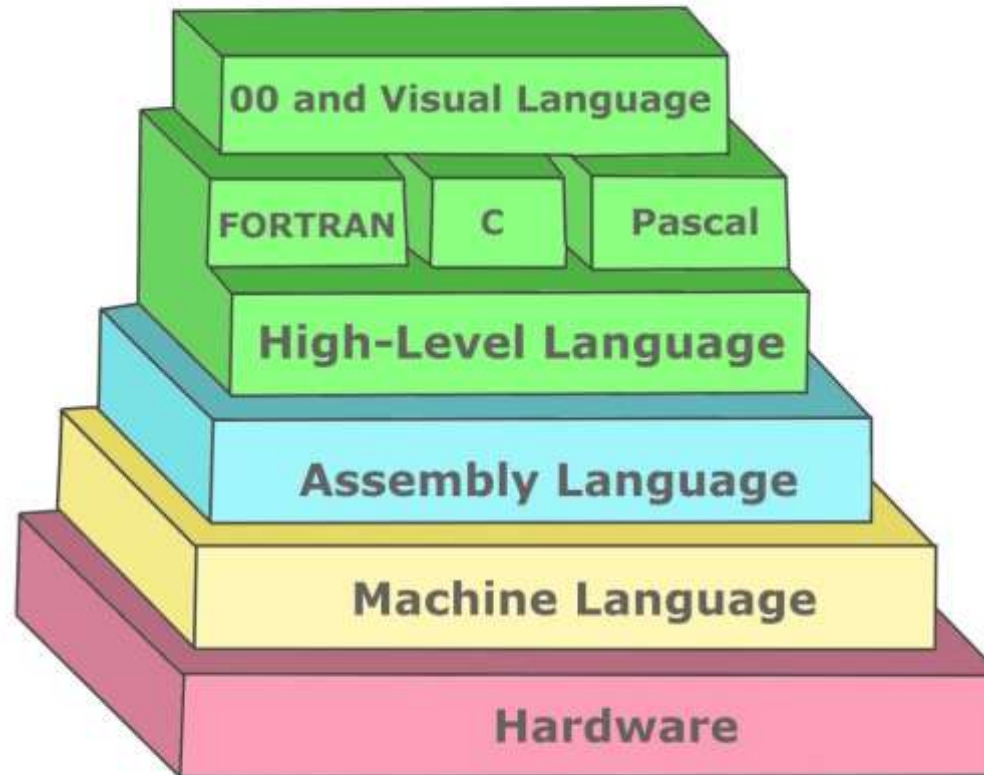# Computer Programming

What is Computer Programming?

- **Computer programming** is the process of designing and building an executable computer program to accomplish a specific computing result or to perform a specific task

- The purpose of programming is to find a sequence of instructions that will automate the performance of a task

- The source code of a program is written in one or more languages that are intelligible to programmers (called high level programming languages)

- The computer will take that source code and convert it to a language that it understand (called machine language)

- Because it's very hard for humans to write code in machine language we developed the high level programming languages and the process to convert them into machine language
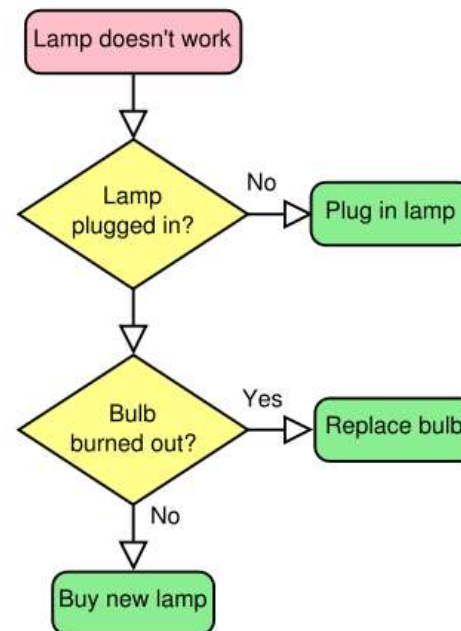
What is Computer Programming?

What is Algorithm?

● In computer science an **algorithm** is a set of steps for a computer program to accomplish a task

● algorithms are not just in the computer science context, We are using algorithms every day to perform every task in our lives

For example - fixing lamp algorithm:

What is a Good Algorithm?

- We can create a lot of different algorithms to accomplish the same task

- A good algorithm is an algorithm that should:
    - Successfully perform the task it meant to perform
    - Be efficient - accomplish the task with the least steps posible and use minimal resources
    - Be easily to understand - maintainable algorithm that reflects easily the creator thinking process
    - Be flexible - know how to handle all kinds of exceptions and errors
    - Be balanced - balance between efficient and readable

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What is a Flowchart?

- A **flowchart** is a type of diagram that represents a workflow or process

- The flowchart shows the steps as boxes of various kinds, and their order by connecting the boxes with arrows

- This diagrammatic representation illustrates a solution model to a given problem

- Flowcharts are used in designing and documenting simple processes or programs

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Examples for Flowcharts

Fixing a lamp flowchart
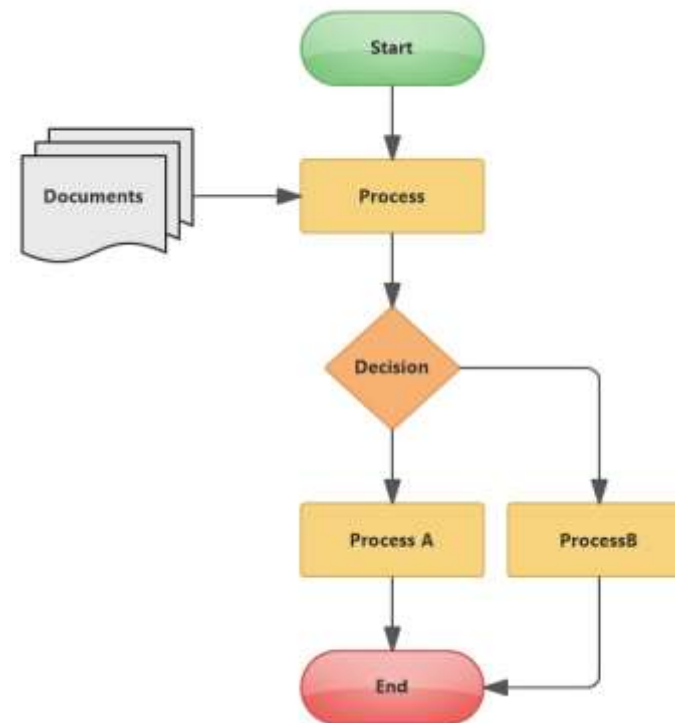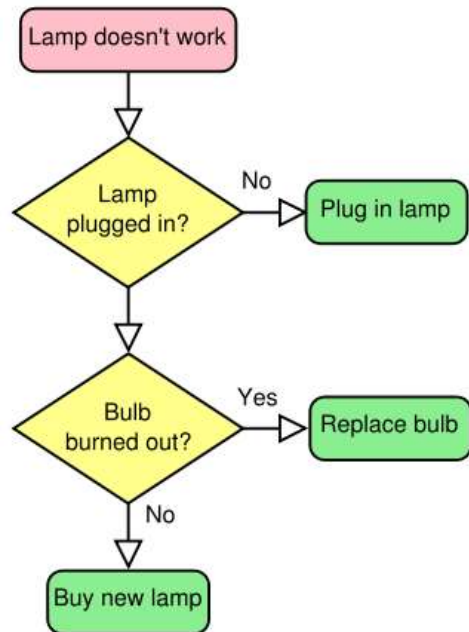
Flowchart Symbols

Start / End Symbol

Determine the start and end points of the flowchart
(usually with the world "Start" or "End" inside it

Action Symbol

The action can represent a single step like ("add sugar")
or much complex process like ("make coffee")

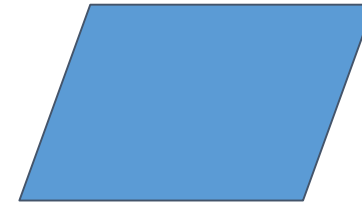## Decision Symbol

The decision represent different choices
that in order to complete the process we should choose from
Every choice can lead to different actions in the diagram

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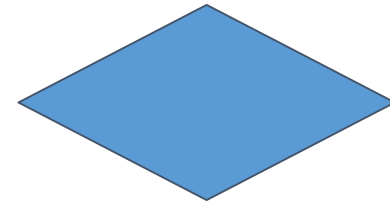
Flowchart Symbols

Input / Output Symbol

Represent information that the program will show during the process (for example print a response)

Making Coffee Process Flowchart

What is a Programming Flowchart?

- A **programming flowchart** is a flowchart that show the <u>data flow</u> of a programing algorithm

- By using programming flowcharts we can easily describe the logic and the steps behind our algorithm

- Also, by using programming flowcharts we can easily test our algorithm efficiency and find edge cases and errors we should handle

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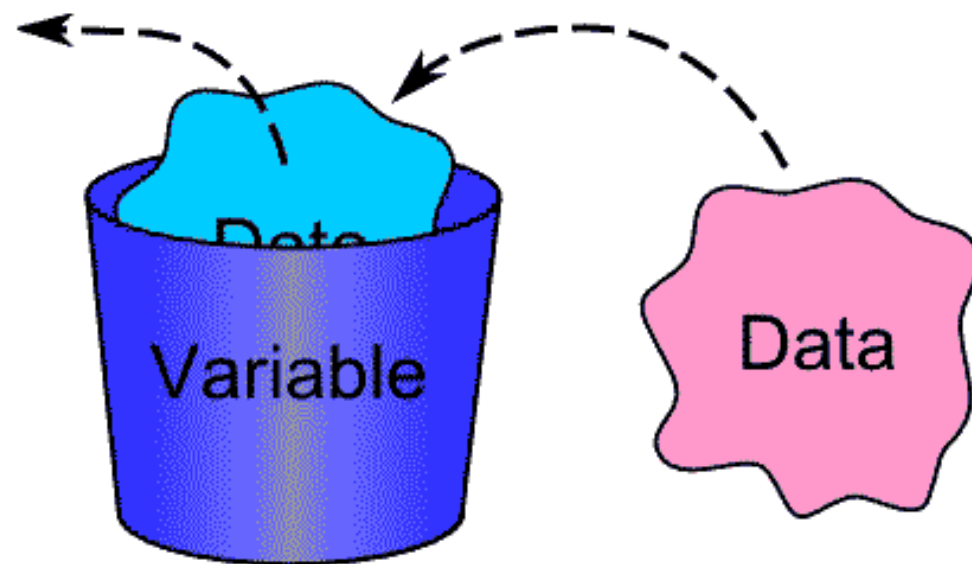
Programming Flowchart

Let's try to create a simple programming flowchart:

Our simple algorithm should get 3 integers as an input and find the largest integer

How can we do it?

Note: We don't know what the integers are going to be except the fact that they are integers

Variables

What are Variables?

- **Variables** are used to store information that we will want to use and save in our computer program, They are a very important concept in computer science

- You can think of variables as containers that hold data that you assigned to it

- Variables provide a way of labeling data with a descriptive name, so us and others could more easily understand our program

- Variables sole purpose is to label and store data in memory, This data can then be used throughout your program

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How Variables will solve our Flowchart problem?

By using a **variables** we could store our input numbers and use them wherever we need in our flowchart

For example:

We could store every integer we got as an input as a letter and use the letter as reference to the integers we got -

- variable "a" will be first integer input
- variable "b" will be second integer input
- variable "c" will be third integer input

Now every time we will right "a", "b" or "c" this will be a reference to our inputs so our program will replace this variable name with the value it stored

Our Flowchart should look like this:
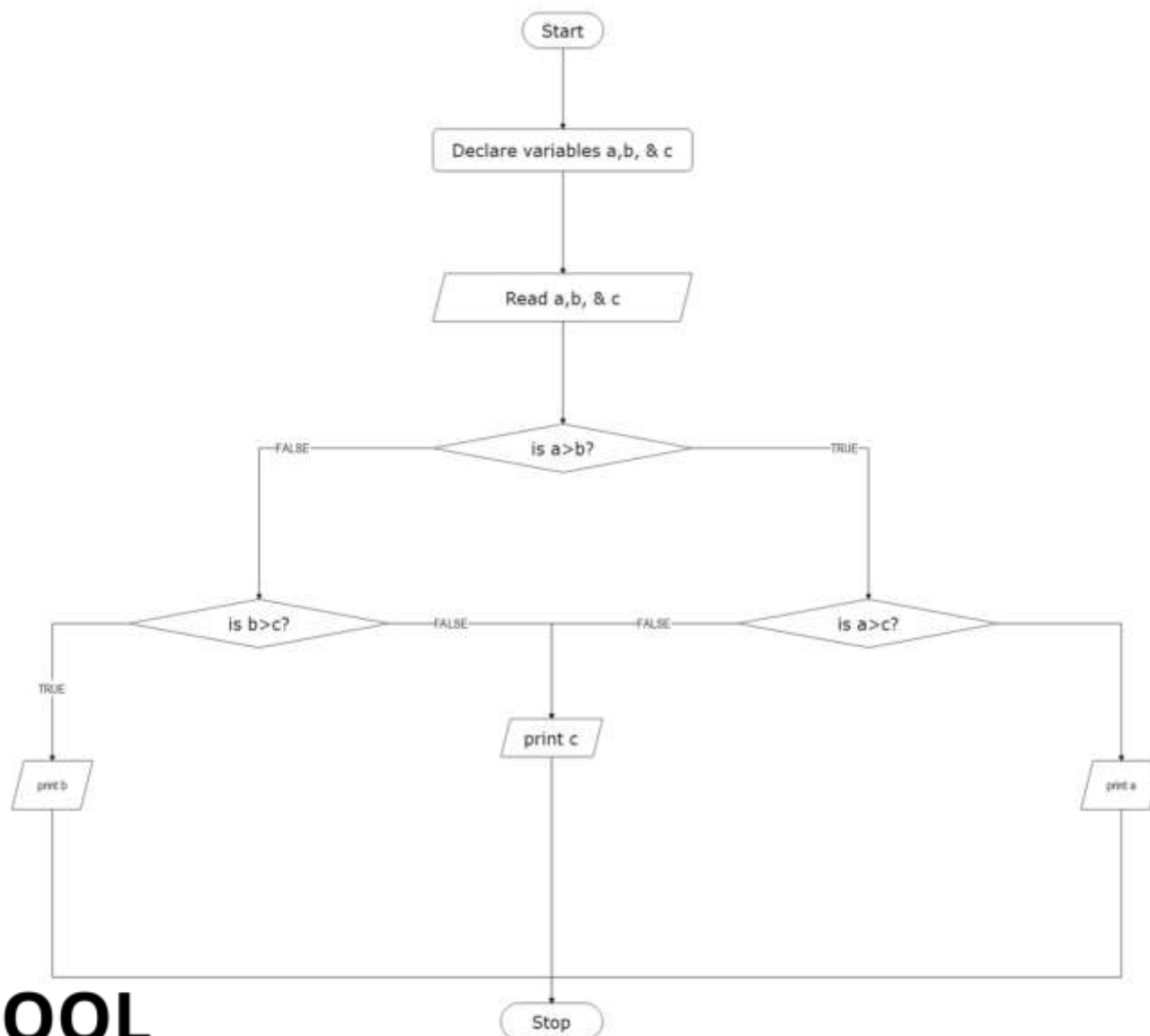
Primitives Variables Types

- Primitive variables are variables that have a fixed size in memory

- We should choose what primitive variable to use by knowing the type of the data that we want to store and the size of it

- The larger the size of our variable to more space it will take in our memory This is why it is important to use the right variable for the right purpose

- Unlike more complex variables (we will learn about them later in the course), primitive variables doesn't have any additional methods

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Primitives Variables Types

We have 7 different types of primitive variables:

- byte -   size: 1 byte   (-128 to 127)
- short -   size: 2 bytes   (-32,768 to 32,767)
- int -   size: 4 bytes   (-2,147,483,648 to 2,147,483,647)
- long -   size: 8 bytes   (-9,223,372,036,854,775,808 to 9,223,372,036,854,775,807)
- float -   size: 4 bytes   Stores fractional numbers, can store 6 to 7 decimal digits
- double -   size: 8 bytes   Stores fractional numbers, can store 15 decimal digits
- boolean -   size: 1 bit   Stores true or false values
- char -   size: 2 bytes   Stores a single character/letter or ASCII values

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Class Exercise - Programming Flowchart

Class Exercise - Programming Flowchart

Instructions:

- Write programming flowcharts, as we learned in this leacure, that show the algorithm for performing those tasks:

  - An algorithm that takes 3 whole numbers and a "isSum" variable
    If the "isSum" variable is true -> your program should return the sum of all the numbers
    If the "isSum" variable is false -> your program should return the largest number from all 3 numbers given

  - An algorithm that takes a minute number and convert it to second
    For example - if you got the number 2 you should return 2*60 = 120 seconds

- Use primitive variables in your flowchart to save the arguments, think what variable type will be better to use for saving each argument
- Think about all the edge cases that your program can have and reflect them in your flowchart

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Class Exercise - Programming Flowchart Solution

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