6.0001 - Introduction to Computer Science and Programming using Python

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1 Lecture : What is Computation?

Goal 1- Make code readable!

1.0.1 TOPICS

- Represent knowledge with Data structures
- Iteration and recursion as computational metaphors
- abstraction of procedures and data types
- organize and modularize systems using objects classes and methods
- Different classes of algorithms ,searching and sorting
- Complexity of Algorithms

1.1 What does a Computer Do?

- Performs calculations.
- Remembers results
- It knows only what you tell them
- What type of calculations?: Only the built in ones and the ones defined .
  - Built in:(+, - , * , /)
  - Ones you define from previous types

1.2 TYPES OF KNOWLEDGE

- Declarative knowledge: Statement of fact
- Is a recipe: "How to?"→ sequence of steps

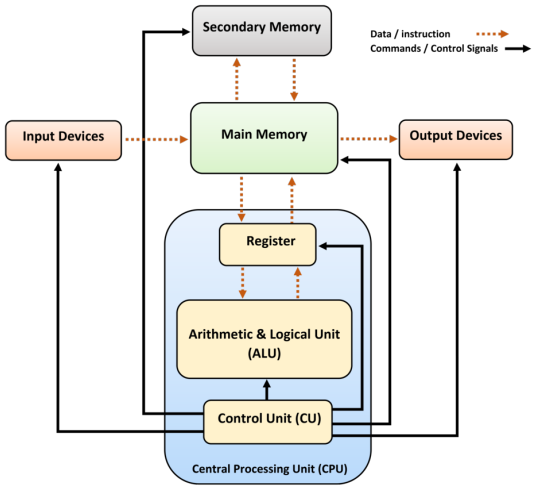
1.3 WHAT IS A RECIPE

- Sequence of simple steps
- Flow of control process that specifies when each step is executed
- A means of determining when to stop
  - ex: 1+2+3 is an algorithm

1.4 TYPES OF COMPUTERS

- Fixed program computer
  - Calculator
- Stored program computer
  - machine stores and executes

1.5 BASIC MACHINE ARCHITECTURE



1.6 Turing contributions :

- Turing showed that you can computer anything using the following primitives:
  - Move left
  - Move right
  - Read
  - Write
  - Scan
  - Do Nothing

1.7 Universal Turing Machine

The machine had unlimited memory in the form of a "tape" on which one could write zeroes and ones and a handful of simple primitive instructions.

- Church-Turing thesis : If a function is computable, a Turing machine can be programmed to compute it. It means a function is computable a Turing machine can be programmed to compute it.
- Halting problem: Impossible to write a program that takes an arbitrary program as input and print true iff the input will run forever

1.8 PRIMITIVE CONSTRUCTS IN PYTHON

- include literals Eg the number 3.2 and the string 'abc') and infix operators Eg: + and /
- Syntax: Syntax of a language defines which string of characters are well formed : Eg sequence of primitives (3.2+3.2) is syntactically well formed BUT,3.2 3.2 is not.
- Static Semantics: Defines which syntatically valid strings have a meaning.
- Semantics: of a language associates a meaning with each syntactically correct string of symbols that

1.9 What can happen if a program has an error?

- It might crash
- It might keep running non-stop
- It might run into competition and produce an answer that might or might not be correct