

Introduction to Coding in Python

Fermilab - TARGET 2018
Week 1



Coding is a language

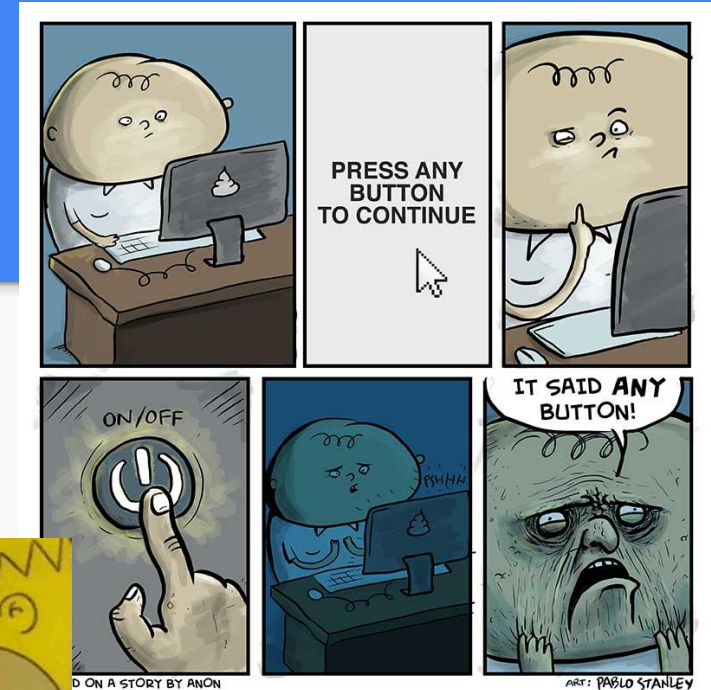
First for humans, then for computer

1. Rigor and Formality
2. Abstraction
3. Modules
4. Divide et Impera (Divide, Conquer and Glue)
5. Models
6. Incremental steps

Rigor and Formality

Be clear and concise

Computers are really good at following precise orders

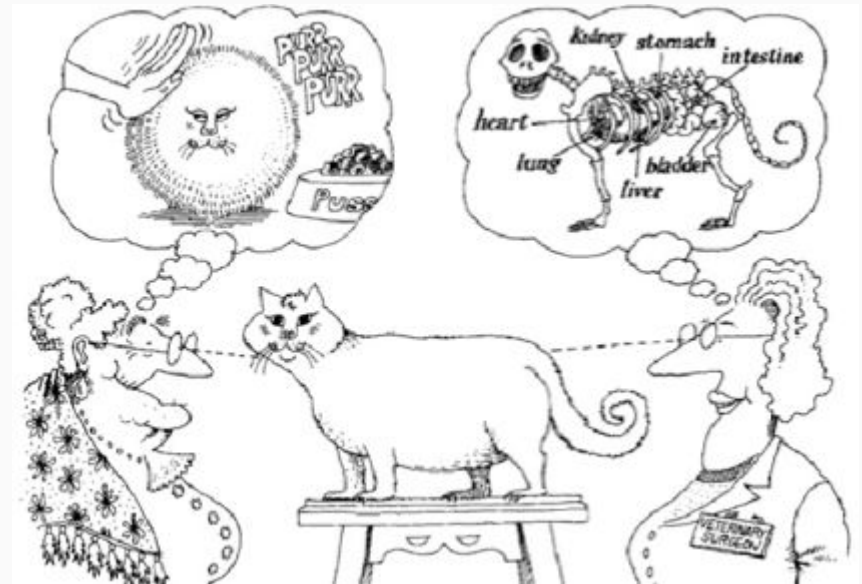


Abstraction

Useful representation of a real object

Isolate what is important for you

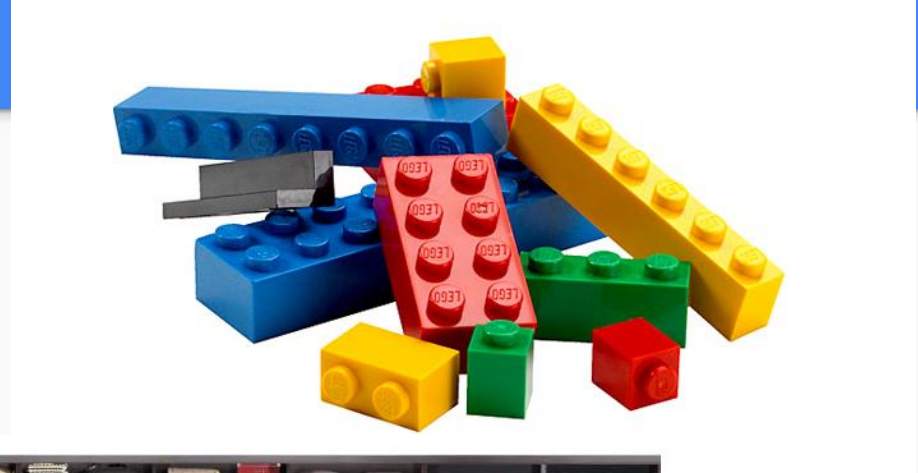
- e.g . a cat



Modules

Large systems are built with components called modules

Interfaces between modules allow to combine them in a mix-and-match way

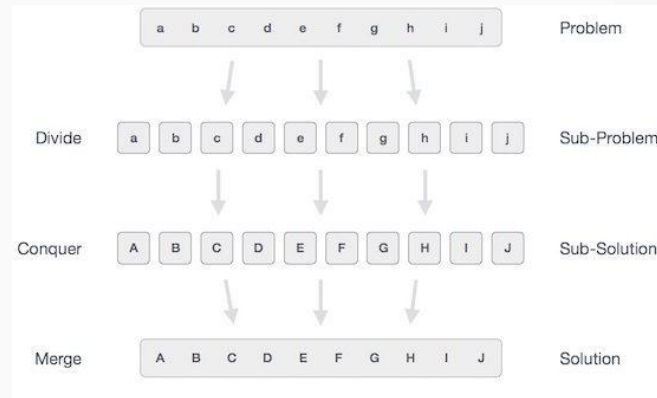


Divide et Impera

Divide: Split in pieces

Conquer: Solve each piece

Merge the solution



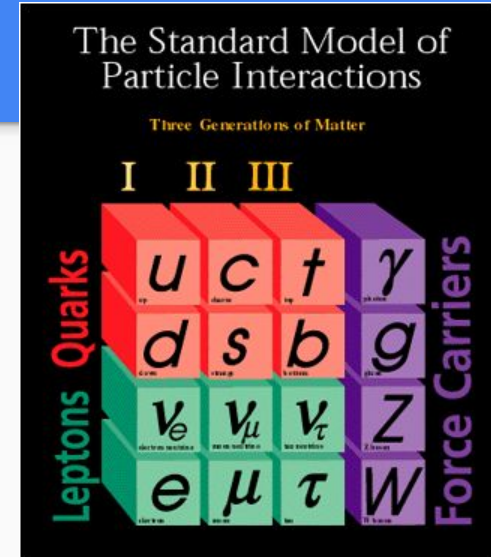
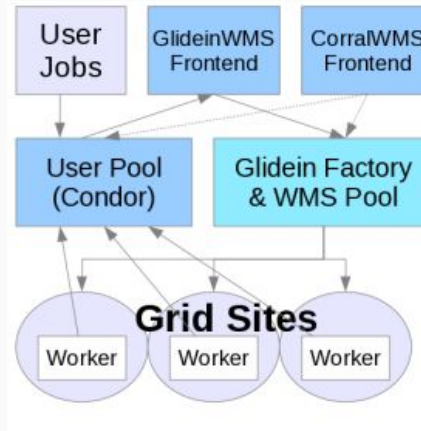
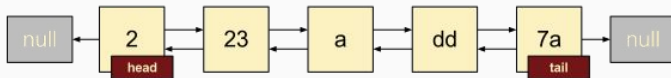
Models

Simple models can describe complex artifacts

Use models:

- to describe what you do
- to create elements that behave like a real system

Linked List



Incremental steps

One small step at the time

Plan for expansion

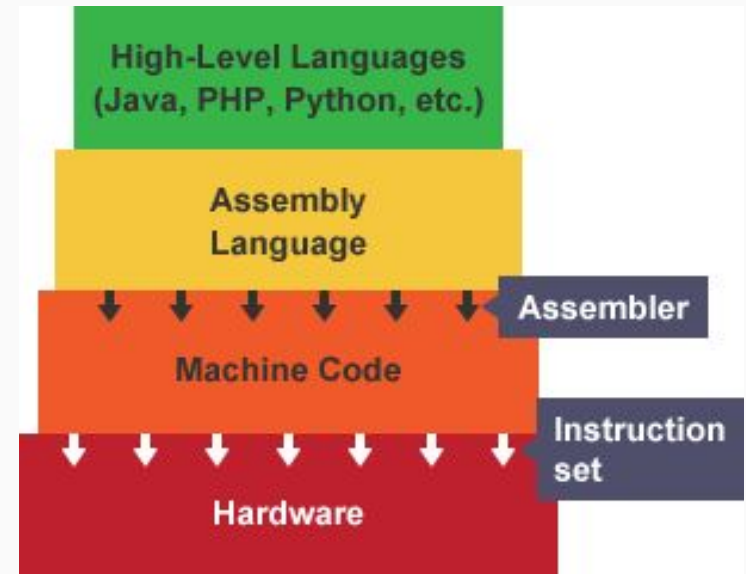


Low to High Level Programming Languages

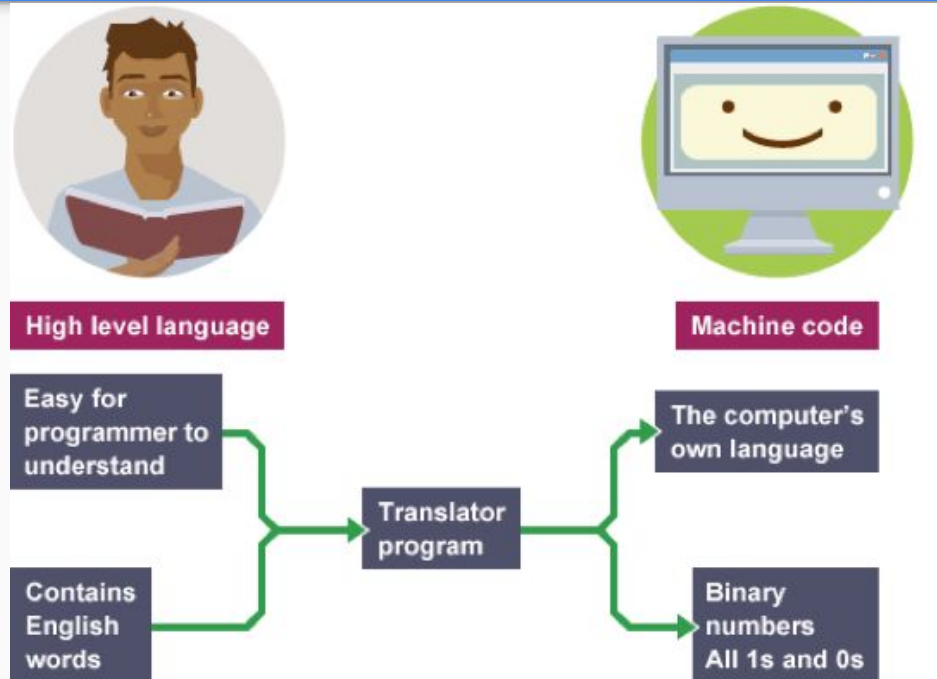
Machine code - computers hardware understand binary numbers

Assembly - 1 to 1 mapping to computer instructions

(High level) Programming language - simpler and more understandable, need to be translated for the computer



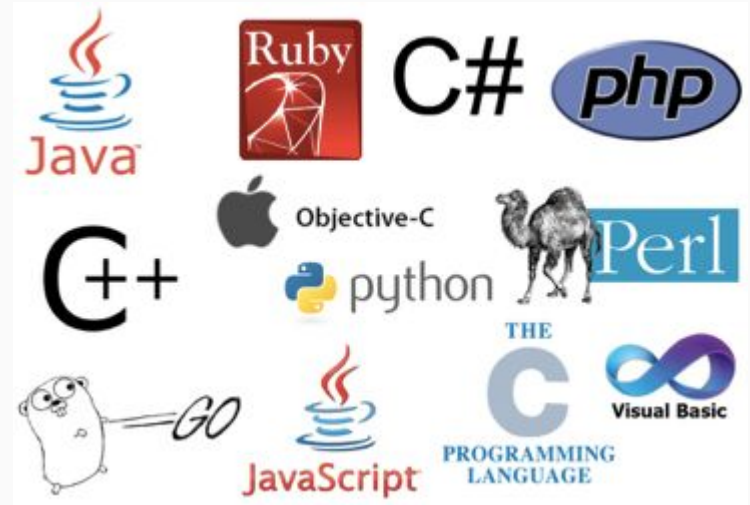
Compiler or Interpreter



Programming language

A programming (or coding) language is a set of syntax rules that define how code should be written and formatted.

- Python
- Java
- Scala
- JavaScript
- SQL
- Swift
- C, C++, C#
- FORTRAN

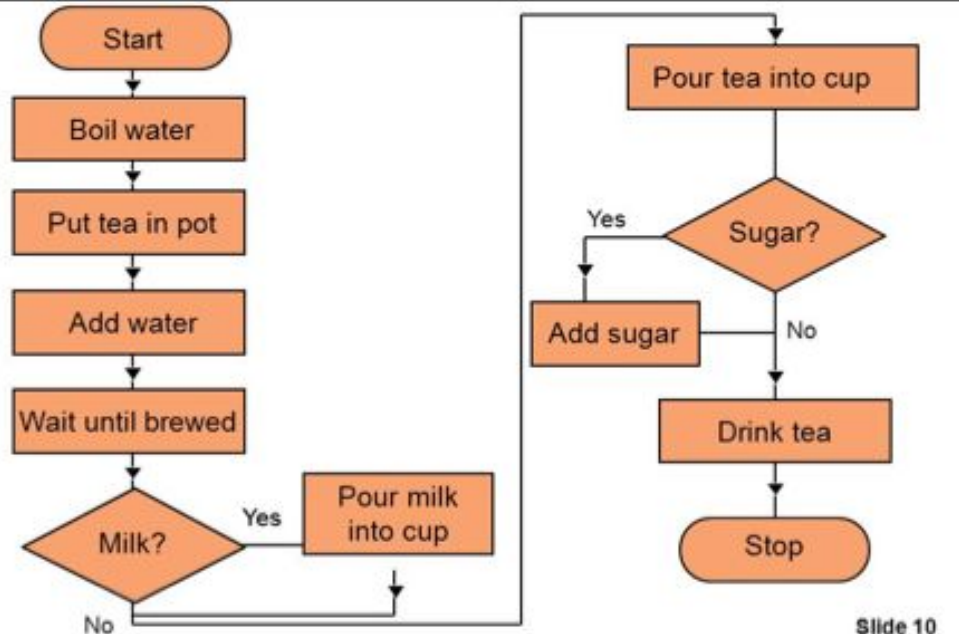


Algorithm

Self-contained step-by- step
set of operations to be
performed to solve a specific
problem or a class of
problems



Algorithm: Flowchart and Pseudocode



Start

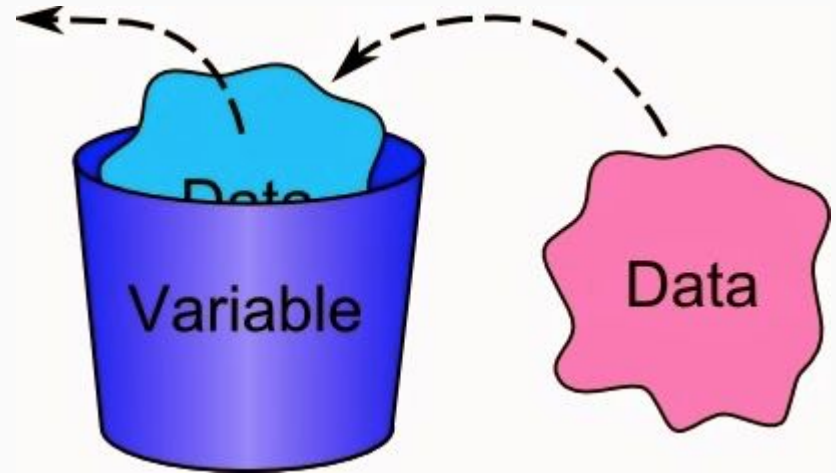
```
| Boil water
| Put tea in a pot
| Add water
| Wait until brewed
| If (Milk?)
| | Pour milk into cup
| EndIf
| Pour tea into cup
| If (Sugar?)
| | Add sugar
| EndIf
| Drink tea
```

Stop

Variable

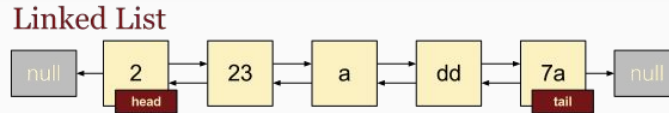
Variables are used to store information to be referenced and manipulated in a computer program

Variables have a name, value, representation, a type

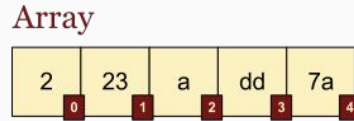


(Complex) Data Structures

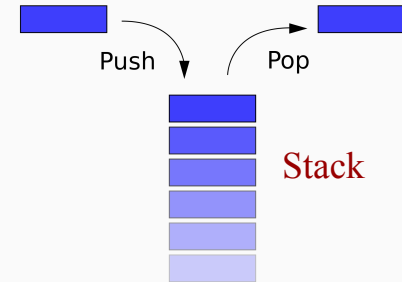
List



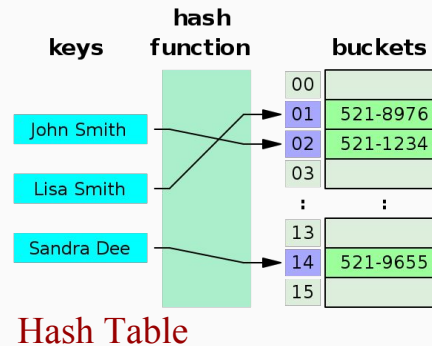
Array



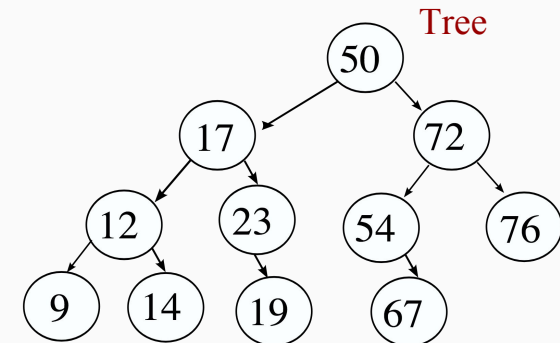
Stack



Hash Table (Map/Dictionary)



Tree



Software - Global term for all the components (programs) distinct to hardware that tell a device what to do and how to behave

Application - A type of software that does a certain task. Intended for a particular platform or device. Often needs user interaction to function

Program - (algorithm + data structures) Sequence of instructions that comply the rules of a specific programming language, written to perform a specified task with a computer

If you have an idea for an Application then

- Write down the algorithm to sketch out your ideas
- Use your own words
- Think about data structures
- Select a programming language
- Only then write the code (and remember to test it, deploy it, document it and use it!)

Why Python

- You Can Use Python for Pretty Much Anything
- Python Is Beginner Friendly and can adapt to your style
- Python Saves Time (batteries are included!)
- Python is a requested skill and pays well
- Is the 2nd most popular programming language in the world
- Python Is Widely Used in Data Science
- All the Big Names use Python (major tech companies like YouTube, IBM, Yahoo, Dropbox, Quora, Mozilla, Instagram, and others)
- We use Python a lot at Fermilab

Let's code!

```
#include <stdio.h>
int main(void)
{
    int count;

    for (count = 1; count <= 500; count++)
        printf("I will not throw paper airplanes in class.");
    return 0;
}
```

AMEND 10-3



Acknowledgements

Thank you to Jeny Teheran for letting me use some material from her TechSavvy presentation

Thanks to Pythonbytes, Indeads, Dice, PYPL for news about Python popularity