

Introduction to Computing Systems

Course Contents

Part I: Introduction to Computers

- System Unit.
- Processing Unit.
- I/O Devices.
- Storage System.

Part II: Coding

- Data Types and Data Representation.
- Number Systems.
- Complements.
- Arithmetic Addition and Subtraction.

Part III: Compression Techniques

- Entropy and Information.
 - Lossy and Lossless Compression.
 - Theoretical Limits of Lossless Data Compression.
 - Compression Algorithms.
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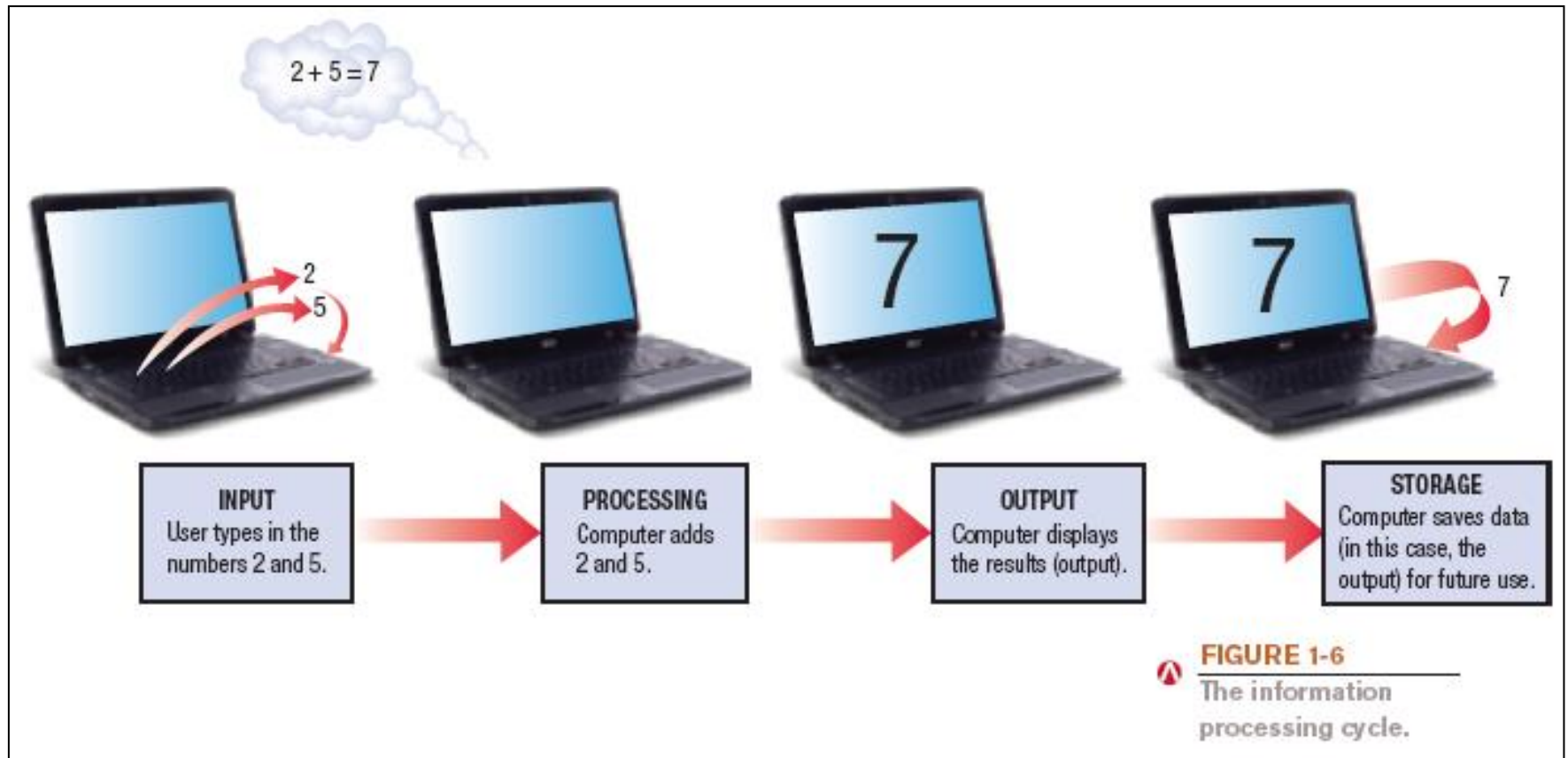
Computers in Your Life

- Why learn about computers?
- Why do you need basic computer literacy?
- List all the ways we use computers in our lives..
 - Looking up information and news
 - Exchanging e-mail
 - ...

What Is a Computer and What Does It Do?

- ▶ Computer: **A programmable, electronic device that accepts data, performs operations on that data, and stores the data or results as needed**
 - ▶ Computers follow instructions, called **programs**, which determine the tasks the computer will perform
- ▶ **5 Basic Computer operations**
 - ▶ Input: Entering data into the computer
 - ▶ Processing: Performing operations on the data
 - ▶ Output: Presenting the results (information)
 - ▶ Storage: Saving data, programs, or output for future use
 - ▶ Communications: Sending or receiving data

What Is a Computer and What Does It Do?



Data vs. Information

- Data
 - Raw, unorganized facts
 - Can be in the form of text, graphics, audio, or video
- Information
 - Data that has been processed into a meaningful form
- Information processing
 - Converting data into information

Computer Users and Professionals

- Computer users (end users)
 - People who use a computer to obtain information
- Computer professionals include:
 - Programmers
 - Write programs computers use
 - Systems analysts
 - Design computer systems
 - Computer operations personnel
 - Manage day-to-day computer operations
 - Security specialists
 - Secure computers and networks against hackers

Computer Hardware

- Hardware: The physical parts of a computer
 - **Internal hardware**
 - Located **inside** the main box (system unit) of the computer
 - **External hardware**
 - Located **outside** the system unit
 - Connect to the computer via a **wired or wireless** connection
 - There is hardware associated with all five computer operations
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Hardware

- **Input devices**
 - Used to input data into the computer
 - Keyboards, mice, scanners, cameras, microphones, joysticks, touch pads, touch screens, fingerprint readers, etc.
 - **Processing devices**
 - Perform calculations and control computer's operation
 - Central processing unit (CPU) and memory
 - **Output devices**
 - Present results to the user
 - Monitors, printers, speakers, projectors, etc.
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Hardware

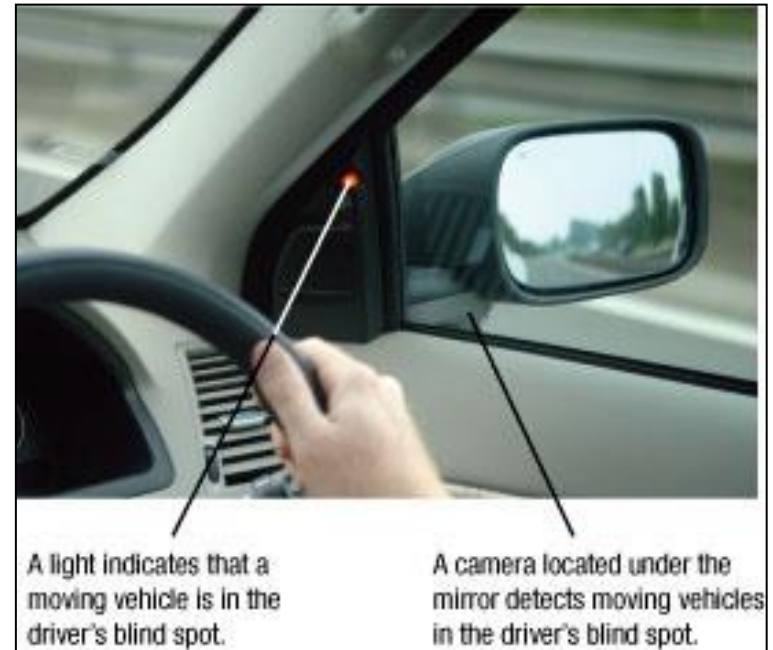
- **Storage devices**
 - Used to store data on or access data from storage media
 - Hard drives, CD/DVD discs and drives, USB flash drives, etc.
 - **Communications devices**
 - Allow users to communicate with others and to electronically access remote information
 - Modems, network adapters, etc.
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Computers to Fit Every Need

- Six basic categories of computers:
 - Embedded computers
 - Mobile devices
 - Personal computers
 - Midrange servers
 - Mainframe computers
 - Supercomputers
-

Category 1: Embedded Computers

- **Embedded computer:** Embedded into a product and designed to perform specific tasks or functions for that product
- Cannot be used as general-purpose computers
- Often embedded into:
 - Household appliances
 - Thermostats
 - Sewing machines
 - Cars



Category 2: Mobile Devices

- **Mobile device:** A very small device with some type of built-in computing or Internet capability
- Typically based on mobile phones
- Typically have small screens and keyboards
- Examples:
 - Smartphones
 - Handheld gaming devices
 - Portable digital media players



FIGURE 1-13
Smartphones. Most mobile devices today are based on the mobile phone.

Category 3: Personal Computers (PCs)

- **Personal computer:** A small computer designed to be used by one person at a time
- **Desktop computers:** Fit on or next to a desk
 - Can use tower case, desktop case, or all-in-one
 - Can be PC- compatible or Macintosh
 - Not designed to be portable



Category 3: Personal Computers (PCs).....

- **Notebook (laptop) computers:** Typically use clamshell design
- **Tablet computers:** Can be slate tablets or convertible tablets
- **Netbooks:** Small notebooks; rapidly growing type of PC
- **Ultra-mobile PCs (UMPCs):** Handheld computers



Convertible Tablet

FIGURE 1-15
Portable computers.

Thin Client and Internet Appliances

- Thin client or network computer (NC)
 - Device designed to access a network for processing and data storage
 - Lower cost, increased security and easier maintenance
 - Limited or no local storage
 - Not able to function as a computer if network is down
- Internet appliance
 - Specialized network computer designed for Internet access and/or e-mail exchange
 - Some designed to be used in the home

Thin Client and Internet Appliances...

- Can be built into another product such as a refrigerator or telephone console
- Can be a stand-alone device
- Can include Internet-enabled gaming consoles

FIGURE 1-16

Thin clients and Internet appliances.



Courtesy of NComputing

THIN CLIENTS



Courtesy of Sony Electronics, Inc.

STAND-ALONE INTERNET DEVICES



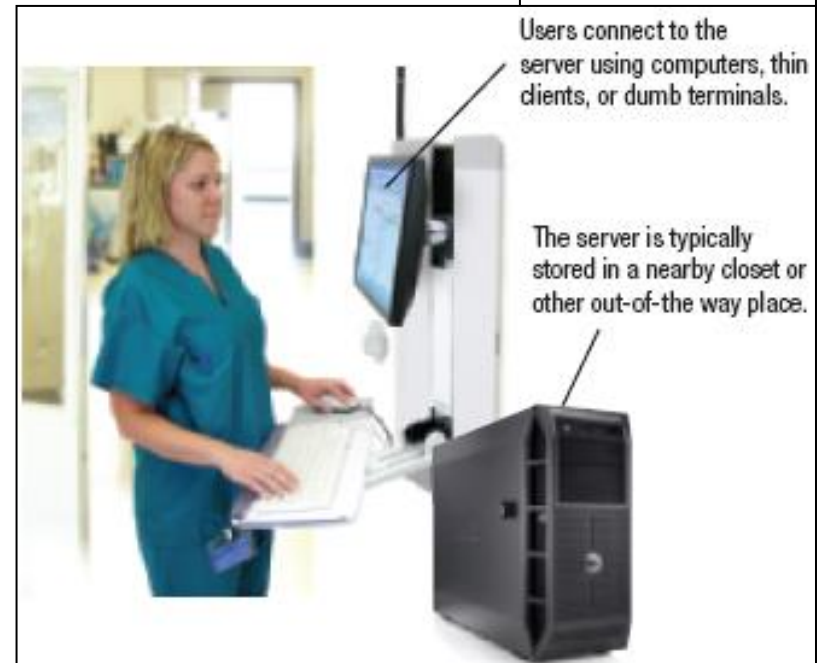
Barone Firenze/Shutterstock.com

INTERNET-ENABLED GAMING CONSOLES

Category 4: Midrange Servers

- Midrange server: A **medium-sized** computer used to host programs and data for a small network
 - Users connect via a network with a computer or dumb terminal

FIGURE 1-17
Midrange servers.
Midrange servers are used to host data and programs on a small network, such as a school computer lab or medical office network.



Category 5: Mainframe Computers

- Mainframe computer: **Powerful** computer used by several large organizations to **manage** large amounts of centralized data
 - Standard choice for large organizations, hospitals, universities, large businesses, **banks**, government offices
 - Located in **climate-controlled** data centers and connected to the rest of the company computers via a network
 - Larger, more **expensive**, and more powerful than midrange servers
 - Usually operate 24 hours a day
 - Also called high-end servers or enterprise-class servers

FIGURE 1-18
Mainframe computers.



Category 6: Supercomputers

- Supercomputer: Fastest, **most expensive, most powerful** type of computer
 - Generally run one program at a time, as fast as possible
 - **Commonly built by connecting hundreds of smaller computers, supercomputing cluster**
 - Used for space exploration, missile guidance, satellites, weather forecast, oil exploration, scientific research, complex Web sites, decision support systems, 3D applications, etc.



FIGURE 1-19
The Roadrunner supercomputer. Supercomputers are used for specialized situations in which immense processing speed is required.