
- Consider rods of length 8 and 6.
- Measure the longer with the shorter.
- Take the remainder **if any**.
- **Repeat** the process until the longer can be exactly measured as an integer multiple of the shorter.

# GCD Algorithm - Intuition



$$\text{Gcd}(8, 6) = 2.$$

# GCD Algorithm - Intuition



$$\text{Gcd}(102, 21) = 3$$

# Euclid's method for gcd

- Suppose  $a > b$ . Then the gcd of  $a$  and  $b$  is the same as the gcd of  $b$  and the remainder of  $a$  when divided by  $b$ .

$$\text{gcd}(a,b) = \text{gcd}(b, a \% b)$$

**Proof:**

Exercise



# GCD Algorithm

**Data:** Integers  $m$  and  $n$

if  $n > m$  then Interchange  $m$  and  $n$ ;

while  $n \neq 0$  do

$g \leftarrow m \% n$ ;

$m \leftarrow n$ ;

$n \leftarrow g$ ;

end

return  $m$ ;



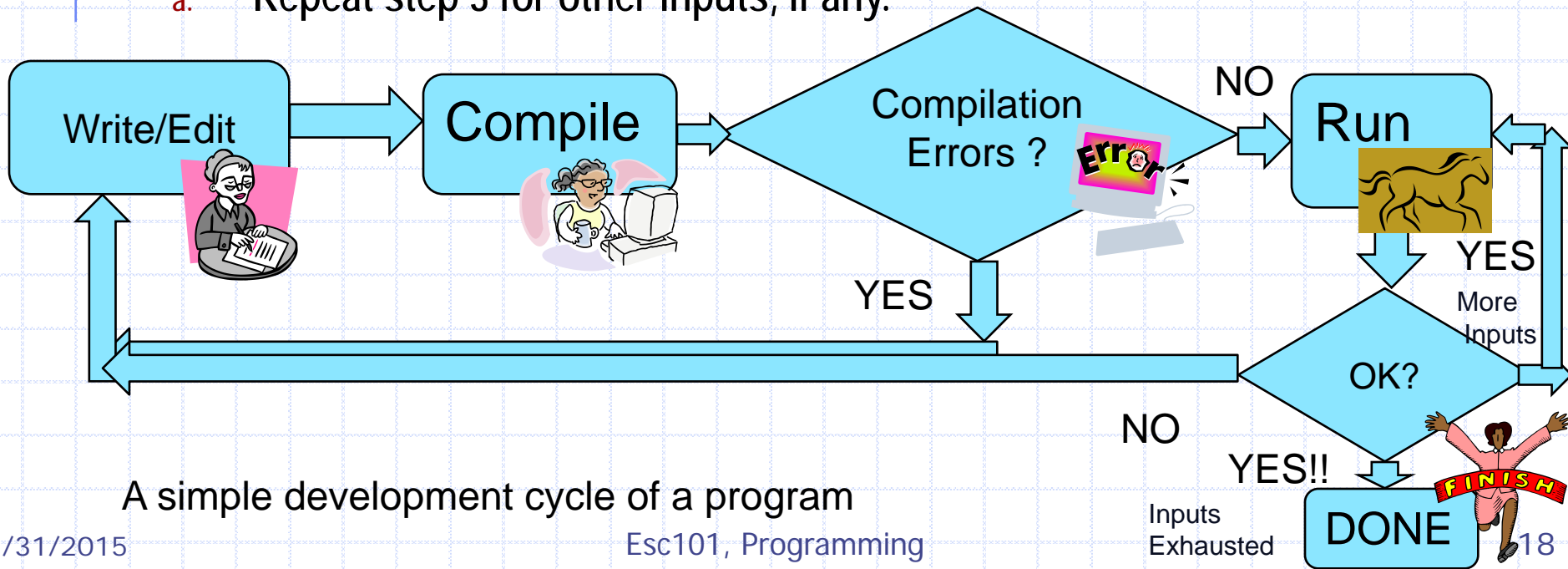


# Overview of Programming

Using C

# The Programming Cycle

1. Write your program or **edit** (i.e., change or modify) your program.
2. **Compile** your program. If compilation fails, return to editing step.
3. **Run** your program on an input. If output is not correct, return to editing step.
  - a. Repeat step 3 for other inputs, if any.



A simple development cycle of a program

# IDE for Edit-Compile-Run cycle

- In this course, you will be using an Integrated Development Environment (IDE). IDE will be available through your browser.
- First login to the system.
- Type in your program in the editor of the IDE.
- Use the compile button to compile.
- Run button to run.
  - The labs in the first week will introduce you to the system in more detail.

THE #1 PROGRAMMER EXCUSE  
FOR LEGITIMATELY SLACKING OFF:

"MY CODE'S COMPILING."

HEY! GET BACK  
TO WORK!

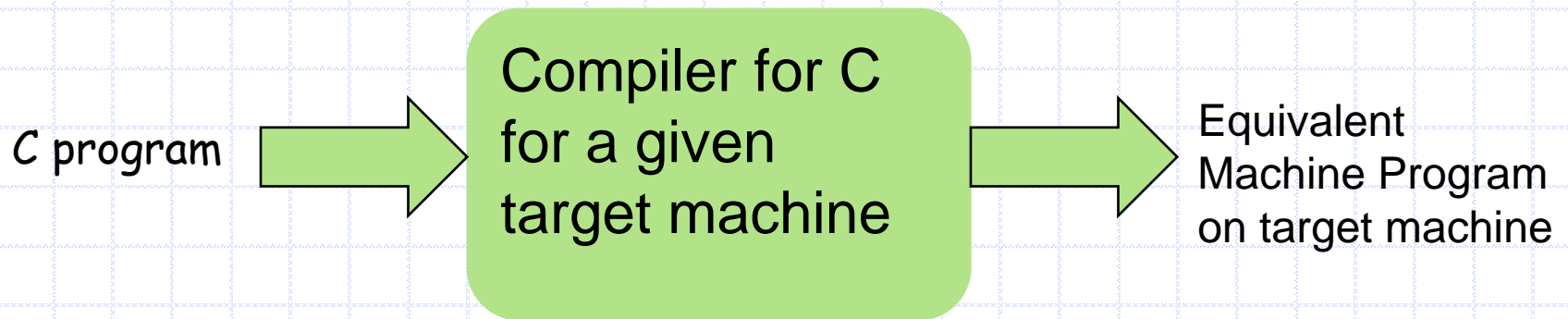
COMPILING!

OH. CARRY ON.



# Why program in high level languages like C

- Writing programs in machine language is long, tedious and error-prone.
- They are also not portable—meaning program written for one machine may not work on another machine.
- Compilers work as a bridge.
- Take as input a C program and produce an equivalent machine program.



# Simple! Program

- Today we will see some of the simplest C programs.

```
# include <stdio.h>
int main ( ) {
    printf("Welcome to ESC101");
    return 0;
}
```

The program prints the message "Welcome to ESC101"

# Program components

```
# include <stdio.h>
```

```
int main ()
```

```
{
```

```
    printf("Welcome to ESC101");
```

```
    return 0;
```

```
}
```

1. This tells the C compiler to include the standard input output library.

2. Include this line routinely as the first line of your C file.

printf is the function called to output from a C program. To print a string, enclose it in " " and it gets printed. For now, do not try to print " itself.

"return" returns the control to the caller (program finishes in this case.)

main() is a function. All C programs start by executing from the first statement of the main function.

printf("Welcome to ESC101"); is a **statement** in C. Statements in C end in semicolon ;