

Unit 6

The Ins and Outs of a Computer

What's Inside a Computer?

Computer Components

Unit 6

The Ins and Outs of a Computer

INPUT AND OUTPUT DEVICES

Pre-reading Activities

In this unit, you will

- improve your understanding of the target technical words.
- learn about various supporting topic sentences (cause and effect) in writing.
- learn how to preview a reading comprehension passage through pre-reading questions to improve comprehension.
- be familiar with the input and output devices of a computer.

I. Target Academic Vocabulary

Check out the meanings and functions of the target academic words in a monolingual and bilingual dictionary.

Peripherals (n)

Interpret (v)

Implement (v)

Handwriting practice lines for the word "Implement". There are four sets of lines, each consisting of a solid top line, a dashed midline, and a solid bottom line.

Serial (adj)

Handwriting practice lines for the word "Serial". There are three sets of lines, each consisting of a solid top line, a dashed midline, and a solid bottom line.

Portion (n)

Handwriting practice lines for the word "Portion". There are three sets of lines, each consisting of a solid top line, a dashed midline, and a solid bottom line.

Equivalent (adj)

Handwriting practice lines for the word "Equivalent". There are three sets of lines, each consisting of a solid top line, a dashed midline, and a solid bottom line.

Resistive (adj)

Handwriting practice lines for the word "Resistive". There are three sets of lines, each consisting of a solid top line, a dashed midline, and a solid bottom line.

Emulate (v)

Handwriting practice lines for the word "Emulate". There are three sets of lines, each consisting of a solid top line, a dashed midline, and a solid bottom line.

II. Writing development

Cause and effect

A paragraph can be developed through a cause and effect situation. As you use a cause-effect method of development, it can be assumed that you are supporting your topic sentence by listing. There is always a causal relationship between a topic sentence and supporting sentences. In other words, supporting sentences become a list of either *effect* (what a certain situation has led to or has resulted in), or *causes* (reasons or explanations why something is the way it is, or why it happened the way it did).

Structural signals

Group 1. Sentence connectors: The purpose of these connectors is to join two complete grammatical sentences. A semicolon (;) comes before the sentence connector and a comma (,) comes after it.

A user touches the screen; **as a result**, a change in the electrical current appears.

;consequently,
; therefore,
; because of this,
; hence,

Group 2. Conjunctions: Unlike the group 1, the conjunctions, such as *so* and *for* are preceded by a comma (,). For example:

A user touches the screen, **so** a change in the electric current appears.

A change in the electric current appears, **for** a user touches the screen.

III. Pre-reading questions:

Read and respond to the questions below, and then discuss them in pair/group.

1.What do you think about the input and output devices in a computer?

2.What are the effects of having touch screens in high-tech devices?

3.Is a touch screen an input device or output one? Provide your reasons adequately.

IV. Reading comprehension passage

This passage discusses the input and output devices in a computer and describes adequately each of the devices along with examples.

INPUT AND OUTPUT DEVICES

The computer will be of no use unless it is able to communicate with the outside world. In simple terms, input devices bring information INTO the computer and output devices take information OUT of a computer system. These input/output devices are also known as peripherals since they surround the CPU and memory of a computer system.

In Computer engineering, the term I/O is used to describe any program, operation or device that transfers data to or from a computer and to or from a peripheral device. Every transfer is an output from one device and an input into another. Devices such as keyboard and mice are input-only devices while devices such as printers are output-only. A writable DVD device is both an input and an output. Some commonly used Input/Output devices are listed in the table below.

<i>Input Devices</i>	<i>Output Devices</i>
Keyboard	Monitor
Mouse	GPS (Global Positioning System)
Joystick	Printer
Scanner	Plotter
Light Pen	Speaker

Note that the designation of a device as either input or output depends on the perspective. Mouse and keyboard take physical movement as input that the human user outputs and convert it into signals that a computer can understand. The output from these devices is input for the computer. Similarly, printers and monitors take input signals that a computer outputs. They then convert these signals into representations that human users can see or read. For a human user, the process of reading or seeing these representations is receiving input. These interactions between computers and humans are studied in a field called a human-computer interaction.

In a computer architecture, the combination of the CPU and main memory is considered the brain of a computer, and from that point of view, any transfer of information from or to that combination, for example to or from a disk drive, is considered I/O. An I/O interface is required whenever the processor drives the I/O device. The interface must have a necessary logic to interpret the device address generated by the processor. Handshaking should be implemented by the interface using appropriate commands (like BUSY, READY, and WAIT), and the processor can communicate with an I/O device through the interface. If different data formats are being exchanged, the interface must be able to convert serial data to parallel form and vice-versa. There must be provision for generating interrupts and the corresponding numbers for further processing by the processor if required.

1. Addressing I/O devices

The CPU and its supporting circuitry provide either memory-mapped I/O or Port-mapped I/O. Memory mapped I/O is mapped into the same address space of main memory, and is accessed in the same way. Port-mapped I/O uses a separate, dedicated address space and is accessed via a dedicated set of microprocessor instructions. A computer that uses memory-mapped I/O accesses hardware by reading and writing to specific memory locations, using the same assembly language instructions that a computer would normally use to access memory. Port-mapped I/O requires the use of instructions, which are specifically designed to perform I/O operations.

If you use a microprocessor or microcontroller that does not support port-mapped I/O, then you have to use memory mapped I/O. Microprocessors that support port-mapped I/O include Intel x86 and compatible processors, and also the Zilog Z80 and Intel 8080. Microprocessors that do not support port-mapped I/O (and hence require the use of memory-mapped I/O) include the Motorola 6800 and the MOS Technology 6502.

The advantage of port-mapped I/O is that it makes for neater code and requires fewer external components to implement I/O. However, it adds to the complexity and pins count of the microprocessor itself. A number of I/O devices are introduced in the next section.

2. Keyboard

A 'keyboard' is a human interface device, which is represented as a layout of buttons. Each button, or key, can be used to either input a linguistic character to a computer, or to call upon a particular function of the computer. Traditional keyboards use spring-based buttons, though newer variations employ virtual keys, or even projected keyboards. Figure 1 shows a traditional computer keyboard. Computer keyboards have different portions, each of which contains keys for a specific task.

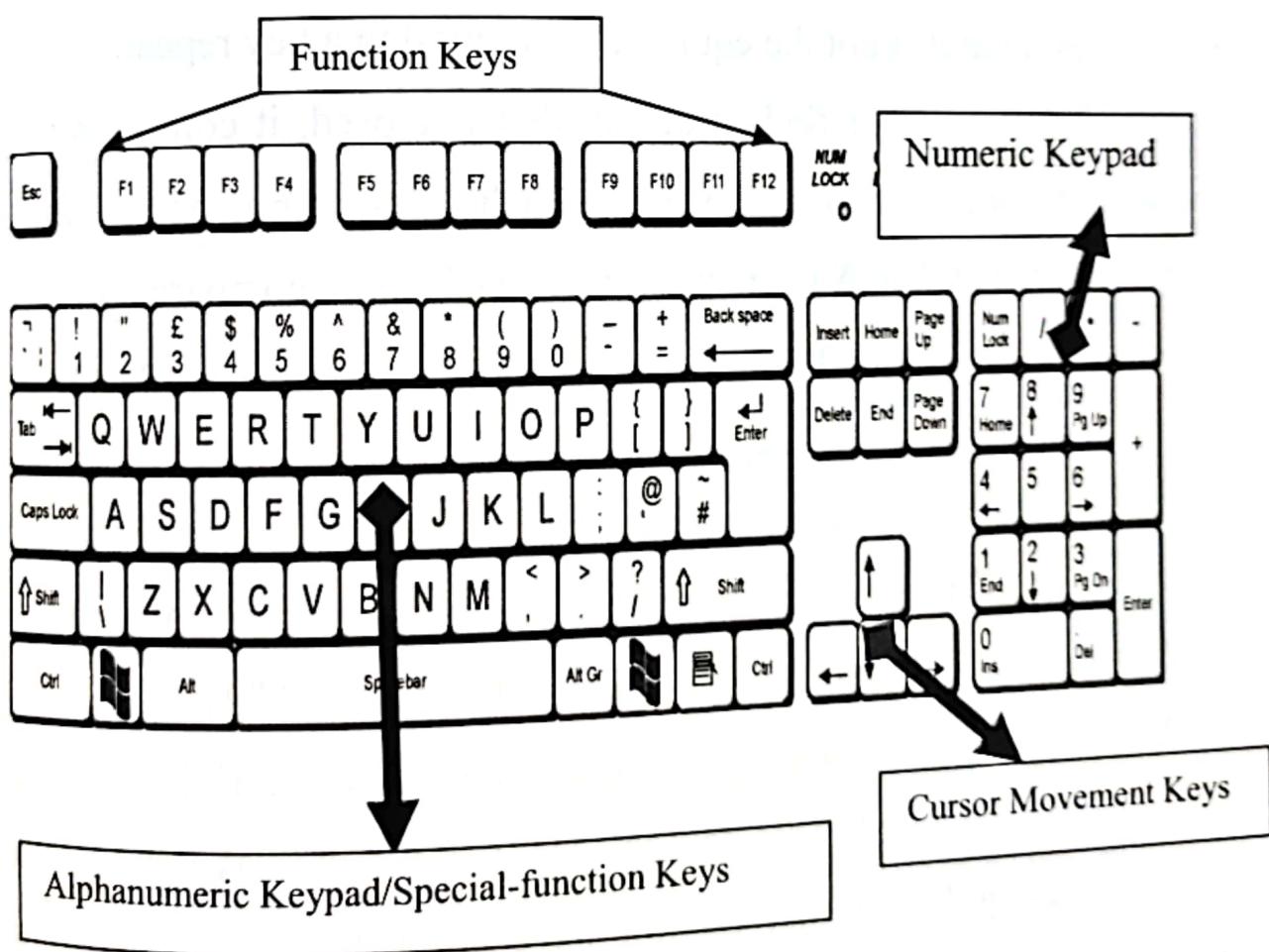


Figure 1: The Keyboard

2.1 Inside the Keyboard

A keyboard is a lot like a miniature computer. It has its own processor and circuitry that carries information to and from that processor. A large part of this circuitry makes up the key matrix. The key matrix is a grid of circuits underneath the keys. In all keyboards (except for capacitive models), each circuit is broken at a point below each key. When you press a key, it presses a switch, completing the circuit and allowing a tiny amount of current to flow through. The mechanical action of the switch causes some vibration, called bounce, which the processor filters out. If you press a key, the processor recognizes it but it is not the equivalent of pressing a key repeatedly.

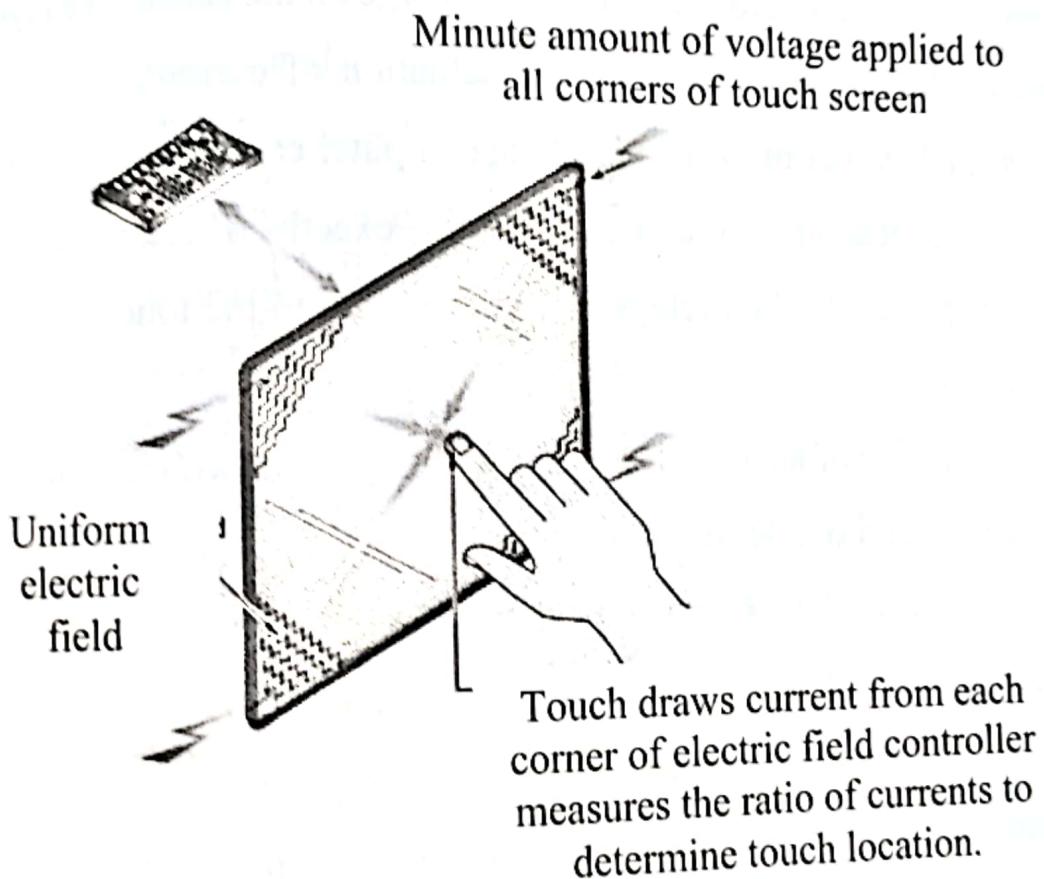
When the processor finds a circuit that is closed, it compares the location of that circuit on the key matrix to the character map in its read-only memory (ROM). A character map is basically a comparison chart or lookup table. It tells the processor the position of each key in the matrix and what each keystroke or combination of keystrokes represents. For example, the character map lets the processor know that pressing the "a" key by itself corresponds to a small letter "a", but the *Shift* and *a* key pressed together correspond to a capital "A."

A computer can also use separate character maps, overriding the one found in the keyboard. This can be useful if a person is typing in a language using letters that do not have English equivalents on a keyboard with English letters. People can also set their computers to interpret their keystrokes as though they were typing on a Dvorak keyboard even though their actual keys are arranged in a QWERTY layout.

3. Touch screen

Touch screens are touch sensitive displays, which can detect location of touches within the touch sensitive display. There are three basic systems that are used to recognize a person's touch:

1. Resistive
2. Capacitive
3. Surface acoustic wave



The resistive system consists of a normal glass panel that is covered with a conductive and a resistive metallic layer. These two layers are separated by thin space, and at the top a scratch-resistant layer is placed. An electrical current runs through the two layers while the monitor is operational. When a user touches the screen, it causes a change in the electrical current, which is identified as a touch event and sent to the

controller present inside the circuit board for processing. Once the coordinates are known, a special driver translates the touch into something that the operating system can understand, similar to the computer mouse "click".

In the capacitive system, a layer that stores electrical charge is placed on the glass panel of the monitor. The human body also carries electric charge. When a user touches the monitor with his/ her finger, some of the charge is transferred to the user, so the charge on the capacitive layer decreases. The circuit measures this fluctuation of current, which is present at each corner of the display. The computer calculates, from the relative differences in charge at each corner, exactly where the touch event takes place and then relays that information to the touch-screen driver software.

On the monitor of a surface acoustic wave system, two transducers (one receiving and one sending) are placed along the X and Y axes of the monitor's glass plate. Ultrasonic waves pass over the screen. When the screen is touched, the object or user absorbs a portion of the wave. This change in the ultrasonic waves registers the position of the touch event and sends this information to the controller for processing.

4. Flash Memory

Flash memory, which is a storage device, is an electronic non-volatile computer storage device that can be electrically erased and reprogrammed. It was developed from electrically erasable programmable read-only memory (EEPROM) technology. There are two main types of flash memory, which are named after the NAND and

NOR logic gates. The internal characteristics of the individual flash memory cells exhibit characteristics similar to those of the corresponding gates. Whereas EEPROMs had to be completely erased before being rewritten, NAND type flash memory may be written and read in blocks (or pages), which are generally much smaller than the entire device. The NOR type allows a single machine word (byte) to be written or read independently.

The NAND type is primarily used in main memory, memory cards, USB flash drives, and similar products, for general storage and transfer of data. The NOR type, which allows true random access and therefore direct code execution, is used as a replacement for the older EEPROM and as an alternative to certain kinds of ROM applications, whereas NOR flash memory may emulate ROM primarily at the machine code level. Flash memory has a grid of columns and rows with a cell that has two transistors at each intersection, and a thin oxide layer separates them. One of the transistors is known as a floating gate, and the other one is the control gate. The floating gate's only link to the row, or word line, is through the control gate. As long as this link is in place, the cell has a value of 1. Changing the value to a 0 requires a curious tunneling process.

5. Tunneling

Tunneling is used to alter the placement of electrons in the floating gate. An electrical charge, usually 10 to 13 volts, is applied to the floating gate. The charge comes from the column, or bit line, enters the

floating gate and drains to the ground. This charge causes the floating-gate transistor to act like an electron gun. The excited electrons are pushed through and trapped on the other side of the thin oxide layer, giving it a negative charge. These negatively charged electrons act as a barrier between the control gate and the floating gate.

Post-reading Activities

I. Reading comprehension

Directions: Mark each statement as T (True), F (False), or NG (Not Given) to the information in the reading comprehension passage.

- 1. The peripherals in a computer are called inputs and outputs.
- 2. Keyboards and mice, like printers, are input devices.
- 3. CPU is not considered the main part of a computer, as it is the main memory.
- 4. The port-mapped I/O creates a neater code and needs fewer external parts to do I/O.
- 5. The comparison between input and output devices was thoroughly discussed.
- 6. Contact bounce inside the keyboard is a vibration made by a mechanical action.
- 7. A layer storing electrical charge on the glass panel of the monitor is called resistive system.
- 8. Two transistors are called a control gate and a tunneling process.

Questions 9-15: Choose the appropriate letter A-C.

9. The term I/O in computer engineering is used to.....
- A. transfer date for program description.
 - B. refer to a device for transferring data.
 - C. make program for writable DVD device.
10. All the following are TRUE about the functions of I/O, but.....
- A. Transferring information.
 - B. Describing a program or operation.
 - C. Converting serial data to parallel form.
11. One of the following is NOT a function of a Keyboard.....
- A. Analyzing data imported in the computer.
 - B. Importing linguistic data to a computer.
 - C. Running a particular task in a computer.
12. What happens when a key is pressed on the keyboard?
- A. A vibration called contact bounce happens.
 - B. A circuit is caused to flow through.
 - C. A separate character map is formed.
13. Which of the following is irrelevant in a touch screen mechanism?
- A. Resistive system.
 - B. Capacitive system.
 - C. Function system.

14. In a touch screen monitor, ultrasonic waves help

- A. indicate the touch event.
- B. absorb the portion of the wave.
- C. transfer the information to the controller.

15. The feature of tunneling is to

- A. change the position of electrons.
- B. act like an electron gun.
- C. push the electron to the other side.

II. Vocabulary activities

Directions: Read each sentence on inputs and outputs of a computer stated below. Circle the one word or phrase in parentheses () that has the same meaning as the underlined word in the sentence. Compare your answers with a partner.

1. Handshaking should be implemented (*done/provided/acted*) by the interface using appropriate commands (like BUSY, READY, and WAIT), and the processor can communicate with an I/O device through the interface.
2. There must be provision (*increase/bridge/supplement*) for generating interrupts and the corresponding type numbers for further processing by the processor if required.
3. If you press and hold a key, the processor recognizes it as the equivalent (*cheap/equal/dissimilar*) of pressing a key repeatedly.
4. The resistive system consists of a normal glass panel that is covered with a conductive (*related/irrelevant/conducted*) and a

resistive metallic layer. These two layers are separated by thin space, and at the top a scratch-resistant layer is placed.

5. Once the coordinates (*harmonies/differences/similarities*) are known, a special driver translates the touch into something that the operating system can understand, similar to the computer mouse "click".
6. Whereas EPROMs had to be completely erased (*covered/cleaned/raised*) before being rewritten, NAND type flash memory may be written and read in blocks (or pages), which are generally much smaller than the entire device.
7. Tunneling is used to alter (*increase/improve/change*) the placement of electrons in the floating gate. An electrical charge, usually 10 to 13 volts, is applied to the floating gate. The charge comes from the column, or bit line, enters the floating gate and drains to the ground.
8. This charge causes the floating-gate transistor to act like an electron gun. The excited electrons are pushed through and trapped (*stuck/increased/decreased*) on other side of the thin oxide layer, giving it a negative charge.

III. Writing development activities

Directions: Use conjunctions (*so* and *for*) in the blanks spaces provided between two sentences and analyze which sentence is '*cause*' and which one is '*effect*'.

1. Different data formats are being exchanged, (.....) the interface must be able to convert serial data to parallel form.

Which sentence is expressing the cause or effect?

.....
.....

2. The interface must be able to convert serial data to parallel form, (.....) different data formats are being exchanged.

Which sentence is expressing cause or effect?

.....
.....

3. A keyboard is a lot like a miniature computer, (.....) it has its own processor and circuitry.

Which sentence is expressing cause or effect?

.....
.....

4. A keyboard has its own processor and circuitry, (.....) it is a lot like a miniature computer.

Which sentence is expressing cause or effect?

.....
.....

5. Some of the charge is transferred to the user, (.....) the charge on the capacitive layer decreases.

Which sentence is expressing cause or effect?

.....
.....

Directions: Use sentence connectors (*as a result, consequently, therefore, because of this, and hence*) in the blanks spaces provided between the two phrases in a sentence.

1. Different data formats are being exchanged,

(.....); the interface must be able to convert serial data to parallel form.

2. A keyboard is a lot like a miniature computer,

(.....); it has its own processor and circuitry.

3. The charge on the capacitive layer decreases,

(.....); some of the charge is transferred to the user.