

National University
Advance Computing – 3
Object Oriented Programming

**Introduction to Computer Programs and
programming Languages**

Computer Programs and Programming Languages

- A **computer program** is a series of instructions that directs a computer to perform tasks
 - Created by a **programmer** using a **programming language**



Software Categories

- System SW
 - Programs written for computer systems
 - Compilers, operating systems, ...
- Application SW
 - Programs written for computer users
 - Word-processors, spreadsheets, & other application packages

What Is an Operating System?

- An interface between the hardware and the user.
- Provides an easy and efficient use of the system resources.

Programs

- Programs are written in programming languages
 - PL = programming language
 - Pieces of the same program can be written in different PLs
 - Languages closer to the machine can be more efficient
 - As long as they agree on how to communicate
- A PL is
 - A special purpose and limited language
 - A set of rules and symbols used to construct a computer program
 - A language used to interact with the computer

Computer Languages

- Machine Language
 - Uses binary code
 - Machine-dependent
 - Not portable
- Assembly Language
 - Uses mnemonics
 - Machine-dependent
 - Not usually portable
- High-Level Language (HLL)
 - Uses English-like language
 - Machine independent
 - Portable (but must be compiled for different platforms)
 - Examples: Pascal, C, C++, Java, Fortran, . . .

Machine Language

- The representation of a computer program which is actually read and understood by the computer.
 - A program in machine code consists of a sequence of machine instructions.
- Instructions:
 - Machine instructions are in binary code
 - Instructions specify operations and memory cells involved in the operation

Example:

Operation	Address
0010	0000 0000 0100
0100	0000 0000 0101
0011	0000 0000 0110

Assembly Language

- A symbolic representation of the machine language of a specific processor.
- Is converted to machine code by an assembler.
- Usually, each line of assembly code produces one machine instruction (One-to-one correspondence).
- Programming in assembly language is slow and error-prone but is more efficient in terms of hardware performance.
- Mnemonic representation of the instructions and data
- **Example:**

Load	Price
Add	Tax
Store	Cost

High-level language

- A programming language which use statements consisting of English-like keywords such as "FOR", "PRINT" or "IF", ... etc.
- Each statement corresponds to several machine language instructions (one-to-many correspondence).
- Much easier to program than in assembly language.
- Data are referenced using descriptive names
- Operations can be described using familiar symbols
- Example:

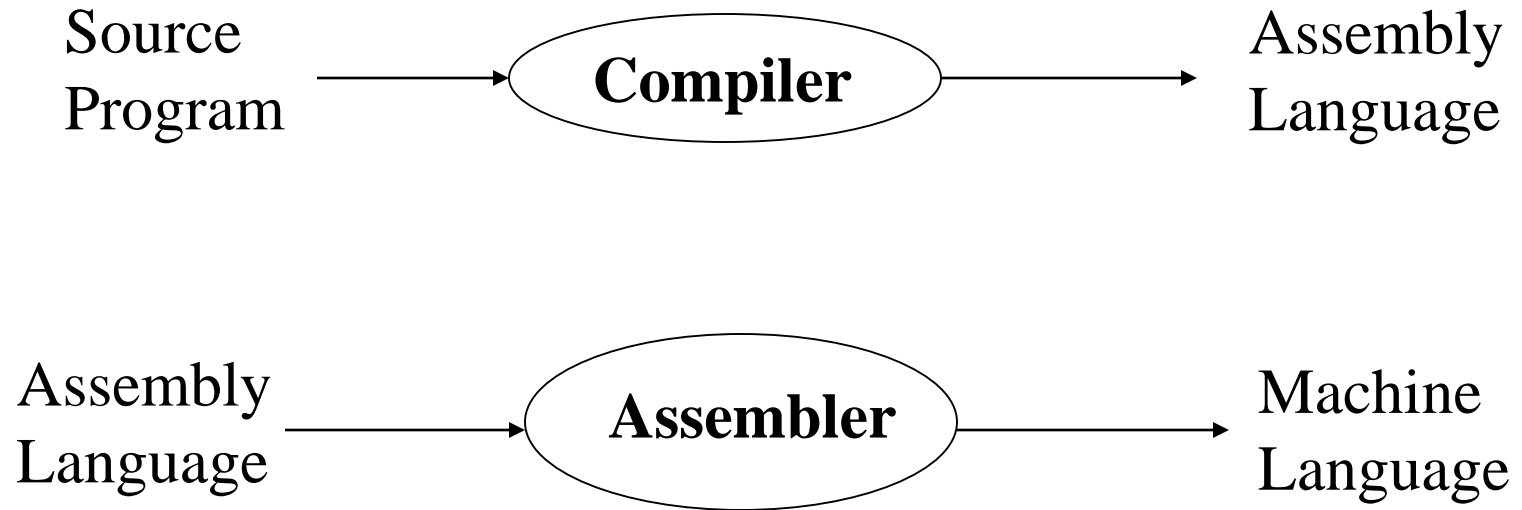
Cost := Price + Tax

Compilers & Programs

- **Compiler**

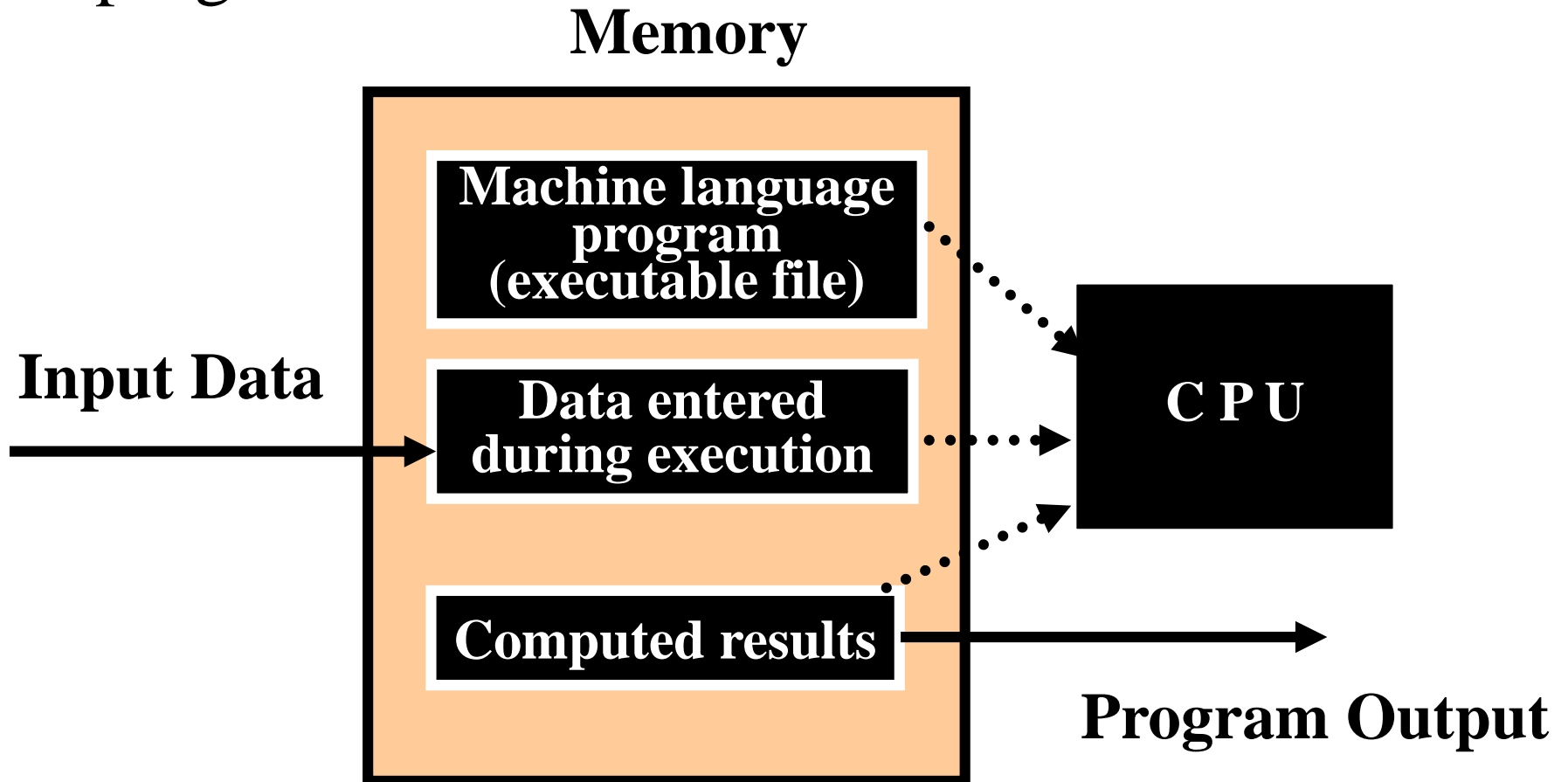
- A program that converts another program from some source language (or high-level programming language / HLL) to machine language (object code).
- Some compilers output assembly language which is then converted to machine language by a separate assembler.
- Is distinguished from an assembler by the fact that each input statement, in general, correspond to more than one machine instruction.

Compilation into Assembly L



Running Programs

- Steps that the computer goes through to run a program:



Program Execution

- Steps taken by the CPU to run a program (instructions are in machine language):
 1. Fetch an instruction
 2. Decode (interpret) the instruction
 3. Retrieve data, if needed
 4. Execute (perform) actual processing
 5. Store the results, if needed

Program Errors

- Syntax Errors:
 - Errors in grammar of the language
- Runtime error:
 - When there are no syntax errors, but the program can't complete execution
 - Divide by zero
 - Invalid input data
- Logical errors:
 - The program completes execution, but delivers incorrect results
 - Incorrect usage of parentheses

History of Java

- A group of 13 Sun employees including James Gosling started the “Green Project” in 1991 with the intention of planning for the next wave in computing.
- They designed the *7 which was “an interactive, handheld home-entertainment device controller with an animated touchscreen user interface”
- Gosling’s contribution to the project was an entirely new processor independent language call “Oak”.

History of Java (continued)

- To make a long story short, people at Sun decided to use this new language for the web.
- At the Sun World conference in May 1995, Marc Andreessen of Netscape announced an agreement to integrate Java into its browser. This meant that webpages were no longer going to be static.
- Over the next few years, java became very popular for writing applets (small programs included on webpages)
- Today in addition to writing applets, Java is used for writing large applications as well as applications for mobile devices
- For more on the history of Java, check out: <http://java.sun.com/features/1998/05/birthday.html>

Characteristics of Java

- ☞ Java is simple
- ☞ Java is object-oriented
- ☞ Java is distributed
- ☞ Java is interpreted
- ☞ Java is robust
- ☞ Java is secure
- ☞ Java is architecture-neutral
- ☞ Java is portable
- ☞ Java's performance
- ☞ Java is multithreaded
- ☞ Java is dynamic

Thank You