

ME 171 Computer Programming Language

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Lecture 1 Introduction

Language: Mode of Communicating

- We, the human being, need language to interact each other.
- It is only the language for the lack of which we can not communicate to animals or insects.
- Every electronic devices (starting from a LED to Core i3 processor) works only on two basic operation: On (0) and Off (1).
- That means, combination of only two digits (0 and 1) is sufficient enough to interact with any electronic devices.
- In case of high performance multi-tasking device like a computer this combination is not so much human friendly that necessitates another mode of communication: **Programming Language**.



Programming Languages

- A programming language is a set of rules that create a pathway to let a computer know what the operator or programmer wants to do with it.
- It is a notational system for describing a computational problem from a *human readable* to *machine readable* form.

Computer Languages

- **Machine Language**
 - Uses binary code
 - Machine-dependent
 - Not portable
- **Assembly Language**
 - Uses mnemonics
 - Machine-dependent
 - Not usually portable
 - Efficient but difficult to understand
 - Used for mainly operating system development
- **High-Level Language (HLL)**
 - Uses English-like language
 - Machine independent
 - Portable (but must be compiled for different platforms)
 - Easy to write and understand
 - Used for complex scientific and engineering tasks
 - Examples: Pascal, **C**, **C++**, Java, Fortran, **Python** . . .

Machine Language

- The representation of a computer program which is actually read and understood by the computer.
 - A program in machine code consists of a sequence of machine instructions.
- Instructions:
 - Machine instructions are in binary code
 - Instructions specify operations and memory cells involved in the operation

Example:

Operation	Address
0010	0000 0000 0100
0100	0000 0000 0101
0011	0000 0000 0110

Assembly Language

- A symbolic representation of the machine language of a specific processor.
- Is converted to machine code by an assembler.
- Usually, each line of assembly code produces one machine instruction (One-to-one correspondence).
- Programming in assembly language is slow and error-prone but is more efficient in terms of hardware performance.
- Mnemonic representation of the instructions and data
- **Example:**

```
Load Price
Add Tax
Store Cost
```

High-Level Language

- A programming language which use statements consisting of English-like keywords such as "FOR", "PRINT" or "IF", ... etc.
- Each statement corresponds to several machine language instructions (one-to-many correspondence).
- Much easier to program than in assembly language.
- Data are referenced using descriptive names.
- Operations can be described using familiar symbols.
- A machine language system program called a compiler is needed to compile or transform the code into machine readable form.
- Example:

Cost := Price + Tax

Computer Languages

High-level program

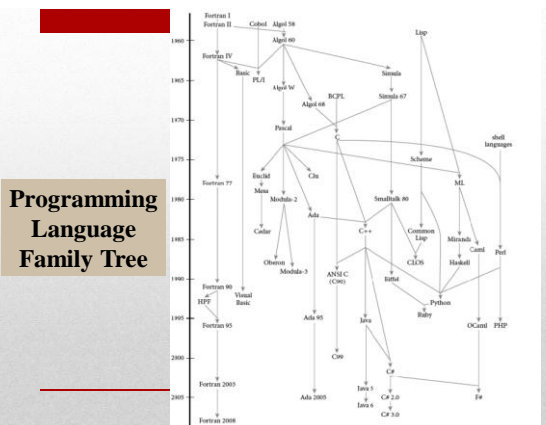
```
class Triangle {
...
float surface()
return b*h/2;
}
```

Low-level program

```
LOAD r1,b
LOAD r2,h
MUL r1,r2
DIV r1,#2
RET
```

Executable Machine code

```
0001001001000101001001
001110110010101101001.
..
```



Programming Languages

- Two broad groups
 - Traditional programming languages
 - Sequences of instructions
 - First, second and some third generation languages
 - Object-oriented languages
 - Objects are created rather than sequences of instructions
 - Some third generation, and fourth and fifth generation languages

Typical Programming Languages

- FORTRAN
 - FORmula TRANslation.
 - Developed at IBM in the mid-1950s.
 - Designed for scientific and mathematical applications by scientists and engineers.
- COBOL
 - Common Business Oriented Language.
 - Developed in 1959.
 - Designed to be common to many different computers.
 - Typically used for business applications.

Typical Programming Languages

- BASIC
 - Beginner's All-purpose Symbolic Instruction Code.
 - Developed at Dartmouth College in mid 1960s.
 - Developed as a simple language for students to write programs with which they could interact through terminals.
- C
 - Developed by Bell Laboratories in the early 1970s.
 - Provides control and efficiency of assembly language while having third generation language features.
 - Often used for system programs.
 - UNIX is written in C.

Typical Programming Languages

- C++
 - An object-oriented programming language.
 - It is C language with additional features.
 - Widely used for developing system and application software.
 - Graphical user interfaces can be developed easily with visual programming tools.
- JAVA
 - An object-oriented programming language similar to C++ that eliminates lots of C++'s problematic features
 - Allows a web page developer to create programs for applications, called **applets** that can be used through a browser.
 - Objective of JAVA developers is that it be machine, platform and operating system independent.

Special Programming Languages

- Scripting Languages
 - JavaScript and VBScript
 - Php and ASP
 - Perl and **Python**
- Command Languages
 - sh, csh, bash
- Text processing Languages
 - LaTeX, PostScript
- HTML
 - HyperText Markup Language.
 - Used on the Internet and the World Wide Web (WWW).
 - Web page developer puts brief codes called **tags** in the page to indicate how the page should be formatted.

Course Outline

Almost everything about C
(approximately up to Custom Data Types)

An introduction of programming on Python
(up to 3-4 lectures)

Course Material

1. Teach Yourself C - *Herbert Schildt*

2. The C Programming Language -
Brian W. Kernighan, Dennis M. Ritchie

3. Programming in ANSI C -
E Balagurusamy

