MENOUFIA UNIVERSITY
FACULTY OF COMPUTERS AND INFORMATION

First Year (First Semester)

Introduction to Computers

LECTURE ONE

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Introduction to Computers

What is a Computer?

- Computer
  - Device capable of performing computations and making logical decisions
  - Computers process data under the control of sets of instructions called computer programs
  - A computer is a machine that manipulates data according to a list of instructions.
  - A computer can also be defined as an electronic machine that accepts input (data), processes it and gives out results (information)

What is a Computer?

- Hardware
  - Various devices comprising a computer
    - Keyboard, screen, mouse, disks, memory, CD-ROM, and processing units
- Software
  - Programs that run on a computer
- **Data and Information**
  - Computers process data into information.
  - **Data (**data is plural for datum**) is a collection of unprocessed items,** which can include text, numbers, images, audio, and video.
  - **Information conveys meaning and is useful to** people.

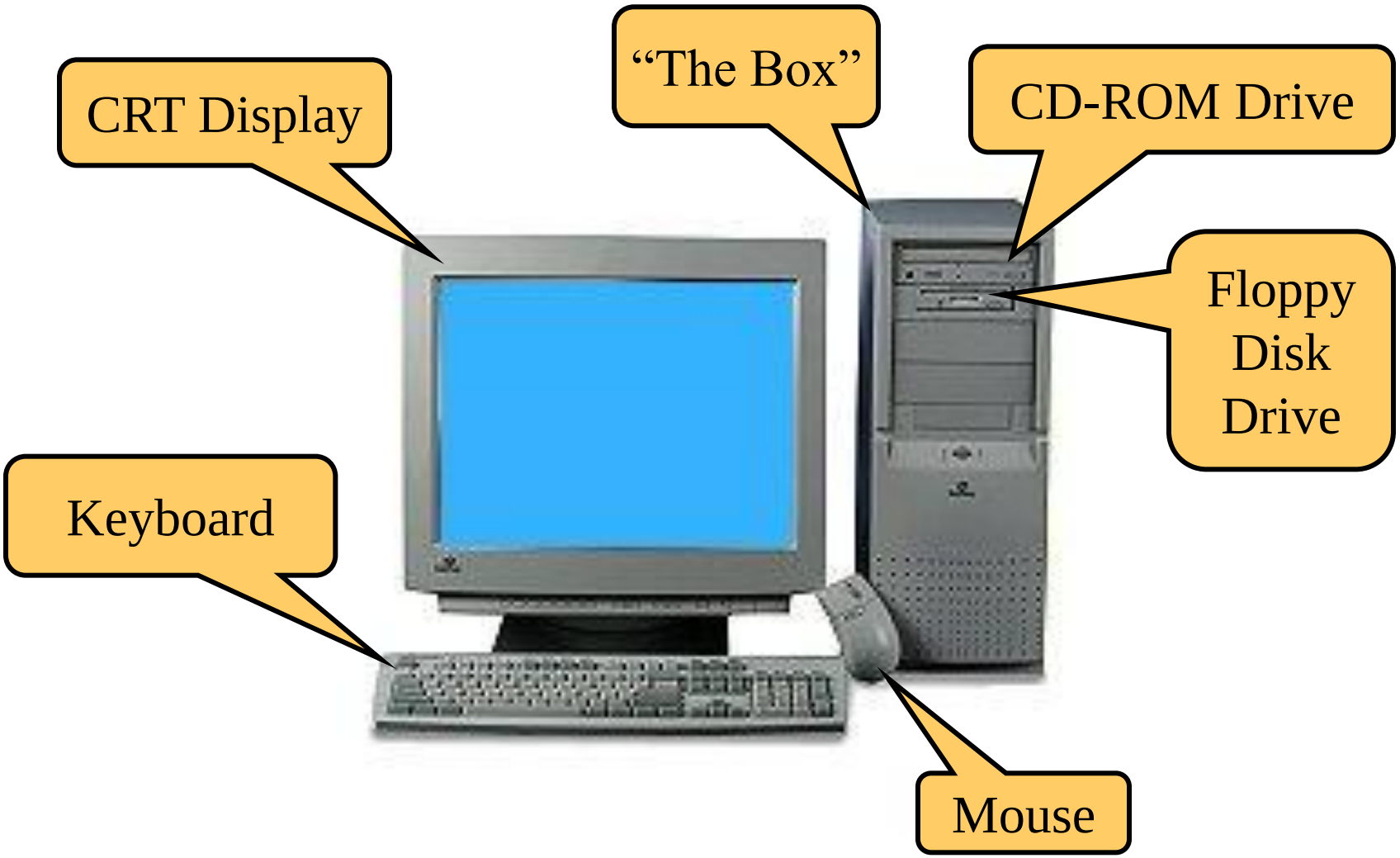
COMPUTER

A computer is a programmable machine. The two principal characteristics of a computer are:

- It responds to a specific set of instructions in a well-defined manner.
- It can **execute** a prerecorded list of instructions (a program).

- Modem computers are **electronic and digital**.
  - The actual machinery –wires, translators, and circuits - is called **hardware**;
  - the instructions and data are called **software**.

COMPUTER

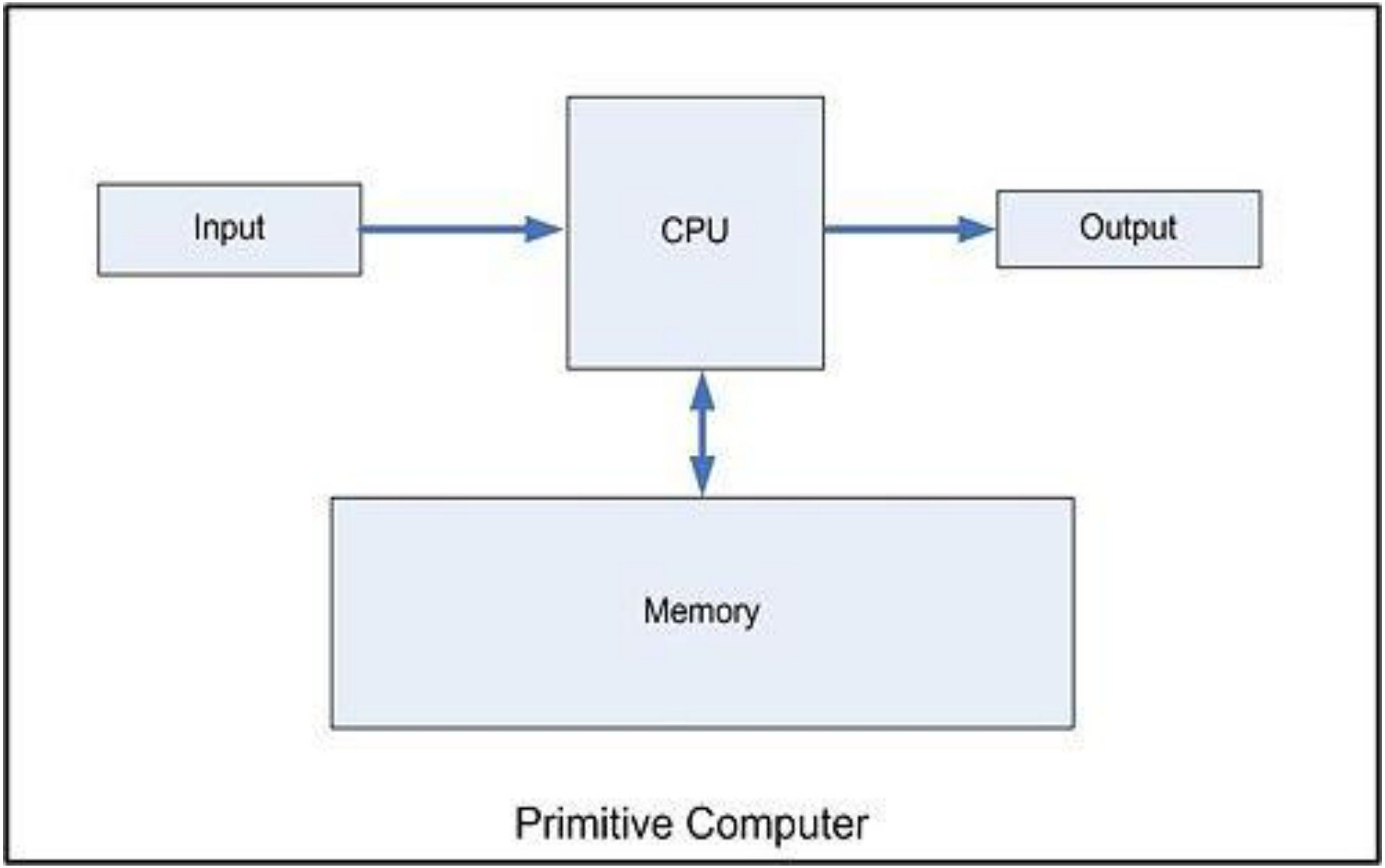

CRT Display
“The Box”
CD-ROM Drive
Floppy Disk Drive
Keyboard
Mouse

Computers, Memory, and Input/Output

- A basic computer consists of **three major components**: CPU (Central Processing Unit), I/O (Input/Output), and Memory
  - Data comes through Input and the CPU processes the data based on a program which is in Memory. The result is returned to Memory or is presented to the user.
  - CPU itself consists of Arithmetic and Logic Unit (ALU), Control Unit (CU) and Registers.

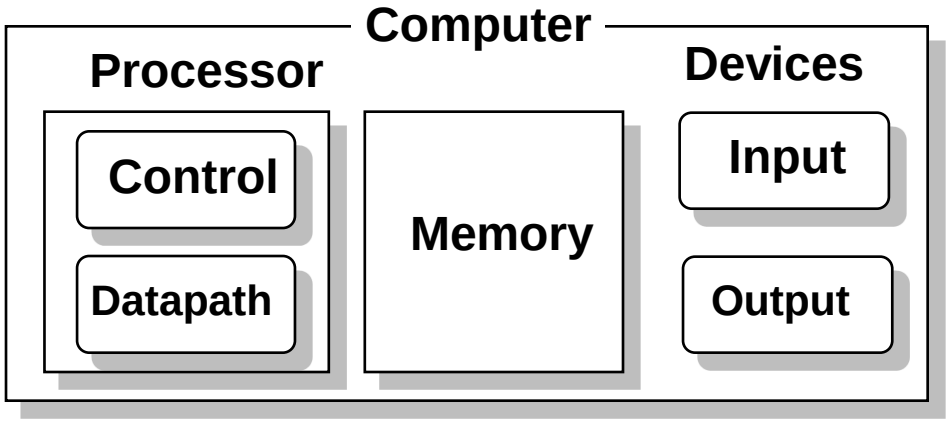
- In addition to these components, many others make it possible for the **basic** components of a computer to work together efficiently.
- For example, every computer requires *a* **bus** that transmits data from one part of the computer to another.

Computers, Memory, and Input/Output



Five Classic Components

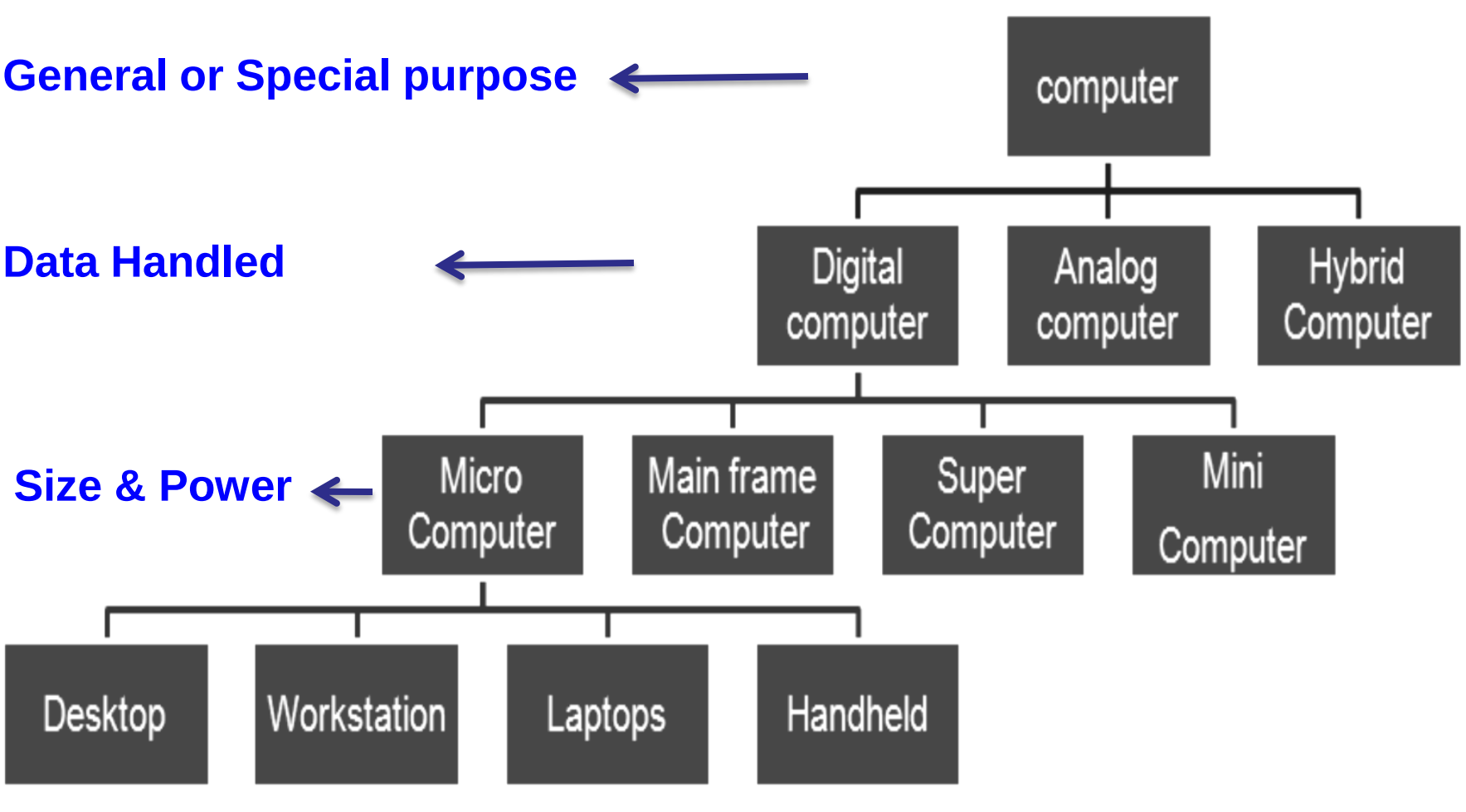
- Since the 1940's, computers have 5 classic components
- Input devices
  - Keyboard, mouse, …
- Output devices
  - Display, printer, …
- Storage devices
  - Volatile memory devices: DRAM, SRAM, …
  - Permanent storage devices: Magnetic, Optical, and Flash disks, …
- Datapath
- Control



Together, they are called the Processor

- Newly 6th component: Network
  - Essential component for communication in any computer system

TYPES OF COMPUTERS



TYPES OF COMPUTERS

Computers can be classified by their **size** and **power** as follows:

- **Personal Computer**
  - A small, single-user computer based on a microprocessor.
  - In addition to the microprocessor, a personal computer has a- keyboard for **entering** data, a monitor for displaying information, and a storage device for saving data.
- **Workstation**
  - A powerful, single-user computer.
  - A workstation is like a personal computer, but it has a more powerful microprocessor and a higher-quality monitor.

TYPES OF COMPUTERS

Computers can be classified by their size and power as follows:

- ***Minicomputer*** A multi-user computer capable of supporting 10 to hundreds **of users** simultaneously.
- ***Mainframe*** *A* powerful multi-user computer capable of supporting many hundreds of users simultaneously.
- **Supercomputer** An extremely fast computer that can perform hundreds of millions of instructions per Second.

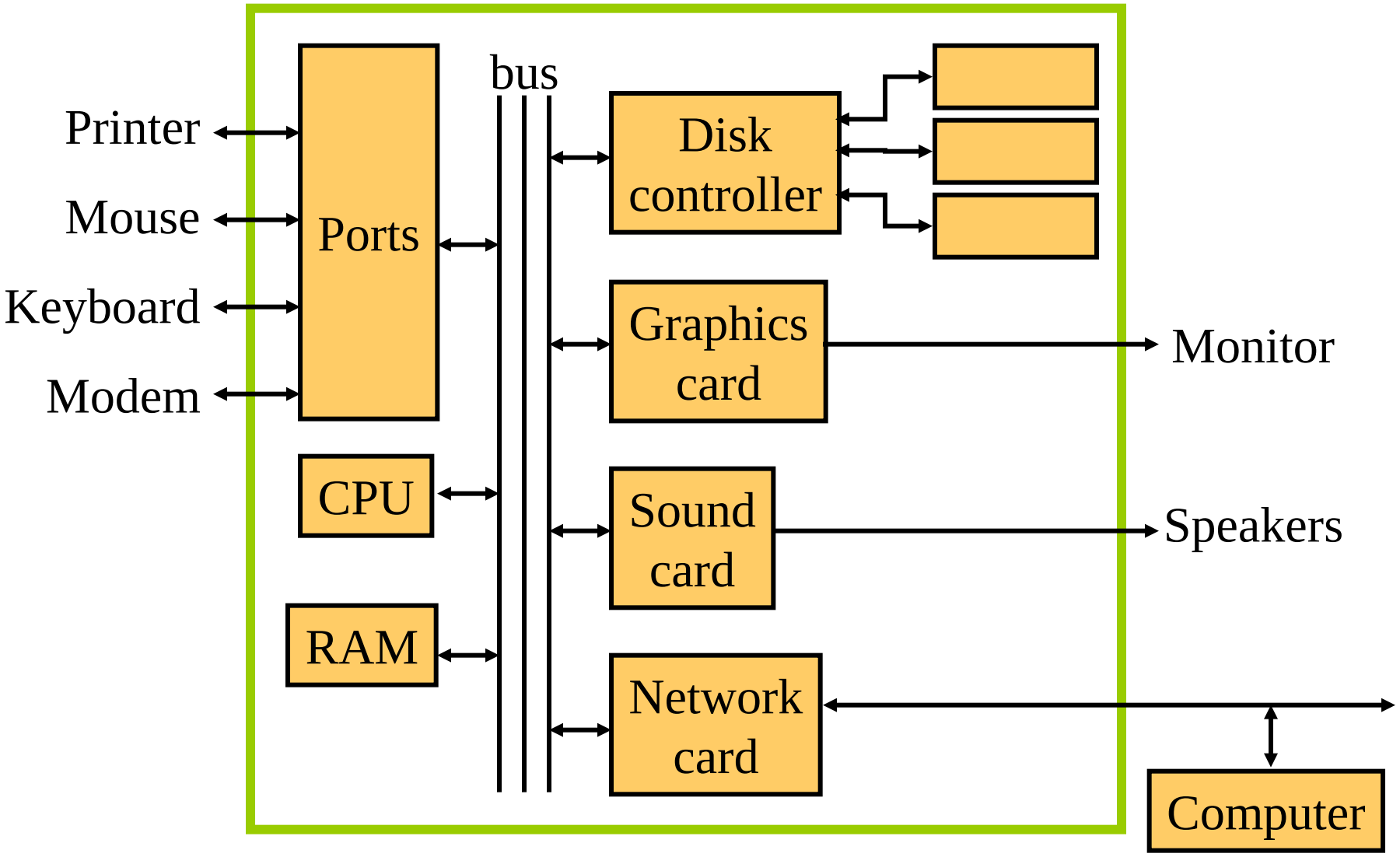
MICROCOMPUTERS

- The most familiar kind of computer is the microcomputer.
- In the past, microcomputers have been considered to be of two types:
  - Personal Computers
  - Workstations.

Personal Computers (PCs)

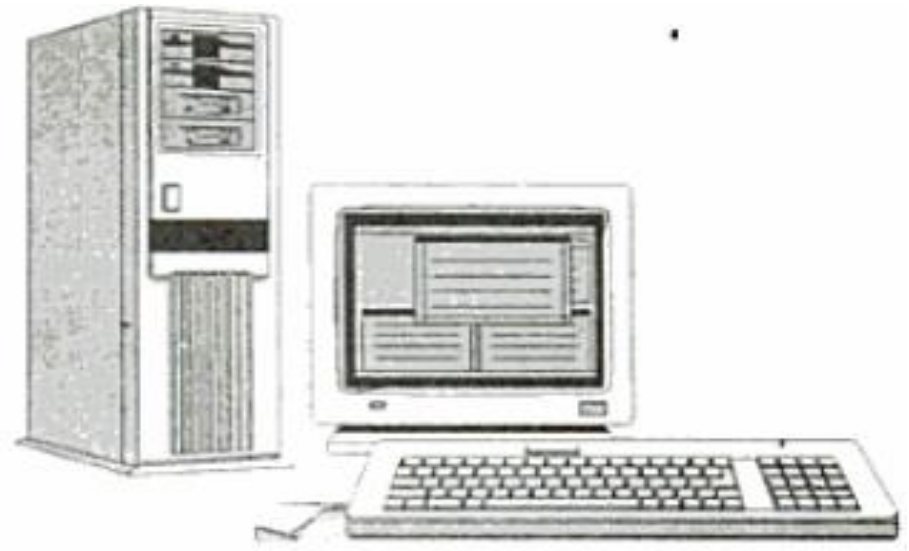
- PCs were desktop or portable machines.
- These machines ran comparatively easy-to-use applications software such as the word processors, spreadsheets, etc.
- They were usually easier to use and more affordable than workstations.

Personal Computer



WORKSTATIONS

- They are Expensive, powerful machines used by engineers, scientists, and other professionals who processed a lot of data.
- People who need to run complex programs and display both work in progress and results graphically also use workstations.



Portable Computers

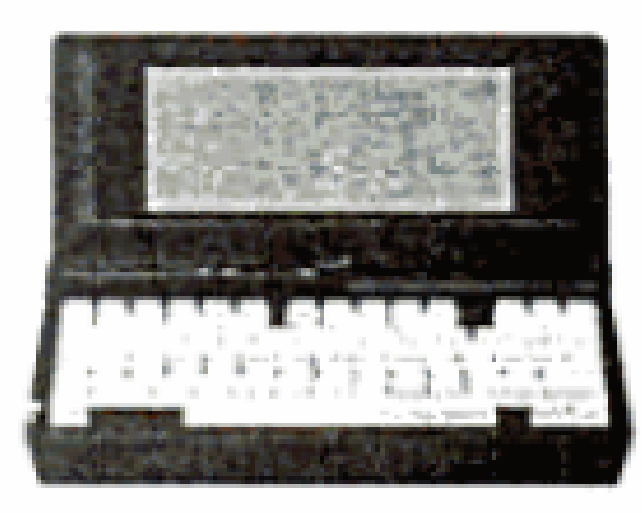
- Computers are becoming smaller yet more powerful.
- One type of PC that is rapidly growing in popularity is the portable computer, which can be easily carried around.
- There are categories of portable computers:
  - Laptops or Notebook PCs,
  - Subnotebooks
  - Personal Digital Assistants.
  - …

Laptops/Notebooks Laptops

- **Laptops/Notebooks**
  - Laptops may be either AC-powered, battery-powered, or both.
  - These computers are ideal for users who have to work away from their offices.

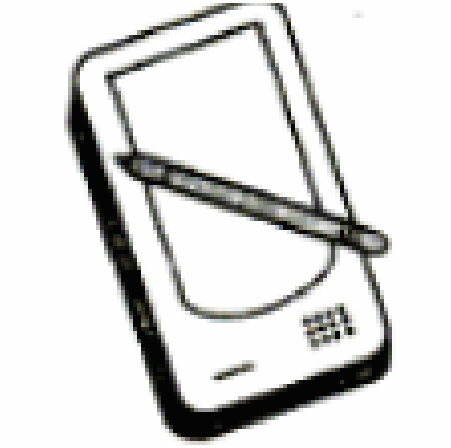
Subnotebooks

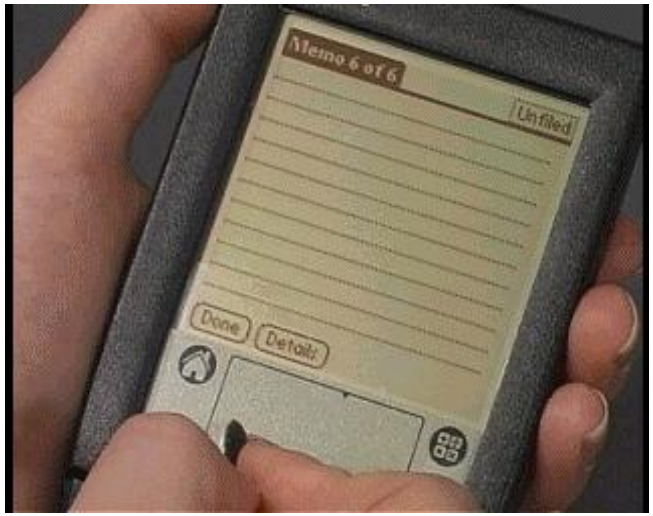
- Subnotebooks are for frequent flyers and life-on-the-road professionals.
  - Subnotebook users give up a full display screen and keyboard in exchange for less weight.
  - These computers fit easily into any briefcase.



Personal Digital Assistants (PDAs)

- PDAs are much smaller than the subnoteboohs.
- They combine pen inputs writing recognition, personal organizational tools, and communication capabilities in a very small package.
- Typical users are executives, businessmen, etc, who use these machines for their day-to-day activities — scheduling organization





Smart Phone

- **It Offering the convenience of** one-handed operation, a **smart phone is an Internet enabled** phone that usually also provides PDA capabilities.
- In addition to basic phone capabilities, a smart phone allows you to send and receive e-mail messages and access the Web

Wearable Computers

- **Wearable Computers**: These computers can be worn on the body and are often used in the study of behavior modeling and human health.
- Military and health professionals have incorporated wearable computers into their daily routine, as a part of such studies. When the users' hands and sensory organs are engaged in other activities, wearable computers are of great help in tracking human actions. Wearable computers do not have to be turned on and off and remain in operation without user intervention.

Tablets

- Tablets are mobile computers that are very handy to use. They use the touch screen technology.
- Tablets come with an onscreen keyboard or use a stylus or a digital pen. Apple's iPad redefined the class of tablets.

MINICOMPUTERS

- Minicomputers, mid range computers were first developed as special-purpose mainframe computers.
- They were used, for instance, to control machines in a manufacturing unit.
- However, now they are widely used as general-purpose computers.
- the more powerful minicomputer models are called superminis.
- One of the popular minicomputer systems is the VAX made by Digital Equipment Corporation.
- Minicomputers work well in what are known as **Distributed Data Processing (DDP).**
- The 12-bit PDP-8 minicomputer of the Digital Equipment Corporation was the first successful minicomputer.

MAINFRAMES

- Mainframe computers can process several million-program instructions per second. Large organizations rely on these room-size systems to handle large programs with lots of data,
- Mainframes are mainly used by insurance companies, banks, airline and railway reservation systems, etc. An advanced mainframe made by IBM is S/390.

SUPERCOMPUTERS

- Supercomputers are the fastest calculating devices ever Invented.
  - A desktop microcomputer processes data and instructions in millionths of a second or microseconds.
  - A supercomputer, by contrast, can operate at speeds measured in nanoseconds and even in picoseconds — one thousand to one million times as fast as microcomputers,
- Most supercomputers are used by government agencies. These machines are for applications requiring very large programs and huge amounts of data that must be processed quickly.
  - Examples of such task are weather forecasting, oil exploration, weapons research, and large-scale simulation.

Supercomputers

- The highly calculation-intensive tasks can be effectively performed by means of supercomputers. **Quantum physics, mechanics, weather forecasting, molecular theory** are best studied by means of supercomputers.
- Their ability of parallel processing and their well-designed memory hierarchy give the supercomputers, large transaction processing powers.

Network computers

- Network computers are computers with minimal memory, disk storage and processor power designed to connect to a network, especially the Internet.
- This is really a variation on:
  - diskless workstations
  - disk workstations
- Network computers take this idea one step further by also minimizing the amount of memory and processor power required by the workstation.

Servers

- **Servers**: They are computers designed to provide services to client machines in a computer network.
  - They have larger storage capacities and powerful processors.
  - Running on them are programs that serve client requests and allocate resources like memory and time to client machines.
  - They are very large in size, as they have large processors and many hard drives.
  - They are designed to be fail-safe and resistant to crash.

Embedded Computers

- An **embedded computer is a special-purpose computer that functions as a component in a larger** product.
- A variety of products contain embedded computers:
  - Consumer electronics
  - Home automation devices
  - Automobiles
  - Process controllers and robotics
  - Computer devices and office machines
- Because embedded computers are components in larger products, they usually are small and have limited hardware.
  - Embedded computers perform various functions, depending on the requirements of the product in which they reside.
  - Embedded computers in printers, ……

Characteristics of Computers

- **All** computers have certain common characteristics irrespective of their type and size.
- Computers are not just adding machines, they are capable of doing complex activities and operations.

Characteristics of Computers

- **Word Length**
  - A digital computer operates on binary digits - 0 and 1.
  - It can understand information only in terms of **0**s and **1**s. A binary digit is called a **bit**.
  - A group **of** 8 bits **is** called a **byte**.
  - The number of bits that a computer can **process at a time in parallel** is called its word length.
    - Commonly used word lengths are 8, 16, 32 or 64 bits- Word length is the measure of the computing power of a computer.

Characteristics of Computers

- **Speed**
  - Computers can calculate at very high speeds.
  - A microcomputer, for example, can execute millions of instructions per second over and over again without **any** mistake.
  - As the power of the computer increases, the speed also increases.

Characteristics of Computers

- **Storage**
  - Computers have their main memory and auxiliary memory systems. A computer **can** store a large amount of data.

- **Accuracy**
  - The accuracy of a computer system is very high.
  - Errors in hardware can occur, but error detecting and correcting techniques will prevent false results.
  - In most cases, the errors are due to the human factor rather than the technological flaws.

Characteristics of Computers

- **Automation**
  - The level of automation achieved in a computer is phenomenal.
- **Diligence**
  - Diligence means being constant and earnest in effort and application.
  - Human beings suffer from weakness like tiredness, lack of concentration, etc. Humans have feelings, they become sad, depressed, bored, and negligent and it will reflect on the work they do.

What Computers Can Do

- The computer is a truly amazing machine.
- Few tools let you do so many different tasks computers do.
- Whether you want to do stock market analysis, publish a newsletter, design a building or play games, you can do it with a computer

WHAT COMPUTERS CAN DO

- Businesses use computers for a variety of purposes ranging from decision-making to electronic commerce. Scientists and researchers use computers to develop theories, to collect and test data, to simulate test environments, and to exchange information electronically with colleagues around the world.
- In medicine today, computers are used for everything from diagnosing illnesses to monitoring patients during surgery and controlling permanent prostheses.
- Now, computers have found their way to classrooms and everyone from school children to research students use computers to work for their own intellectual benefit.
- **Musicians** and singers have teamed up with computers to create an amazing range of instruments and sounds simply try playing a keyboard. The musical instrument digital interface (MIDI) is a system that synchronizes hardware and software that produces electronic tones.

WHAT COMPUTERS CAN'T DO

- There is no doubt that computers are fulfilling their promise to perform certain tasks better, faster and cheaper.
- In terms of the analogy with the automobile industry, if the automobile industry had grown like the computer industry

ADVANTAGES OF USING COMPUTERS

- The benefits of computers are
  - speed,
  - reliability,
  - consistency,
  - storage, and
  - communications.

ADVANTAGES OF USING COMPUTERS

- **Speed:** When data, instructions, and information flow along electronic circuits in a computer, they travel at incredibly fast speeds.
- **Reliability:** The electronic components in modern computers are dependable and reliable because they rarely break or fail
- **Consistency:** Given the same input and processes, a computer will produce the same results

ADVANTAGES OF USING COMPUTERS

- **Storage:** Computers store enormous amounts of data and make this data available for processing anytime it is needed.

- **Communications:** Most computers today can communicate with other computers, often wirelessly.
  - Computers allow users to communicate with one another.

DISADVANTAGES OF USING COMPUTERS

Some disadvantages of computers relate to

- the violation of privacy,
- Public safety,
- the impact on the labor force,
- health risks, and
- the impact on the environment.

DISADVANTAGES OF USING COMPUTERS

- **Violation of Privacy:** In many instances, where personal and confidential records were not protected properly, individuals have found their privacy violated and identities stolen.
- **Public Safety**: Adults, teens, and children around the world are using computers to share publicly their photos, videos, journals, music, and other personal information.
  - Some of these unsuspecting, innocent computer users have fallen victim to crimes committed by dangerous strangers.

DISADVANTAGES OF USING COMPUTERS

- **Impact on Labor Force:** Although computers have improved productivity and created an entire industry with hundreds of thousands of new jobs, the skills of millions of employees have been replaced by computers.
  - Thus, it is crucial that workers keep their education up-to-date.
  - A separate impact on the labor force is that some companies are outsourcing jobs to foreign countries instead of keeping their homeland labor force employed.

DISADVANTAGES OF USING COMPUTERS

- **Health Risks:** Prolonged or improper computer use can lead to health injuries or disorders.
- Computer users can protect themselves from health risks through proper workplace design, good posture while at the computer, and appropriately spaced work breaks. Another health risk, called computer addiction.

DISADVANTAGES OF USING COMPUTERS

- **Impact on Environment:** Computer manufacturing processes and computer waste are depleting natural resources and polluting the environment.
  - Strategies that can help protect the environment include recycling, regulating manufacturing processes, extending the life of computers, and immediately donating replaced computers.