FUNCTIONAL UNITS OF COMPUTER DETAIL

WEEK 2

WHAT IS COMPUTER?

- **C**ommon **O**perating **M**achine **P**articularly/**P**urposely **U**sed for **T**echnological/**T**rade, **E**ducational and **R**esearch.

BASIC FUNCTION OF A COMPUTER

- In general terms, there are only four basic functions that a computer can perform:

- ■ **Data processing:**

- Data may take a wide variety of forms, and the range of processing requirements is broad. However, we shall see that there are only a few fundamental methods or types of data processing.

- ■ **Data storage:**

- Even if the computer is processing data on the fly, the computer must temporarily store at least those pieces of data that are being worked on at any given moment. Thus, there is at least a short- term data storage function.

- Equally important, the computer performs a long- term data storage function.

- Files of data are stored on the computer for subsequent retrieval and update.

BASIC FUNCTION OF A COMPUTER (CONTD….)

- **Data movement:**

- The computer's operating environment consists of devices that serve as either sources or destinations of data.

- When data are received from or delivered to a device that is directly connected to the computer, the process is known as input–Output (I/O), and the device is referred to as a peripheral.

- When data are moved over longer distances, to or from a remote device, the process is known as data communications.

- ■ **Control:**

- Within the computer, a control unit manages the computer's resources and orchestrates the performance of its functional parts in response to instructions.

FUNCTIONAL UNITS OF DIGITAL SYSTEM

- Computer is a processing machine that process the information in digital form i.e. (0's & 1's).

- Means digital computer can only understand binary language (0's & 1's). If any analog quantity is to be processed, they must be converted into digital form before processing.

- The computer architecture of the digital devices you use in your everyday life follows a set of instructions. These instructions are given by the functional units of a computer to the different hardware components. The hardware devices implement the instructions given by the functional units of computer.

- You are already familiar with the hardware devices. They consist of the common keyboard, mouse, and the display of a computer. Moreover, even electronic circuits make up an important part of the hardware.

- However, a computer system cannot work properly work without its functional units. They are more essential parts of a computer system.

- **Input unit,**

- **Central Processing Unit,**

- **Memory unit Arithmetic & logical unit,**

- **Control unit**

- **Output unit.**

FUNCTIONAL UNITS OF A DIGITAL SYSTEM
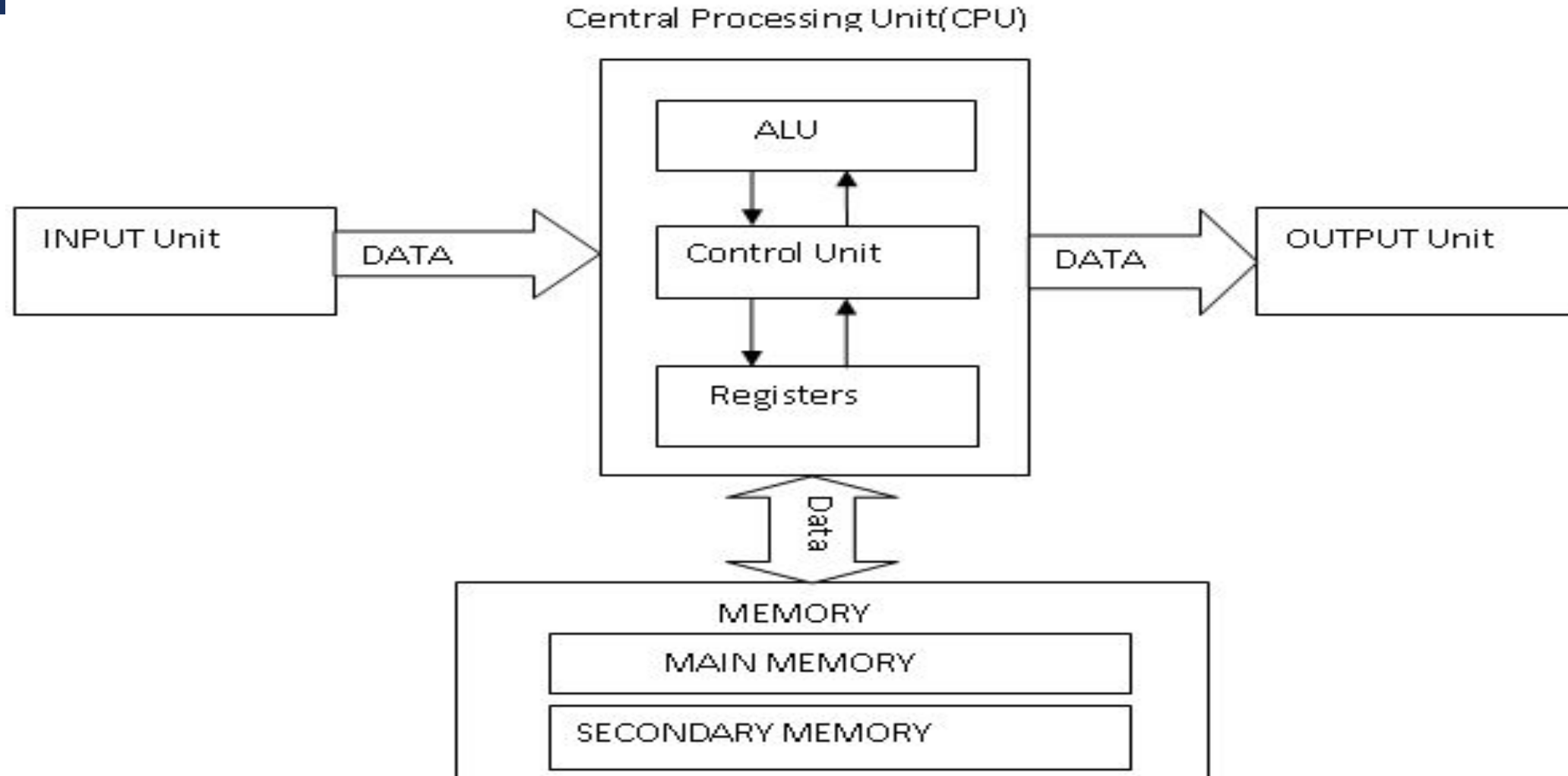
WHAT DO THE FUNCTIONAL UNITS DO?

- All five functional units are responsible for particular tasks. Below we will discuss how these functional units of computer contribute to processing and solving complex problems.

Input Unit:

- Computers need to receive data and instructions to solve any problem. The input unit links the external world or environment to the computer system. It consists of one or more input devices.

- The source program/high level language program/coded information/simply data is fed to a computer through input devices keyboard is a most common type.

- Whenever a key is pressed, one corresponding word or number is translated into its equivalent binary code over a cable & fed either to memory or processor.

- Joysticks, trackballs, mouse, scanners etc are other input devices.

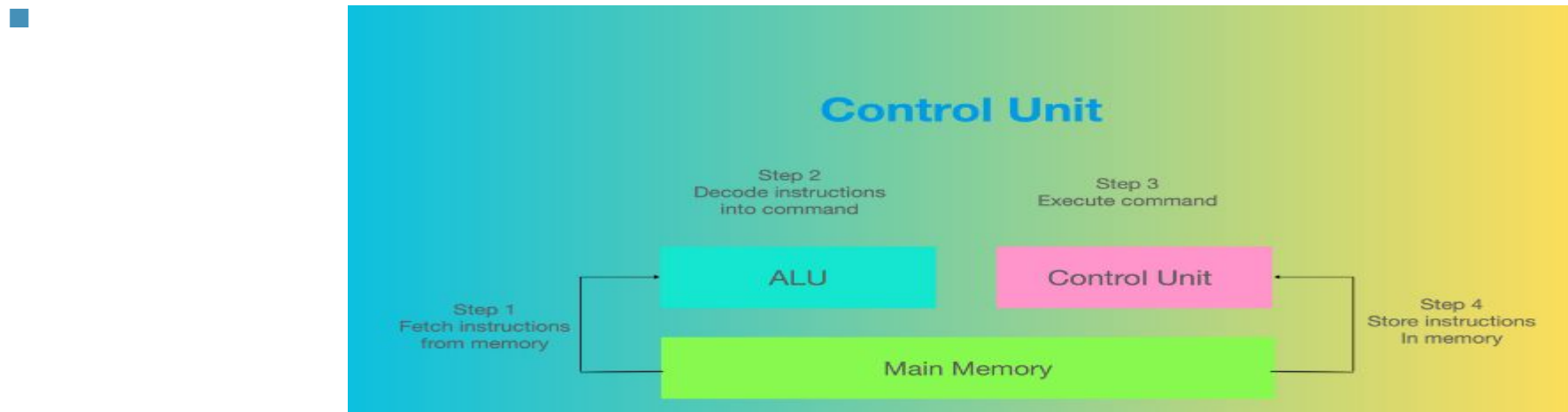# FUNCTIONAL UNITS OF A DIGITAL SYSTEM (CONTD…)

Central Processing Unit(CPU)

Once the data and instructions are received from the input device, they are to be processed in this unit. So it can be considered the heart or brain of the computer system. It consists of three major units:

- CU
- ALU
- Registers

CONTROL UNIT

- The control unit is an essential part of the computer as it controls data flow which is sent and received by the CPU. The control unit acts as a coordinator. In this way, the control unit is responsible for accepting the input of the data, placing it in memory, processing the stored input, and generating the output. In this way, it can be seen that the control unit is also an interpreter which decodes the information, converts it into executable data, and instructs the other components of the computer system to undertake the required action.

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Control Unit

Step 2
Decode instructions
into command

Step 3
Execute command

ALU

Control Unit

Step 1
Fetch instructions
from memory

Step 4
Store instructions
In memory

Main Memory

FUNCTIONAL UNITS OF A DIGITAL SYSTEM (CONTD...)

- **Arithmetic and Logic Unit**: Most of the computer operations are executed in ALU of the processor like addition, subtraction, division, multiplication, etc. the operands are brought into the ALU from memory and stored in high speed storage elements called register.

- Then according to the instructions the operation is performed in the required sequence.

- **Register:** A register may hold an <u>instruction</u>, a storage address, or any kind of data (such as a bit sequence or individual characters). Some instructions specify registers as part of the instruction. For example, an instruction may specify that the contents of two defined registers be added together and then placed in a specified register.

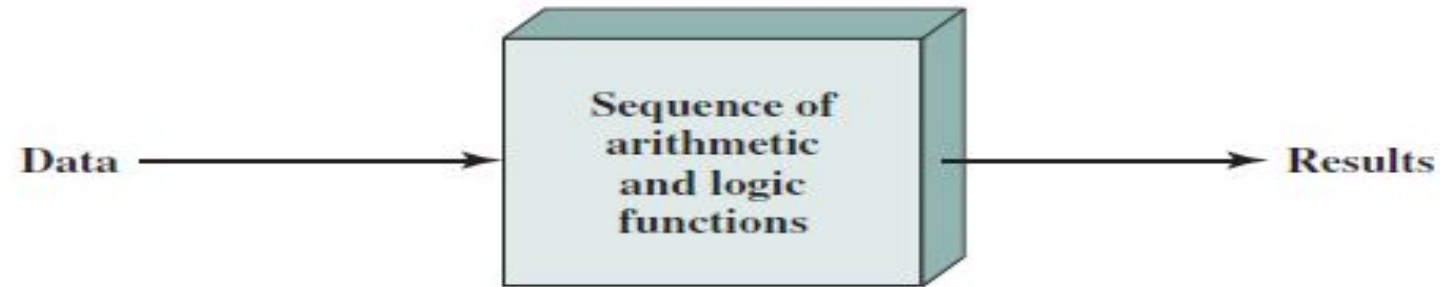# FUNCTIONAL UNITS OF A DIGITAL SYSTEM (CONTD...)

Memory Unit:

- The data and instructions required for processing have to be stored in the memory unit before actual processing starts.

- Similarly, the results generated have to be preserved before it is displayed.

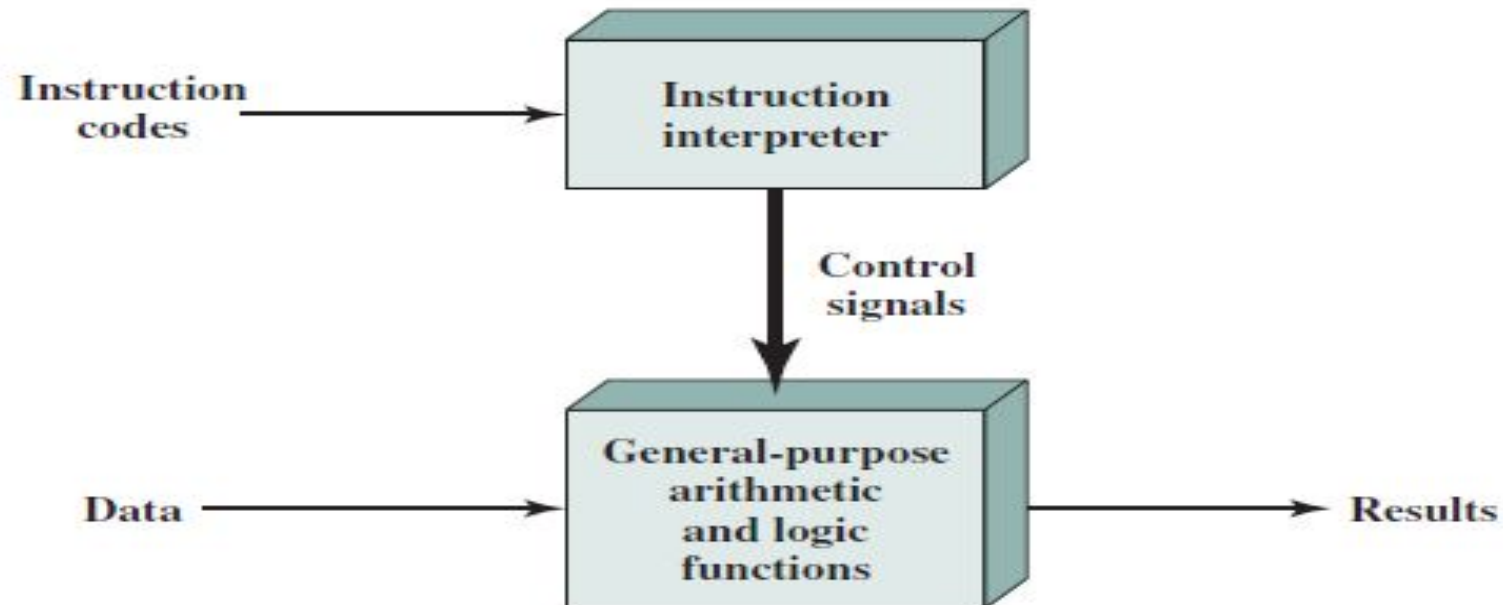- The memory unit thus provides space to store input data, intermediate results and final output generated.

Output Unit :

- It is used to print or display the result obtained by the execution of a program.

COMPUTER COMPONENTS

Data ───────────▶ Sequence of arithmetic and logic functions ───────────▶ Results

(a) Programming in hardware

Instruction codes ───────────▶ Instruction interpreter

Control signals

Data ───────────▶ General-purpose arithmetic and logic functions ───────────▶ Results

(b) Programming in software

COMPUTER COMPONENTS: HARDWARE PROGRAMMING

- There is a small set of basic logic components that can be combined in various ways to store binary data and perform arithmetic and logical operations on that data.

- If there is a particular computation to be performed, a configuration of logic components designed specifically for that computation could be constructed.

- We can think of the process of connecting the various components in the desired configuration as a form of programming. The resulting "program" is in the form of hardware and is termed a ***hardwired program.***

COMPUTER COMPONENTS: SOFTWARE PROGRAMMING

- Now consider this alternative. Suppose we construct a general-purpose configuration of arithmetic and logic functions.

- This set of hardware will perform various functions on data depending on control signals applied to the hardware. With general-purpose hardware, the system accepts data and control signals and produces results.

- Thus, instead of rewiring the hardware for each new program, the programmer merely needs to supply a new set of control signals.

- Each code is, in effect, an instruction, and part of the hardware interprets each instruction and generates control signals. To distinguish this new method of programming, a sequence of codes or instructions is called *software.*

INTERACTION OF CPU AND MAIN MEMORY

- The CPU exchanges data with memory. For this purpose, it typically makes use of two internal (to the CPU) registers:

- A memory address register **(MAR),** which specifies the address in memory for the next read or write,

- A memory buffer register **(MBR),** which contains the data to be written into memory or receives the data read from memory.

- Similarly, an I/O address register **(I/OAR)** specifies a particular I/O device.

- An I/O buffer register**(I/OBR)** is used for the exchange of data between an I/O module and the CPU.
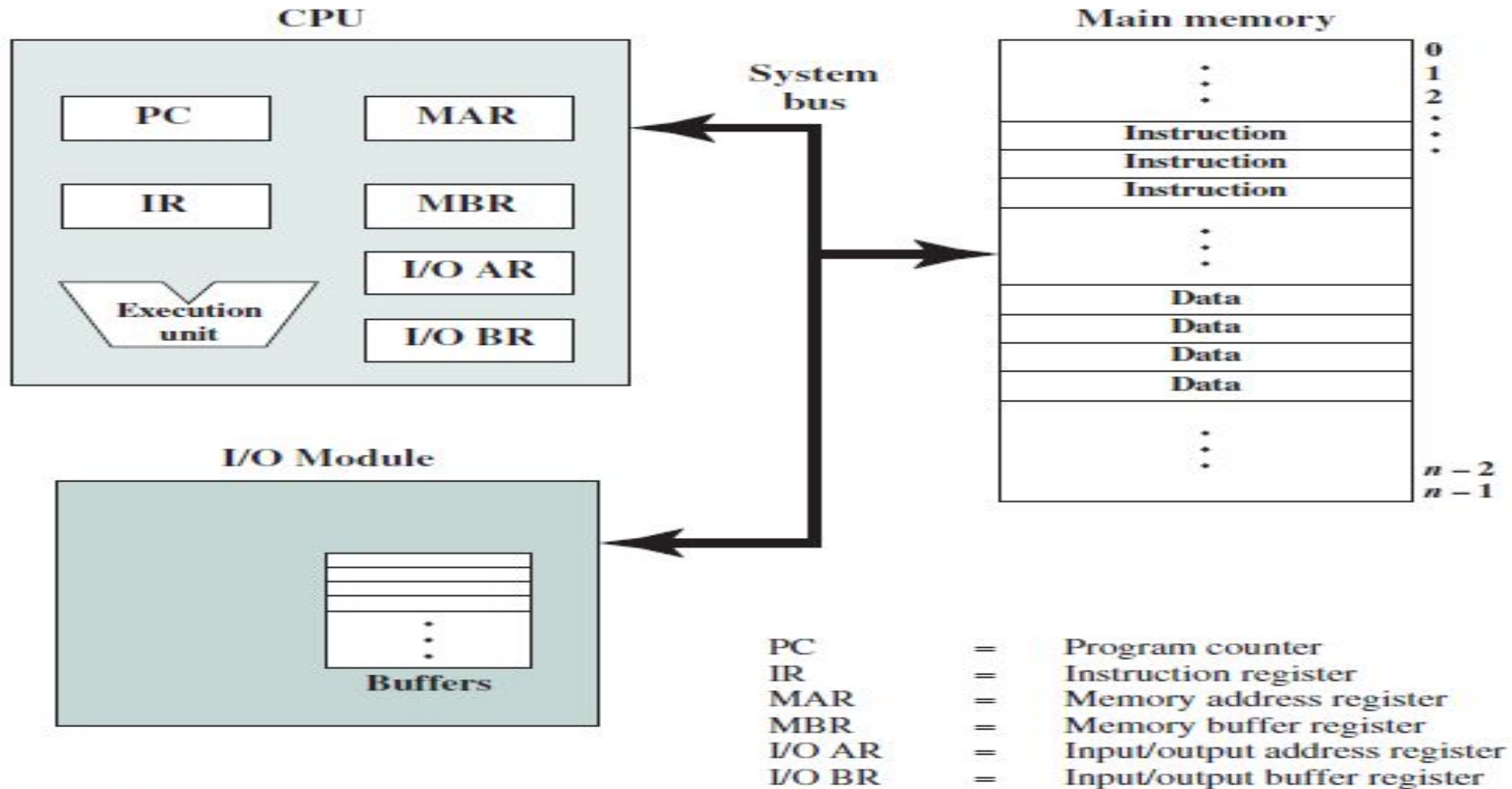
Figure 3.2   Computer Components: Top-Level View

INSTRUCTION FETCH AND EXECUTE

- In its simplest form, instruction processing consists of two steps:

- The processor reads (fetches) instructions from memory one at a time and executes each instruction.

- Program execution consists of repeating the process of instruction fetch and instruction execution.

- The instruction execution may involve several operations and depends on the nature of the instruction.

- The processing required for a single instruction is called an **instruction cycle.**
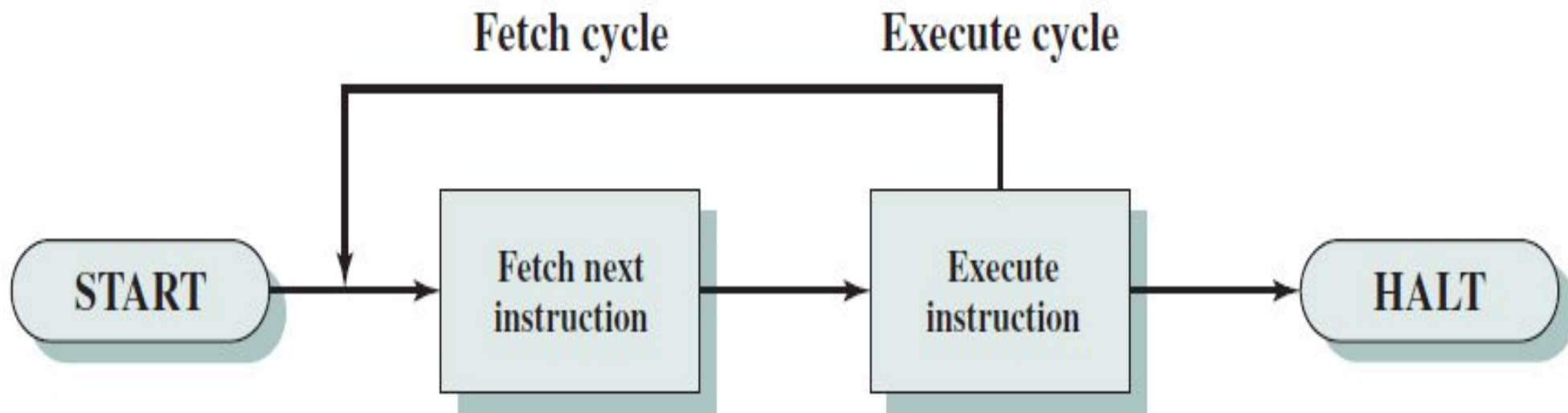
INSTRUCTION FETCH AND EXECUTE (CONTD…)

Figure 3.3 Basic Instruction Cycle

THANK YOU

TO BE CONTINUED ……