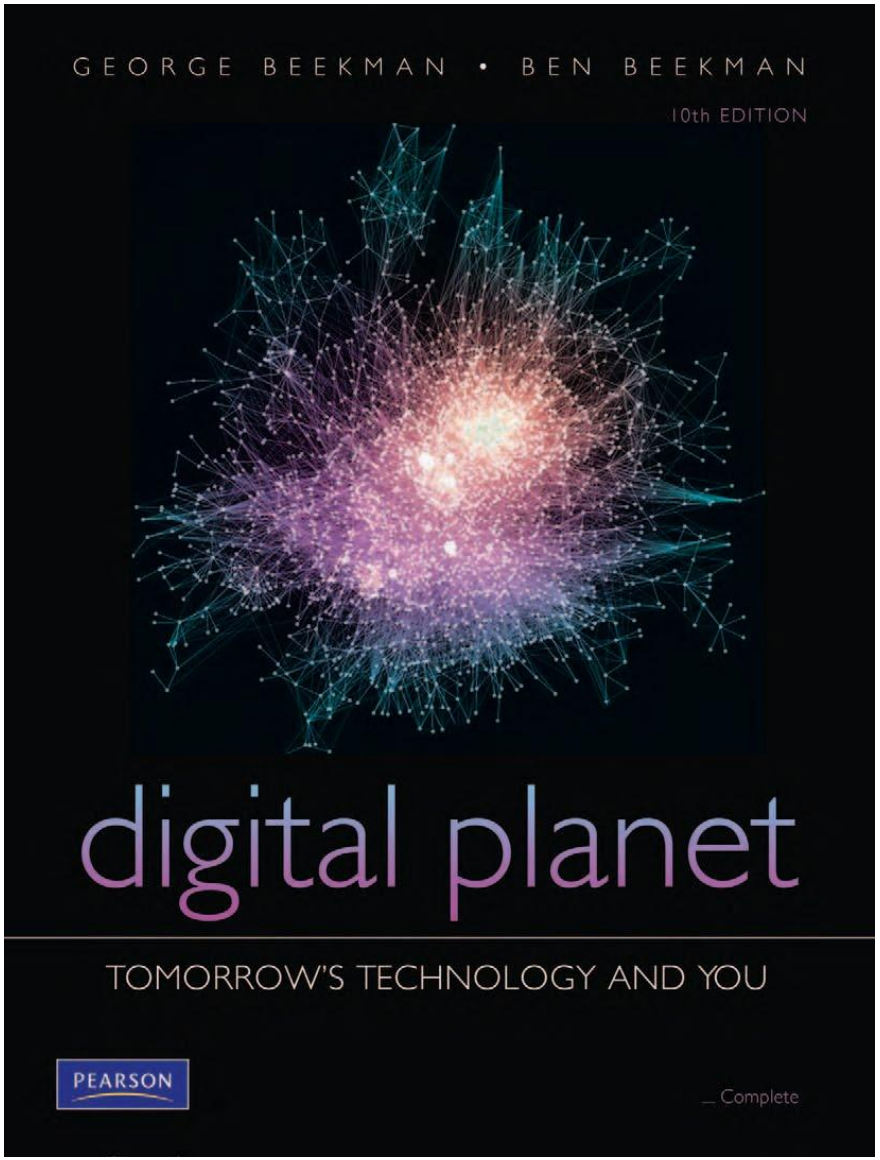


Digital Planet:

Tomorrow's Technology and You

George Beekman • Ben Beekman

Tenth Edition

Digital Planet: Tomorrow's Technology and You

Chapter 2

Hardware Basics

Inside the Box

Chapter 2 Objectives

- ✓ **Explain in general terms how computers store and manipulate information (تخزين البيانات)**
- ✓ **Describe the basic structure and organization of a computer (معمارية الحاسوب الداخلية)**
- ✓ **Discuss the computer system's main internal components and the ways they interact (أجزاء الحاسوب)**
- ✓ **Explain why a computer typically has different types of memory and storage devices (انواع الذاكرة)**

What Computers Do

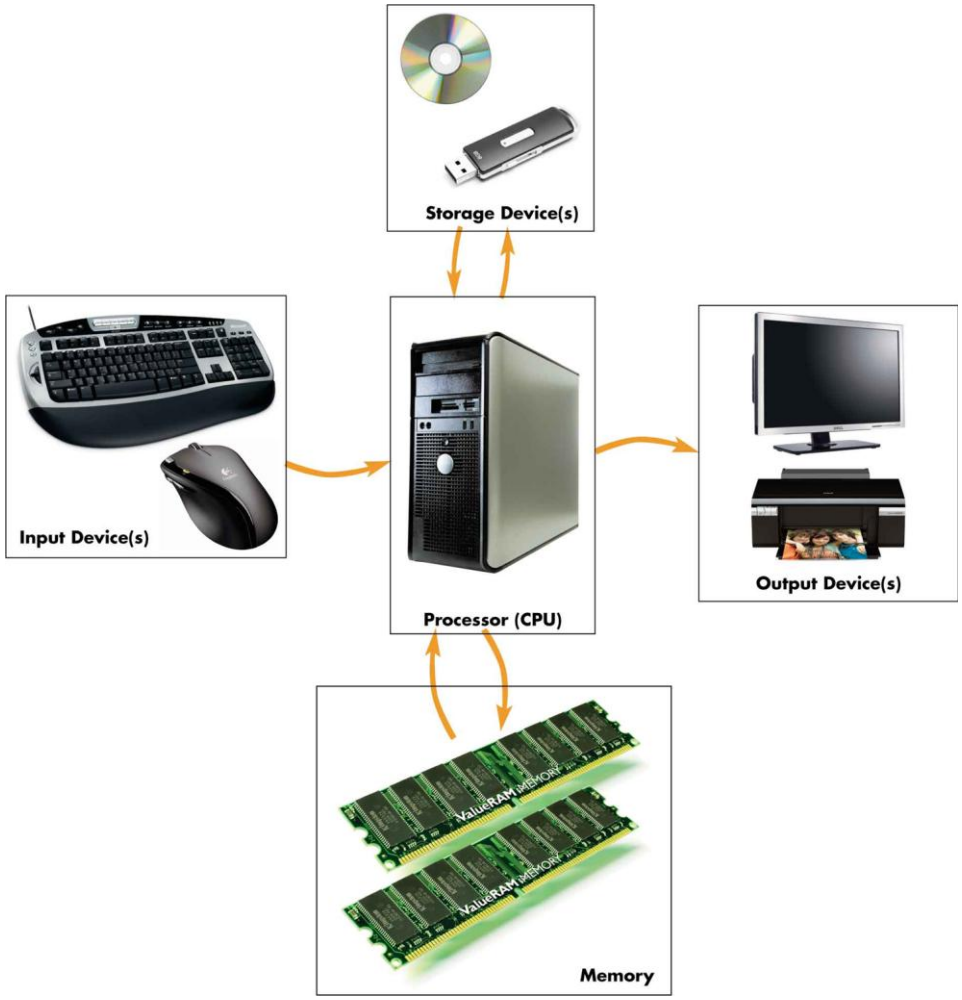
Four basic operations:

- ✓ ***Receive input:*** Accept information from outside world
- ✓ ***Process information:*** Perform arithmetic or logical operations on information
- ✓ ***Produce output:*** Communicate information to outside world
- ✓ ***Store information:*** Store and retrieve information from memory and storage devices

What Computers Do (cont.)

Hardware components

- ***Input devices***
- ***Output devices***
- ***Microprocessor (CPU)***
- ***Memory*** and ***storage devices***
  - Primary storage
  - Secondary storage
- ***Peripherals***



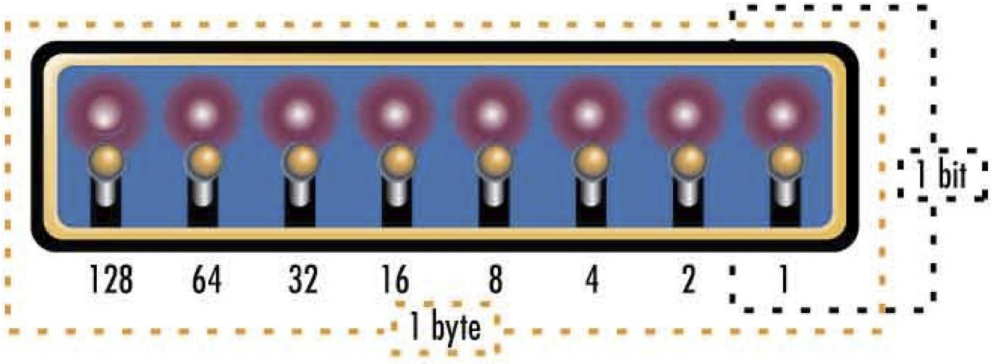
Bit Basics

✓ ***Bit:*** From **B**inary dig**it**

- Smallest unit of information computer can process
- Can have one of two values: 0 or 1

✓ ***Byte***

- Collection of 8 bits
- Can represent 256 different messages ($256 = 2^8$)



Bits as Numbers

- ✓ Denotes all numbers with combinations of 0s and 1s
- ✓ Decimal numbers automatically converted to binary
- ✓ Binary number processing hidden from user

Decimal	Binary	Decimal	Binary
0	0000	5	0101
1	0001	6	0110
2	0010	7	0111
3	0011	8	1000
4	0100	9	1001

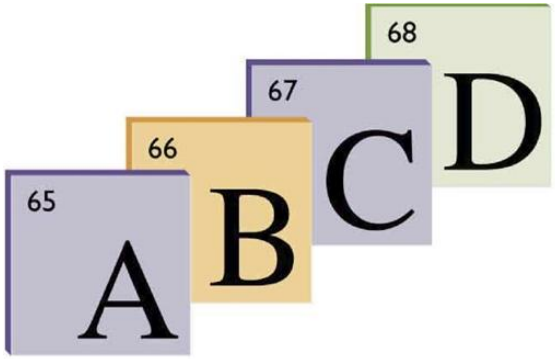
Bits as Codes

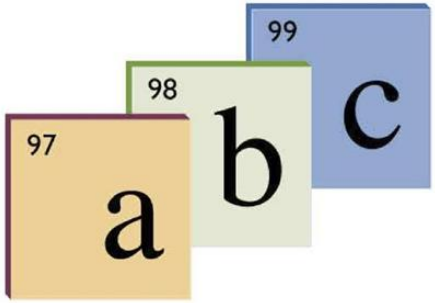
- **Codes represent each letter,** digit, and special character
- ***ASCII:*** Most widely used
  - Each character is a unique 8-bit code
  - 256 unique codes for 26 letters, 10 digits, special characters
- ***Unicode:*** Supports more than 100,000 unique characters

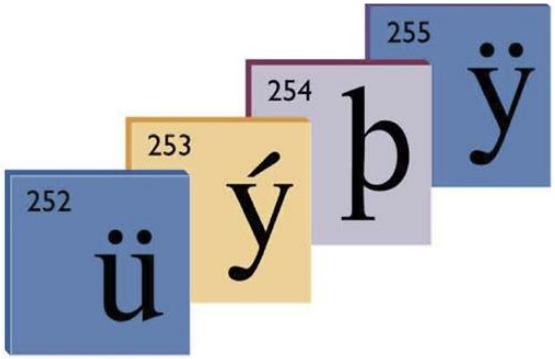
Character	ASCII binary code
A	01000001
B	01000010
C	01000011
D	01000100
E	01000101
F	01000110
G	01000111
H	01001000
I	01001001
J	01001010
K	01001011
L	01001100
M	01001101
N	01001110
O	01001111
P	01010000
Q	01010001
R	01010010
S	01010011
T	01010100
U	01010101
V	01010110
W	01010111
X	01011000
Y	01011001
Z	01011010
0	00110000
1	00110001
2	00110010
3	00110011
4	00110100
5	00110101
6	00110110
7	00110111
8	00111000
9	00111001

The World's Languages

- ✓ ASCII character set was originally designed to include only English-language characters from 0 to 127







- ✓ Unicode's international standard character set allows for more than 100,000 distinct codes to include Chinese, Korean, Japanese, and Arabic characters

Bits, Bytes, and Buzzwords

Byte = 8 bits or one character in ASCII

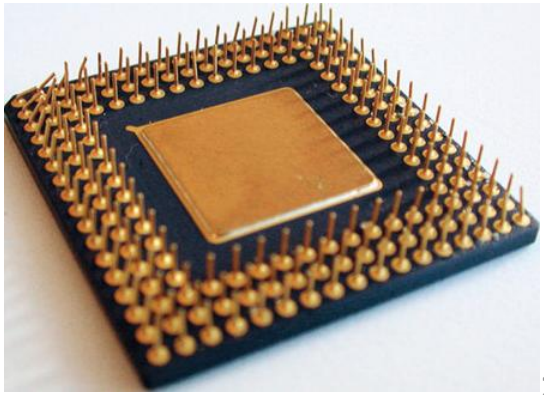
- ***Kilobyte*** (KB, K) ≈ 1,000 bytes
- ***Megabyte*** (meg, MB) ≈ 1,000 KB or 1 million bytes
- ***Gigabyte*** (gig, GB) ≈ 1,000 MB or 1 billion bytes
- ***Terabyte*** (TB) ≈ 1 million MB or 1 trillion bytes
- ***Petabyte*** (PB) ≈ 1 quadrillion bytes

The Computer's Core: CPU and Memory

- ✓ A digital computer is a collection of on/off switches designed to transform information from one form to another. بوابات المنطقية داخل الحاسوب لتحويل البيانات من شكل لاخر
- ✓ The user provides the computer with patterns of bits—***input***—and the computer follows instructions to transform that input into a different pattern of bits—***output***—to return to the user.

The CPU: The Real Computer

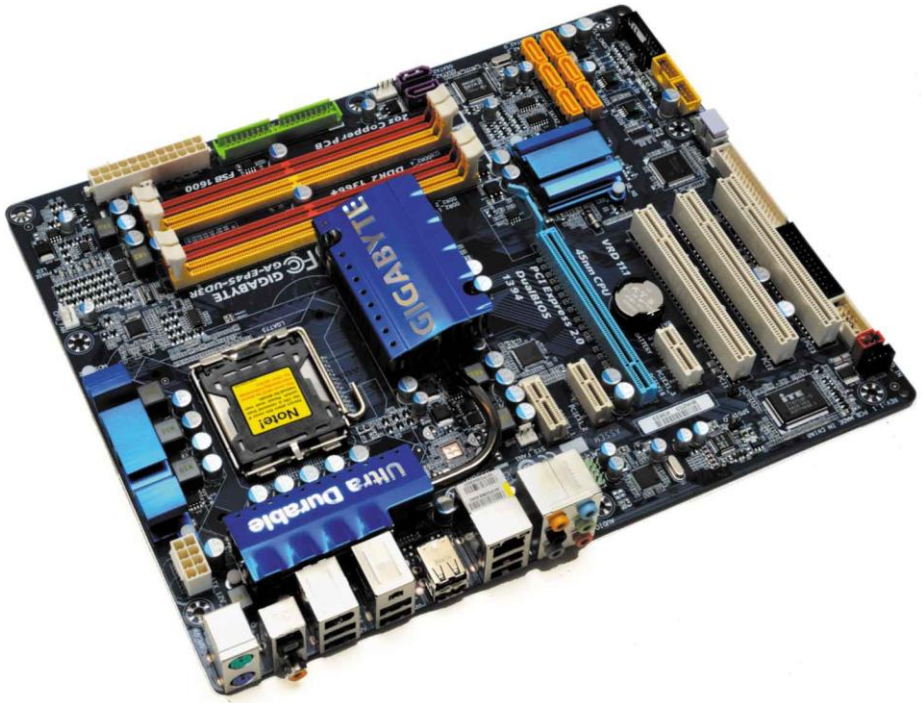
- ✓ CPU often called “processor” المعالج الدقيق
- ✓ Performs transformations of input into output
- ✓ Interprets and executes instructions in programs
- ✓ Performs arithmetic and logical data manipulations
- ✓ Communicates with other parts of the computer system indirectly through memory



The CPU: The Real Computer (cont.)

✓ Modern Microprocessor

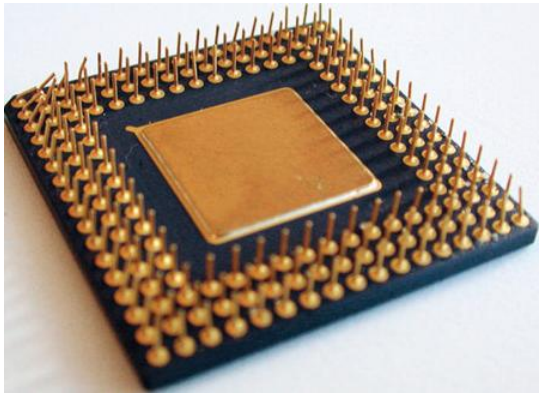
- Complex collection of electronic circuits
- CPU housed with other chips on circuit board
- Circuit board containing computer's CPU is called ***motherboard***



The CPU: The Real Computer (cont.)

✓ Choosing a Computer

- Type of CPU is important part of decision
- Two important factors to consider:
  - Compatibility (التوافقية)
  - Performance (الاداء)



Compatibility (توافقية)

- ✓ note that not all software is ***compatible*** with every CPU.
- ✓ Every processor has built-in set of instructions.
- ✓ CPUs in same family are generally ***backward compatible***.
  - Designed to process instructions handled by earlier models
- ✓ AMD processors made to be compatible with Intel.
- ✓ Programs written for Linux can't run on Windows.

Performance (الاداء)

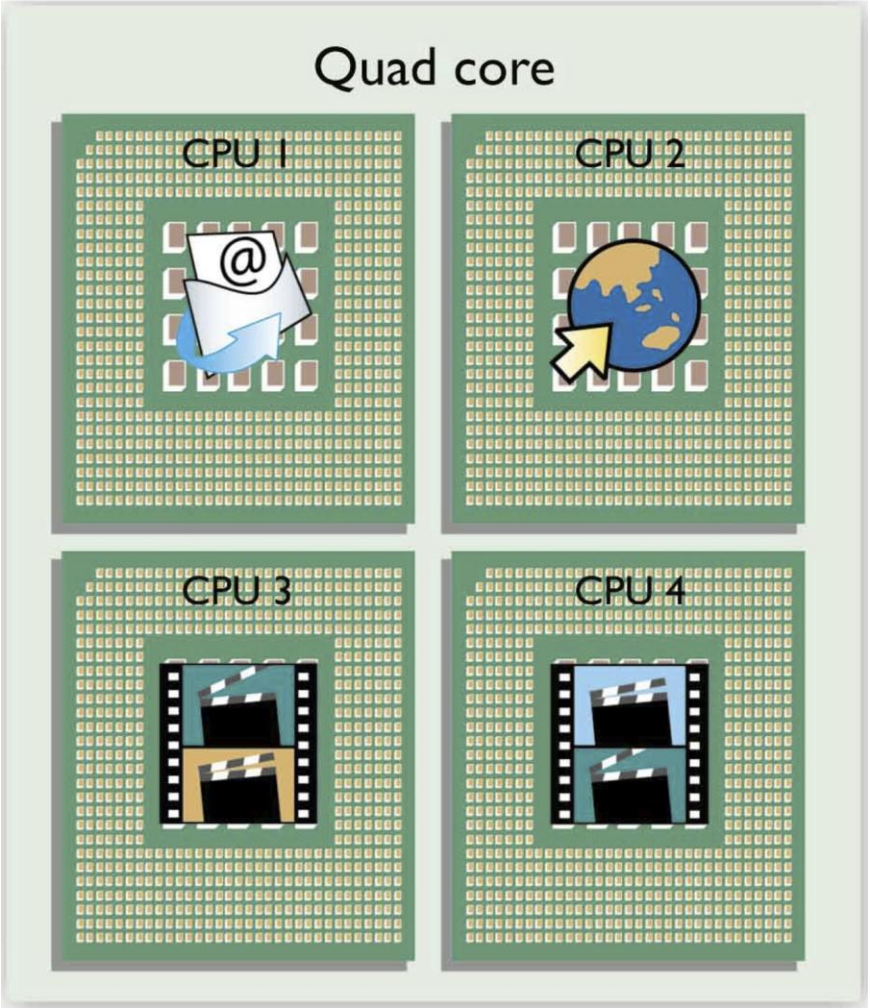
ما هي سرعة جهازك؟

- ✓ Some processors faster than others
- ✓ Performance is determined by:
  - Speed of internal ***clock***—measured in ***gigahertz*** (GHz)
  - ***Architecture*** of processor
  - Number of bits processor can process at one time
    - Typically 32 or 64 bits—called ***word size***
- ✓ Heat generated increases with clock speed

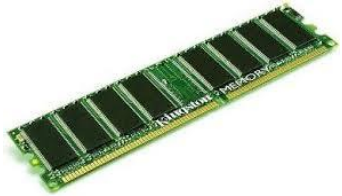
Performance (cont.)

✓ Multicore Processors

- Single chip contains multiple CPUs (cores)
  - Run simultaneously
  - Divide work
  - Most new PCs have at least two cores.
  - Quad core becoming common



The Computer's Memory
الذاكرة



✓ *Random access memory (RAM)* ذاكرة الوصول العشوائي

- Most common type of primary storage
- Stores program instructions and data temporarily
- Memory locations have unique addresses
- Volatile—disappears when power is turned off

ذاكرة الوصول العشوائي هي الذاكرة الرئيسية في الحاسوب، تستعمل لتخزين التعليمات والبيانات، خلية في الذاكرة لها عنوان خاص وفريد .نفقد كل ما في الذاكرة عند انقطاع الكهرباء

The Computer's Memory (cont.)

✓ ***Read-only memory (ROM)*** ذاكرة القراءة فقط

- Information is etched on chip when manufactured
- Stores start-up instructions and other critical information

✓ ***Complementary metal-oxide semiconductor (CMOS)***

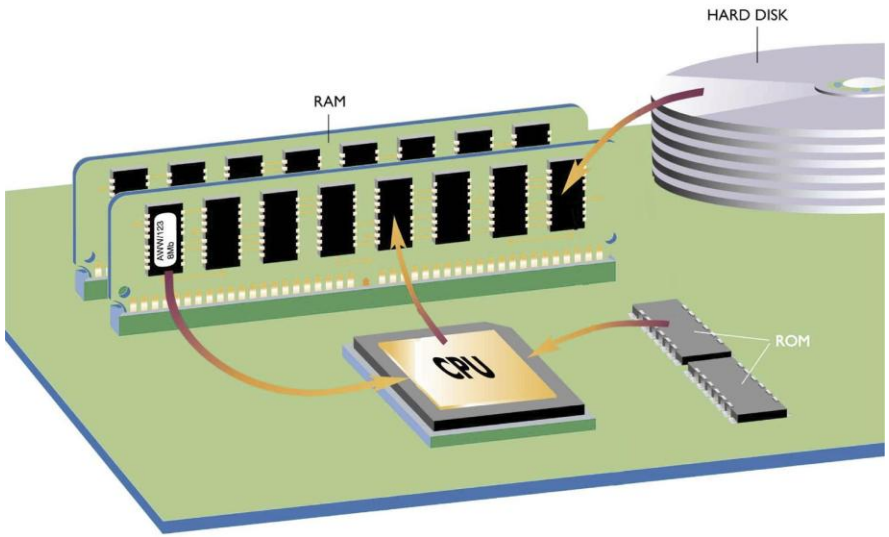
- Special low-energy type of RAM

✓ ***Flash memory*** ذاكرة وميضية

- Can be written and erased repeatedly
- Used for digital cameras, cell phones, handheld computers

Memory

1. When starting a computer, the CPU automatically begins executing operating system instructions stored in ROM.
2. The executing instructions help the system start up and tell it how to load the operating system—copy it from disk into RAM.
3. Once instructions for the operating system are loaded into RAM, the CPU is able to execute them.



Buses
الناقل

لنقل البيانات بين المعالج والذاكرة واجهزة التخزين

- ✓ Information travels between components on the motherboard through wires called ***internal buses*** or just ***buses***.
- ✓ Buses: Bridges between processor and RAM
- ✓ Buses connect to:
  - Storage devices in bays
  - ***Expansion slots***
  - External buses and ports

Ports
منافذ

- ✓ Computer has variety of ports to meet diverse needs
  - ***Video port(s)*** to connect monitors
  - ***Audio ports*** to connect speakers and/or headphones
  - ***USB ports*** to connect keyboards, pointing devices, printers, cameras, disk drives, portable storage devices, and more
- ✓ Some ports connected directly to system board
- ✓ Others connected to ***expansion cards***

Peripherals
الاجهزة الطرفية/الملحقات

- ✓ Slots and ports make it easy to add peripherals to computer system.
- ✓ Some peripherals, such as keyboards and printers, serve as communication links between people and computers.
- ✓ Other peripherals link computer to other machines.
- ✓ Still others provide long-term storage media.

Chapter 2 Summary

- ✓ A computer manipulates patterns of bits represented by two symbols: 0 and 1.
- ✓ Bits can be grouped into coded messages that represent alphabetic characters, pictures, colors, sounds, and other kinds of information.
- ✓ The microprocessor follows software instructions to perform calculations and logical manipulations that transform input data into output.

Summary (cont.)

- ✓ Not all CPUs are compatible with each other.
- ✓ Modern CPUs employ multicore or many core processing systems that speed calculations.
- ✓ The CPU uses RAM (random access memory) as a temporary storage area.
- ✓ ROM (read-only memory) contains unchangeable information.

Summary (cont.)

- ✓ The CPU and main memory are housed in silicon chips on the motherboard and other circuit boards inside the computer.
- ✓ Buses connect to slots and ports that enable the computer to communicate with internal devices and external peripherals.