

ED1021 - Introduction to computation and visualisation

L3 - Basics of Programming

Ramanathan Muthuganapathy (<https://ed.iitm.ac.in/~raman>)

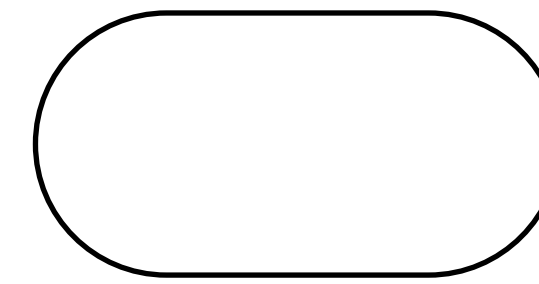
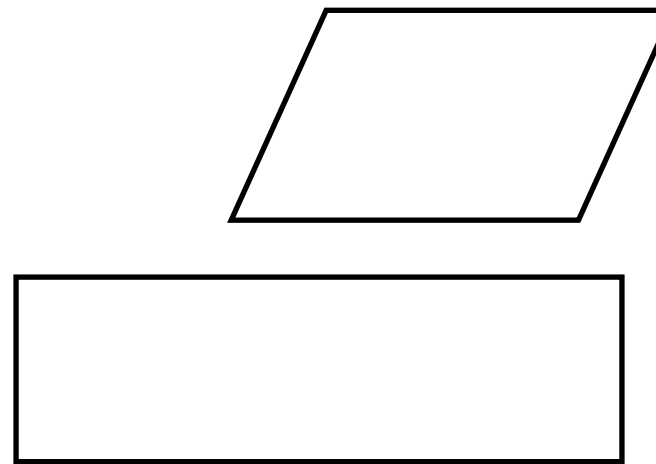
Course web page: <https://ed.iitm.ac.in/~raman/introcomp.html>

Moodle page: Available at <https://courses.iitm.ac.in/>

Flowchart - Recap

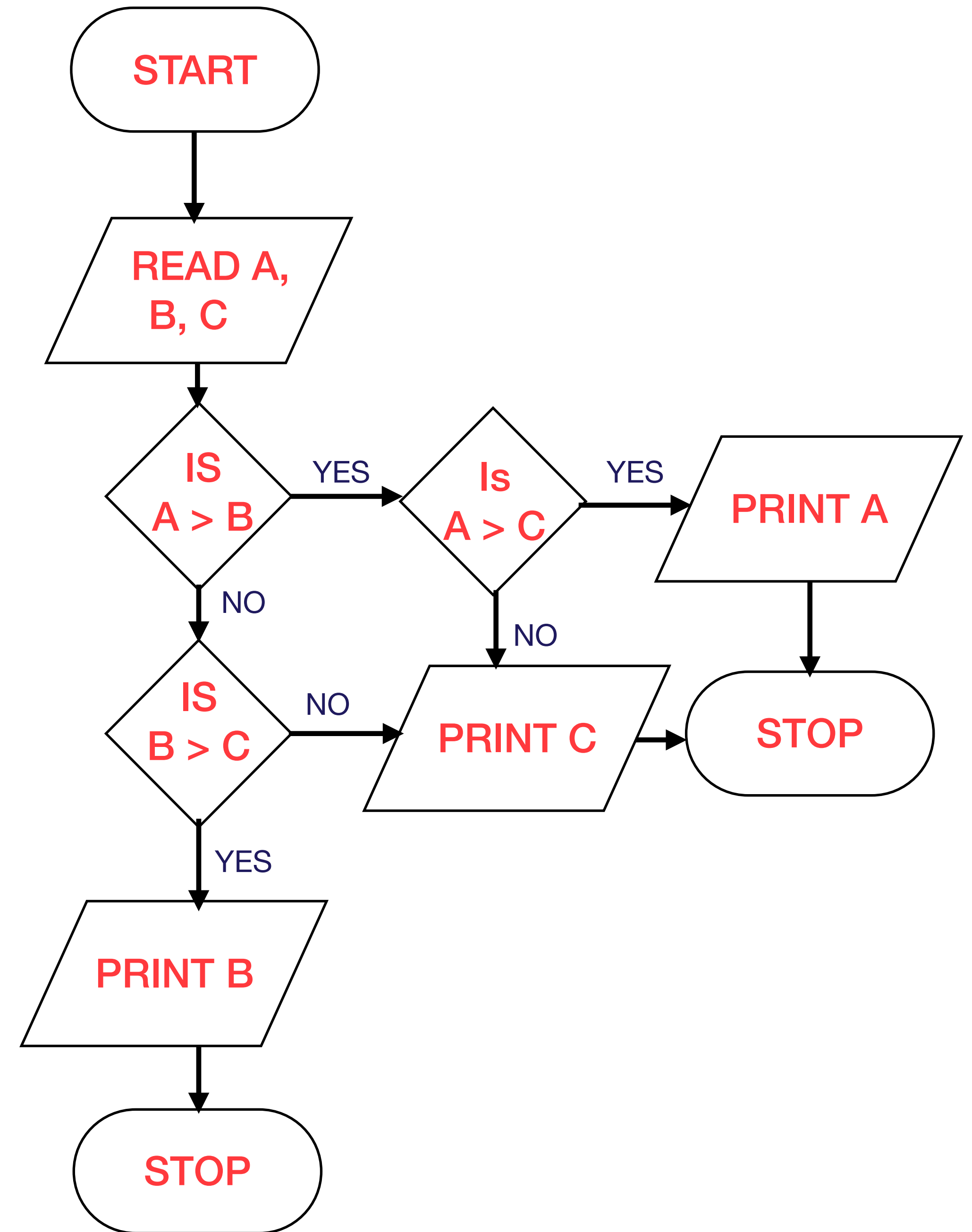
Basic shapes and purpose

- Start and stop - Oval or rounded rectangle
- Input / Output - Parallelogram
- Instructions - rectangle.



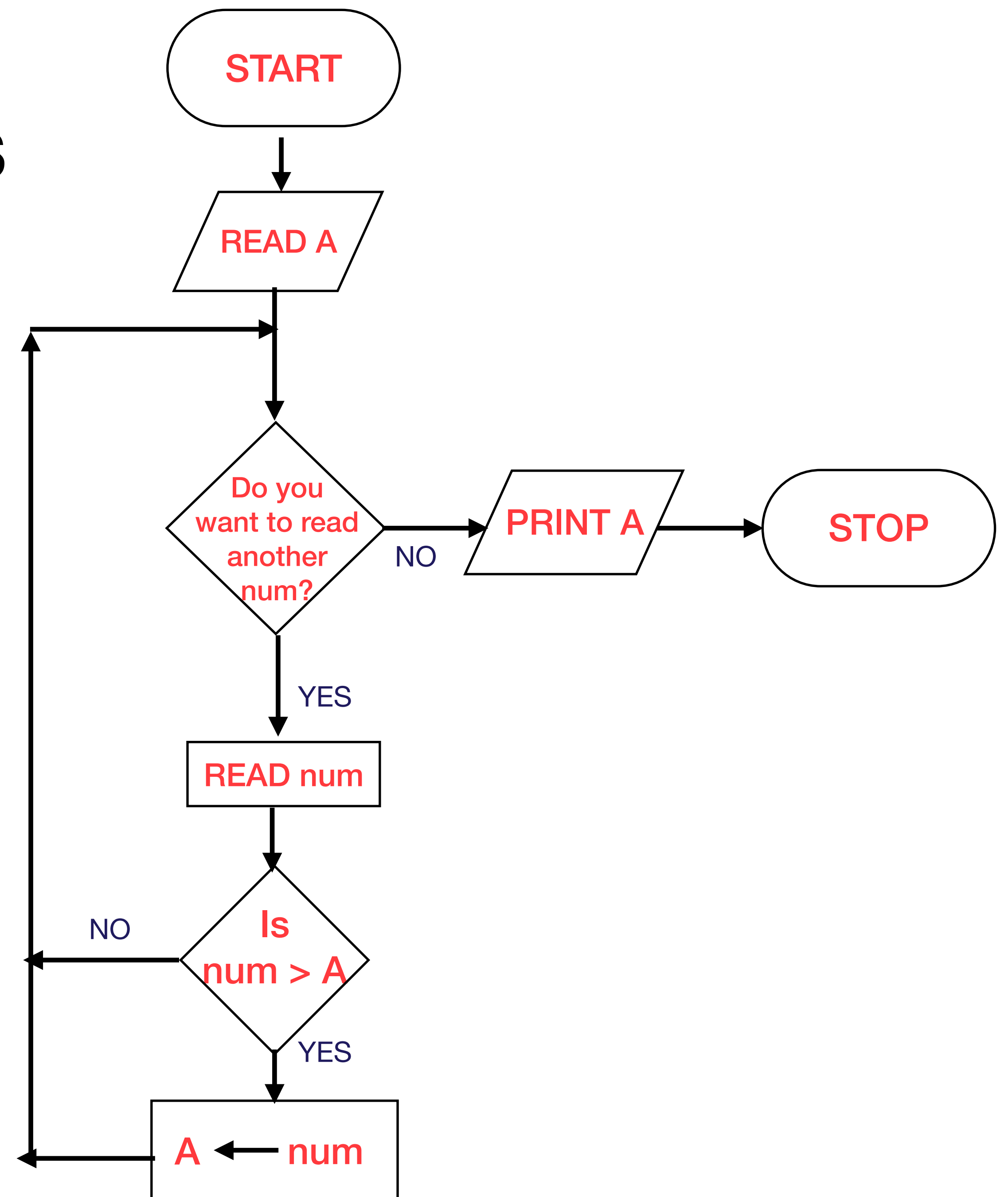
Flowchart

Finding the greatest of three numbers



Largest of a few numbers

One way of solving!



What is computer programming?

Recap

- Set of instructions to a computer written in 'English-like' language, typically called as High-level language, to achieve a specific task (e.g, from simple computing task of addition of two numbers all the way upto mimicking human brain).
- Design and build an executable computer program
- The 'program' that you write is called 'Source code'.
- Used in almost all forms of life: Games, Robotics, Modeling, Analysis. nowadays the popular ones such as machine/deep learning etc.

Programming Languages

- Programming is done using what are called as 'Programming Languages'
- Several programming languages are available - C, C++, Python, R, MATLAB, Mathematica, JAVA (for a full set, see https://en.wikipedia.org/wiki/List_of_programming_languages)
- The goal of this course is to make you learn the programming language 'C', comprehensively!
- NOTE: PROGRAMMING CAN BE LEARNT ONLY BY PROGRAMMING

A Sample Program

Hello world example (Source code)

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

```
int main() {  
    printf("Hello, World!\n");  
    return 0;  
}
```

A Sample Program

Addition of two numbers (Source code)

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

```
int main() {  
    int a, b, c; // a, b, c are called variables  
    a = 2;  
    b = 3;  
    c = a + b;  
    printf("c = %d\n", c);  
    return 0;  
}
```


‘C’

- ‘C’ requires `Syntax’ (rules)
- C is Syntax heavy (Each and everything that you write has to follow certain rules).

Numeric Constants

basically numbers and hence they are constants!

- In computers, a number is represented in the form of Binary Digits (bits).
- Bits are a combination of 0's and 1's. E.g. 2 is 10 in binary form, 3 is 11 and so on...
- Basically, bits are of 'base 2' representation.
- However, we don't have to know the details of bits.
- Hence, we can represent the numbers in the usual way.

Numeric Constants

convert a number to binary

- Qn: How to convert a `number' to its binary form?

Numeric Constants

Types

- Integer constants
- Floating point constants

Numeric Constants

Integer Constants

- Decimal Integer Constants.
- Octal Integer Constants.
- Hexadecimal Integer Constants.

Numerical Constant

Decimal Integer Constant

- 'base 10' representation.
- 0, 1,, 9 are the numbers to be used.
- Must have at least one digit.
- No decimal point.
- First digit should not be 0
- Examples: 2, 456, +385, -25678, etc.
- Qn: Give some examples for what is NOT a decimal integer constant?

Numerical Constant

Octal Integer Constant

- `base 8' representation.
- 0, 1,, 7 are the numbers to be used.
- Must have at least one digit.
- No decimal point.
- First digit should be 0
- Examples: 02, 0456, +0385, -02567, etc.
- Qn: Give some examples for what is NOT an octal integer constant?

Numerical Constant

Hexadecimal Integer Constant

- `base 16' representation.
- 0, 1,, 9 are the numbers to be used along with `letters' a, b,, f
- Must have at least one digit.
- No decimal point.
- First digit should be 0x or 0X
- Examples: 0x2, 0x456e, +0X385AB, -0x2569EF, etc.
- Qn: Give some examples for what is NOT an hexadecimal integer constant?

Numerical Constant

floating point constant (fractional form)

- contains a decimal point.
- A digit needs to be present before and after the decimal point.
- Examples: 2.45, 1.0, +3.865, −2.34567, etc.
- Qn: Give some examples for what is NOT a floating point constant?

Numerical Constant

floating point constant (Exponential form)

- $58.5 = 585 \times 10^{-1}$
- This is written as 585E-1
- Another Example: $58500 = 585 \times 10^2$
- This is written as 585e2
- Rule: (Mantissa) E (exponent)
- Mantissa can be an integer or have floating point (in fractional form)
- Exponent part is always a decimal integer constant (could be +ve or -ve).
- Qn: Give some examples for what is NOT a floating point constant?

Numerical Constant

floating point constant (Exponential form)

- MORE QUESTIONS?

Numeric Constants

Range

- HW: Find out the range of constants for both integer and floating point constants?