Computer I

Lecture No. 2
C++ Fundamentals

Al-Mustaqbal University College of Engineering & Technology
Biomedical Engineering Department
MSc. in Computer Engineering: Hamza Waleed Hamza

What Is Programming and Program Development Life Cycle ?

- Programming is **a process of problem solving**

- Step 1: Analyze the problem
  - Outline the problem and its requirements
  - Design steps (algorithm) to solve the problem

- Step 2: Implement the algorithm
  - Implement the algorithm in code
  - Verify that the algorithm works

- Step 3: Maintenance
  - Use and modify the program if the problem domain changes

Algorithm:
  - Step-by-step problem-solving process

The Problem Analysis–Coding–Execution Cycle

- Understand the Overall problem
- Understand problem requirements
  - Does program require user interaction?
  - Does program manipulate data?
  - What is the output?
- If the problem is complex, divide it into subproblems
  - Analyze each subproblem as above

The Problem Analysis–Coding–Execution Cycle (cont'd.)

- Run code through compiler
- If compiler generates errors
  - Look at code and remove errors
  - Run code again through compiler
- If there are no syntax errors
  - Compiler generates equivalent machine code
- Linker links machine code with system resources

The Problem Analysis–Coding–Execution Cycle (cont'd.)

- Once compiled and linked, loader can place program into main memory for execution
- The final step is to execute the program
- Compiler guarantees that the program follows the rules of the language
  - Does not guarantee that the program will run correctly

The Language of a Computer

- Machine language: language of a computer
- Binary digit (bit):
  - The digit 0 or 1
- Binary code:
  - A sequence of 0s and 1s
- Byte:
  - A sequence of eight bits

The Evolution of Programming Languages

- Early computers were programmed in machine language
- To calculate `wages = rates * hours` in machine language:

```
100100 010001    //Load
100110 010010    //Multiply
100010 010011    //Store
```

The Evolution of Programming Languages

- Assembly language instructions are mnemonic
- Assembler: translates a program written in assembly language into machine language

TABLE 1-2 Examples of Instructions in Assembly Language and Machine Language

Assembly Language	Machine Language
LOAD	100100
STOR	100010
MULT	100110
ADD	100101
SUB	100011

The Evolution of Programming Languages

- Using assembly language instructions, `wages = rates • hours` can be written as:

```
LOAD   rate
MULT    hour
STOR    wages
```

The Evolution of Programming Languages

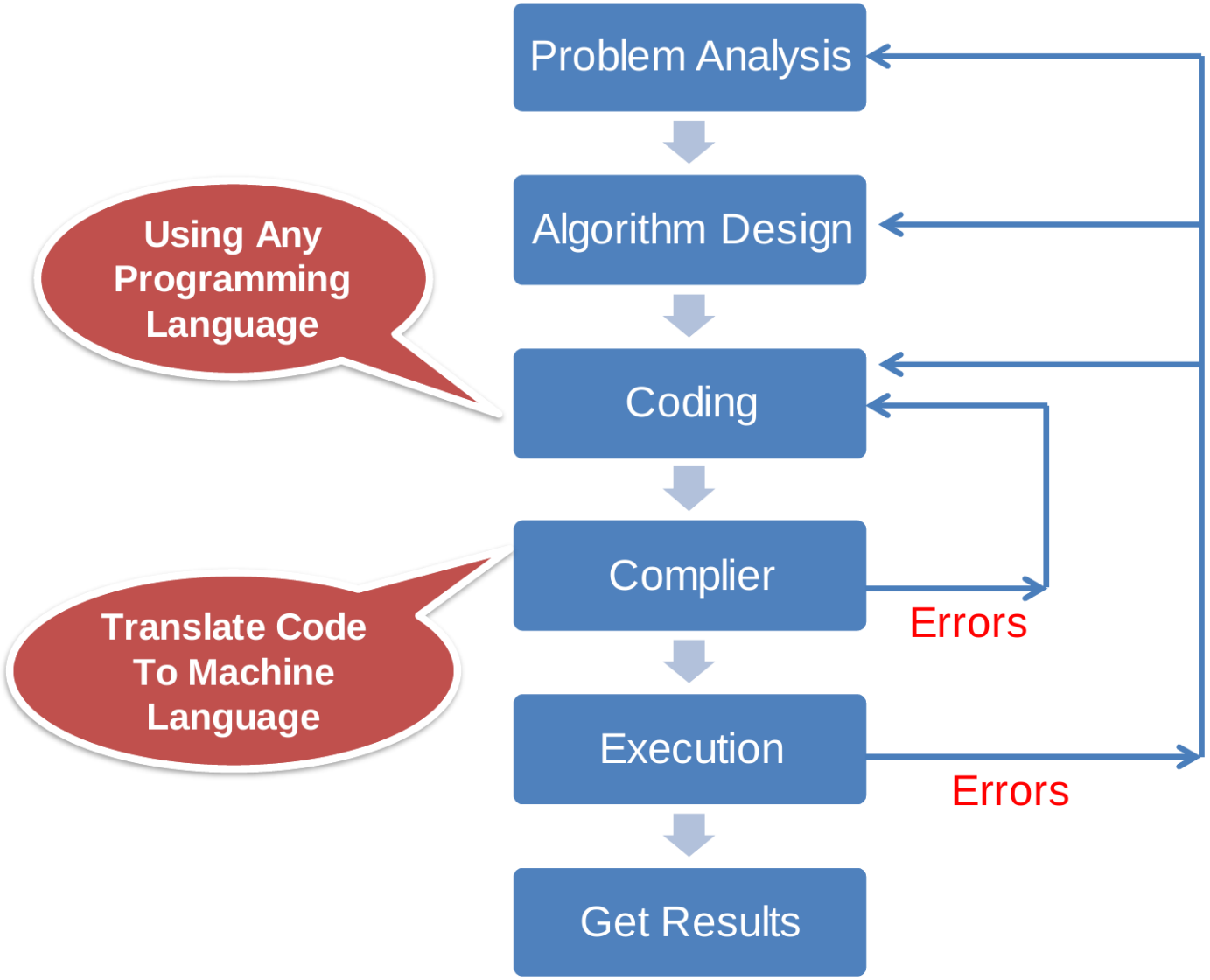
- High-level languages include Basic, FORTRAN, COBOL, Pascal, C, C++, C#, and Java

- **Compiler**: translates a program written in a high-level language machine language

- The equation `wages = rate • hours` can be written in C++ as:

```
wages = rate * hours;
```

The Problem Analysis–Coding–Execution Cycle



Think

Then

Write Code

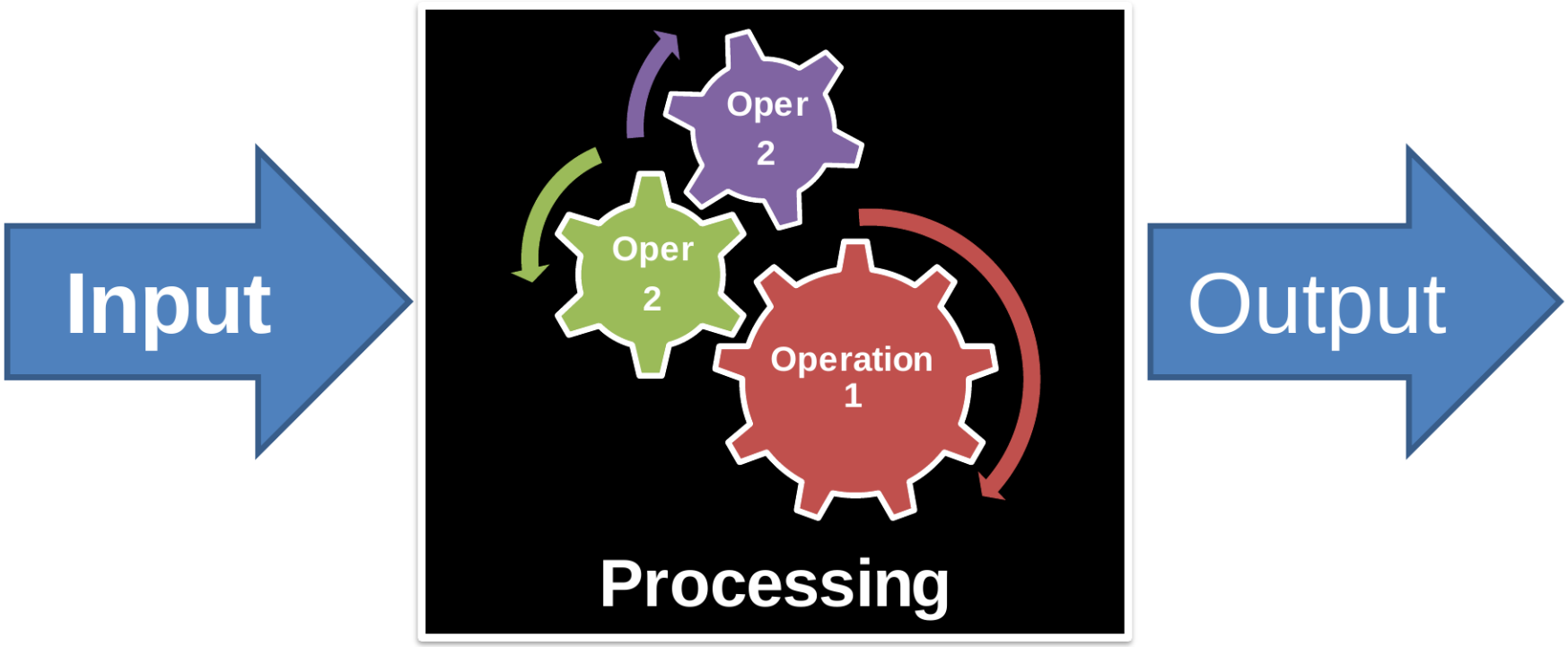
Basic Definitions

- Programming language:
  - a set of rules, symbols, and special words used to write computer programs.

- Computer program
  - Sequence of statements whose objective is to accomplish a task.

- Syntax:
  - rules that specify which statements (instructions) are legal

Computer System



Example 1

- **Write a program to find the Area of a rectangle**

The area of the Rectangle are given by the following formula:

Area = Rect Length * Rect Width.

Input :

Rectangle Length , Rectangle Width.

Processing :

Area = Rect Length * Rect Width.

Output :

Print Out The area.

Example 2

- **Write a program to find the perimeter and area of a square**

The perimeter and area of the square are given by the following formulas:

```
perimeter = Side Length * 4
area = Side Length * Side Length
```

Input:

Square Side Length

Processing:

perimeter = Side Length * 4

area = Side Length * Side Length

Output:

Print Out The Perimeter and Area.

Your First Program in C++

```
#include <iostream>
using namespace std;

int main()
{
  cout << "My first C++ program." << endl;
  return 0;
}
```

The Output is :(My first C++ program.)