

Numerical Programming in Fortran Part-I

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Basic components of a computer

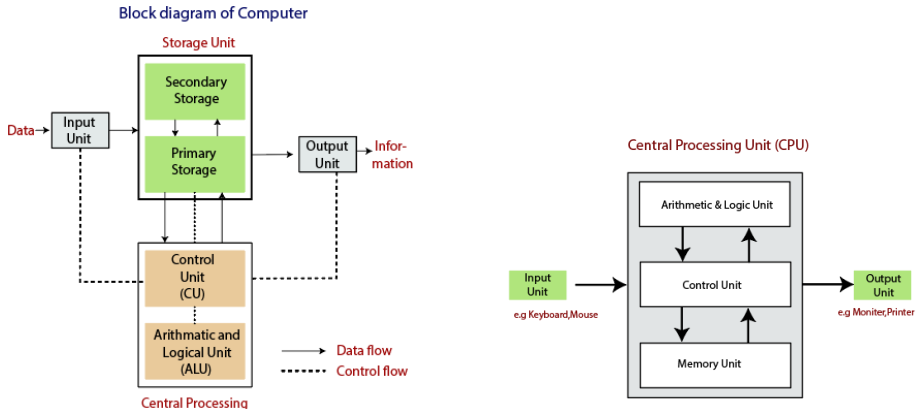


Figure 1: Components of a computer. Figure source-Internet.

Machine language

- Memory part of a computer consists of millions of circuit lines and each line is called a cell. If there is a fix voltage (normally 5 volt), then number 1 is stored else 0 is stored in the particular cell.
- Computers store data and perform calculations using only binary digits (0 and 1).
- Thus, the task to be given to a computer must be given only in binary form, i.e, one has to write a computer program using only binary numbers 0 and 1.

An example of a program in binary number may be written as

1101 1010 1000 0010

1100 1111 0001 0011

1001 1000 1111 0000

0001 1100 0101 1001

- The above program is said to be in **machine language**.
- We see that writing a computer program in machine language tedious task. *People invent machines to make life simple not difficult.*
- What is the alternative of this?

Assembly language

- People developed a programming language in which it was easier to write codes. The language consists of mnemonics such as, SUB, ADD, MUL, LDA,... etc. This language is called as **assembly language**.

A simple program

```
ADD X
```

```
SUB Y
```

```
MOV Z
```

```
LDA A
```

- Computer understands only machine language programs, therefore, assembly language program must be translated into a machine language program.
- People developed programs (or softwares) which can translate assembly language program into a machine language program. This program or software is called as *assembler*. One has to install assembler in the computer to perform this task.
- The assembly language program is called as the *source program* and machine language program is called as the *object program*.

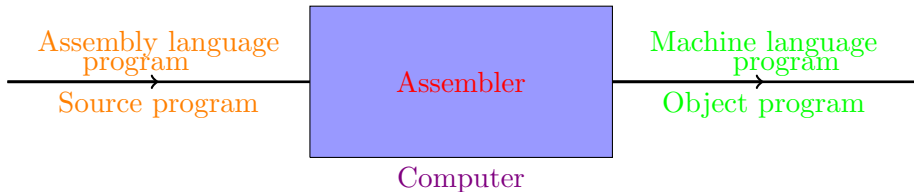


Figure 2: A schematic diagram to show translation of assembly language program into machine language program

High-level language

- Since we have program/software which can translate source program into machine language program which a computer understands. Can we write program or codes in English-like language instead of using only mnemonics to write programs? Of course yes!
- These type of computer programs are called **high-level language** programs.
- Some examples of high-level computer languages are BASIC, COBOL, PASCAL, FORTRAN, C, C++, JAVA, etc.

- Our main focus will be on FORTRAN language. FORTRAN is the abbreviation of *FORmula TRANslation*.
- Fortran is the oldest high-level computer language.
- The software which converts high-level language program into a machine language is called a **compiler**.

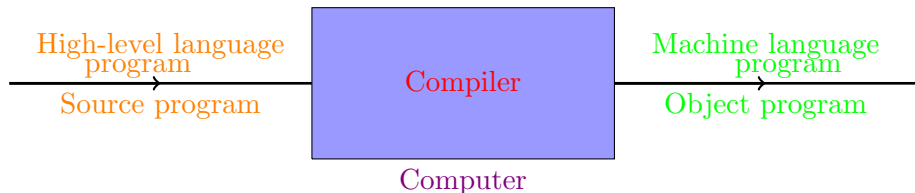


Figure 3: A schematic diagram to show translation of high-level language program into machine language program

Note: We have separate compiler for each-high level language, e.g., for Fortran language, we have a Fortran compiler, for C language we have a corresponding C compiler, etc.

Flow chart

The process of performing a particular task by a computer can be represented by flow chart.

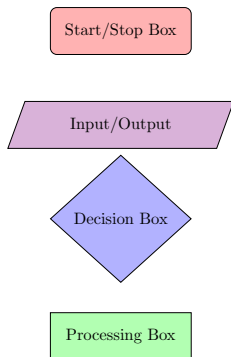


Figure 4: Symbols of flow chart

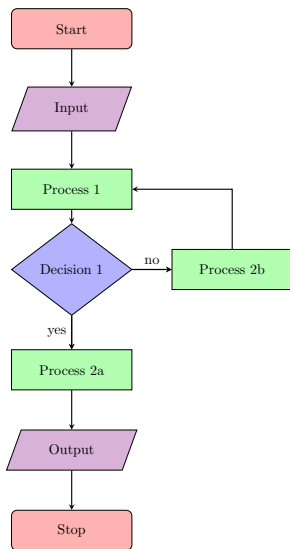


Figure 5: Flow chart to perform a general task

Flow chart to read two numbers and print smaller

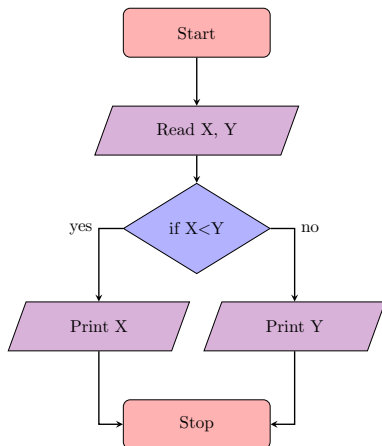


Figure 6: Flow chart to find smaller number between two numbers

Thank You