MA 511: Computer Programming
Lecture 2
http://www.iitg.ernet.in/psm/indexing_ma511/y08/index.html

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Semester 1, 2008-09
Mon 10:00-10:55 Tue 11:00-11:55 Fri 9:00-9:55 Class: 1G2
MA512 Lab: Wed 14:00-16:55
Computer Characteristics

• Computer are used to transmit, store and manipulate information i.e., data

• Data type:
  – Numeric data
  – Character data
  – Graphic data
  – Sound

• To process a particular set of data, the computer must be given an appropriate set of instructions called a program.
Program

• A computer program is a sequence of instructions (written in a particular sequence in a computer related language) that are executed by a CPU.

• **Machine code** or **machine language**
Machine language instructions

A computer can interpret and execute a set of coded instructions called machine language instructions.

<table>
<thead>
<tr>
<th>Operation code</th>
<th>memory location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 0110</td>
<td>10001110</td>
</tr>
<tr>
<td>2. 0111</td>
<td>10001111</td>
</tr>
<tr>
<td>3. 1000</td>
<td>01110001</td>
</tr>
</tbody>
</table>

• Load (0110) from memory location 10001110 to CPU register
• Add (0111) the contents of 10001111 to the value of the register
• Result which is in register is to be copied (1000) into location 01110001 of the memory.
Problems in machine language coding

• Very cumbersome to work
  – More than 100 different machine instruction codes and hundreds of thousands of locations in memory.
• Different type of computer has its own unique instruction set
  – Operation codes are differ from one machine model to another
• One machine language program written for one type of computer cannot be run on another type of computer without significant alterations.
• Rewrite the program for different machines.

Computer program should be written in a high level programming languages which is independent of machine language.
High Level Language

• A single instruction in High Level Language is equivalent to several instructions machine language.
• Simplicity
  – Instruction set is more compatible with human language.
• Uniformity and portability
  – A program written for one computer can generally be run on many different computer with a little or no alteration.
• General purpose language
  – C, Pascal, Fortran and BASIC.
• Special purpose language
  – CSMP, SIMAN: simulation language
  – LISP: List processing language, is widely used for AI.
Compilation or Interpretation

• Compiler:
  – Translate entire program into machine language before executing any instructions.

• Interpreter:
  – process through a program by translating and executing single instructions or small group instructions.
Complier/interpreter

- **Complier/interpreter** is itself a computer program. It accept a program in a high level language like C as input, and generates a corresponding machine language program as output.
- The high level program is called **source program**
- The resulting machine language program is called the **object program**.
- Every computer must have its own compiler or interpreter for a particular high level language.
Computer Language

Problem → Flow Chart → High Level language program → Translator → Sequence of machine instructions

Source program → Compiler → Object program

Source Program

High Level language

Translator X → Machine language X
Translator Y → Machine language Y
Translator Z → Machine language Z
Computer Algorithms

• Fundamental knowledge necessary to solve problems using a computer.

Definition:
  – finite sequence of instructions to be carried out in order to solve a given problem.

Instruction must be written in a precious notation, can be interpreted and executed by a computing machine are called computer programming.

The notation is called computer programming language.

**Programming language**
  – artificial language that can be used to control the behavior of a computer
  – defined by syntactic and semantic rules which describe their structure and meaning respectively.

Example:
  different syntaxes (languages), but result in the same semantic:
  – `x += y;` (C, Java, etc.)
  – `x := x + y;` (Pascal)
  – Let `x = x + y;` (early BASIC)
  – `x = x + y` (most BASIC dialects, Fortran)
Developing Algorithms

• Flow Charts
  – illustrates pictorially the sequence in which instructions are carried out in an algorithm.
Pick the largest of three nos

START

READ A, B, C

Is A > B?

Yes

Is A > C?

Yes

PRINT A
STOP

No

No

PRINT C
STOP

Is B > C?

Yes

PRINT B
STOP

No

No

STOP
Flow Charts

- **Convention**
  - Parallelograms are used to represent input/output.
  - Rectangles are used to indicate any processing operation such as storage and arithmetic.
  - Diamond shaped boxes are used to indicate questions asked or conditions tested.
  - Rectangles with rounded ends are used to indicate the beginning or end points.
  - Circle is used to join different parts of a flow chart, called connector.
  - Arrows indicate the direction to be followed in a flow chart.