C++ Programming: Overview of computers and programming

Outline

- Hardware components of a computer system

- High-level programming languages

- Edit, Compile, link, execute

- Algorithm, program

Computer Hardware

- Central Processing Unit
- Main Memory
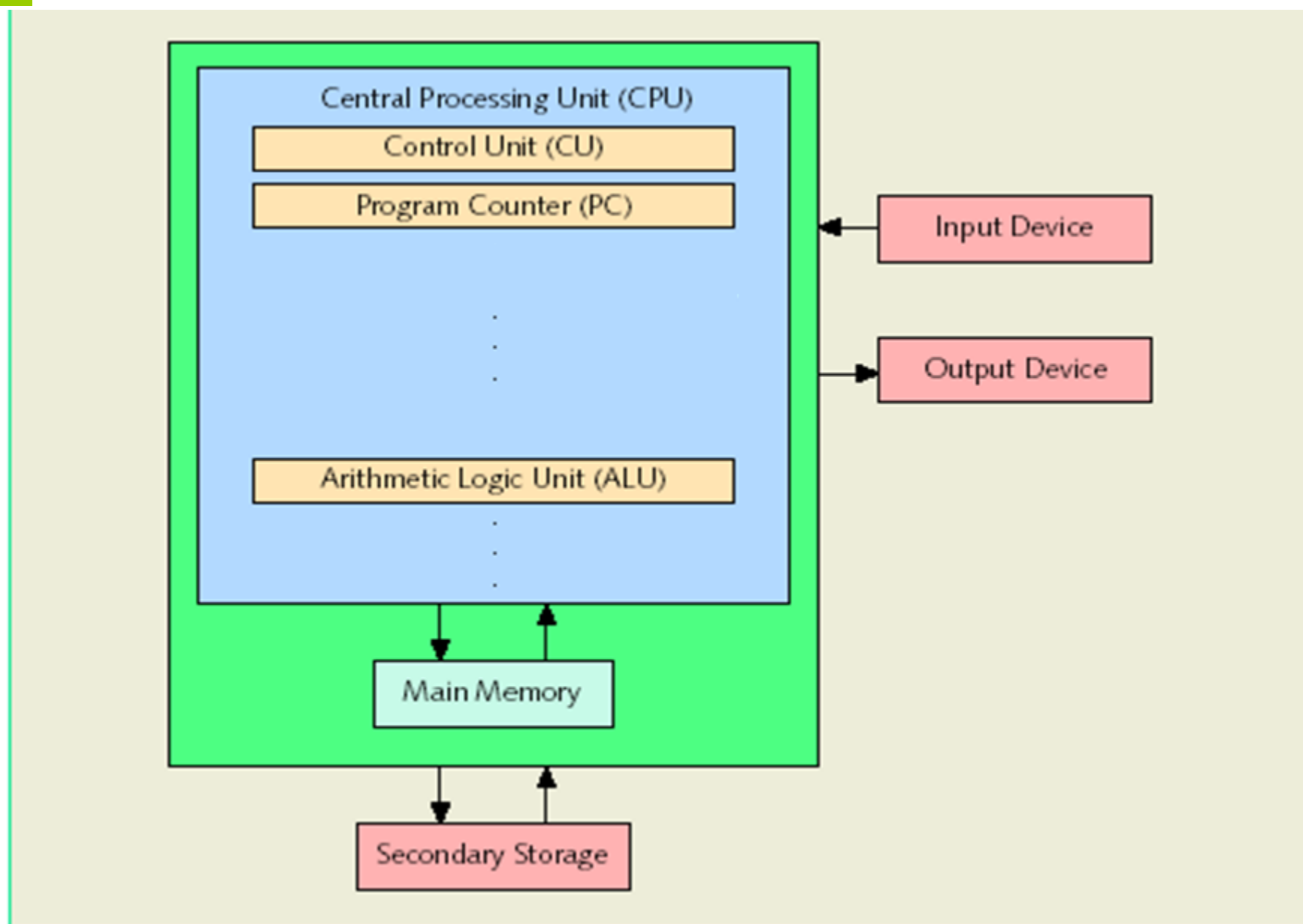- Secondary Storage
- Input/Output Devices

Figure 1-1 Hardware components of a computer **(Edited)**

CPU (Central Processing Unit)

- <u>CU (Control Unit)</u>:

  - Reads instructions from memory and executes them

- <u>PC (program counter)</u>: points to next instruction to be executed

- <u>ALU (arithmetic logic unit)</u>: carries out all arithmetic and logical operations

Main Memory

- Directly connected to the CPU

- All programs must be loaded into main memory before they can be executed

- All data must be brought into main memory before it can be manipulated

- When computer power is turned off, everything in main memory is lost: hence secondary storage is needed

The Language of a Computer

- Digital signals are sequences of 0s and 1s

- 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

High-Level Languages

- Machine language: sequence of low level instructions (not in this course)

- High-level language: high level statements

  int a;   *//allocate memory for an integer called a*

  int b*;   //allocate memory for b*

  b= 2;   *//store 2 in b*

  a = 3*b-1; *// store 3*(value of b)-1 in a*

- Include **C, C++,**Fortran**,** Java, **Matlab**

Processing a Program (continued)

- Compiler: translates a program to machine language. If compiler generates errors
  - Look at code and remove errors
  - Run code again through compiler
- Linker: combines object program with other programs provided by the SDK to create executable code

  Ex: statement x = cos(y) linked with the cosine function in the math library

- The last step is to load and execute the program

Problem Solving

- Programming is a process of problem solving
- Problem solving techniques
  - Analyze the problem and outline the problem requirements
  - Design steps (algorithm) to solve the problem
- Algorithm:
  - Step-by-step problem-solving process
  - Solution achieved in finite amount of time
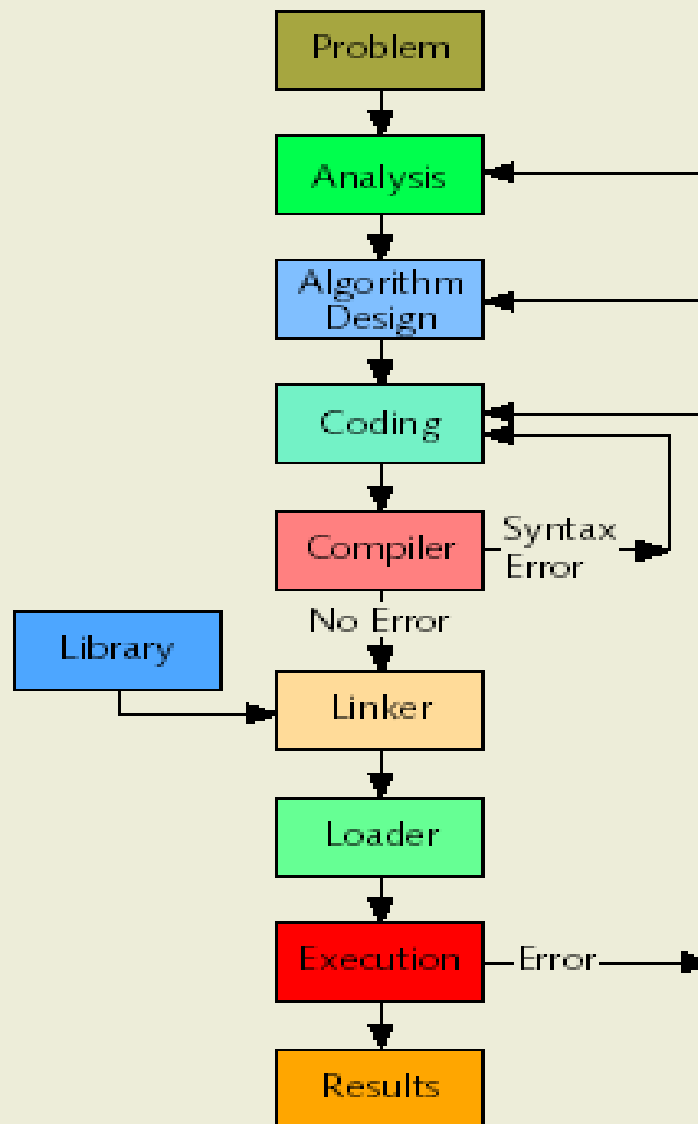- Implement algorithm in code and debug

Figure 1-4 Problem analysis–coding–execution cycle