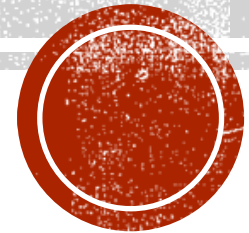# CSC 101/CSC 111 – INTRODUCTION TO COMPUTER SCIENCE (3 UNITS) LECTURE 2

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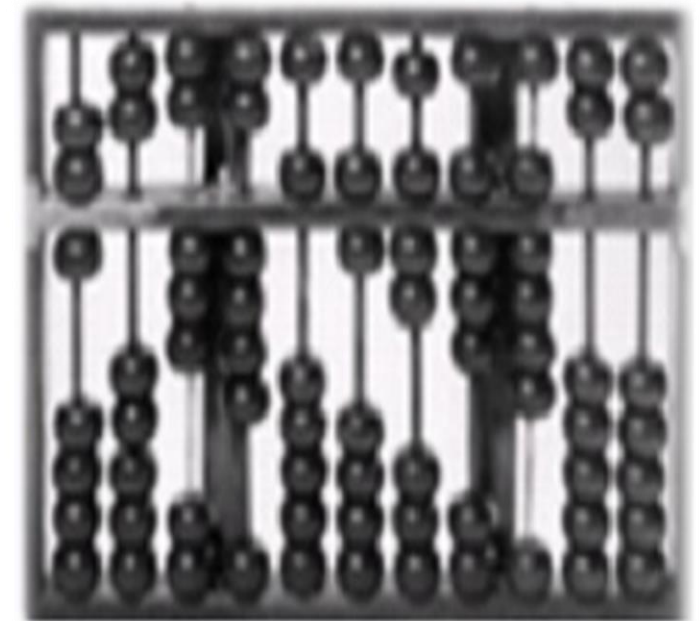MOUNTAIN TOP UNIVERSITY, OGUN STATE, NIGERIA

COURSE OUTLINE

- Definition of Computer

- History and Overview of Computing and Computers

- Evolution of Ideas and Machines from Mechanical Computer to Multimedia Computer

- Introduction to computing system
  - Basic elements of a computer system hardware
  - Block diagram, data/instruction flow, control flow

- Software types, packages and applications

- Characteristics of computer

- Problem solving using flowcharts and algorithms

- Data representation in computer system

- Communications and networks
  - World wide web, network access, network architectures, data communications. Safety and security

- File management in Windows and basic word processors, spreadsheets, presentation, graphics and other applications

- Introduction to programming:
  - Statements, symbolic names, arrays, expressions and control statements
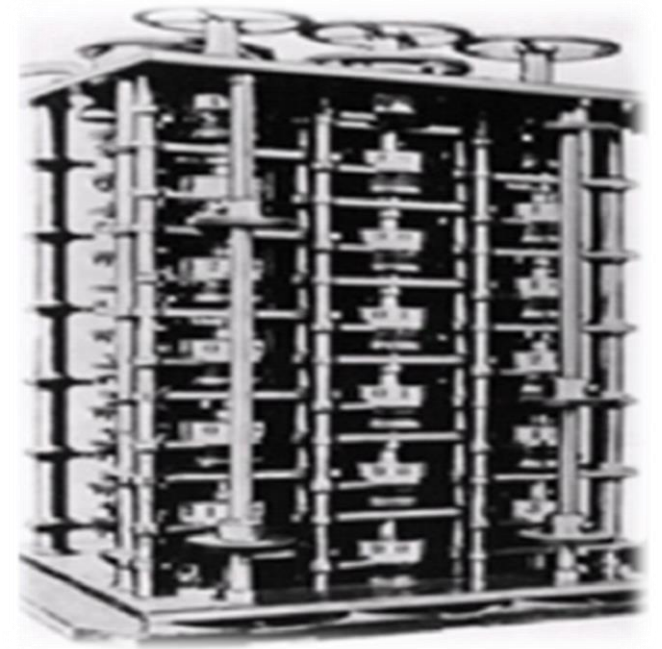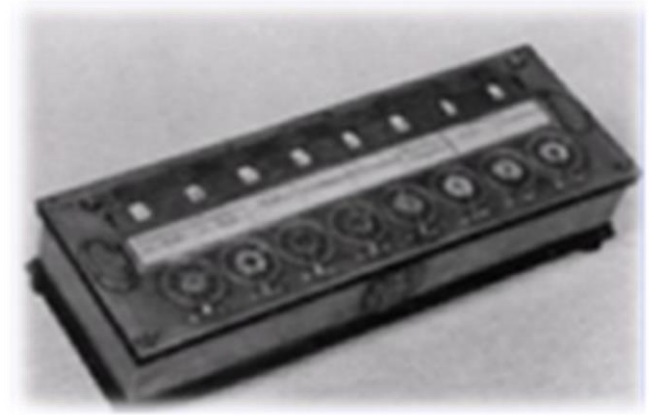
HISTORY OF THE COMPUTER HARDWARE

- The term computer dates back to the 1600s. However, until the 1950s, the term referred almost exclusively to a human who performed computations.
  - For human beings, the task of performing large amounts of computation is one that is laborious, time consuming, and error prone.
  - Thus, the human desire to mechanize arithmetic is an ancient one.

- One of the earliest devices developed for simplifying human arithmetic was the abacus already in use in ancient Mesopotamia, Asian, Indian, Persian, Greco-Roman, and Mezo-American societies and still in use today in many parts of the world.

- Comprised of an organized collection of beads or stones moved along rods or in grooves.
  - an abacus is, like the modern computer, a —digital arithmetic machine.
    - in that its operations mimic the changes in digits that occur when humans do basic arithmetic calculations.
    - However, not all of these abacus systems used decimal – base-10 – numerals; some of these societies used base-16, base-20, or base-60 numeral systems.

HISTORY OF THE COMPUTER HARDWARE...

- The young French mathematician **Blaise Pascal** (1623-1662) invented one of the first gear-based adding machines to help with the enormous amount of calculations involved in the computing of taxes.

- Operationally, the decimal version of the —Pascaline‖ had much in common with a genre of calculators that were commonly used by grocery store shoppers in the U.S. and elsewhere during the 1950s and 1960s.

- In 1822, English mathematician Charles Babbage (1792-1871) unveiled the first phase of his envisioned —Difference Engine‖ which also used ten-position gears to represent decimal digits.

- It was capable of performing more complex calculations than the basic arithmetic of an adding machine like the Pascaline.

- However, the engineering of the Difference Engine became so complicated that, for this and other reasons, Babbage abandoned the project.

- There are two main difficulties here, illustrating two key concepts in computing.
  - First, these devices were —mechanical – i.e., they were devices that required physically moving and interconnected parts.
  - Such a device is almost certain to be slower, more prone to failure, and more difficult to manufacture than a device that has no moving parts.

- In contrast, —electronical devices such as vacuum tubes of the sort used in early radios have, by definition, no moving parts.

- Thus, one of the earliest *electronic* digital computers, the ENIAC was created.
  - It represented each decimal digit not with a 10-state *mechanical* device like a gear but, rather, with a column of 10 **vacuum tubes.**
  - The tubes could electronically turn on and off to represent the 0-9 counting sequence of a decimal digit without requiring any physical movement.

HISTORY OF THE COMPUTER HARDWARE…

- The ENIAC was engineered by **J. Presper Eckert** and **John Mauchly** at the University of Pennsylvania from 1943 to 1946.
  - The 30-ton ENIAC required 18,000 vacuum tubes, consuming enormous amounts of electrical power for its day.
  - This is largely because ENIAC required 10 vacuum tubes to represent each decimal digit.

- In contrast, the *first* electronic digital computer developed by **John Atanasoff** and **Clifford Berry** at Iowa State University from 1937-1942, like all electronic digital computers today, used a *binary* – i.e., Base-2 numeral system.
  - Decimal digits are based on powers of 10, where every digit one moves to the left represents another power of 10: ones (100), tens (101), hundreds (102), thousands (103), etc.
  - Thus, the decimal number ―**two hundred fifty-five**‖ is written as ―**255**,‖ conceiving of it arithmetically as the sum of **2** hundreds, **5** tens, and **5** ones.
  - Thus, to store this number, ENIAC would only have to turn on 3 vacuum tubes, but there are still a total of 30 vacuum tubes required just to represent all of the possibilities of these three digits.

HISTORY OF THE COMPUTER HARDWARE...

- On the other hand, **binary digits** – also known as —**bits** -- are based on powers of **2**, where every digit one moves to the left represents another power of 2:
  - ones (2^0), twos (2^1), fours (2^2), eights (2^3), sixteens (2^4), etc.

- Thus, in binary, the number **eighteen** would be written in Base-2 as **10010**, understood arithmetically as the sum of **1** sixteen, **0** eights, **0** fours, **1** two, and **0** ones:

1	0	0	1	0
sixteens	eights	fours	two	ones

- Likewise, the number —**two-hundred fifty-five** would be written in binary numerals as **11111111**, conceived arithmetically as the sum of **1** one-hundred twenty eight, **1** sixty-four, **1** thirty-two, **1** sixteen, **1** eight, **1** four, **1** two, and **1** one :

1	1	1	1	1	1	1	1
one hundred twenty-eights	sixty-fours	thirty-twos	sixteens	eights	fours	two	ones

- Why on earth would computer engineers choose to build a machine to do arithmetic using such a cryptic, unfamiliar form of writing numbers as a binary, Base-Two numeral scheme?
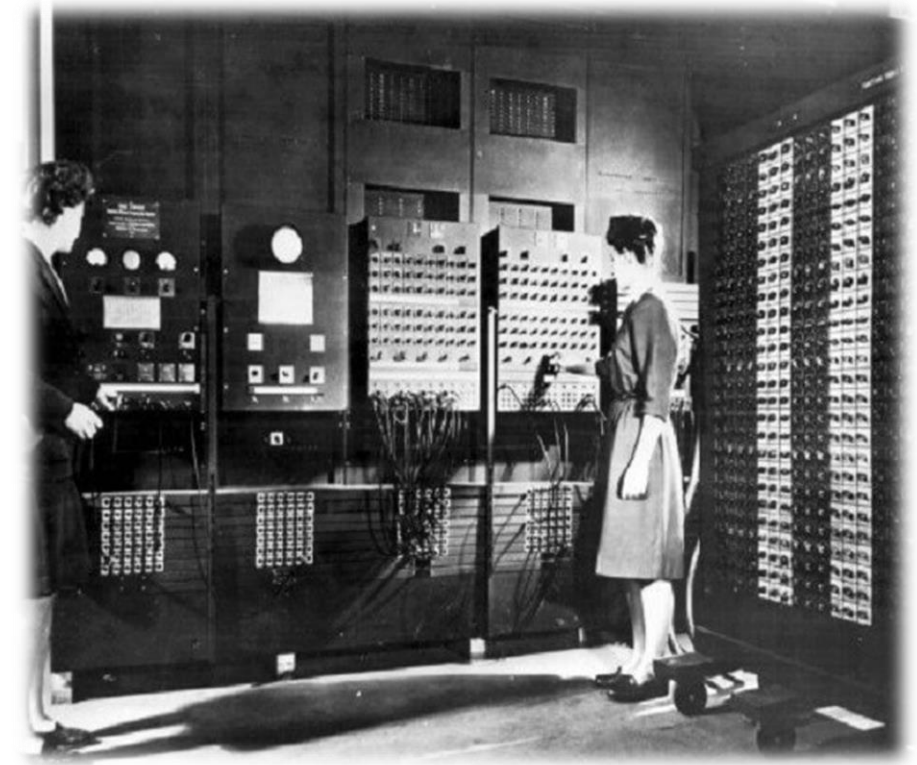
- In any digital numeral system, each digit must be able to count up to **one less than** the base.
  - Thus, in the case of the Base-10 system, counting sequence of each decimal digit runs from **0** up to **9**, and then back to 0.
  - To represent a decimal digit, then, one must be able to account for all 10 possibilities in the counting sequence, 0 through 9.
  - So one must either use a device with ten possible states, like the ten-position gear used in the Pascaline, or ten separate devices, like the ten separate vacuum tubes used for each digit in the ENIAC.

- However, the binary numeral system is Base-2.
  - Thus, given that its digits also need only to be able to count as high as one less than the base, this means that the counting sequence of each binary digit runs from **0** only up to **1**, and then back again to 0 already.
  - In other words, whereas ten different numbers can appear in a decimal digit, 0 through 9, the only number that will ever appear in a binary digit is a **0** or a **1**.
  - Thus, rather than having to account for the 10 possibilities of a decimal digit, one can represent a binary digit with only a single device that has two possible states.
  - For example, one could represent each binary digit with a simple on/off switch, where the —**on** position represents a **1** and the —**off**" position represents a **0**:

eights   fours   twos   ones
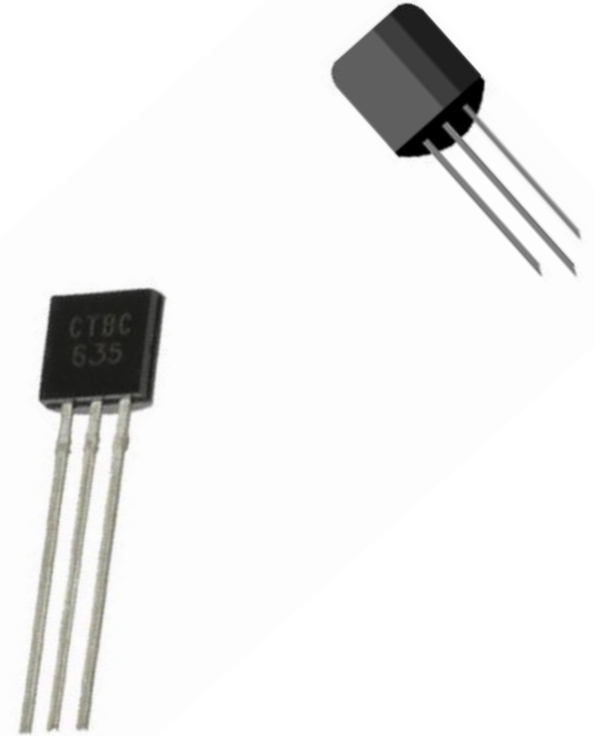
GENERATIONS OF COMPUTER — 1G

- These computers were created between the years 1940 to 1956.

- The first generation of the computer used vacuum tubes for the circuitry and the magnetic drums for the memory and taking up the big rooms.

- It was very expensive to operate and uses a great amount of electricity and produced a large amount of heat.

- It relied on the machine language, the lowest level programming language which was understood by the computers to perform the various functions and operations.

- It can only solve one problem at a time and can't do multitasking work.

- The input was based on the punched cards and the paper tape and the output was displayed on the printouts.

- ENIAC and UNIVAC are examples of the first generation of the computer.

- The first commercial computer was UNIVAC which was delivered to the business client.

- These computers were created between the years 1956 to 1963

- Transistors were used in the second generation of the computer and transistors replaced the vacuum tubes.
  - The first transistor was invented in 1947 but didn't find use in the computer till 1950.

- Transistors are superior to the vacuum tube because computers became smaller, cheaper and faster.
  - However, transistors produced large amount of heat that subjected the computer to damage.

- The input was based on the punched cards and paper tapes and outputs were displayed on the printouts which were the same as the first generation of computer.

- It moved to the symbolic or assembly language from the cryptic binary machine language.
  - This language allowed the programmers to specify the input or instructions in words.
  - High-level programming languages were also developed at the same time.
  - The first computer of the second generation was developed for the atomic energy industry.
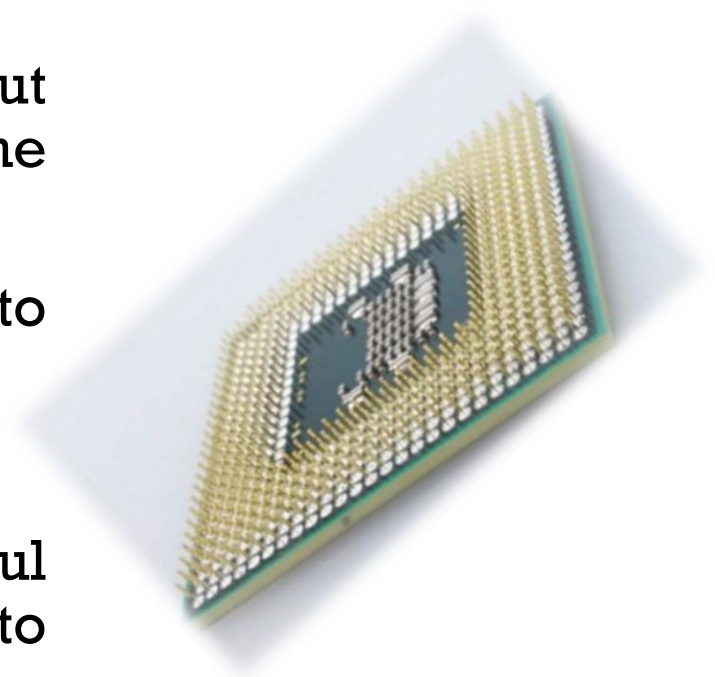
GENERATIONS OF COMPUTER – 3G

- These computers were created between the years 1964 to 1971

- The integrated circuits were used in the third generation of the computer.

- Transistors were placed on the silicon chips known as semiconductors which increases the speed and efficiency of the computer drastically.

- Users could use keyboards and monitors to interface with an OS (operating system) instead of directly with punched cards and printouts.

- The computer could run many applications at one time (multi-tasking).

- Computers were smaller, cheaper and more reliable than its predecessors.

GENERATIONS OF COMPUTER – 4G

- These computers were created between the years 1971 to 2010

- The microprocessor brought in the fourth generation of computers.

- Thousands of the integrated circuits (ICs) were built on the single silicon chip.

- The first generation of computer occupied an entire room but the fourth generation of computer could fit into the palm of the hand.

- In 1971 Intel 4004 chips were developed which was located to all the components of the computer.

- IBM introduced its first computer for home users in 1981.

- The fourth generation of the computer became more powerful and could be linked together to form the networks which led to internet development.

- In the fourth generation of computer, we saw the development of the GUIs, keyboard, mouse and other hand handled devices.

GENERATIONS OF COMPUTER – 5G

- These computers were created between the years 2010 till present.
  - The fifth generation of the computer is based on artificial intelligence and is still in development.
  - Computer devices with artificial intelligence are still in development, but some of these technologies are beginning to emerge and be used such as voice recognition.

- There are many applications which are used in this generation like voice recognition which is being used today.
  - The use of superconductors and parallel processing helps to make the AI a reality.
  - Leaning to the future, computers will be radically transformed again by quantum computation, molecular and nano technology.

- The goal or target of this generation is to develop the devices that respond to natural languages.
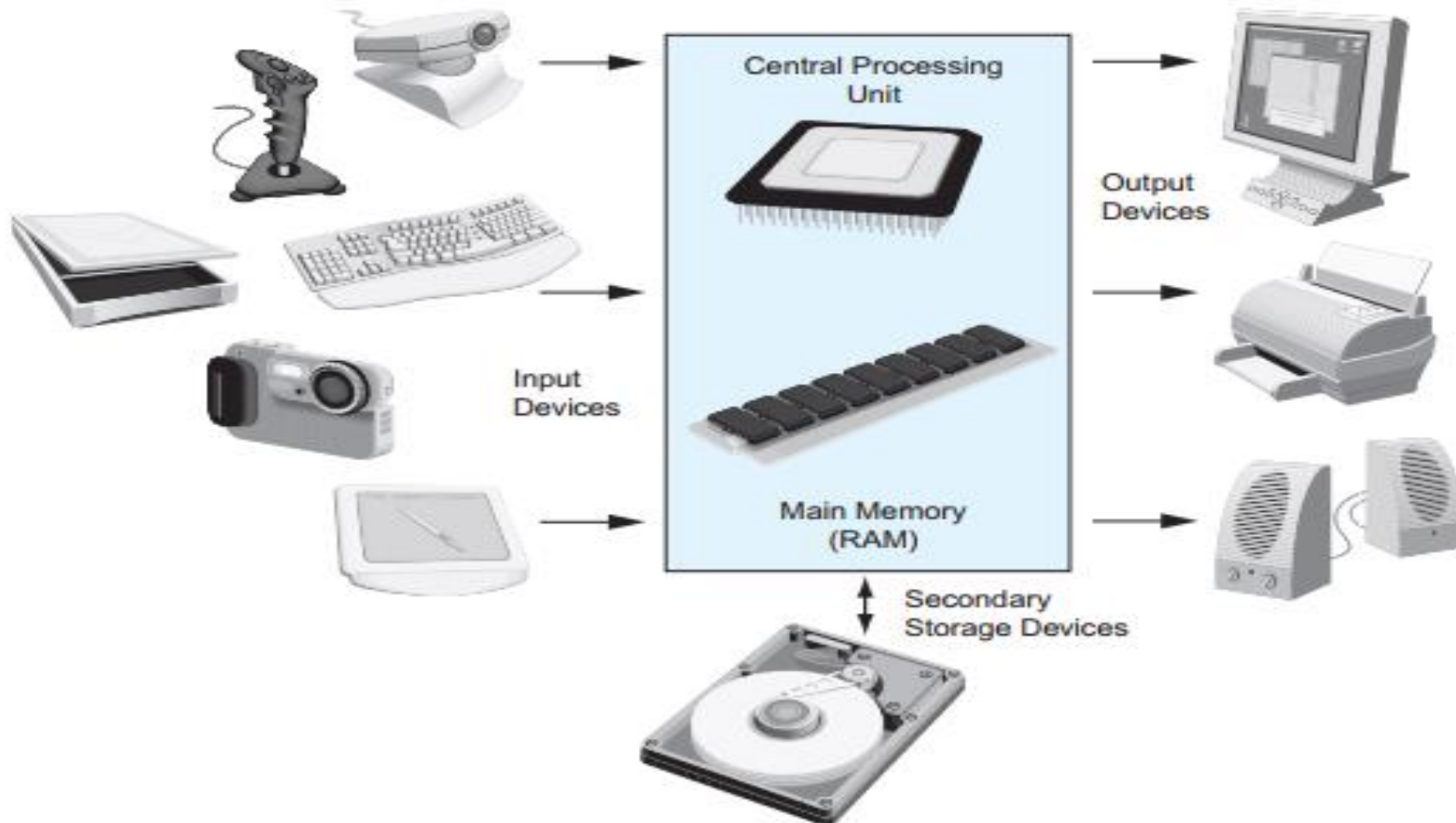
COMPONENTS OF COMPUTER - HARDWARE

- The term hardware refers to all of the physical devices, or components, that a computer is made of.
  - A computer is not one single device, but a system of devices that all work together. Like the different instruments in a symphony orchestra, each device in a computer plays its own part.

- If you have ever shopped for a computer, you've probably seen sales literature listing components such as microprocessors, memory, disk drives, video displays, graphics cards, and so on.

- A typical computer system consists of the following major components:
  - The central processing unit (CPU)
  - Main memory
  - Secondary storage devices
  - Input devices
  - Output devices

COMPONENTS OF COMPUTER – HARDWARE..

COMPONENTS OF COMPUTER – HARDWARE
THE CPU

- When a computer is performing the tasks that a program tells it to do, we say that the computer is running or executing the program.
  - The central processing unit, or CPU, is the part of a computer that actually runs programs.
  - The CPU is the most important component in a computer because without it, the computer could not run software.

- In the earliest computers, CPUs were huge devices made of electrical and mechanical components such as vacuum tubes and switches.
  - The ENIAC, which is considered by many to be the world's first programmable electronic computer, was built in 1945 to calculate artillery ballistic tables for the U.S. Army. This machine, which was primarily one big CPU, was 8 feet tall, 100 feet long, and weighed 30 tons.

- Today, CPUs are small chips known as microprocessors.
  - In addition to being much smaller than the old electromechanical CPUs in early computers, microprocessors are also much more powerful.

COMPONENTS OF COMPUTER – HARDWARE
THE RAM (MAIN MEMORY)

- You can think of main memory as the computer's work area.
  - This is where the computer stores a program while the program is running, as well as the data that the program is working with.
  - For example, suppose you are using a word processing program to write an essay for one of your classes.
  - While you do this, both the word processing program and the essay are stored in main memory.

- Main memory is commonly known as random-access memory, or RAM.
  - It is called this because the CPU is able to quickly access data stored at any random location in RAM.
  - RAM is usually a volatile type of memory that is used only for temporary storage while a program is running.
  - When the computer is turned off, the contents of RAM are erased.
  - Inside your computer, RAM is stored in chips.

COMPONENTS OF COMPUTER – HARDWARE
SECONDARY STORAGE DEVICES

- Secondary storage is a type of memory that can hold data for long periods of time, even when there is no power to the computer.
  - Programs are normally stored in secondary memory and loaded into main memory as needed. Important data, such as word processing documents, payroll data, and inventory records, is saved to secondary storage as well.

- The most common type of secondary storage device is the disk drive.
  - A disk drive stores data by magnetically encoding it onto a circular disk.
  - Most computers have a disk drive mounted inside their case.
  - External disk drives, which connect to one of the computer's communication ports, are also available.
  - External disk drives can be used to create backup copies of important data or to move data to another computer.

- USB drives are small devices that plug into the computer's USB (universal serial bus) port, and appear to the system as a disk drive.
  - These drives do not actually contain a disk.
  - They store data in a special type of memory known as flash memory.
  - USB drives, which are also known as memory sticks and flash drives, are inexpensive, reliable, and small enough to be carried in your pocket

COMPONENTS OF COMPUTER – HARDWARE
I/O DEVICES

- Input Devices
  - Input is any data the computer collects from people and from other devices.
  - The component that collects the data and sends it to the computer is called an input device.
  - Common input devices are the keyboard, mouse, scanner, microphone, and digital camera.
  - Disk drives and optical drives can also be considered input devices because programs and data are retrieved from them and loaded into the computer's memory.

- Output Devices
  - Output is any data the computer produces for people or for other devices.
  - It might be a sales report, a list of names, or a graphic image.
  - The data is sent to an output device, which formats and presents it.
  - Common output devices are video displays and printers. Disk drives and CD recorders can also be considered output devices because the system sends data to them in order to be saved.

COMPONENTS OF COMPUTER – SOFTWARE

- Software
  - If a computer is to function, software is not optional.
  - Everything that a computer does, from the time you turn the power switch on until you shut the system down, is under the control of software.
  - There are two general categories of software: system software and application software.

- System Software
  - *An operating system* is the most fundamental set of programs on a computer. The operating system controls the internal operations of the computer's hardware, manages all of the devices connected to the computer, allows data to be saved to and retrieved from storage devices, and allows other programs to run on the computer.
  - *Utility Programs* performs a specialized task that enhances the computer's operation or safeguards data. Examples of utility programs are virus scanners, file compression programs, and data backup programs.
  - *Software Development Tools* are the programs that programmers use to create, modify, and test software. Assemblers, compilers, and interpreters are examples of programs that fall into this category.