CSN-103: Fundamentals of Object Oriented Programming

Computer as a Programmed Machine

- What computers do? How they do it?

  – *Almost* like a human being

    • A task need to be done

      – Formulate a **sequence** of steps to compete the task

      – Execute these steps

  – Not like a human being

    • Vague steps/instructions

      – Natural language is a problem

      – All possible steps are "pre-defined": Instruction Set

Machine Language

- The only language a computer can understand
- Machine Language→ Consists of instructions

$$1010\ \ 1110\ \ 0011\ \ 0101\ \ 0101\ \ 0000\ \ 1011$$
$$1000\ \ 1110\ \ 1011\ \ 0001\ \ 0101\ \ 0110\ \ 1001$$
$$1011\ \ 1010\ \ 0111\ \ 0101\ \ 1111\ \ 0100\ \ 1111$$

Binary String of 0s and 1s

- No need for are processing/translation. Directly executed by the processor
- Machine Dependent: Each computer type (architecture) has its own machine language
  - Not Portable
- Advantage: Extremely fast
- Disadvantage: Programmer unfriendly → Programming errors

Assembly Languages

- Uses English like abbreviations such as ADD, SUB, MUL etc.
- But computers only understand Machine Language!!!
- Require a software → Assembler
  - Convert Assembly language to Machine language
- Example program:

```
MOV A, 1011
MOV B, 1100
ADD A,B
```

| Assembly Language Program | → | Assembler | → | Machine Language Code |
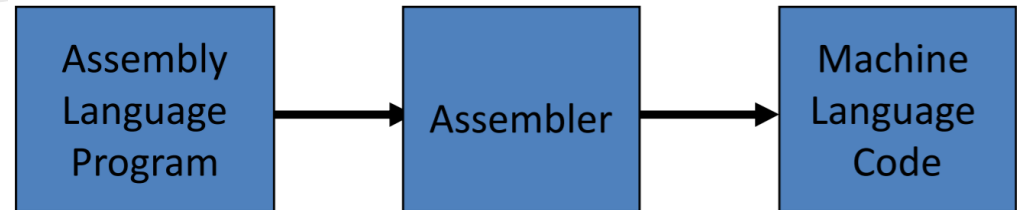
- Advantage: Programmer friendly
- Disadvantage: Program is still quite lengthy, slow execution, not portable

High Level Languages

- English like statements

- Much easier to learn and remember

- Need an additional program
  - Compiler: Convert high level language instructions to Machine language instructions

- Example Programming languages: BASIC, PASCAL, C++, C, JAVA, Python etc.

- Advantage: Extremely friendly to programmers
  - One high level language → Multiple machine language instructions
  - Shorter programs → Easy to debug
  - PORTABLE

- Disadvantage: Slower execution

Definition

- Algorithm: A finite sequence of unambiguous statements to solve a specific problem in finite time

- Program: An implementation of an algorithm in some programming language
  - A sequence of instructions that comply the rules of a specific programming language

- Data Structure: A data structure is a data organization, management, and storage format that enables efficient access and modification
  - Array, Linked List, Tree, Graph, Stack, Queue

Example Algorithms

- An algorithm to find the product of 2 numbers and display it on the screen

  Step 1: Start

  Step 2: Read two number A, B

  Step 3: $P = A*B$

  Step 4: Display P

  Step 5   End

Note: Simple English statements can be considered as an Algorithm: Pseudocode

Example Algorithms

- An algorithm to swap (exchange) two numbers
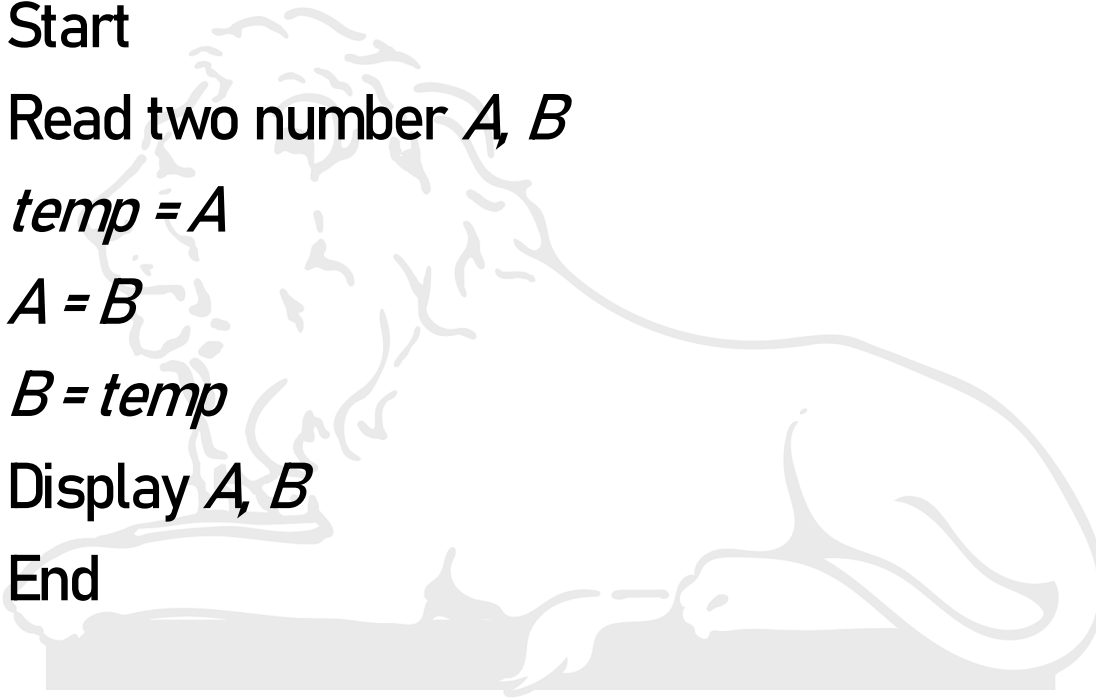
  Step 1: Start

  Step 2: Read two number A, B

  Step 3: $temp = A$

  Step 4: $A = B$

  Step 5: $B = temp$

  Step 6: Display A, B

  Step 7: End

Flowchart

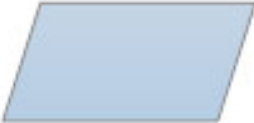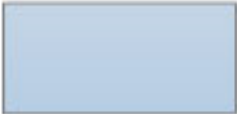- A flowchart is a type of **diagram** that represents a workflow or process

OR

Flowchart is a pictorial/graphical representation of an algorithm

- Contains different types of boxes
  - For different types of instructions
  - Boxes have standardized meanings
  - Instructions are written inside boxes

- Directional arrows indicate the exact sequence in which the instructions are to be executed
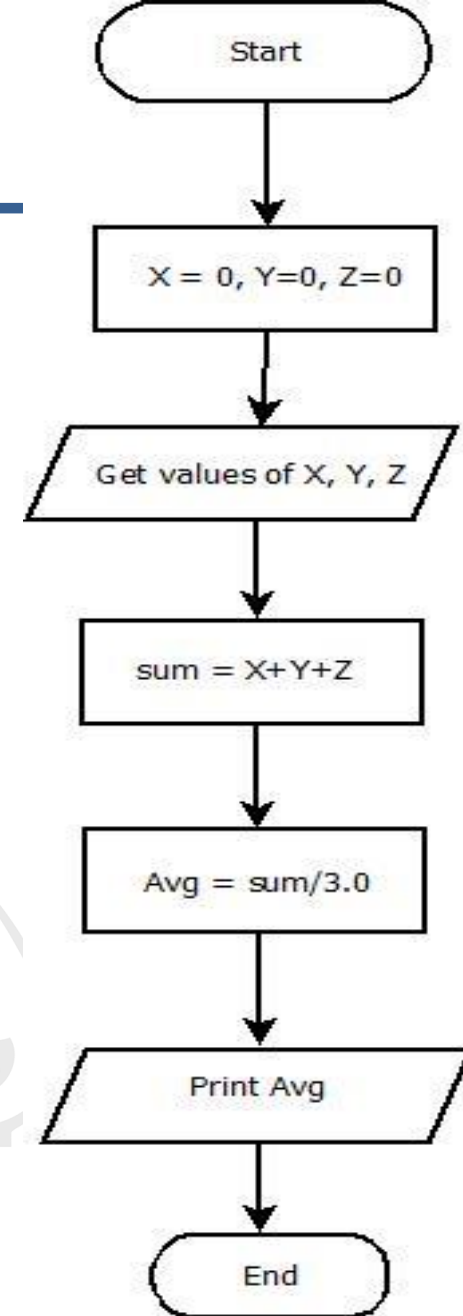
Flowchart Symbols

Symbol	Name	Function
(oval)	Start/end	An oval represents a start or end point
(arrow)	Arrows	A line is a connector that shows relationships between the representative shapes
(parallelogram)	Input/Output	A parallelogram represents input or output
(rectangle)	Process	A rectangle represents a process
(diamond)	Decision	A diamond indicates a decision

Example Flowcharts

- Finding Average of three numbers

Start

X = 0, Y=0, Z=0

Get values of X, Y, Z

sum = X+Y+Z

Avg = sum/3.0

Print Avg

End

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Example Flowcharts

- Finding if a number is both greater than 50 and even.
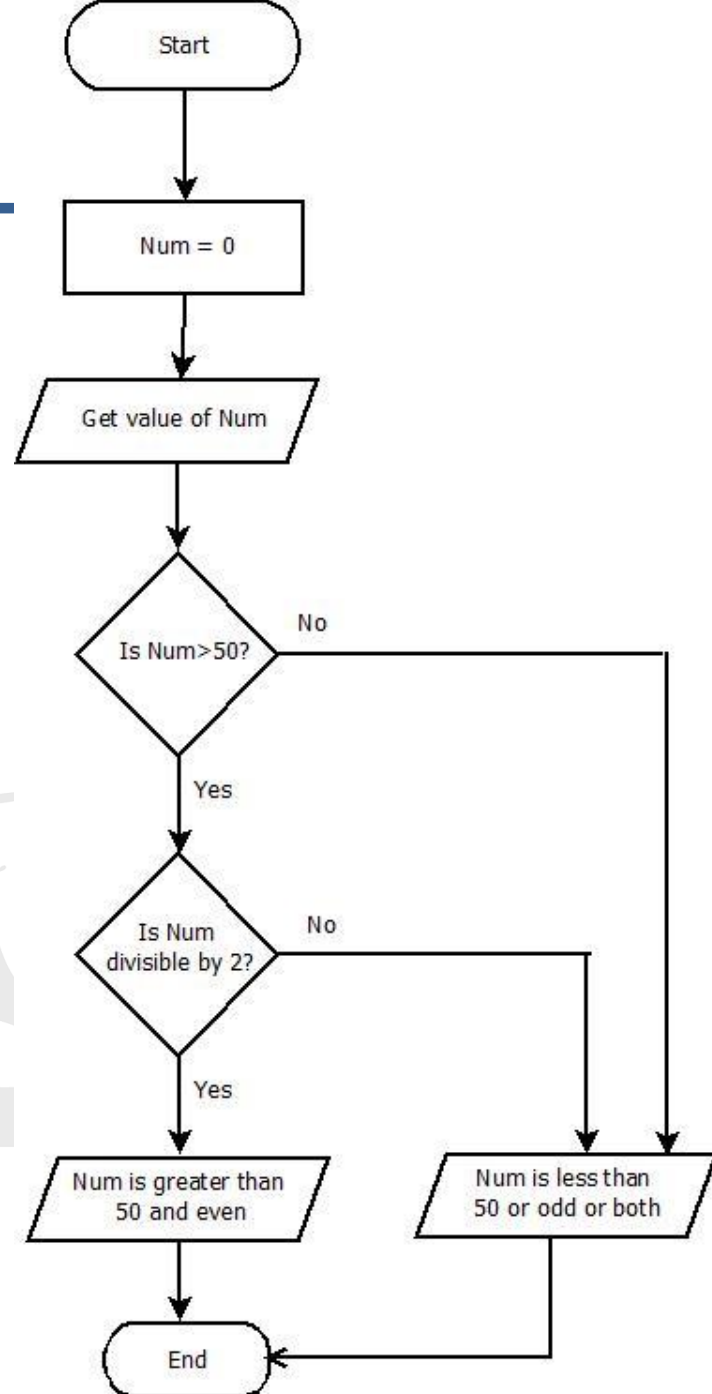
Online Compilers

- **www.hackerrank.com**

- **www.ideone.com**

- **www.tutorialspoint.com**

- **www.codechef.com**

References

- "Flowchart Symbols", SmartDraw LLC, [Online]
  https://www.smartdraw.com/flowchart/flowchart-symbols.htm

- Harold L Rogler, "Introduction to Computer Systems", Second Edition, August 2015

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