Introduction

ORGANIZATION OF PROGRAMMING LANGUAGES

JUCHEOL MOON

Is this a program?

```
public class HelloWorld {
    public static void main(String[] args) {
        System.out.println("Hello, World");
    }
}
```

Is this a program?

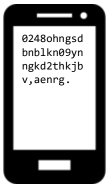
```
++++++++[>++++[>++>+++>+++>+<<<<-]>+>+>->>+[<]<-]>>.>---.+++++++..+++.>>.<-
.<.+++.------.--------.>>+.>++.
```

BF written by Urban Mueller (https://en.wikipedia.org/wiki/Brainfuck)

- '>' : move the memory pointer to the next cell,
- '<' : move the memory pointer to the previous cell,
- '+' : increment the memory cell under the memory pointer,
- '-' : decrement the memory cell under the memory pointer,
- ',' : fills the memory cell under the memory pointer with the ASCII value of next character from the input,
- '.' : writes the contents of the memory cell under the memory pointer as a character with the corresponding ASCII value,
- '[' : moves to the command following the matching ']', if the memory cell under the memory pointer is zero, and
- ']' : moves to the command following the matching '[', if the memory cell under the memory pointer is not zero.
- https://fatiherikli.github.io/brainfuck-visualizer

Is this a program?

```
0248ohngsdbnblkn09ynngkd2thkjbv,aenrg.
```

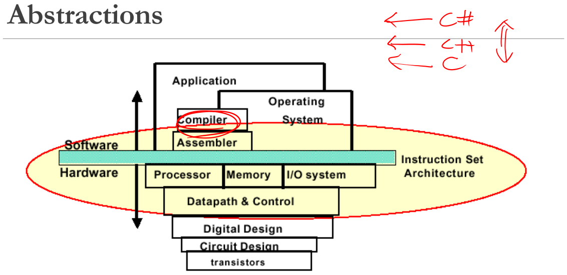


How to specify language?

- English specification
- Reference implementation
- Formal language
  - https://docs.python.org/3/reference/grammar.html

How does the computer understand program?

Abstractions



What is a programming language?

- A language
  - To write computer programs
  - Performing computation or algorithm
  - Controlling external devices
  - Communicate with another person

Why study programming languages?

- Don't want to study CECS444?
- Help you make better use of language you use
- Some languages are similar; easy to walk down family tree
- Design a new programming language

Why are there many programming languages?

- Orientation toward special purposes/hardware.
  - Conflicting needs
  - Scientific computing
  - Business applications
  - System programming
- Diverse ideas about what is pleasant to use
- Proprietary interests, commercial advantage
  - Widely used languages are slow to change
  - Productivity vs. training cost

What is a good programming language?

- Is there an universally accepted criteria for language design?
  - No
- Is a good language one more people use?
  - No

What makes a language successful?

- Easy to learn
- Easy to express things, easy use once fluent, "powerful"
- Possible to compile to very good code
  - Good code? fast / small
- Backing of a powerful sponsor

In 1960's

What were they called by?

FORTRAN, Formula Translation