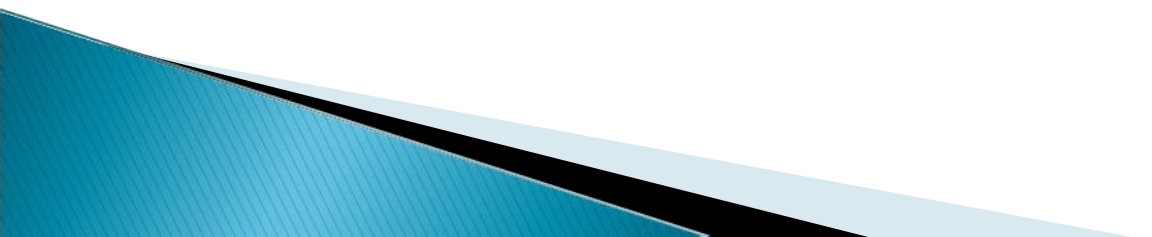
Introduction of Programming Languages

Programming Language Concepts

- *What is a programming language?*
- *Why are there so many programming languages?*
- *What are the types of programming languages?*
- *Does the world need new languages?*



What is a Programming Languages

- *A programming language is a set of rules that provides a way of telling a computer what operations to perform.*
- *A programming language is a set of rules for communicating an algorithm*
- *It provides a linguistic framework for describing computations*

What is a Programming Language?

A programming language is a notational system for describing computation in a machine-readable and human-readable form.

A programming language is a tool for developing executable models for a class of problem domains.

domains.

What is a Programming Language

- *English is a natural language. It has words, symbols and grammatical rules.*
- *A programming language also has words, symbols and rules of grammar.*
- *The grammatical rules are called syntax.*
- *Each programming language has a different set of syntax rules.*

Why Are There So Many Programming Languages

- *Why does some people speak French?*
- *Programming languages have evolved over time as better ways have been developed to design them.*
  - *First programming languages were developed in the 1950s*
  - *Since then thousands of languages have been developed*
- *Different programming languages are designed for different types of programs.*

Levels of Programming 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

```
0001001001000101
0010010011101100
10101101001...
```

What Are the Types of Programming Languages

- *First Generation Languages*
- *Second Generation Languages*
- *Third Generation Languages*
- *Fourth Generation Languages*
- *Fifth Generation Languages*

First Generation Languages

- *Machine language*
  - *Operation code – such as addition or subtraction.*
  - *Operands – that identify the data to be processed.*
  - *Machine language is machine dependent as it is the only language the computer can understand.*
  - *Very efficient code but very difficult to write.*

Second Generation Languages

- *Assembly languages*
  - *Symbolic operation codes replaced binary operation codes.*
  - *Assembly language programs needed to be "assembled" for execution by the computer.*
  - *Each assembly language instruction is translated into one machine language instruction.*
  - *Very efficient code and easier to write.*

Third Generation Languages

- *Closer to English but included simple mathematical notation.*
  - *Programs written in source code which must be translated into machine language programs called object code.*
  - *The translation of source code to object code is accomplished by a machine language system program called a compiler.*

Third Generation Languages (cont'd.)

- *Alternative to compilation is interpretation which is accomplished by a system program called an interpreter.*
  - *Common third generation languages*
    - *FORTRAN*
    - *COBOL*
    - *C and C++*
    - *Visual Basic*

Fourth Generation Languages

- *A high level language (4GL) that requires fewer instructions to accomplish a task than a third generation language.*
  - *Used with databases*
    - *Query languages*
    - *Report generators*
    - *Forms designers*
    - *Application generators*

Fifth Generation Languages

- *Declarative languages*
- *Functional(?): Lisp, Scheme, SML*
- *Also called applicative*
- *Everything is a function*
- *Logic:Prolog*
- *Based on mathematical logic*
- *Rule- or Constraint-based*

The principal paradigms

- *Imperative Programming (C)*
- *Object-Oriented Programming (C++)*
- *Logic/Declarative Programming (Prolog)*
- *Functional/Applicative Programming*

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*

Traditional Programming Languages (cont'd.)

- *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.*

Object-Oriented Programming Languages (cont'd.)

C++

- *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.*

Object-Oriented Programming Languages (cont'd.)

- *JAVA*
  - *An object-oriented 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*

Special Programming Languages (cont'd.)

- *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.*

What determines a “good” language

- *Formerly: Run-time performance*
  - *(Computers were more expensive than programmers)*
- *Now: Life cycle (human) cost is more important*
  - *Ease of designing,coding*
  - *Debugging*
  - *Maintenance*
  - *Reusability*

Criteria in a good language design

- *Writability: The quality of a language that enables a programmer to use it to express a computation clearly, correctly, concisely, and quickly.*
- *Readability: The quality of a language that enables a programmer to understand and comprehend the nature of a computation easily and accurately.*
- *Orthogonality: The quality of a language that features provided have as few restrictions as possible and be combinable in any meaningful way.*
- *Reliability: The quality of a language that assures a program will not behave in unexpected or disastrous ways during execution.*
- *Maintainability: The quality of a language that eases errors can be found and corrected and new features added.*

Criteria (Continued)

- *Generality: The quality of a language that avoids*
- *special cases in the availability or use of constructs and*
- *by combining closely related constructs into a single more general one.*
- *Uniformity: The quality of a language that similar features should look similar and behave similar.*
- *Extensibility: The quality of a language that provides*
- *some general mechanism for the user to add new constructs to a language.*
- *Standardability: The quality of a language that allows*
- *programs written to be transported from one computer to another without significant change in language structure.*
- *Implementability: The quality of a language that*
- *provides a translator or interpreter can be written. This can address to complexity of the language definition.*