- 4. 1. Introduction to Computer Hardware -

- INDEX -

- 4. 1. 0. Warm up -

1. What do you use a computer for?
2. How many kinds of computers do you know?
3. Can you mention some of their particular features regarding their hardware?
4. Do you think the computer that you are using in the class is fast enough to run the applications that you need?
5. And the computer that you have at home?
6. How often do you exchange your computer for a faster one?
7. Have you ever opened the case of your computer?
8. Do you know any motherboard brand?

- Exercises -

You are going to create a new Google Document inside the "4. Hardware" folder of your Google Drive, named:

"4. 1. Introduction to Computer Hardware - Apellidos, Nombre"

being "Apellidos, Nombre" your Last Name and Name.

Share this Google Document with the teacher (jorge@iesdoctorbalmis.com) with "Edit" permissions.

Inside this Google Document you are going to copy and answer all the "Exercises" of this sub-unit.

- 4. 1. 1. Video - Computer Hardware -

Watch the following video:

https://www.youtube.com/watch?v=YS2UfklyuHE

and answer to these questions:

1. RAM makes …
2. If you look inside different computers, they …
3. The processor makes sure …
4. The bigger the hard drive, the more you can …
5. The faster the processor can complete tasks, the …
6. Write the equivalent part of the house:
    a. Computer ->
    b. Hard drive ->
    c. RAM ->
    d. Processor ->
7. In a hard drive, we store things like …
8. … stores all the things you need for later.

- 4. 1. 2. Reading - Computer Hardware -

Motherboard

A motherboard is the central printed circuit board (PCB) in many modern computers and holds many of the crucial components of the system, while providing connectors for other peripherals.

ASUS P5AD2-E Motherboard - http://www.computerhope.com
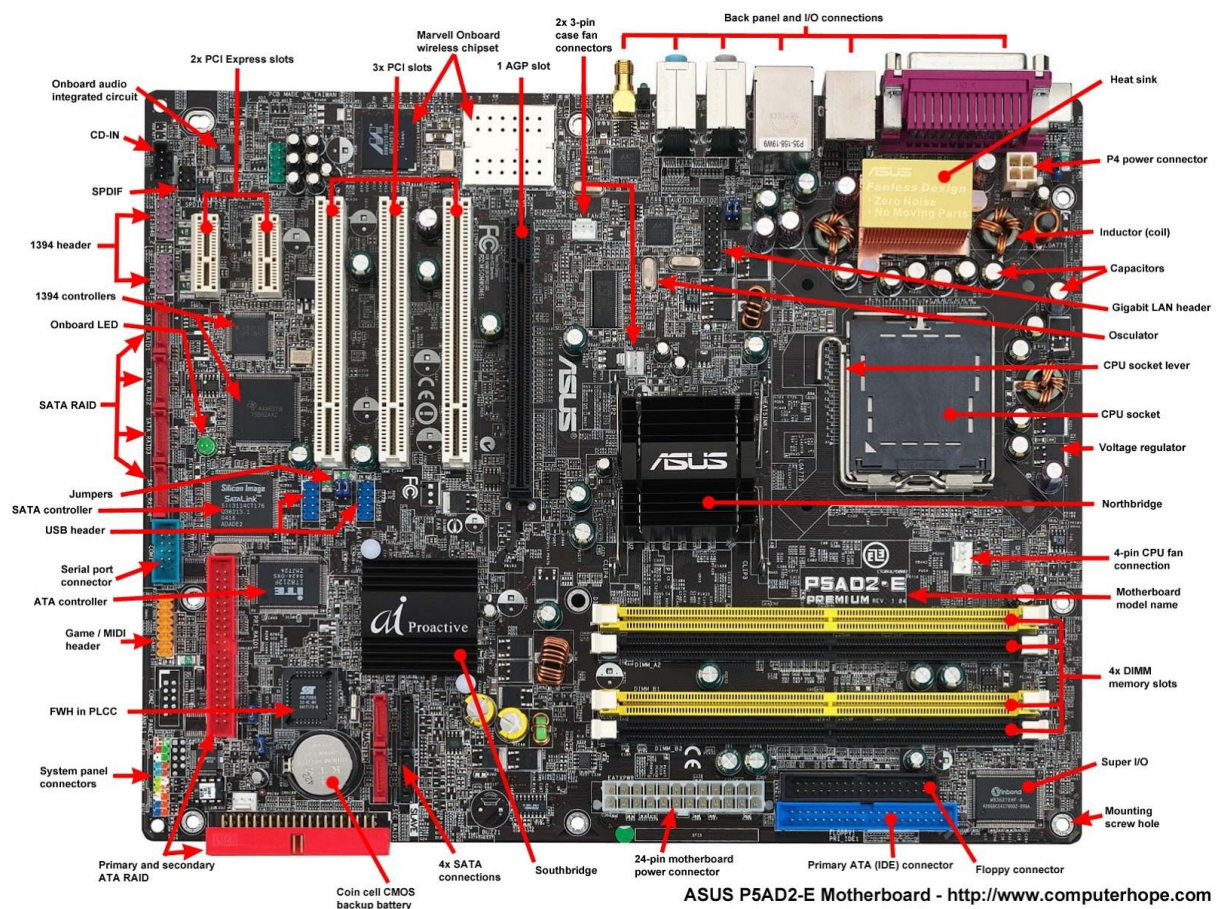
Central processing unit (CPU)

The central processing unit (CPU) or the processor is the portion of a computer system that carries out the instructions of a computer program, and is the primary element carrying out the computer's functions.

It is the unit that reads and executes program instructions. The data in the instruction tells the processor what to do.

The instructions are very basic things like reading data from memory or sending data to the user display, but they are processed so rapidly that we experience the results as the smooth operation of a program.

The form, design and implementation of CPUs have changed dramatically since the earliest examples, but their fundamental operation remains much the same.
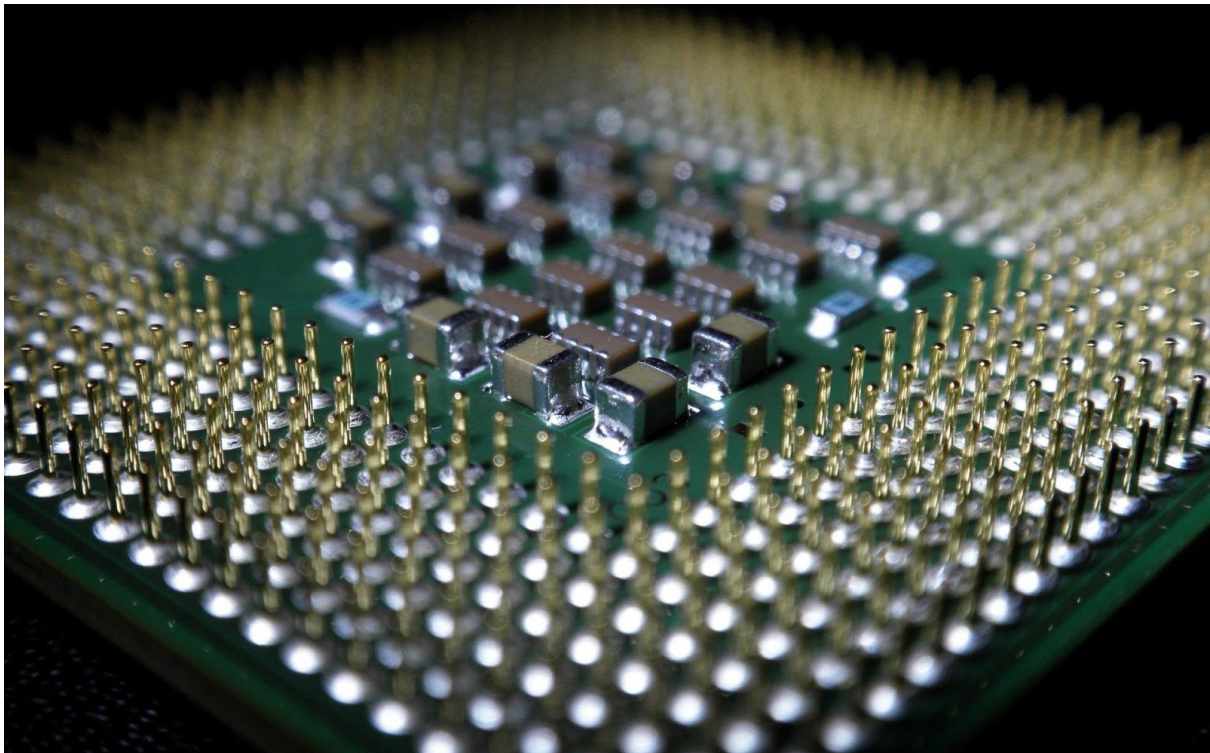
# Random access memory (RAM)

Random access memory (RAM) is a form of computer data storage.

Today, it takes the form of integrated circuits that allow stored data to be accessed in any order (i.e., at random).

"Random" refers to the idea that any piece of data can be returned in a constant time, regardless of its physical location and whether or not it is related to the previous piece of data.

The word RAM is often associated with volatile types of memory, such as Dynamic RAM (DRAM) memory modules, where the information is lost after the power is switched off.
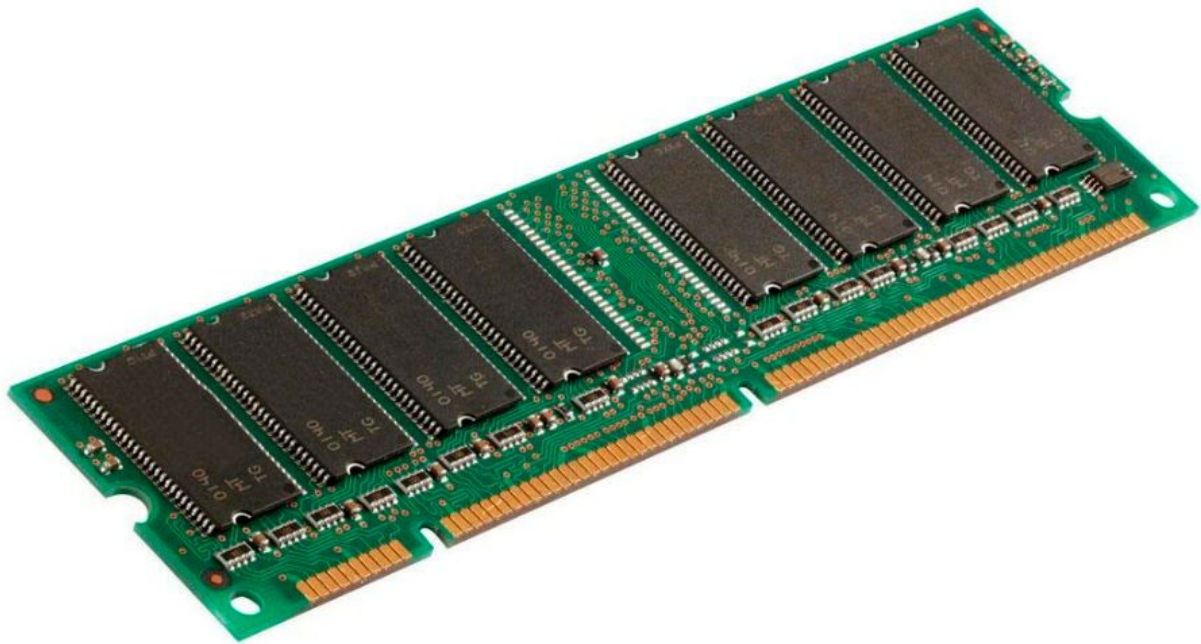
- 4. 1. 3. Exercise - RAM: DDR4 vs DDR5 -

You have to compare DDR4 RAM and DDR5 RAM regarding the following items:

- Voltage.
- Chip densities.
- Frequency (MHz).
- Data transfer rates (MB/s).
- Slots compatibility.
- Processors compatibility.
- Prices.
- Other topics that you find interesting.

You can use the following information to explain the differences between DDR4 and DDR5:

- Text.

- Images.
- Tables.
- Charts.
- Videos.

If you were going to buy a new computer tomorrow, which kind of RAM memory would you choose: DDR4 or DDR5? Why?
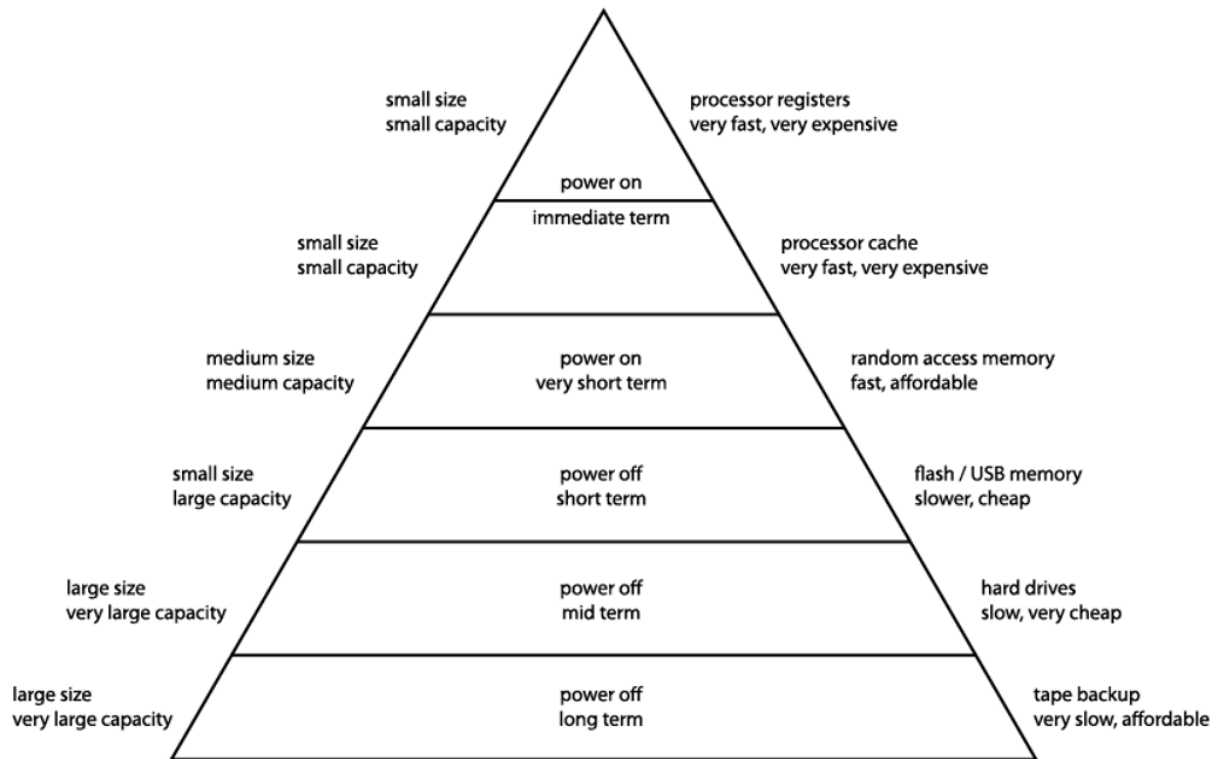
- 4. 1. 4. Video - How Computer Memory Works -

Watch the following video:

https://www.youtube.com/watch?v=p3q5zWCw8J4

and answer to these questions:

1. Everything in a computer's memory takes the form of basic units called …… , or ……
2. Which possible values has a bit?
3. As the number of bits needing to be processed by the CPU grows exponentially, computer designers face a constant struggle between …… , …… and ……
4. What is the memory's latency?
5. Why RAM ("Random Access Memory") is named short-term memory?
6. Explain how a RAM memory cell works.
7. Why that RAM is named DRAM ("Dynamic RAM")?
8. What is the cache memory?
9. DRAM and SRAM (cache memory) can only hold data ……
10. For data to remain once the device is turned off, ……
11. The latency for magnetic hard drives is …… than that of DRAM.
12. Optical storage media (like DVDs and Blu-Rays) have …… than magnetic storage and ……
13. The newest and fastest types of long-term storage are …… How do they work?
14. We tend to think of computer memory as stable and permanent, but ……
15. Which additional weakness do SSDs ("Solid-State Drives") have?
16. Which life expectancy does storage media have?

Computer Memory Hierarchy

small size
small capacity

processor registers
very fast, very expensive

power on
immediate term

small size
small capacity

processor cache
very fast, very expensive

medium size
medium capacity

power on
very short term

random access memory
fast, affordable

small size
large capacity

power off
short term

flash / USB memory
slower, cheap

large size
very large capacity

power off
mid term

hard drives
slow, very cheap

large size
very large capacity

power off
long term

tape backup
very slow, affordable

Hard Disk Drive (HDD)

A hard disk drive (HDD) is a non-volatile storage device for digital data.

It features one or more rotating rigid platters on a motor-driven spindle within a metal case.

Data is encoded magnetically by read/write heads that float on a cushion of air above the platters.

Hard disk manufacturers quote disk capacity in powers of 1000, wherein a terabyte is 1000 gigabytes and a gigabyte is 1000 megabytes. With file systems that measure capacity in powers of 1024, available space appears somewhat less than advertised capacity.

Hard disks drives have fallen in cost and physical size over the years while dramatically increasing capacity.

They have been the dominant device for secondary storage of data in general purpose computers since the early 1960s.

Hard disks drives have maintained this position because advances in their areal recording density have kept pace with the requirements for secondary storage.

Form factors have also evolved over time from large standalone boxes to today's desktop systems mainly with standardized 3.5-inch form factor drives, and mobile systems mainly using 2.5-inch drives.
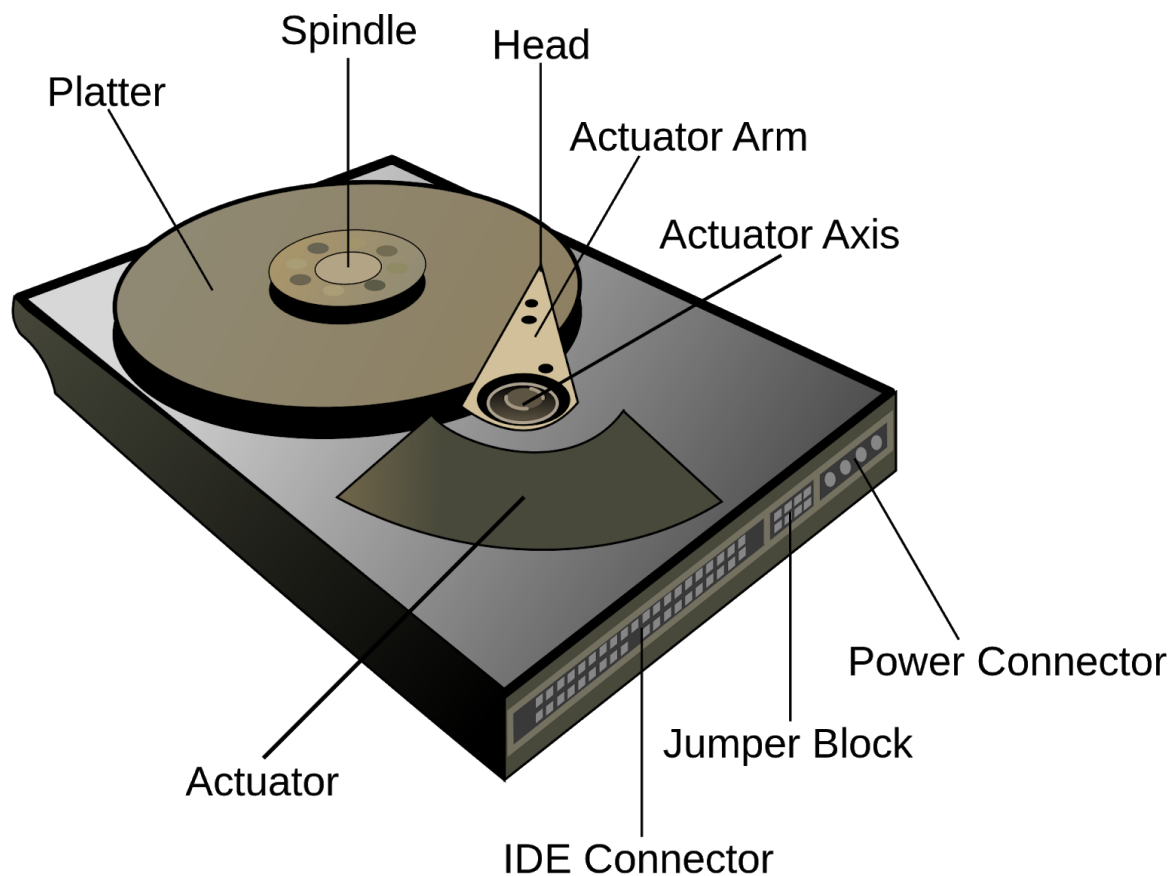
Today's HDDs operate on high-speed serial interfaces, i.e., Serial ATA (SATA) or Serial attached SCSI (SAS).

Latest years have seen the rising of a new hard drive technology: solid-state drive (SSD, also known as a solid-state disk).

SSDs have no moving mechanical components.

This distinguishes them from traditional electromechanical magnetic disks such as hard disk drives (HDDs), which contain spinning disks and movable read/write heads.

Compared with electromechanical disks, SSDs are typically more resistant to physical shock, run silently, have lower access time, and lower latency. However, while the price of SSDs has continued to decline over time, consumer-grade SSDs are still more expensive per unit of storage than consumer-grade HDDs.

Spindle   Head

Platter

Actuator Arm

Actuator Axis

Power Connector

Jumper Block

Actuator

IDE Connector

- 4. 1. 5. Video - How Hard Drives Work -

Watch the following video:

https://www.youtube.com/watch?v=wteUW2sL7bc

and answer to these questions:

1. At the heart of every hard drive is ……
2. In a bit of a magnetic hard drive ……
3. Which object writes the information in the magnetic disc and how?
4. What is the disc's areal density?
5. The areal density of a modern hard drive is ……
6. What is Moore's Law?

Video card

A video card, video adapter, graphics-accelerator card, display adapter or graphics card is an expansion card whose function is to generate output images to a display.

Many video cards offer added functions, such as accelerated rendering of 3D scenes and 2D graphics, video capture, TV-tuner adapter, MPEG-2/MPEG-4 decoding, FireWire, light pen, TV output, or the ability to connect multiple monitors (multi-monitor).

Other modern high performance video cards are used for more graphically demanding purposes, such as PC games.

Video hardware can be integrated on the motherboard, often occurring with early machines.

In this configuration it is sometimes referred to as a video controller or graphics controller.

Modern low-end to mid-range motherboards often include a graphics chipset developed by the developer of the northbridge on the motherboard.

This graphics chip usually has a small quantity of embedded memory and takes some of the system's main RAM, reducing the total RAM available.

This is usually called integrated graphics or on-board graphics, and is low-performance and undesirable for those wishing to run 3D applications.

Almost all of these motherboards allow the disabling of the integrated graphics chip in BIOS, and have an AGP, PCI, or PCI Express slot for adding a higher-performance graphics card in its stead.
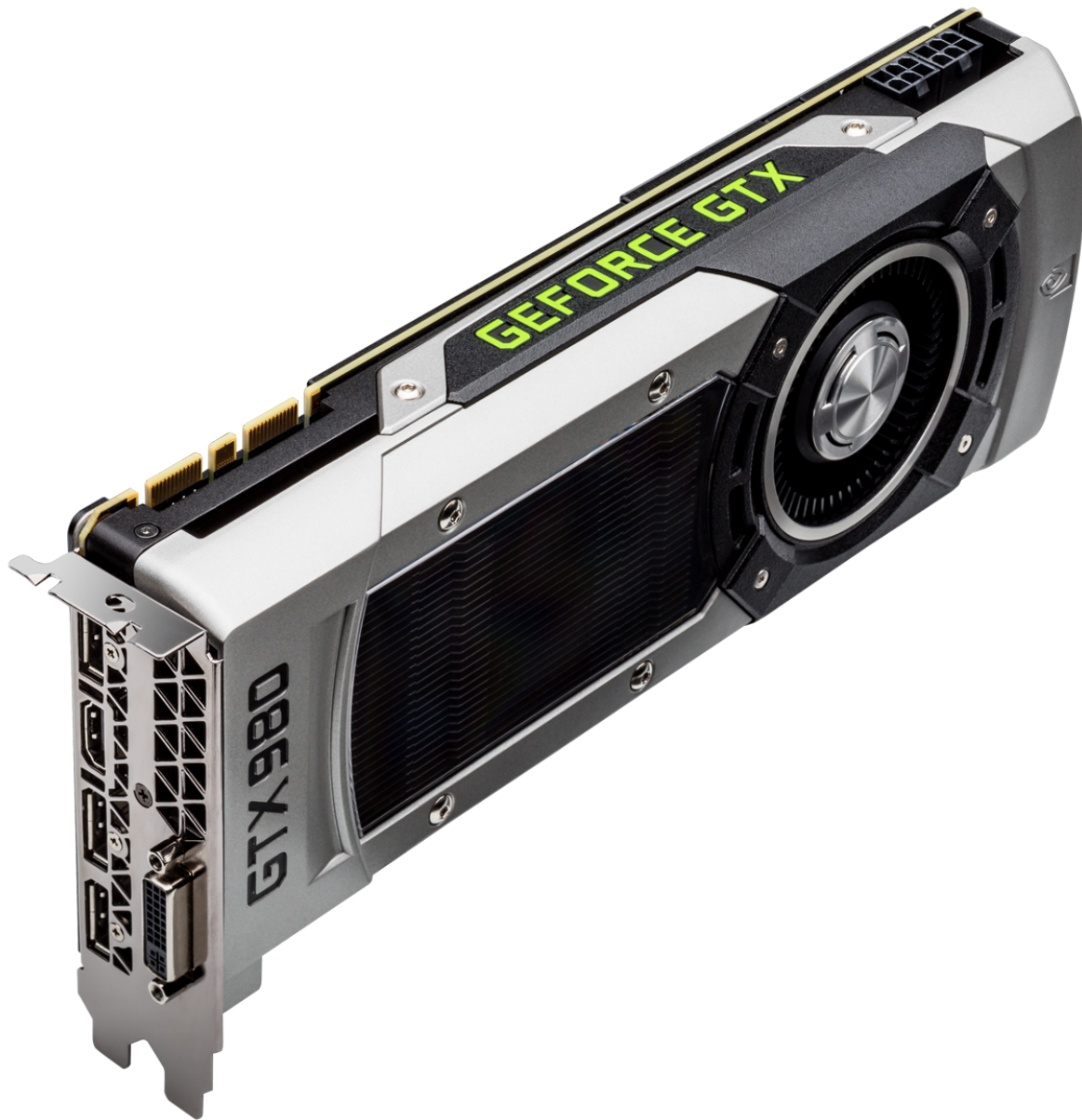
Sound card

A sound card (also known as an audio card) is a computer expansion card that facilitates the input and output of audio signals to and from a computer under control of computer programs.

Typical uses of sound cards include providing the audio component for multimedia applications such as music composition, editing video or audio, presentation, education, and entertainment (games).

Many computers have sound capabilities built in, while others require additional expansion cards to provide for audio capability.
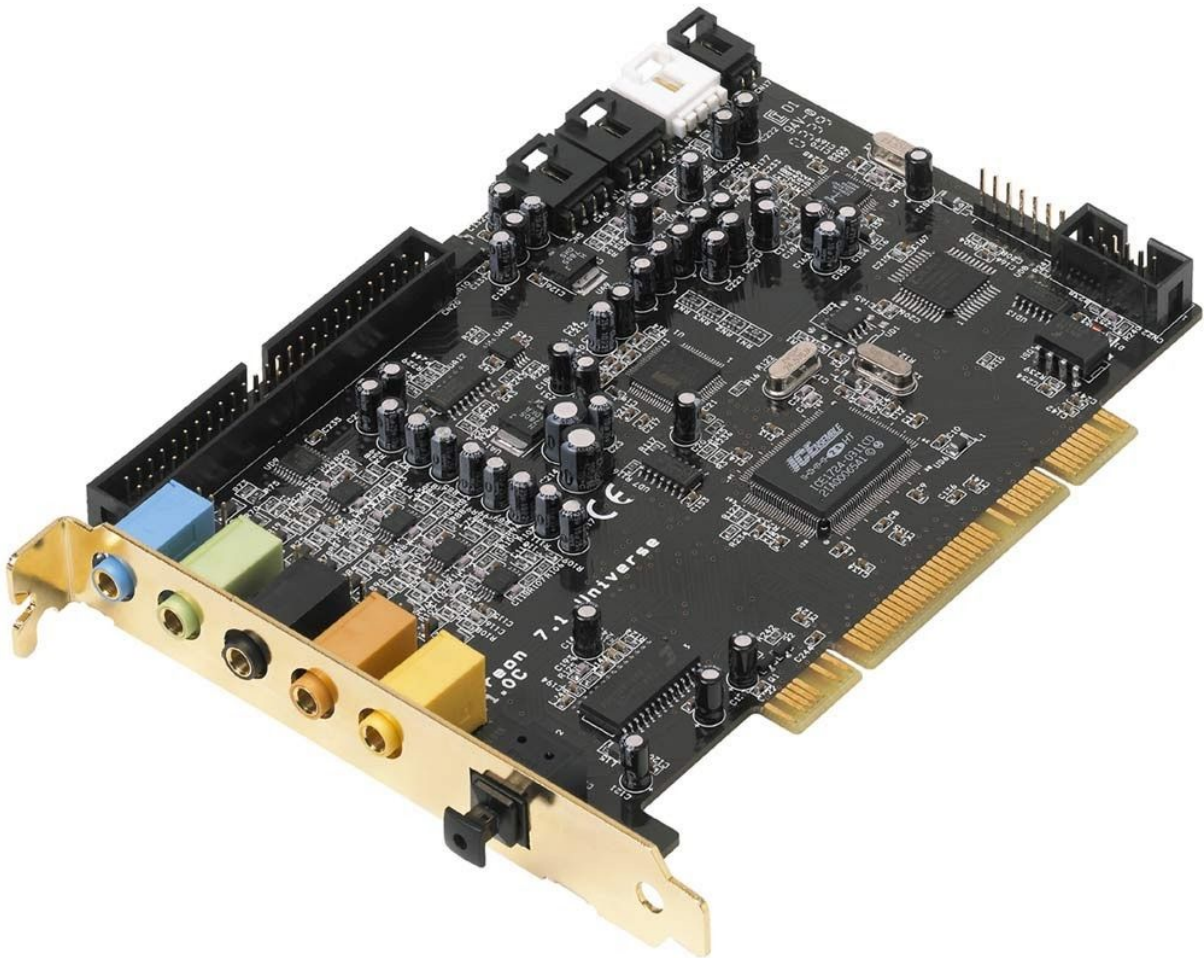
Network interface card (NIC)

A network interface card (NIC) is a hardware device that handles an interface to a computer network and allows a network-capable device to access that network.

The NIC has a ROM chip that contains a unique number, the media access control (MAC) address burned into it.

The MAC address identifies the device uniquely on the LAN.

The NIC exists on the 'Data Link Layer' (Layer 2) of the OSI model.

Power supply unit (PSU)

A power supply unit (PSU) is the component that supplies power to the other components in a computer.

More specifically, a power supply unit is typically designed to convert general-purpose alternating current (AC) electric power from the mains (100-127V in North America, parts of South America, Japan, and Taiwan; 220-240V in most of the rest of the world) to usable low-voltage DC power for the internal components of the computer.

Some power supplies have a switch to change between 230 V and 115 V. Other models have automatic sensors that switch input voltage automatically, or are able to accept any voltage between those limits.

The most common computer power supplies are built to conform to the ATX form factor. This enables different power supplies to be interchangeable with different components inside the computer.

ATX power supplies also are designed to turn on and off using a signal from the motherboard, and provide support for modern functions such as the standby mode available in many computers.
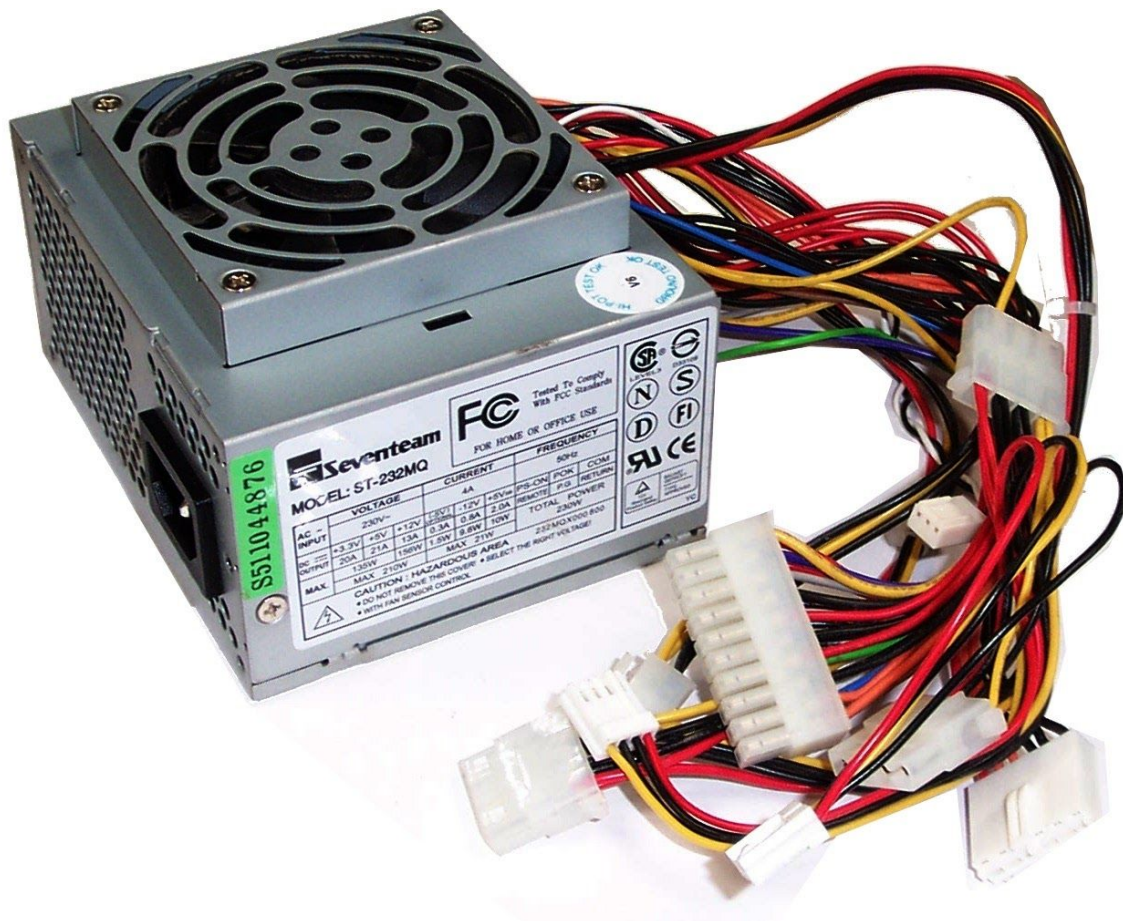
Universal serial bus (USB)

Universal Serial Bus (USB) is a specification to establish communication between devices and a host controller (usually personal computers).

USB is intended to replace many varieties of serial and parallel ports.

USB can connect computer peripherals such as mice, keyboards, digital cameras, printers, personal media players, flash drives, network adapters, and external hard drives.

For many of those devices, USB has become the standard connection method.

USB was designed for personal computers, but it has become commonplace on other devices such as smartphones, PDAs and video game consoles, and as a power cord.

USB 3.0   VS.   USB 2.0
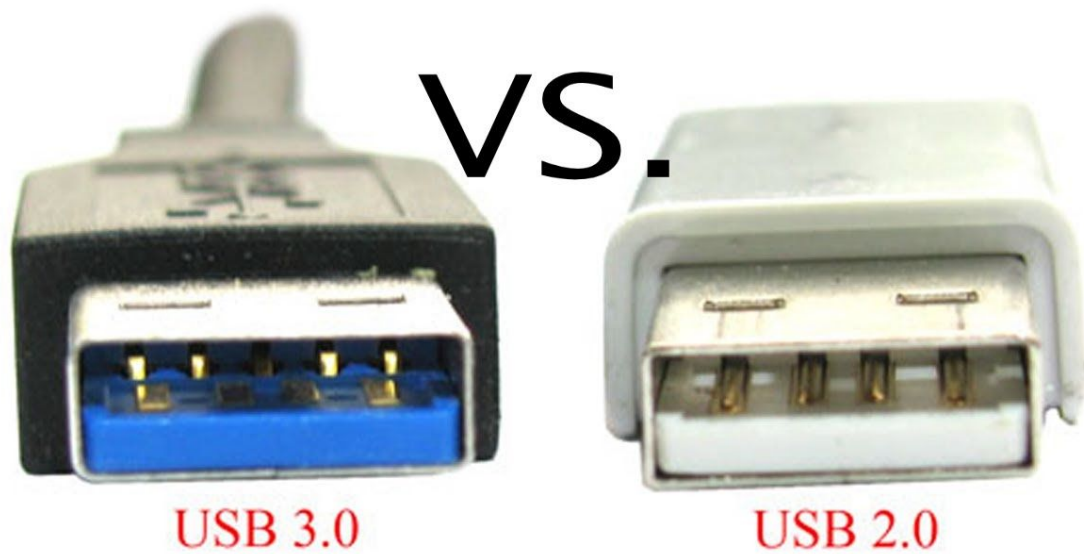
Monitor

A monitor or display is an electronic visual display for computers.

The monitor comprises the display device, circuitry, and an enclosure.

The display device in modern monitors is typically a thin film transistor liquid crystal display (TFT-LCD) thin panel, while older monitors use a cathode ray tube (CRT), typically about as deep as the screen size.

Originally computer monitors were used for data processing and television receivers for entertainment; increasingly computers are being used both for data processing and entertainment.

Displays exclusively for data use tend to have an aspect ratio of 4:3; those used also (or solely) for entertainment are usually 16:9 widescreen.

Keyboard

In computing, a keyboard is a typewriter keyboard, which uses an arrangement of buttons or keys, to act as mechanical levers or electronic switches.

Despite the development of alternative input devices, such as the mouse, touch sensitive screens, pen devices, character recognition, voice recognition, and improvements in computer speed and memory size, the keyboard remains the most commonly used and most versatile device used for direct (human) input into computers.

A keyboard typically has characters engraved or printed on the keys and each press of a key typically corresponds to a single written symbol.

However, to produce some symbols requires pressing and holding several keys simultaneously or in sequence.

While most keyboard keys produce letters, numbers or signs (characters), other keys or simultaneous key presses can produce actions or computer commands.

Mouse

In computing, a mouse is a pointing device that functions by detecting twodimensional motion relative to its supporting surface.

Physically, a mouse consists of an object held under one of the user's hands, with one or more buttons.

It sometimes features other elements, such as "wheels", which allow the user to perform various system-dependent operations, or extra buttons or features that can add more control or dimensional input.

The mouse's motion typically translates into the motion of a cursor on a display, which allows for fine control of a graphical user interface.

- 4. 1. 6. Listening - 4 Laptops -

You are going to listen to a shop assistant giving the description of 4 laptops:

- HP G62.
- HP Envy 14.
- Lenovo ThinkPad T410s.

- Acer Aspire One Netbook.

For each laptop, you have to fill in the following features:

- Type of processor.
- Operating system.
- Battery.
- Hard disk.
- Memory capacity.
- Screen size.

In the Google Document of this sub-unit, insert a table with 5 columns and 7 rows.

In the columns write the 4 laptops, and in the rows write the 6 features.

You have to fill in the table with the information provided in the listening.

Finally, you have to reason which is the "best" and the "worst" computer.

To listen to the audio, just click on the following link:

https://soundcloud.com/user-711735952-896596248/listening-4-laptops

- 4. 1. 7. Writing - Buying a new computer -

You are going to write a paper about computer hardware.

You are going to buy a new computer, so you should detail the kind of hardware that you prefer to buy for your new computer.

You should keep in mind that you have a particular budget to buy this new computer.

Also, you should know the tasks (and explain those tasks in your paper) that you are going to do with the new computer, in order to select the proper hardware components.

You can include links to real hardware components on the web, but remember to describe in the text of your document the features of that component.

Also, it's very important to structure your writing correctly (Introduction, Development, Conclusion) and to use connectors.

You have to write a minimum of 200 words.

- 4. 1. 8. Logic gates and truth tables -

Read the following presentation:

https://www.slideshare.net/jsearle11/digital-logic-gates

- 4. 1. 9. Number Systems -

Read the following presentation:

https://www.slideshare.net/rshahini/computer-number-systems

- Exercise - Number Systems -

1. Convert 1001101 (binary) to decimal.
2. Convert 14 (decimal) to binary.
3. Convert A7 (hexadecimal) to decimal.
4. Convert 25 (decimal) to hexadecimal.
5. Convert 11100011 (binary) to hexadecimal.
6. Convert 6E (hexadecimal) to binary.

- 4. 1. 10. Speaking - Computer Shopping -

Working in pairs, you have to write a dialogue between the owner of a computer store and a customer who wants to buy a computer.

You have to use Google Drive "Documents", create a new Document and share it with your partner in order to write the script of the speaking.

You must use the computer hardware vocabulary that we have studied in class.

The owner of the computer store should advise the client, asking him questions like the following:

- Which type of computer (laptop, PC, etc.) the client wants.
- Which kind of tasks (internet, office, music, video, games, etc.) the client will do with the new computer.
- How much money the client wants to spend.

The client must respond to those questions.

Regarding with these answers, the owner should offer the client 2 computer models with different hardware and pricing.

The client must decide whether or not to buy one of the computers offered by the owner.

It is a good idea to include "stories" in your dialogue, both from part of the owner and the client.

Besides, just before the client purchases the desired computer, the owner can offer some "upsells", like: peripherals, operating system, insurance, technical support…

After you have prepared the dialogue, you must show it to the teacher.

Finally, you must represent the scene to the whole class, without reading any papers, for at least during 5 minutes.

- Vocabulary -

- to run smoothly: funcionar de manera fluida.
- basement: sótano.
- closet: armario.
- butler: mayordomo.
- to carry out: llevar a cabo.
- random: aleatorio.
- briefly: brevemente.
- struggle: conflicto.
- to leak: gotear.
- to leak away: escaparse / perderse.
- platters: platos / discos.
- to feature: estar formado.
- spindle: eje.
- within: dentro de.
- cushion: cojín / capa.
- powers of: potencias de.
- to keep pace: mantener el ritmo.
- consumer-grade: orientado a consumidor final.
- low-end: gama baja.
- mid-range: gama media.
- high-end: gama alta.
- stack: pila.
- grain: grano / sector.
- needle: aguja.
- grooves: ritmos.
- to squeeze: apretar.
- matter: materia.
- chunk: trozo.
- strand: hebra.
- to cram: atiborrar / abarrotar.
- video/graphics card: tarjeta gráfica.
- graphics controller: controladora gráfica integrada.
- on-board graphics: controladora gráfica integrada.
- embedded: integrado.
- built in: integrado.
- burned: grabada.
- general-purpose: de propósito general.
- AC (Alternating Current): corriente alterna.
- DC (Direct Current): corriente continua.
- mains: enchufes.
- mice (irregular plural of mouse): ratones.
- power cord: cable de alimentación.

- circuitry: circuitería.
- enclosure: caja / carcasa.
- to comprise: comprender (estar formado).
- entertainment: entretenimiento / ocio.
- lever: palanca.
- switch: interruptor / conmutador.
- engraved: grabado.
- stead:lugar.