

Chapter 1

Programming Process and Algorithm

- ✓ Programming and Computer Program
- ✓ Problem Solving Process
- ✓ Algorithm
- ✓ Programming Planning Tools (Flowchart and Pseudocode)
- ✓ Pseudocode to find root of $ax^2+bx+c=0$
- ✓ Pseudocode for 2 variables of System Linear Equation
- ✓ Pseudocode for N variables of System Linear Equation
- ✓ Pseudocode for Binary Search Tree

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What is Programming Language?

- A programming language is a special language used to write computer programs.
- Common Programming Language
 - Visual Basic, Java, C++, etc.
- A computer program is a set of instructions that enable the computer to solve a problem or perform a task.

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Type of Programming

- Procedural Programming
 - A *procedure* is a set of programming language statements that, together, perform a specific task.
 - In a procedural program, the data items are commonly passed from one procedure to another.
- Object-Oriented Programming
 - Encapsulation (data hiding)
 - Inheritance (reusability)
 - Polymorphism

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Problems Solving Process

- Problems Solving Process
 - Determine **Output** (information)
 - Identify **Input**
 - Determine **process** necessary to turn given **Input** into desired **Output**
- What is input and output?
 - Input – from files, the keyboard, or other input device
 - Output – to the monitor, printer, file, or other output device

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Problems Solving Process

- Example
 - How fast is a car traveling if it goes 50 miles in 2 hours?
 - **Input:** the distance and time the car has traveled
 - **Process:** $\text{speed} = \text{distance} / \text{time}$
 - **Output:** a number giving the speed in miles per hour

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Program Development Cycle

- **Analyze:** Define the problem.
- **Design:** Plan the solution to the problem.
- **Choose the interface:** Select the objects (text boxes, buttons, etc.).
- **Code:** Translate the algorithm into a programming language.
- **Test and debug:** Locate and remove errors.
- **Complete the documentation:** Organize all the materials that describe the program.

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Types of Errors

- Syntax Error
 - Misspellings:
`lstBox.Itms.Add(3)`
 - Omissions:
`lstBox.Items.Add(2 +)`
 - Incorrect punctuation:
`Dim m; n As Integer`
- Run-time Error
 - Overflow error
`Dim numVar As Integer = 1000000`
`numVar = numVar * numVar`

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Types of Errors

- Logic Error


```
Dim average As Double
Dim m As Double = 5
Dim n As Double = 10
average = m + n / 2
Value of average will be 10. Should be 7.5.
average =(m + n)/ 2 (Correct)
Value is 10
```
- Divide by 0


```
Dim x As Integer=10
Dim r as Integer
Dim y as Integer=0
r=x/y
```

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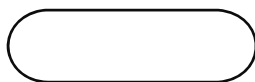
Algorithm

- An algorithm is a step by step series of instructions for solving a problem
- The steps in an algorithm are performed sequentially.
- Two commonly used tools to help document the program logic (the algorithm):
Flowcharts and **Pseudocode**.
- Generally, Flowcharts work well for small problems but Pseudocode is used for larger problems

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Flowchart

- A graphic representation of an algorithm, often used in the design phase of programming to work out the logical flow of a program





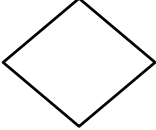

Terminal (start and end)



Flowline

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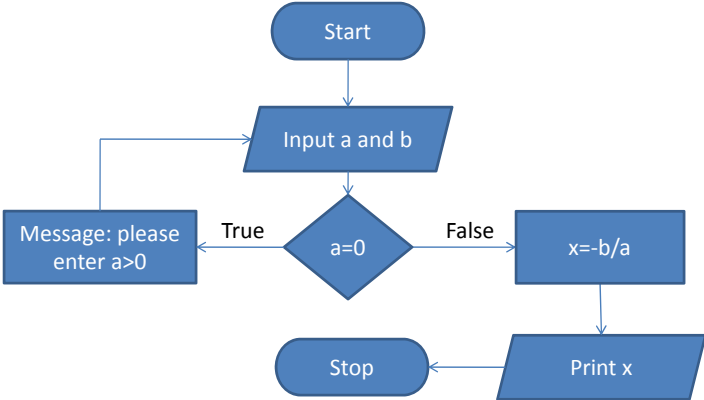
Flowchart

	Input and Output
	Process
	Decision
	Connector

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Flowchart

- Example: find the root of $ax + b = 0$



```
graph TD; Start([Start]) --> Input[/Input a and b/]; Input --> Decision{a=0}; Decision -- True --> Message[Message: please enter a>0]; Message --> Input; Decision -- False --> Process[x=-b/a]; Process --> Print[/Print x/]; Print --> Stop([Stop]);
```

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Pseudocode

- Uses English-like phrases with some Visual Basic terms to outline the program.
- Example : Find the root of $ax+b=0$
 - 1. Input value of a
 - 2. Input value of b
 - 3. If $a=0$ then message "please enter a greater than 0"
 - 4. Else
 - Process: $x = -1*(b/a)$
 - 5. Return x

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Exercises

- Write pseudocode for the following problems
 1. Find root of $ax^2+bx+c=0$
 2. Find the root of System Linear Equation Below:

$$\begin{cases} ax + by = c \\ a'x + b'y = c' \end{cases}$$

Hint: $D=ab'-a'b$, $Dx=cb'-c'b$, $Dy=ac'-a'c$
 $x=Dx/D$, $y=Dy/D$

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Exercises

- Write pseudocode for the following problems:
 3. Find the root of N variables System Linear Equation

$$\begin{cases} a_{11}x_1 + a_{12}x_2 + \dots + a_{1n}x_n = b_1 \\ a_{21}x_1 + a_{22}x_2 + \dots + a_{2n}x_n = b_2 \\ \dots & \dots & \dots & \dots \\ \dots & \dots & \dots & \dots \\ a_{n1}x_1 + a_{n2}x_2 + \dots + a_{nn}x_n = b_n \end{cases}$$

4. Find any value from a list of N values using **Binary Search method (Sorting list)**