E-notes on Classification of Digital Computers

Definition: A Computer
A computer is an electronic device that accepts raw data, processes it according to a set of instructions and required to produce the desired result.

The set of instructions is called Program and can be written using artificial languages like Basic, FORTRAN, C, C++, Java etc.

The programs run under the supervision of an Operating System. Example for popular Operating Systems is Windows, UNIX, LINUX, Solaris etc.

A computer consists of two main components: Hardware and Software:

Hardware

The *hardware* are the parts of computer itself including the Central Processing Unit (CPU) and related microchips and micro-circuitry, keyboards, monitors, case and drives (floppy, hard, CD, DVD, optical, tape, etc...). Other extra parts called peripheral components or devices include mouse, printers, modems, scanners, digital cameras and cards (sound, colour, video) etc... Together they are often referred to as a personal computers or PCs.

Central Processing Unit (CPU) - Though the term relates to a specific chip or the processor a CPU's performance is determined by the rest of the computers circuitry and chips.

Currently the Pentium chip or processor, made by Intel, is the most common CPU though there are many other companies that produce processors for personal computers. Examples are the CPU made by Motorola and AMD.

With faster processors the clock speed becomes more important. It depends on the circuit board that the chip is housed in, or the motherboard, as to whether you are able to upgrade to a faster chip. The motherboard contains the circuitry and connections that allow the various components to communicate with each other.

Though there were many computers using many different processors previous to this we can consider, the 80286 processor the advent of home computers as these were the processors that made computers available for the average person. Using a processor before the 286 involved learning a proprietary system and software. Most new software are being developed for the newest and fastest processors so it can be difficult to use an older computer system.

Keyboard - The keyboard is used to type information into the computer or input information.
There are many different keyboard layouts and sizes with the most common for Latin based languages being the QWERTY layout (named for the first 6 keys). The standard keyboard has 101 keys. Notebooks have embedded keys accessible by special keys or by pressing key combinations (CTRL or Command and P for example). Ergonomically designed keyboards are designed to make typing easier.
Some of the keys have a special use. There are referred to as command keys. The 3 most common are the Control or CTRL, Alternate or Alt and the Shift keys though there can be more (the Windows key for example or the Command key). Each key on a standard keyboard has one or two characters. Press the key to get the lower character and hold Shift to get the upper.

Disk Drives - All disks need a drive to get information off - or read - and put information on the disk - or write. Each drive is designed for a specific type of disk whether it is a CD, DVD, hard disk or floppy. Often the term 'disk' and 'drive' are used to describe the same thing but it helps to understand that the disk is the storage device which contains computer files - or software - and the drive is the mechanism that runs the disk.

Mouse - Most modern computers today are run using a mouse controlled pointer. Generally if the mouse has two buttons the left one is used to select objects and text and the right one is used to access menus. If the mouse has one button (Mac for instance) it controls all the activity and a mouse with a third buttons can be used by specific software programs.

One type of mouse has a round ball under the bottom of the mouse that rolls and turns two wheels which control the direction of the pointer on the screen. Another type of mouse uses an optical system to track the movement of the mouse.

Monitors - The monitor shows information on the screen when you type. This is called outputting information. When the computer needs more information it will display a message on the screen, usually through a dialog box. Monitors come in many types and sizes from the simple monochrome (one color) screen to full color screens.

Most desktop computers use a monitor with a cathode tube and most notebooks use a liquid crystal display (LCD) monitor.

To get the full benefit of today's software with full color graphics and animation, computers need a color monitor with a display or graphics card.

Printers - The printer takes the information on your screen and transfers it to paper or a hard copy. There are many different types of printers with various levels of quality. The three basic types of printer are; dot matrix, inkjet, and laser.

Dot matrix printers work like a typewriter transferring ink from a ribbon to paper with a series or 'matrix' of tiny pins.

Ink jet printers work like dot matrix printers but fire a stream of ink from a cartridge directly onto the paper.

Laser printers use the same technology as a photocopier using heat to transfer toner onto paper.

Modem - A modem is used to translate information transferred through telephone lines or cable. The term stands for modulate and demodulate which changes the signal from digital, which computers use, to analog, which telephones use and then back again. A high speed connection also requires a modem but because the information is transferred digitally it isn't required to change the signal from digital to analog but is used to create the connection between your computer and the computer you are connecting with.

Modems are measured by the speed that the information is transferred. The measuring tool is called the baud rate. Originally modems worked at speeds below 2400 baud but today analog speeds of 56,000 are common. Cable, wireless or digital subscriber lines (DSL) modems can transfer information much faster with rates of 300,000 baud and up.
Modems also use Error Correction which corrects for transmission errors by constantly checking whether the information was received properly or not and Compression which allows for faster data transfer rates. Information is transferred in packets. Each packet is checked for errors and is re-sent if there is an error. Anyone who has used the Internet has noticed that at times the information travels at different speeds. Depending on the amount of information that is being transferred the information will arrive at its destination at different times. The amount of information that can travel through a line is limited. This limit is called bandwidth.

Scanners- Scanners allow you to transfer pictures and photographs to your computer. A scanner 'scans' the image from the top to the bottom, one line at a time and transfers it to the computer as a series of bits or a bitmap. You can then take that image and use it in a paint program, send it out as a fax or print it. With optional Optical Character Recognition (OCR) software you can convert printed documents such as newspaper articles to text that can be used in your word processor. Most scanners use TWAIN software that makes the scanner accessible by other software applications.

Digital cameras allow you to take digital photographs. The images are stored on a memory chip or disk that can be transferred to your computer. Some cameras can also capture sound and video.

Case - The case houses the microchips and circuitry that run the computer. Desktop models usually sit under the monitor and tower models beside. They come in many sizes, including desktop, mini, midi, and full tower. There is usually room inside to expand or add components at a later time. By removing the cover off the case you may find plate covered empty slots that allow you to add cards. There are various types of slots including IDE, ASI, USB, PCI slots.

Notebook computers may have room to expand depending on the type of computer. Most Notebooks also have connections or ports that allow expansion or connection to exterior, peripheral devices such as monitor, portable hard-drives or other devices.

Cards - Cards are components added to computers to increase their capability. When adding a peripheral device makes sure that your computer has a slot of the type needed by the device. Sound cards allow computers to produce sound like music and voice. The older sound cards were 8 bit then 16 bit then 32 bit. Though human ear can't distinguish the fine difference between sounds produced by the more powerful sound card they allow for more complex music and music production.

Color cards allow computers to produce color (with a colour monitor of course). The first color cards were 2 bit which produced 4 colors [CGA]. It was amazing what could be done with those 4 colors. Next came 4 bit allowing for 16 [EGA and VGA ] colors Then came 16 bit allowing for 1024 colors and then 24 bit which allows for almost 17 million colors and now 32 bit is standard allowing monitors to display almost a billion separate colors.

Video cards allow computers to display video and animation. Some video cards allow computers to display television as well as capture frames from video. A video card with a digital video camera allows computers users to produce live video. A high speed or network connection is needed for effective video transmission.

Network cards allow computers to connect together to communicate with each other. Network cards have connections for cable, thin wire or wireless networks.
Cables connect internal components to the Motherboard, which is a board with series of
electronic pathways and connections allowing the CPU to communicate with the other
components of the computer.

Memory - Memory can be very confusing but is usually one of the easiest pieces of hardware
to add to your computer. It is common to confuse chip memory with disk storage. An
example of the difference between memory and storage would be the difference between a
table where the actual work is done (memory) and a filing cabinet where the finished product
is stored (disk). To add a bit more confusion, the computer's hard disk can be used as
temporary memory when the program needs more than the chips can provide.
Random Access Memory or RAM is the memory that the computer uses to temporarily store
the information as it is being processed. The more information being processed the more
RAM the computer needs.
One of the first home computers used 64 kilobytes of RAM memory (Commodore 64).
Today's modern computers need a minimum of 64 MB (recommended 128 MB or more) to
run Windows with modern software.
RAM memory chips come in many different sizes and speeds and can usually be expanded.
Older computers came with 512 KB of memory which could be expanded to a maximum of
640 KB. In most modern computers the memory can be expanded by adding or replacing the
memory chips depending on the processor you have and the type of memory your computer
uses. Memory chips range in size from 1 MB to 512 MB. As computer technology changes
the type of memory changes as well making old memory chips obsolete. Check your
computer manual to find out what kind of memory your computer uses before purchasing
new memory chips.

Software

The software is the information that the computer uses to get the job done. Software needs to
be accessed before it can be used. There are many terms used for process of accessing
software including running, executing, starting up, opening, and others.
Computer programs allow users to complete tasks. A program can also be referred to as an
application and the two words are used interchangeably.
Examples of software programs or applications would be the Operating System (DOS,
Windows 9x/Millenium/XP, O/S2, UNIX, MacOS 9.x/10.x and various others),
Wordprocessor (typing letters), Spreadsheet (financial info), Database (inventory control and
address book), Graphics program, Internet Browser, Email and many others.
As well any document that you create, graphic you design, sound you compose, file you
make, letter you write, email you send or anything that you create on your computer is
referred to as software. All software is stored in files.
Software is stored on a disk or tape whether that disk is a floppy, hard Disk, CD, tape or one
of the dozens of other storage devices available.

Classification of Digital Computers

In general, computers can be classified based upon their mode of use as
1) Computer for simple use
2) Computers for Organizational Use

Simple computers are also called Micro Computers and include Personal Computers, Laptops, PDA (Personal Digital Assistant), Workstations etc.

Some computers will have high configuration. We may not able to get full benefit of what we spent on those computers by using alone. So, they are preferred for organizational use and examples include servers, Mainframes, mini computers and Super computers.
Let us discuss them one by one:

**Personal Computers:** Popularity called PCs.

They are found almost everywhere nowadays. They cost less and are suitable for house and individual use. They comprise of a monitor, a keyboard, CPU with floppy, CD and Hard disks and a mouse at the simplest. We can enhance the components in terms of numbers as well as configurations based upon needs.
They run software like word processors, excel, compilers, image viewers, games, Internet besides the operating system.
They are used basically for simple tasks such as documentation, writing simple programs, to watch movies, listen to the music, to browse Internet to check emails, to download material from web sites etc.

**Laptops:**

They are equivalent to PCs in their functionality. But, very small in size compared to PCs. They are portable, in the sense, you can carry them wherever you travel. They run on battery. As long as the battery can supply the laptops function. Here, monitor, keyboard, storage devices are integrated as one device common power supply.
Advantage is, they are portable and handy. Disadvantages are, they are costly and theft prone. If you want to upgrade the existing configuration, it proved to be still costlier.

**Personal Digital Assistant (PDA)**

They are small computers which can be held in hands. They are used to browse Internet and receive/send short messages. They are also used to store information which can then be transferred to PCs in leisure.
Nowadays they are used to work with smart cards which have user information like Name, their loan or crop details. When the person
comes from a particular department, he will have PDA with him. The farmers can just swipe the card and do necessary transaction. They are good basically for information transfer rather than information processing.

**Workstations:**

They are high end PCs. They contain more memory and high speed processor compared to PCs. They host software requiring more resource. They are used in business but by a single user. Typical work done on workstations includes vide editing, animation, drafting of an architectural design, animation etc.

Computers for Organizational use:

**Servers:**

They are super fast, high configured computers intended to serve the node in a network. Nodes in turn are PCs. They are connected to server which hosts all or most of the software required by them. They run only one copy of the software installed on the server. Hence, Servers should be very fast. They serve all nodes and bit costlier compared to simple PCs. Computers communicate with each other through underlying framework called Network. A network can be as simple as connecting two PCs together to a Local Area Networm popularly called LAN to MAN, the Metropolitan Area Network to WWW, the popular World Wide Web.

**Mainframe computers:**

Mainframes are computers used mainly by large organizations for critical applications, typically bulk data processing such as census, industry and consumer statistics, ERP, and financial transaction processing. The term probably originated from the early mainframes, as they were housed in enormous, room-sized metal boxes or frames. Later the term was used to distinguish high-end commercial machines from less powerful units which were often contained in smaller packages.
Today in practice, the term usually refers to computers compatible with the IBM System/360 line, first introduced in 1965. Otherwise, systems with similar functionality but not based on the IBM System/360 are referred to as "servers." However, "server" and "mainframe" are not synonymous.

Minicomputers:

Minicomputers fall in the range between Mainframes and Microcomputers. They are used by small and mid-size industries.

There were several minicomputer operating systems and architectures that arose in the 1970s and 1980s, but minicomputers are generally not considered mainframes. (UNIX arose as a minicomputer operating system; Unix has scaled up over the years to acquire some mainframe characteristics).

Super computers:

They are the powerful computers available till today. A supercomputer is a computer that led the world (or was close to doing so) in terms of processing capacity, particularly speed of calculation, at the time of its introduction. Today, they have the capacity to do huge processing of data including scientific and military applications. They are the one which enable news channels around the world to bring you up-to-date weather information. The amount of processing goes behind this work is enormous and only super computers can do it.

Applications of Computers:

Computers are used everywhere. They found their application starting with playing games till processing satellite images to give weather information.

At Home:

They are used mostly to check mails or chat with family members abroad. You can do video enabled chatting where you actually can see the person you are talking to. Other applications include gaming, listening to music, watching movies and to do some small documentation task. Students use computers to complete the homework given at school or college.

In Education:

Computer education is becoming mandatory in most of the universities across the world. They basically teach the subjects which enable the students to acquire a job in software
engineering Industry. Teachers use computers as teaching aids which leaves some time for the discussion at the end of session. Nowadays colleges are setting up such a system where student and faculty attendance, syllabus, scheduled of tests, exams etc are put on the web and students, their parents and faculties can access it from anywhere and get updated.

**In Industries**

Mostly the software or the hardware that are produced by companies would be used to automate the manual task. One kind of industry will have the task of producing such products and is called software industry. Other companies which use these services are called clients. Computers can be used to produce pattern in textile industries, colors combinations in paint industries, automate the operation of a machine in an industry using robotics etc.

**In Business:**

They are used in commercial organization for clerical and administrative purposes. Tax calculations, salary slip preparations etc. can be done using computers. Stock market predictions can be done. Banks are using computers to maintain the account details and transactions. E-banking is picking up popularity because of the flexibility of banking sitting at a terminal anywhere. Excluding the matter of much talked security, they are used comfortably by the customers. E – Shopping is one more concept gaining popularity in industry where a customer can buy the displayed items by paying using credit card or cash on delivery options.

**In Entertainment:**

Animations and Special Effects for the movies are done using high end workstations. In Titanic movie they used 100 high end Linux workstations in parallel to produce the special effects. Also, the movies and music are available in the form of CDs, VCDs, and DVDs which cost less compared to watching movies at theatres. People prefer to watch them through these media in their leisure time. Kids enjoy playing games using computers.

**By Government**

A Government use computers at their offices to keep track of attendance of an employee at the simplest to military applications, satellite launching, collecting taxes. They are used almost in every public sector for one or the other task from schools to teach necessary skills to police stations to record complaints for example.