Python Programming

Dr. Cao Tien Dung
School of Engineering - Tan Tao University

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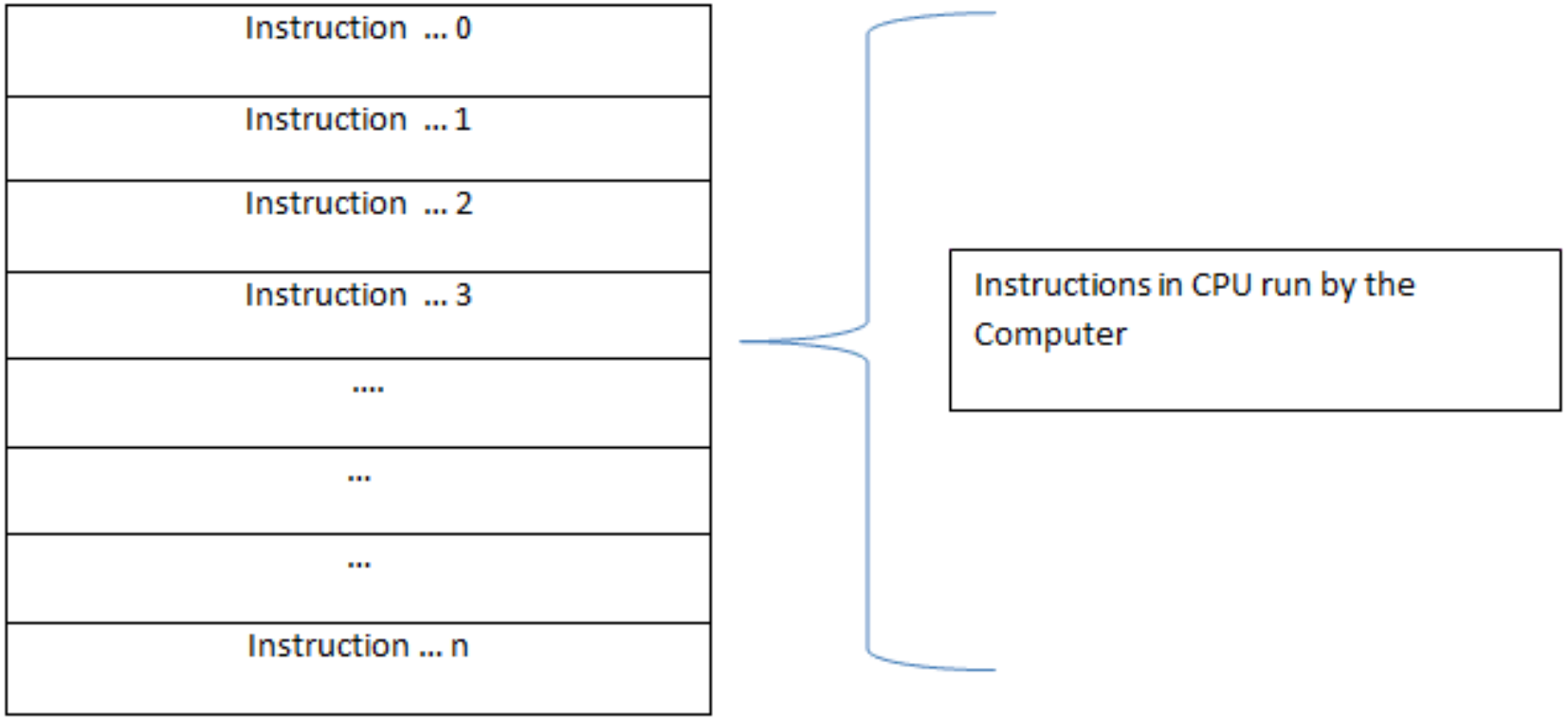
Lesson 1 - Outline

- Introduction to Programming
- Why learn Python for data science
- Setting up Python & working environments (Python, Jupyter, PyCharm, gitlab)
- Running a few programming in Python
- Variable, block & syntax in Python

A computer program

- A program is a set of instructions that the computer executes.

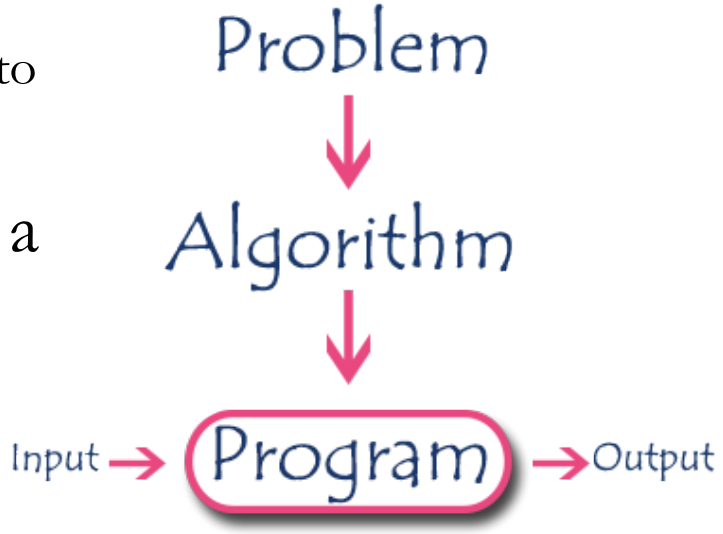


Computer programming

- Computer programming is the process of building and designing an executable computer program for accomplishing a **specific computing task.**
- A computer program usually implement one or more **algorithms**
  - Algorithm is a step by step specification of how to solve a class of problems.
    - precise: specified in a clear and unambiguous way
    - effective: capable of being carried out

Step of programming

- Analyze the problems
- Propose the solution
  - Step by step to solve the problem (**algorithm**)
    - You may need to draw a flowchart to clarify your solution
- Implement your solution using a programming language
- Run application with input and check output



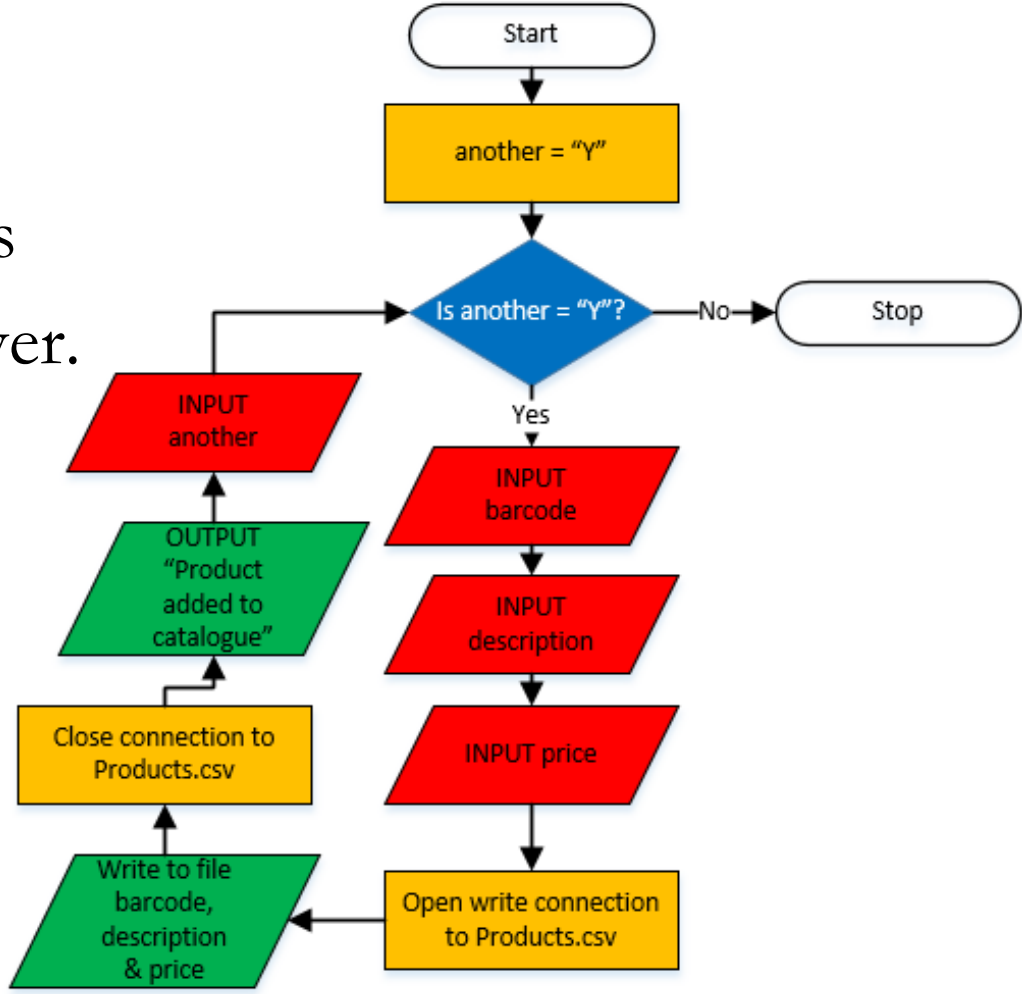
Example of problem solving

- How to swap the different liquid in two bottles?
  - Analyze
    - Name two bottle are A and B
    - Need to have one more bottle, named C?
  - Algorithm (solution)
    1. Transfer liquid from A to C
    2. Transfer liquid from B to A
    3. Transfer liquid from C to B
- Similarly, we swap two values 5 and 7 stored in two variables a and b?

Computer science algorithm

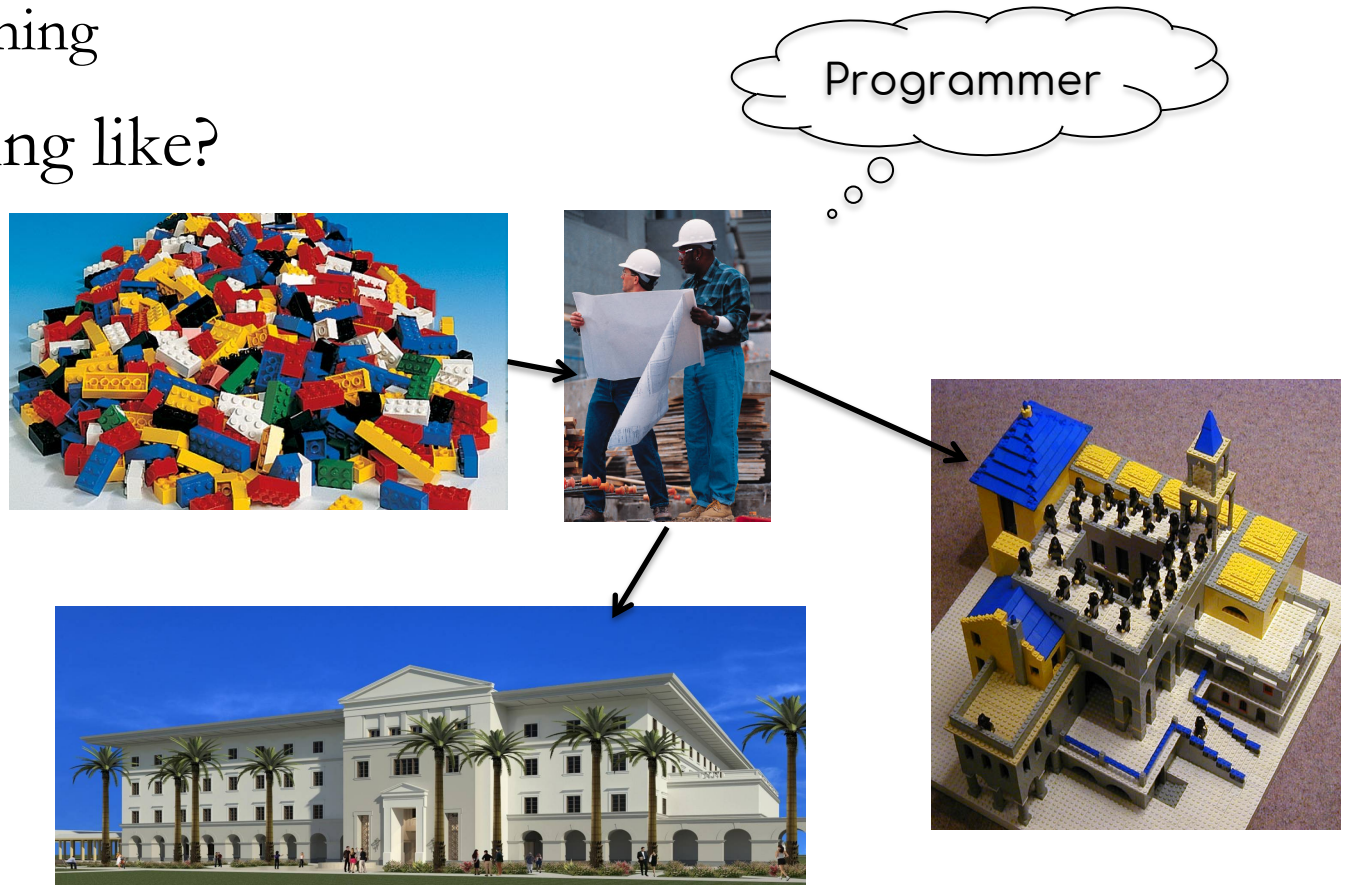
1. Start with input data
2. Do complex calculations
3. Stop when we find answer.

Ex: input product
catalogue and
write to a file



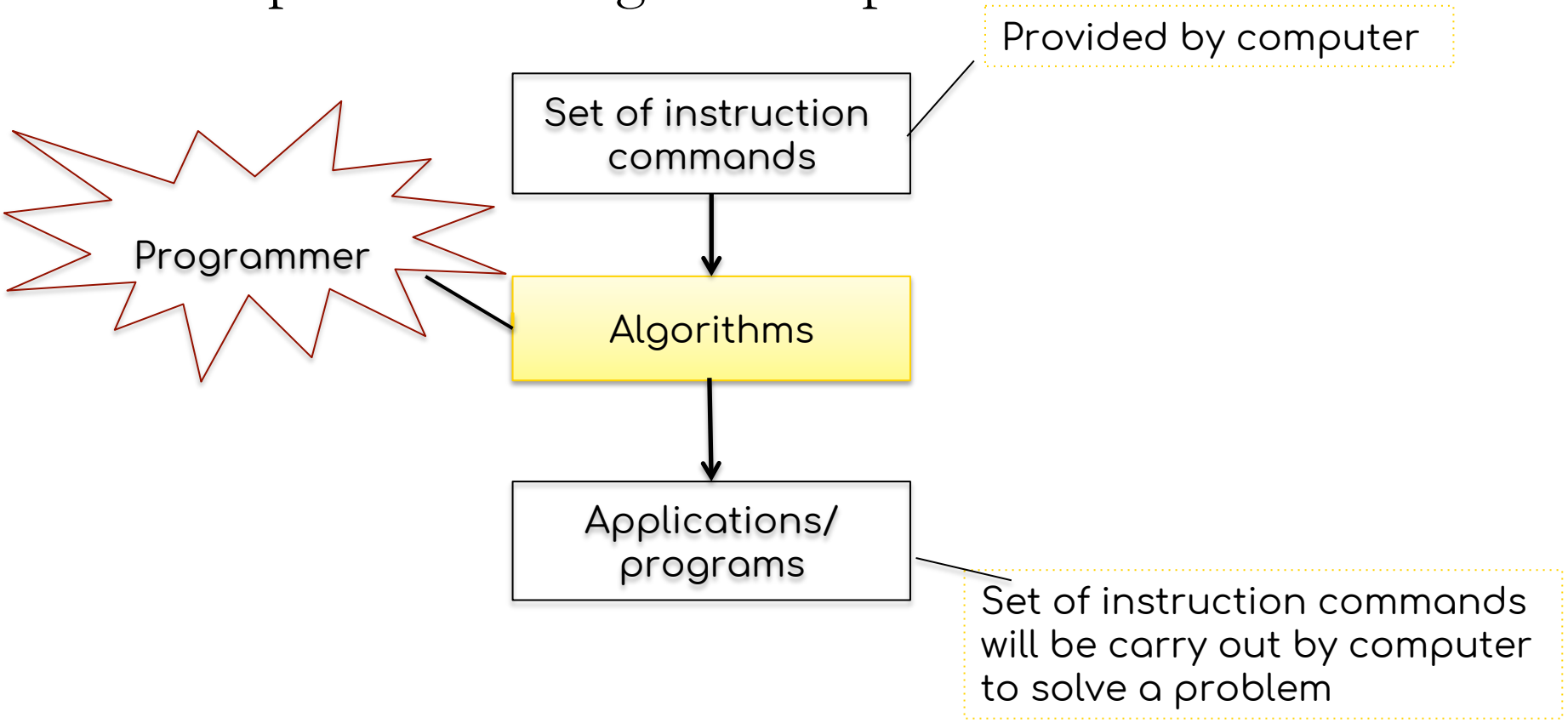
Programming

- How computer executes my algorithms?
  - programming
- Programming like?



Programming

- Solve problems using the computer?



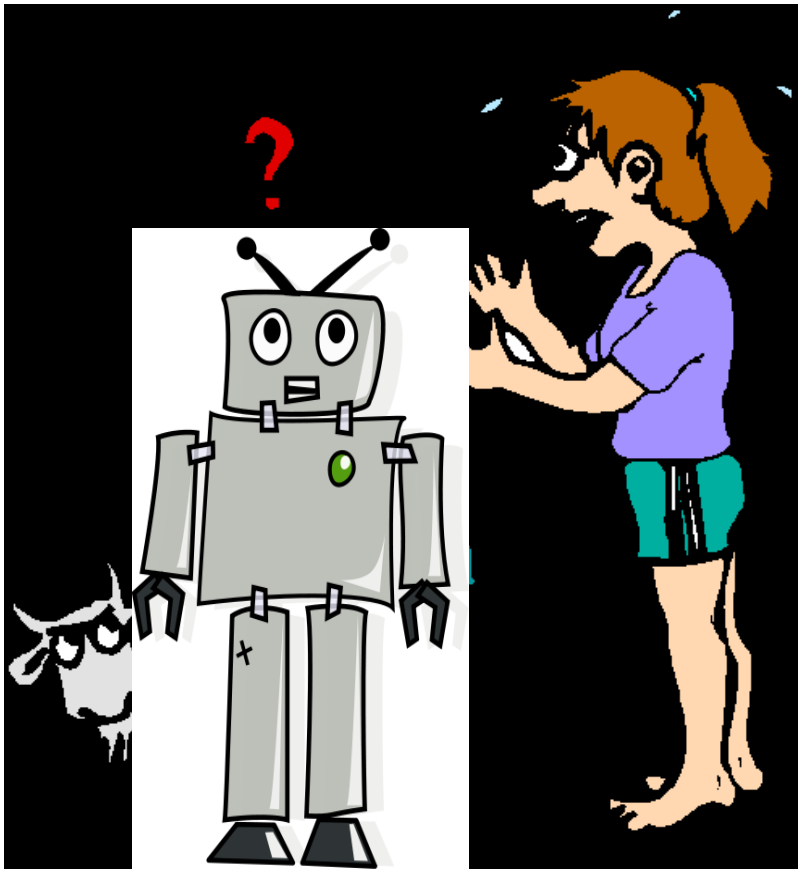
A program example

- Program of product catalogue in python

```
another = "Y"
while another == "Y":
    barcode = input("Enter an 8 digit barcode: ")
    description = input("Enter a product description: ")
    price = input("Enter a price: ")
    file=open("Products.csv","a")
    file.write(barcode + "," + description + "," + price)
    file.close()
    print("Product added to catalogue")
    another = input("Do you want to add another? Y/N ")
```

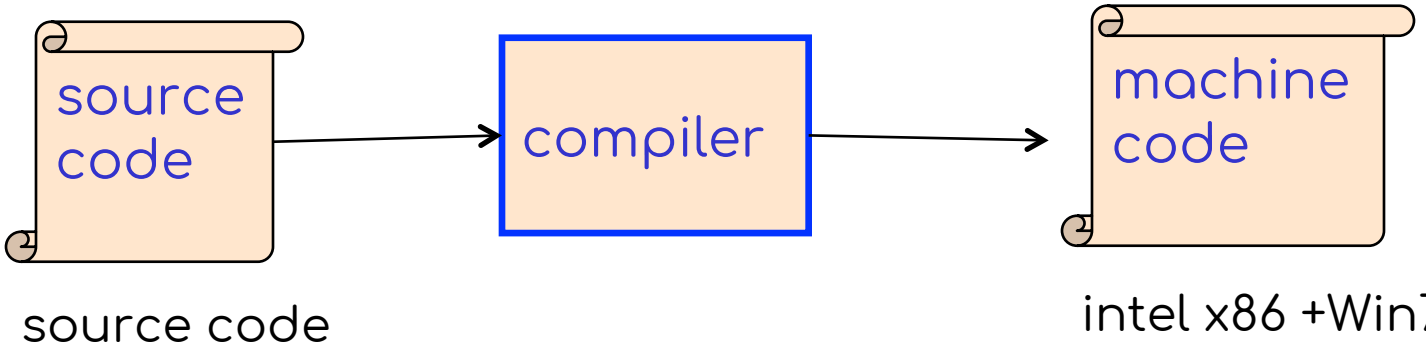
Problem

- Computers: understand machine platform languages---to build efficient hardware
- Programmers: want more readable high-level languages---to be more productive

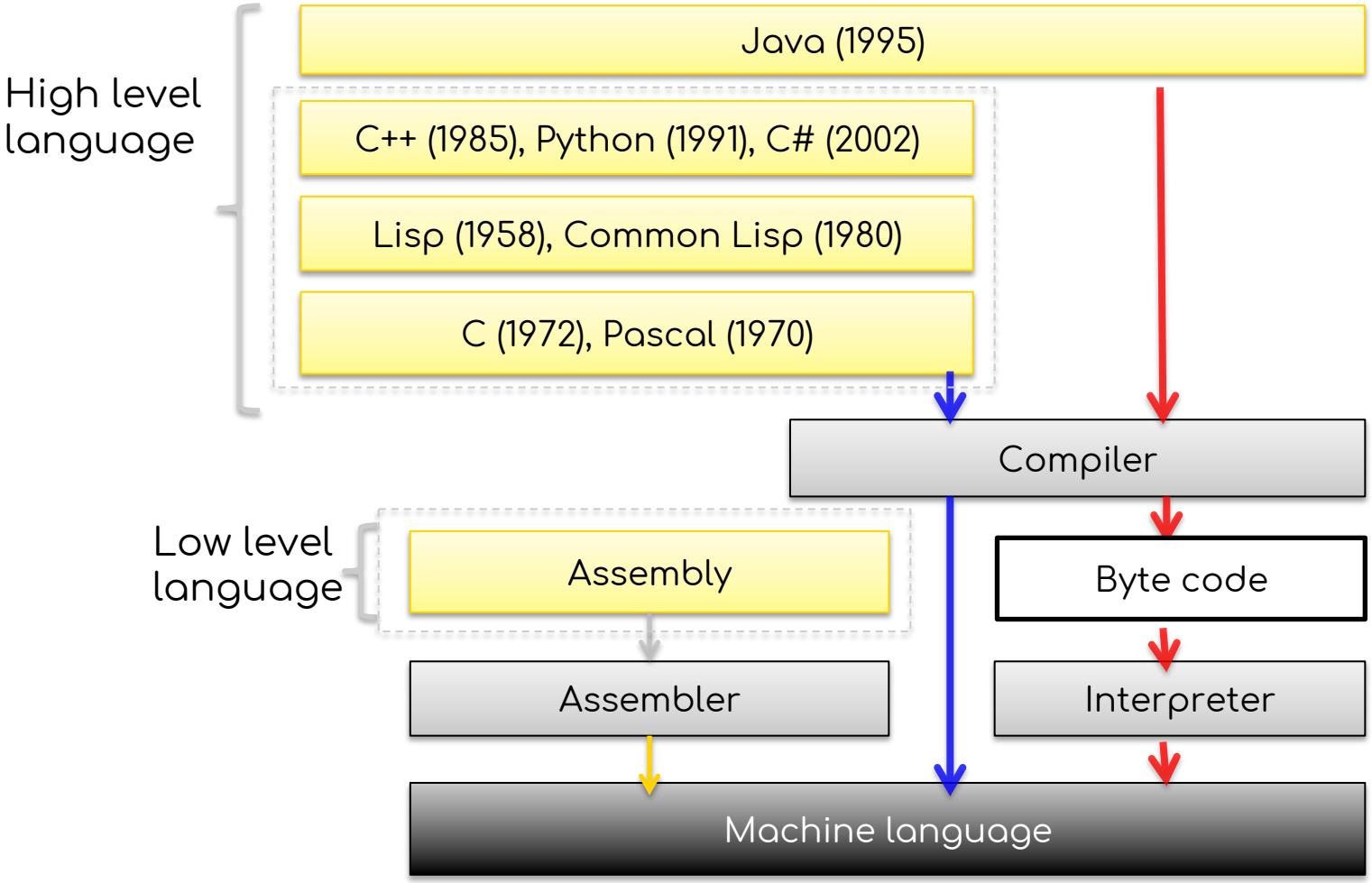


Hire a translator: Compiler

- A program written in a high-level language must be translated into the language of a particular platform (type of CPU and operating system) before execution.
- A compiler is a program which translates source code into a specific target platform (CPU + OS)



Levels of Programming languages



Programming language

- Machine language:

$$00000101 + 0000111 = 00001100$$

It's difficult to remember

- Low-level

  Assembly code:

```
MOV ax, 5; #copy 5 into register ax
ADD  ax, 7; #add 7 to ax
MOV c, ax; #copy ax into variable c
```

- High-level

  C, Java, C#, Python code:

```
c = 5 + 7
```

Learning a programming language

- Just like learn any new language
  - syntax: “new word”.
  - grammar: how to put them together.
  - **programming: tell a coherent story (long story).**
  - library: use plots already written.

Algorithm design

- Decomposition
  - Break a problem into sub-problems
    1. If a sub-problem is simple ➔ solve it (by an algorithm)
    2. If not, break it into sub-sub-problems
    3. Repeat step 1 or 2 until all sub-problems are solved then combine them together
- Implementation
  - Each sub-problem is solved by a function
    - Function may use sub/other function to complete its task.

Data type & variable

- Value that computer store is called data.
- Value has its type ➔ data type
  - Data type is a collection of values that have the same properties and can apply a list of operators over them.
  - Data type
    - Primitive data type: i.g., int, float, character
    - Structure (combine of primitive data): list, string, student,..
- Each data in memory is assigned a name, called variable, to call and use it later.

Operator

- Input data is loaded into memory and will be processed by a list of operators.
- Each data type has its own a set of operators
  - Number: +, -, *, /, …
  - Character/String: concatenation (+), substring, …
  - Set/dictionary: union, subtraction, intersection, pop, push,…
  - All of them have its own assignment operator

Basic control flow

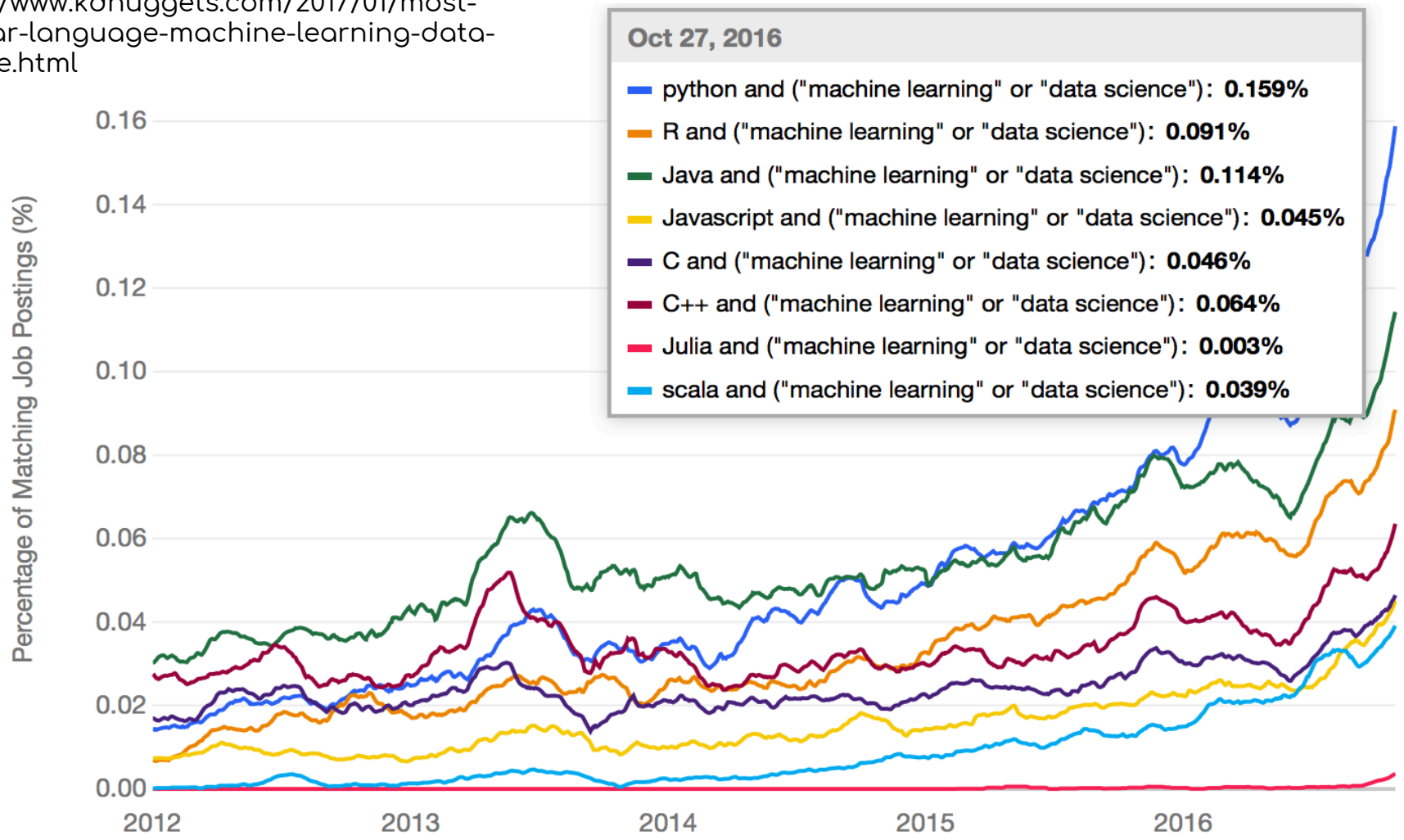
- Sequential
  - The work is processed step by step in a sequential
- Selection
  - Select one of cases to process based on a condition
- Repeating
  - Repeat a work according to a condition. The step of repetition is either known or unknown
  - Usually, we have to update variable status to reach condition

Library

- While writing your program, you may need to use a lot of library functions/modules.
  - Library: a program/ function written by other programmers for a specific purpose.
- Example in Python
  - Numpy: list of function to process number data.
  - Pandas: consider data as series or dataframe and provide list of functions to process it
  - Matplotlib: provide list of function to draw your data on GUI
  - OpenCV: function of computer vision
  - …

Python in ML/ Data Science

https://www.kdnuggets.com/2017/01/most-popular-language-machine-learning-data-science.html



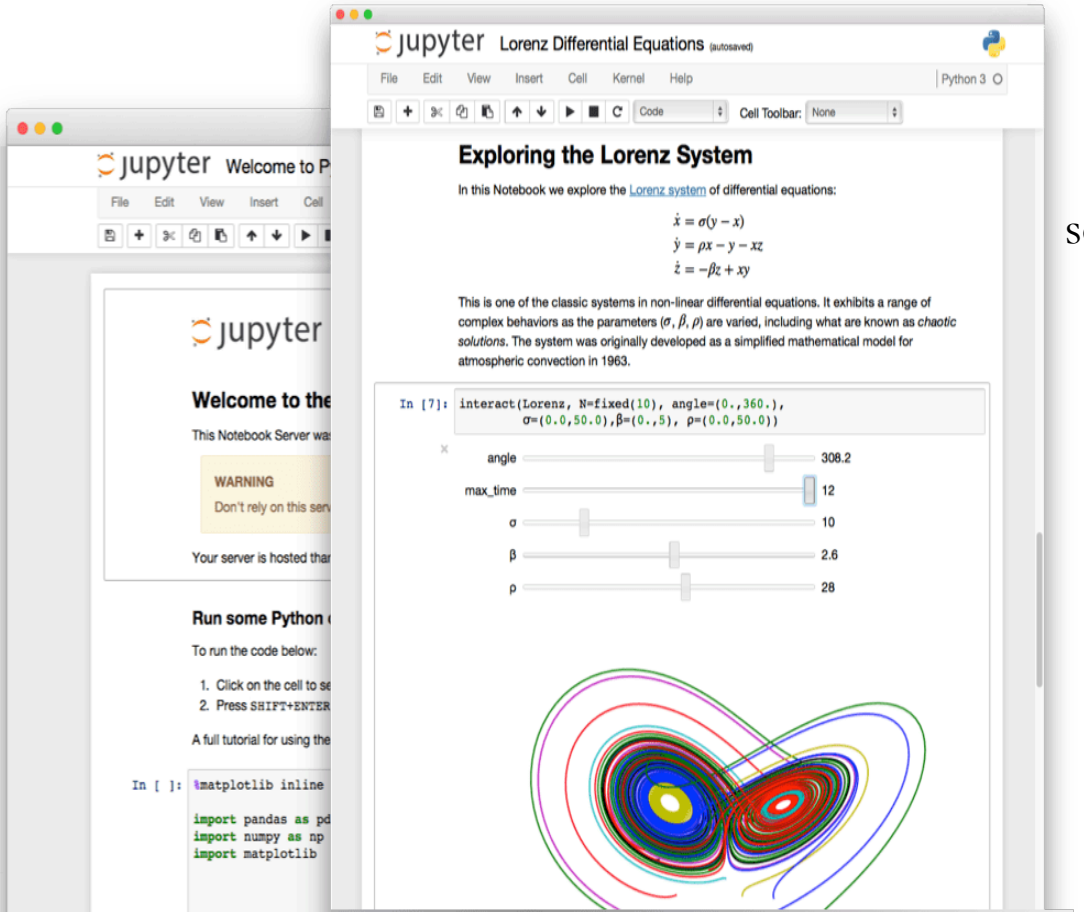
What is Python used for?

- **Web Development**
  - Frameworks such as Django, Flask
- **Data Analysis**
  - Libraries such as NumPy and Pandas
  - Data visualisation libraries like Matplotlib and Seaborn
- **Internet Of Things**
  - Raspberry Pi + python
- **Web Scraping**
  - Example:https://scrapy.org/
- **Computer Vision**
  - OpenCV library
- **Machine Learning**
  - Libraries such as Scikit-Learn, NLTK and TensorFlow.
- **Game Development**
  - PyGame

Programming tool

- Anaconda is the world's most popular Python data science platform (Everything you need 'out of the box').
- Includes:
  - Spyder (IDE/editor – like **Pycharm**) and **Jupyter**
- Download: https://www.anaconda.com/download/

Programming Tools



The Jupyter Notebook is an open-source web application that allows you to create and share documents that contain live code, equations, visualizations and narrative text.

Python code

- Interactive shell

```
>>> a = input('Inserte un número: ')
Inserte un número: 3
>>> a
3
>>> print(a)
3
>>> print('Hola')
Hola
```

- Script

```
a = input('Enter a name')
print('Hello ', a)
```

```
Dungs-MacBook-Pro:Desktop dungcao$ python3 firstprogram.py
Enter a name Dung Cao
Hello   Dung Cao
Dungs-MacBook-Pro:Desktop dungcao$
```

Let practice

- Variable, Block & Syntax in Python
- Version control with gitlab