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SECOND PHASE SUBMISSION OF ASSIGNMENT

COMPUTER SCIENCE

ATLANTIC INTERNATIONAL UNIVERSITY



**COMPUTER SCIENCE
COURSE**

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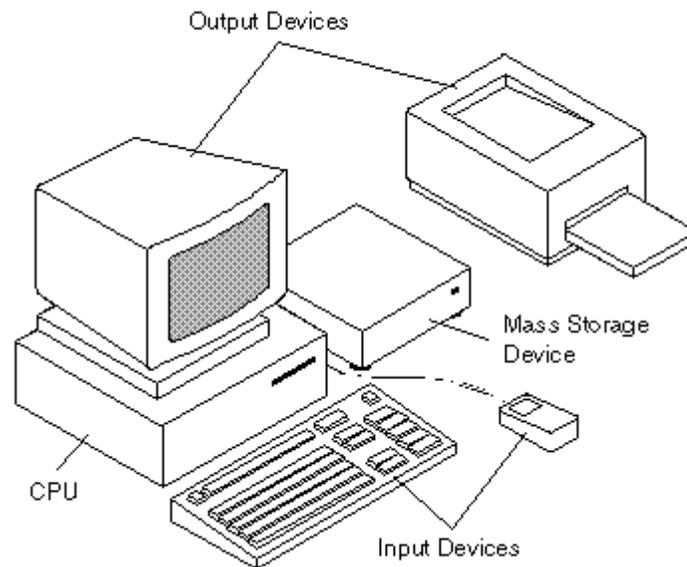
INTRODUCTION TO COMPUTERS AND COMPUTER SCIENCE

What is Computer Science

The study of computers, including both hardware and software design. Computer science is composed of many broad disciplines, including artificial intelligence and software engineering

a) Computer

A computer is a device that works under the control of stored programs, automatically accepting, storing and processing data to produce information.



Its programmable machine.

The two principal characteristics of a computer are:

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

Modern computers are electronic and digital. The actual machinery, wires, transistors, and circuits are called *hardware*; the instructions and data are called *software*.

All general-purpose computers require the following hardware components:

- **Memory** : Enables a computer to store, at least temporarily, data and programs.
- **Mass storage device**: Allows a computer to permanently retain large amounts of data. Common mass storage devices include disk drives and tape drives.
- **Input device** : Usually a keyboard and mouse, the input device is the conduit

through which data and instructions enter a computer.

- **Output device** : A display screen, printer, or other device that lets you see what the computer has accomplished.
- **Central processing unit (CPU)**: The heart of the computer, this is the component that actually executes instructions.

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

Computers can be generally classified by 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.
- **Minicomputer** : A multi-user computer capable of supporting from 10 to hundreds of users simultaneously.
- **Mainframe** : A powerful multi-user computer capable of supporting many hundreds or thousands of users simultaneously.
- **Supercomputer** : An extremely fast computer that can perform hundreds of millions of instructions per second.

a) CPU

The CPU is the brains of the computer. Sometimes referred to simply as the processor or central processor, the CPU is where most calculations take place. In terms of computing power, the CPU is the most important element of a computer system.

On large machines, CPUs require one or more printed circuit boards. On personal computers and small workstations, the CPU is housed in a single chip called a microprocessor.

Two typical components of a CPU are:

- The arithmetic logic unit (ALU), which performs arithmetic and logical operations.
- The control unit (CU), which extracts instructions from memory and decodes and executes them, calling on the ALU when necessary.

b) Program

It's a set of instructions that is written in the language of the computer. A program is used to make a computer perform a specific task e.g. producing a payroll.

The computer is only able to obey a program instruction if the program has been stored within the computer thus this implies that the computer must be able to input and store programs in addition to data hence the computer works under the control of stored programs.

c) Hardware

This is a general term used to describe all the electronic and mechanical elements of the compute, together with all the devices used with the computer.

d) Software

It's a general term used to describe all the various programs that may be used on a computer system together with their associated documentation.

Types of software

- i) Application software
- ii) Systems software

i) Application Software

It's software that is designed to be put to specific practical use.

There are two types of this kind of software namely:

- Specialist application software
- Applications packages

Specialist application software

It's a program with associated documentation, designed specifically to carry out particular tasks e.g. controlling company's stock control, solving a set of mathematical equations

Application Packages

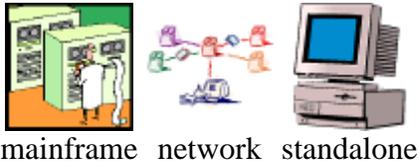
Its suites of programs with associated documentation used for a particular type of problem. Many packages are designed in such a way that they can be used for a variety of similar problems e.g. a payroll packages are sometimes produced in forms that enable them to be setup and used by different companies each having slightly different ways in which they need to produce their payroll.

- ii) Systems Software.

They are programs, with associated documentation, that control the way the computer operates or provide facilities that extend the general capabilities of they system e.g. The Operating System. The operating system controls the performance of the computer by doing a variety of jobs to ensure that proper , orderly and efficient use of hardware by application programs hence most applications programs can only work if there is an operating system

Basic Functions of a computer illustrated by the below figures/pictures

Basic Functions of a Computer



Input



Enter Data

Processing



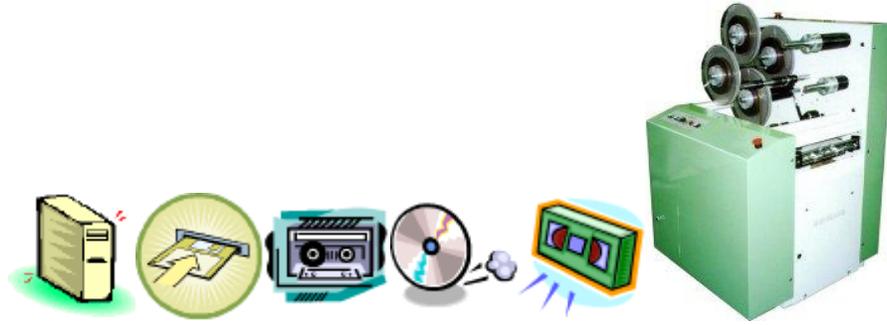
Manipulate Data

Output



"View" Processed Data

Storage



DATA REPRESENTATION AND TRANSMISSION

Characters

This is a set of letters, digits and other symbols are frequently used to represent data items e.g. names, prices this kind of a set of symbols is known as a **Character set**.

Keyboard devices, including ordinary typewriters have their own character sets, which are commonly engraved onto the keys. Keyboard devices are frequently used to input data into the computer.

When a keyboard of the computer input device is pressed the device produces an electrical signal that represents the key's character to the computer. The transmission passes through a cable from the device to the computer and the signal for each individual character is a series of electrical pulses called pulse train.

The system of representing pulse levels by the symbol "0" and "1" corresponds to a system of representing numbers called **Binary numbers systems**. The binary number system also uses only the two symbols "0" and "1" hence the binary number is known as **BITS**

Start and stop bits – start bit it's the first bit in the pulse train to be transmitted. Its purpose is to signify that start of a character transmission to the transmission. The start and stop bit are always of opposite polarity i.e. if one is 1 the other is 0 hence the change in pulse level takes place when a start bit is transmitted.

Transmission

There are two modes of data transmission namely:

- a) Asynchronous
- b) Synchronous

Asynchronous Transmission

The ASYNCHRONOUS (ASYNC) format for data transmission is a procedure or protocol in which each information CHARACTER or BYTE is individually synchronized or FRAMED by the use of Start and Stop Elements, also referred to as START BITS and STOP BITS. Intervals between characters may be uneven.

The Asynchronous Transmission Format is also known as START-STOP mode or CHARACTER mode. Each character or byte is framed as a separate and independent unit of DATA that may be transmitted and received at irregular and independent time intervals. The characters or bytes may also be transmitted as a contiguous stream or series of characters. It is the common method of transmission between a computer and a modem

The character or byte may contain the number of bits required to allow translation of the BIT PATTERN into a group of symbols used to represent:

- LETTERS (alpha characters)
- NUMBERS (numerical values)
- PUNCTUATION MARKS
- CONTROL ELEMENTS

Synchronous Transmission

The transmission of data in which both stations are synchronized. Codes are sent from the transmitting station to the receiving station to establish the synchronization, and data is then transmitted in continuous streams.

Synchronous Transmission sends packets of characters at a time. Each packet is preceded by a Start Frame which is used to tell the receiving station that a new packet of characters is arriving and to synchronize the receiving station's internal clock. The packets also have End Frames to indicate the end of the packet. The packet can contain up to 64,000 bits depending on the protocol. Both Start and End Frames have a special bit sequence that the receiving station recognizes to indicate the start and end of a packet. The Start and End Frames may be only 2 bytes each.

This method of data communication requires the source and destination to synchronize their clocks together. This synchronization of the clocks can occur externally to the data information or be incorporated with the data information. There are two types of synchronous data transmission (or communication):

- a. Externally clocked synchronous transmission
- b. Internally encoded synchronous transmission

The advantage to having the clocks synchronized is that longer blocks of data can be sent without loss of synchronization

Start Frame	DATA up to 64,000 bits of data or 8K Bytes	End Frame
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Efficiency

Synchronous transmission is more efficient than asynchronous

Data representation on magnetic media

Invisible spots of magnetism are created in the magnetic surface of the medium. These spots which can be magnetized in one of the two directions correspond to 0 or 1 according to the direction of magnetization. This mode of storage is widely used by mainframes for backing storage but mostly used to hold archive copies of data i.e. The data is recorded onto the tape and then the tape is removed from the computer and held in a safe place for future use.

Parity Bit

A **parity bit** is a binary digit that indicates whether the number of bits with value of one in a given set of bits is even or odd. Parity bits are used as the simplest error detecting code.

There are two types of Parity bit

- a) Even parity bit
- b) Odd parity bit

a) Even Parity Bit

Refers to the parity-checking mode in which each set of transmitted bits must have an even number of set bits. The parity checking system on the sending side ensures even parity by setting the extra parity bit if necessary.

b) Odd Parity Bit

An odd parity bit is set to 1 if the number of ones in a given set of bits is even (making the total number of ones odd).

Parity Checking

In communications, parity checking refers to the use of parity bits to check that data has been transmitted accurately. The parity bit is added to every data unit (typically seven or eight bits) that are transmitted. The parity bit for each unit is set so that all bytes have either an odd number or an even number of set bits.

Assume, for example, that two devices are communicating with even parity (the most common form of parity checking). As the transmitting device sends data, it counts the number of set bits in each group of seven bits. If the number of set bits is even, it sets the parity bit to 0; if the number of set bits is odd, it sets the parity bit to 1. In this way, every byte has an even number of set bits. On the receiving side, the device checks each byte to make sure that it has an even number of set bits. If it finds an odd number of set bits, the receiver knows there was an error during transmission.

The sender and receiver must both agree to use parity checking and to agree on whether parity is to be odd or even. If the two sides are not configured with the same *parity sense*, communication will be impossible.

Parity checking is the most basic form of error detection in communications. Although it detects many errors, it is not foolproof, because it cannot detect situations in which an even number of bits in the same data unit are changed due to electrical noise. There are many other more sophisticated protocols for ensuring transmission accuracy

Parity checking is used not only in communications but also to test memory storage devices. Many PCs, for example, perform a parity check on memory every time a byte of data is read.

DOCUMENT PROCESSING

Document file

Each document is stored in the computer individually by name in what is called a file. Many document files take the form of a formatted sequence of characters. In their simplest form such files are called text files because they consist of printable characters organized into lines of text. A small number of control characters signify tabs, page breaks and the divisions between lines.

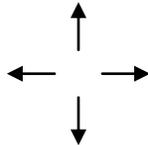
Editors

Text files can be created and modified with the aid of a special program called text editor. The most basic types of editor provide a means of editing text file on a line by line basis with each line being identified by a line number. These line editors are rather outdated.

Modern Text

Modern text editors normally display the file's text on the screen. There are numerous text editors in use today and they are often associated with particular operating system. i.e the editor "Vi" is commonly found on computers using an operating called Unix.

Text editors can be used both to create new files and to edit existing files. When an existing text file is edited the editor "reads" the characters from the file and displays them on the screen. The editor may also display the cursor in the top left hand corner. The cursor usually can be moved around the document using by means of the four cursor keys as shown



The text file will normally hold far more characters than can fit onto one screen display. A typical screen is 80 characters wide and may only display about 24 lines of text. The document size is not limited to the size of the screen. although they have disappeared from view they are still retained within the computers memory. Thus the screen acts like a window on the text, which can be moved up or down by means of the cursor keys.

In some editors the editor counts the number of spaces remaining and forces the word onto a new line if necessary hence this feature is called word wrap. Therefore the carriage return key is used only to force a blank line.

Most editors also incorporate cut and paste facilities whereby a section of text can be selected and moved to a different part of the document. A variation on this is to copy the selected section of text, without removing it from its original position. Such operations

often require the use of special function keys. The selection is normally made by first marking a start position and then moving the cursor to the end position.

The editor may provide other functions on highlighted text i.e. it might be possible to save the highlighted text in a separate new text file.

A search and replace facility is another frequently provided feature. It allows the user to replace a single word or phrase wherever it occurs in the document with another word or phrase for example on pressing "F5" key the user might be prompted the question FIND?. There are many features provided by a text editor.

Word Processing

Most word processors are carried out using specialist word processing software on ordinary computer/PCs. Hence the term word processor is used to refer to a word processing program or a complete word processing software package e.g. WordPerfect, Word

A word processing program allows users to create, edit, format, store and print text documents. A document is anything that can be type i.e. a memo, letter, a book, a report...

In most offices word processor have virtually replaced typewriters as a means of producing documents thus compared with a typewriter, word processing has a number of advantages

- a) The ability to store typed documents in a computer
- b) The ability to correct mistakes
- c) The ability to view the document on screen before printing
- d) The ability to print the document many times
- e) You are able to move sections of text to another part of the document
- f) The ability to insert or delete words, sentences or paragraphs

Another common formatting technique is text justification which means the alignment of text against a margin. Left justification means alignment against the left margin, right justification means alignment against the right margin and full justification means both the left and right justification.

When a document has been completed it can be saved for long term storage onto backing store as a file. The file normally has a format much complex than that of a text file and is usually directly usable by the word processing program which created it. The same document can be loaded back into the word processing program at a later time without needing to be retyped.

Within a word processing software package there may be a number of ancillary programs which can be used in conjunction with word processed documents to enhance the standard facilities i.e. Mail merge. In this it's possible to produce a standard letter into which the name and address of a number of clients in turn are merged and series of individual letters printed. Each recipient of the letter receives an original print.

Many word processing software include spell checking facilities. The spell check program comes with its own dictionary and its able to scan through the document and report

wherever a word is found which does not exist in its dictionary. The user is then able to correct the word or leave it as it was originally spelt.

Some spell checking programs can be left to search through a document and mark every doubtful word for later checking by the user. Others can check against their dictionary of words so quickly that they can provide immediate feedback to the user as each word is typed in.

Many spell checkers provide the user with a list of alternative words which are similar in spelling or sound to the doubtful word.

Another useful facility is thesaurus. This is a program which allows the user to choose an alternative word to a selected word and the user points to a particular word and is presented with a list of alternatives.

Desktop Publishing (DTP)

Desktop publishing system is a computer with the necessary hardware and software to enable the user to carry out computerized typesetting. A desktop publishing system will be able to handle document layouts involving not only printed text but diagrams and images too. The monitor screens in DTP systems are bit mapped with the grid of pixels on the screen being used to represent both images and text characters.

Document Processing Using GUIs

The cut and paste options on the edit menu can not only be used within a single document they can also be used to move text between one document and another. The user can be editing one document while referring to another. Its this kind of features that help users to improve productivity.

Graphical features can be used to good effect to aid the appearance of the word processor. i.e. a ruler can be displayed across the top of the document window so that the user can see the document's width and the tab marks.

The most significant additional facility of the GUI interface for document preparation is the use of graphical packages to produce illustrations for inclusion into documents

MAIN STORAGE

Main Storage holds data and programs currently in use by the processor. You can also refer to it as Main memory hence its able to retain information that may be later being recalled or accessed.

Features of Main Memory

- ❖ Data must be transferred to main storage before it can be processed by the processor. High access speeds then contribute to fast processing.
- ❖ Its operation is wholly electronic and consequently very fast and reliable. In the most modern computers the electronic memory circuits are also highly miniaturized.
- ❖ Data is almost instantly accessible fro main memory because of its electronic operation and close proximity to the processor.

Main Memory stores

- a) Data awaiting output
- b) Data currently being processed
- c) Instructions awaiting to be obeyed
- d) Data awaiting processing
- e) Instructions currently being obeyed.

There are various types of Main memory i.e. ROM

ROMS – It's a non-volatile semi-conductor in which all cell states are set permanently during manufacture. A set of instructions stored in this way is said to he hard wired and is often called firmware. This technique is often used to extend the instruction set of the computer by storing special purpose subroutines hence this are known as micro-programs. ROM is frequently used to store data or instructions which the computer needs all the time from the moment it is switched on.

Other types of ROM

- ❖ PROM
- ❖ EPROM
- ❖ EAROM
- ❖ EEROM

PROM (Programmable Read Only Memory). The PROM is programmable by the user hence the data is held permanently once the PROM is programmed.

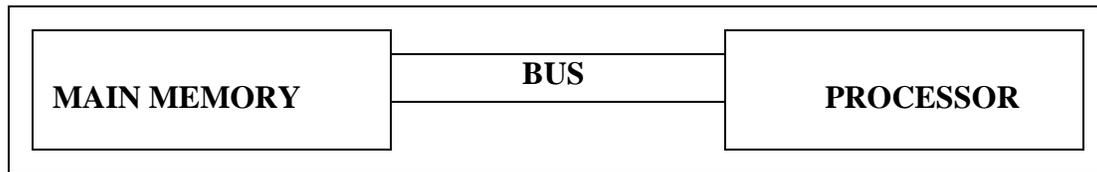
EPROM (Erasable Programmable Read Only Memory). It's like PROM in that it can be programmed by the user but has the advantage that it can be erased and reprogrammed. EPROM must be removed from the computer in order to be erased. Special devices known as EPROM eraser for this task.

EAROM (Electrically Alterable Read Only Memory) These memories can be read, erased and rewritten without removing them from the computer. However, the erasing and rewriting process is very slow compared with reading, thus limits their use

EEROM (Electrically Erasable Read Only Memory) This memory is the same as EAROM

BUSES

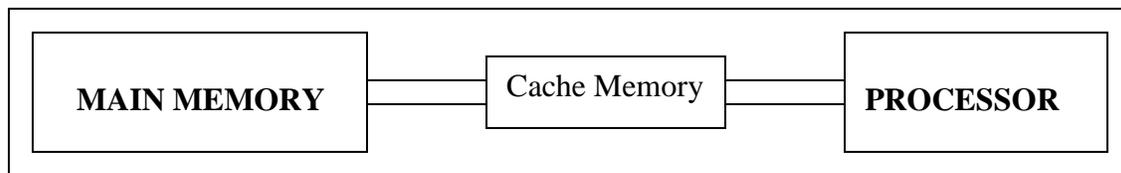
Data is normally transferred between main storage and the processor along a device known as a **BUS** which is effectively a means of sending multiple bits of data in parallel



The wider the bus the more bits it can transfer in parallel hence the faster the rate of data transfer. The bus width typically matches the word size i.e. an 8bit bus being used with a computer having 8bit memory.

Cache Memory

These chips tend to be expensive this memory chips are used to provide a “cache” which is a temporary holding area for data which is currently subject to repeated access. The processor can access this data more quickly and there is therefore an overall speed improvement. The cache is between main storage and processor hence acting as a holding area through which all data and instructions pass



BACKING STORAGE

Magnetic diskette unit and magnetic diskette (Floppy Disk)

Floppy disk unit/floppy diskette is extremely popular storage medium particularly when used with microcomputer systems such as personal computers.

Features of Floppy Disk unit

- ❖ Floppy disk units are single drive units able to hold a single disk. Single drive units are often incorporated physically into the body of personal computers.
- ❖ The action of inserting the diskette activates a turntable, which rotates the diskette and also brings a read and write head into contact with the disk. The read write head is moved to and from across the disk in order either to record data on the disk surface (a write) or to read back data which has previously been recorded.
- ❖ Each disk is inserted into a narrow slot in the front of the disk drive. The slot sometimes has a small flap over it to protect the unit from dust. The diskette is pushed into the slot and then automatically clips into place. A push button is used to for releasing the diskette when its to be removed.
- ❖ A typical floppy disk rotates at about 360 rpm compared with the hard disk which rotates ten times faster.

Features of a Floppy Disk

- ❖ Data is stored on tracks, sectors and cylinders in a way directly comparable to the hard disk.
- ❖ A pliable disk permanently sealed within rigid, smoothly lined, protective plastic envelope, which keeps the whole disk surface covered and protected when not in use.
- ❖ Data is stored on tracks, sectors and cylinders in a way directly comparable to that used for hard disk.
- ❖ Computers read and write data in multiples of one or more sectors. This unit of data transfer is called a cluster or allocation unit.

Optical Disk Unit and Optical Disk

There are three basic types of optical disk and all of them use laser to write or read data. All three provide a means of storing very large volumes of data.

- ❖ CD ROM (Compact Disk Read-Only Memory)
- ❖ WORM (Write Once Read Many)
- ❖ EO (Erasable Optical)

❖ CD ROM (Compact Disk Read-Only Memory)

A type of optical disk capable of storing large amounts of data -- up to 1GB, although the most common size is 650MB (megabytes). A single CD-ROM has the storage capacity of 700 floppy disks, enough memory to store about 300,000 text pages.

All CD-ROMs conform to a standard size and format, so you can load any type of CD-ROM into any CD-ROM player. In addition, CD-ROM players are capable of playing audio CDs, which share the same technology.

CD-ROMs are particularly well-suited to information that requires large storage capacity. This includes large software applications that support color, graphics, sound, and especially video. They are a replacement for the Vinyl LP record.

❖ WORM (Write Once Read Many)

In computer storage media, WORM (write once, read many) is a data storage technology that allows information to be written to a disc a single time and prevents the drive from erasing the data. The discs are intentionally not rewritable, because they are especially intended to store data that the user does not want to erase accidentally. Because of this feature, WORM devices have long been used for the archival purposes of organizations such as government agencies or large enterprises.

Its type of optical media, WORM devices were developed in the late 1970s and have been adapted to a number of different media. The discs have varied in size from 5.25 to 14 inches wide, in varying formats ranging from 140MB to more than 3 GB per side of the (usually) double-sided medium. Data is written to a WORM disc with a low-powered laser that makes permanent marks on the surface.

❖ EO (Erasable Optical)

They are Optical rewritable disks. The disk unit is similar to that used by WORM but works on a slightly different principle. Instead of burning a pattern onto the disk surface the laser heats spots on the disk surface which is made of a special alloy. Magnetic molecules in the alloy surface can be aligned by a magnetic field when warmed by the laser but cool again to leave a semi-permanent magnetic pattern comparable to that found on a magnetic disk. There users can write to, read from, and erase from EO disks as often as they can. EO disks require special hardware.

WORKSTATIONS AND TERMINALS

A workstation is a computer intended for individual use that is faster and more capable than a personal computer. It's intended for business or professional use. Workstations and applications designed for them are used by small engineering companies, architects, graphic designers, and any organization, department, or individual that requires a faster microprocessor, a large amount of random access memory (RAM), and special features such as high-speed graphics adapters.

A **computer terminal** is an electronic or electromechanical hardware device that is used for entering data into, and displaying data from, a computer or a computing system. Typically it provides a text terminal interface over a serial line.



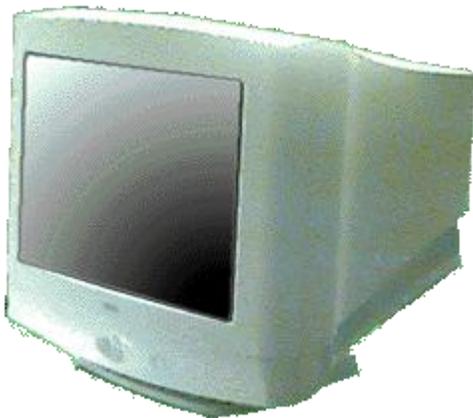
OUTPUT DEVICES

These devices display information that has been held or generated within a computer. Some examples are shown below.

- ❖ VDU or Monitor
- ❖ Printers
- ❖ Plotters
- ❖ Robot
- ❖ Synthesized Voice
- ❖ Machine Tool

❖ VDU or Monitor

Visual Display Units (VDU) or monitors are used to visually interface with the computer and are similar in appearance to a television.



A cathode ray monitor



A plasma monitor

Visual Display Units display images and text which are made up of small blocks of colored light called pixels. The resolution of the screen improves as the number of pixels is increased. Most monitors have a 4:3 width to height ratio.

❖ Printers

You can print out information that is in the computer onto paper. By printing you create what is known as a 'hard copy'.

There are different kinds of printers which vary in their speed and print quality.

The two main types of printer are impact and non-impact.

❖ Plotters

Plotters are used to produce graphs or diagrams.
Plotters can be of two types:

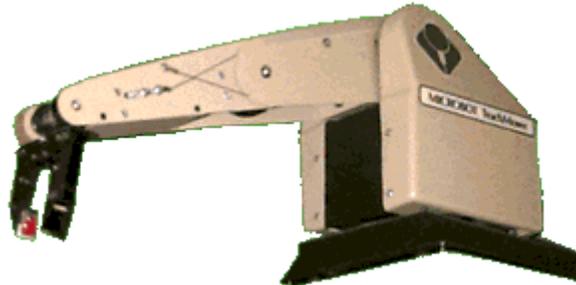
- Pen plotters
- Electrostatic plotters

Pen plotters have an ink pen attached to draw the images, and electrostatic plotters work similarly to a laser printer.

❖ Robot

Robots are able to perform a variety of tasks as a result of executing instructions contained within a program.

We are still a long way from the science fiction robots and androids portrayed by the film industry.



A robot arm

Robots in a business sense mean automated machines designed to perform mundane operations which require accuracy, such as assembling cars.

They are seldom manufactured to resemble the human form.

❖ **Synthesized Voice**

Voice synthesis has a robotic sound due to the difficulties of replicating the complexities of human speech and pronunciation.

Voice answer back (VAB) is used to respond to telephone enquiries, such as the speaking clock.



A speak and spell toy

Educational applications include "Speak & Spell" and arithmetic trainers.

❖ **Machine Tool**

Computer Aided Manufacturing (CAM) tools are used to manufacture a variety of products.

Repetitive functions are controlled by sets of computer instructions.

Machine tools automate factory production and have the advantage over humans of high accuracy, and they never require a coffee break!

REFERENCE

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