*I*NFORMATION

*T*ECHNOLOGY

COMPUTER HARDWARE –

SYSTEM BASICS

Table of Contents

The Components of a Computer System

The basic components of the computer have not varied since the earliest computers were made in the early 1950's. The only real changes have been in the number and variety of input and output devices. All computer systems today consist of:

A Central Processing Unit (CPU)
A Keyboard
Monitor
Mouse
One or more removable disk units (Floppy Disks)
Hard Disk, usually inside the system unit, non-removable
Most have a CD Rom drive, some have a CD Writer
Printer

Most of these devices are shown in the diagram below:

Scanner

Monitor – sometimes called the Cathode Ray Tube (CRT) or Visual Display Unit (VDU)

CD Rom Drive

Speakers

Floppy Disk Drive

CPU and Hard Disk are inside the main box or System Unit

Keyboard

Mouse
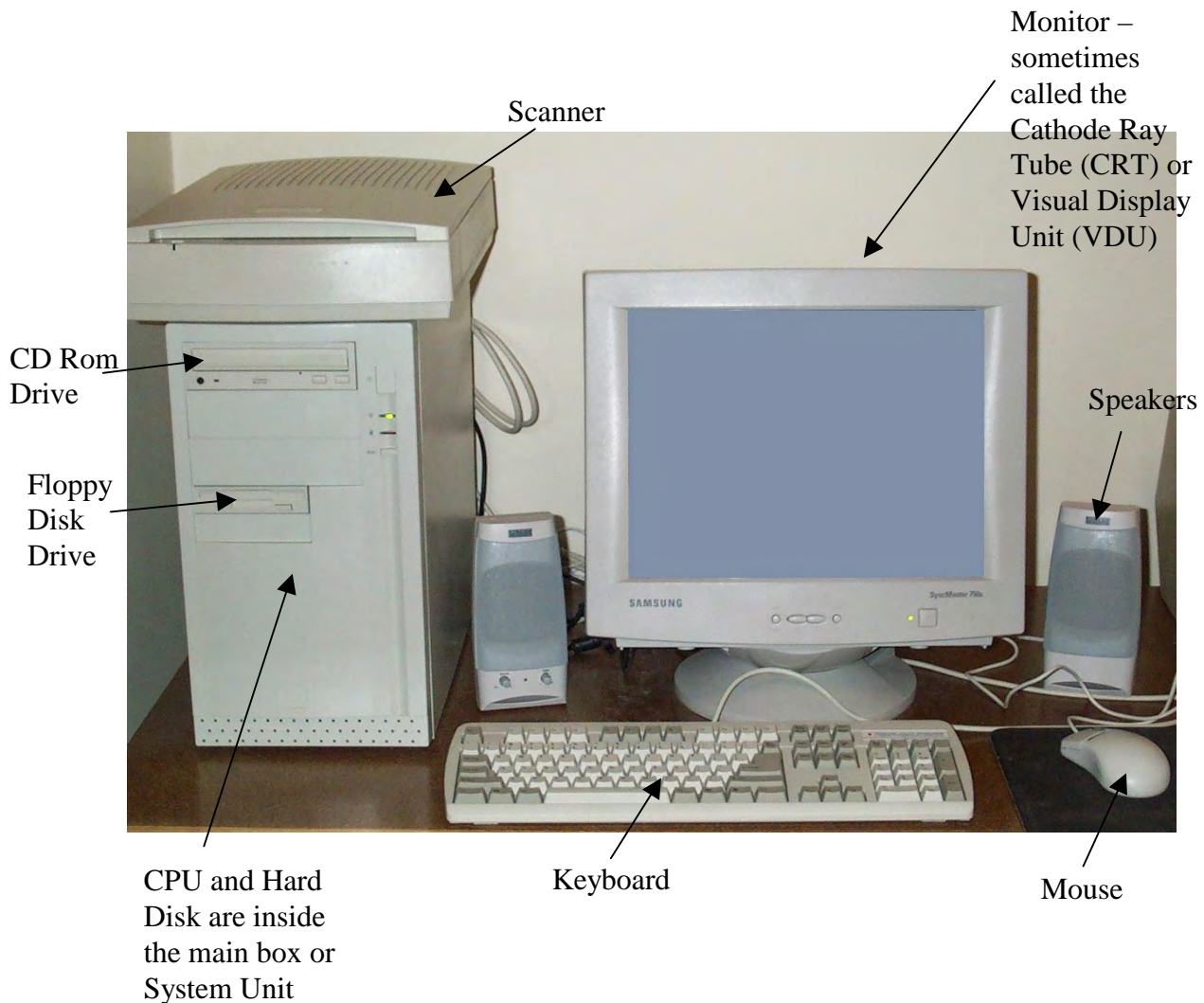
The architecture of the computer, in other words the underlying design for the computer, which is attributed to Von Neumann is shown diagrammatically below:

Central Processing Unit (CPU)
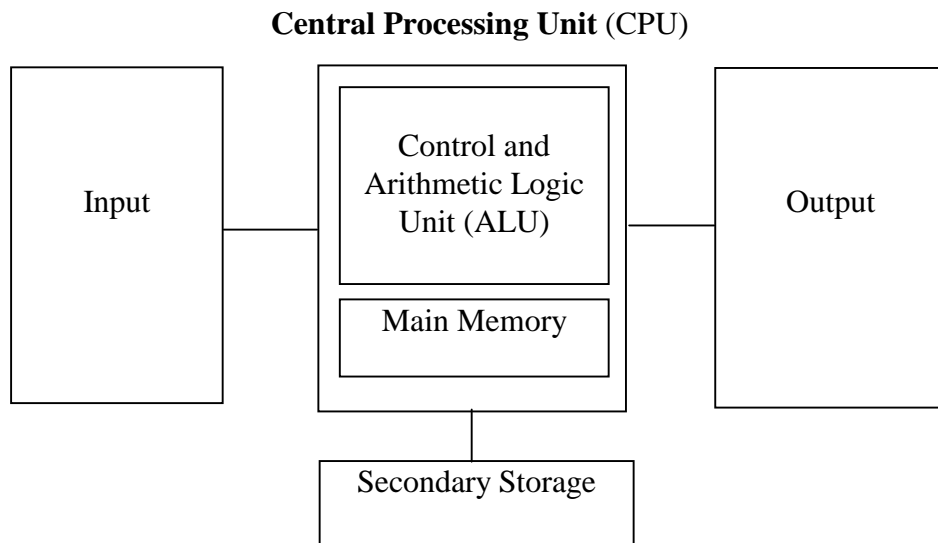
Inside the Computer

Very little can be seen inside the main System Unit of the computer. If the System Unit is opened however, an assortment of devices can be seen. The picture below shows the inside of what is called a Tower case. This means that the computer monitor isn't sitting on top of the CPU system, but is sitting beside the monitor in a tall box called a Tower case.
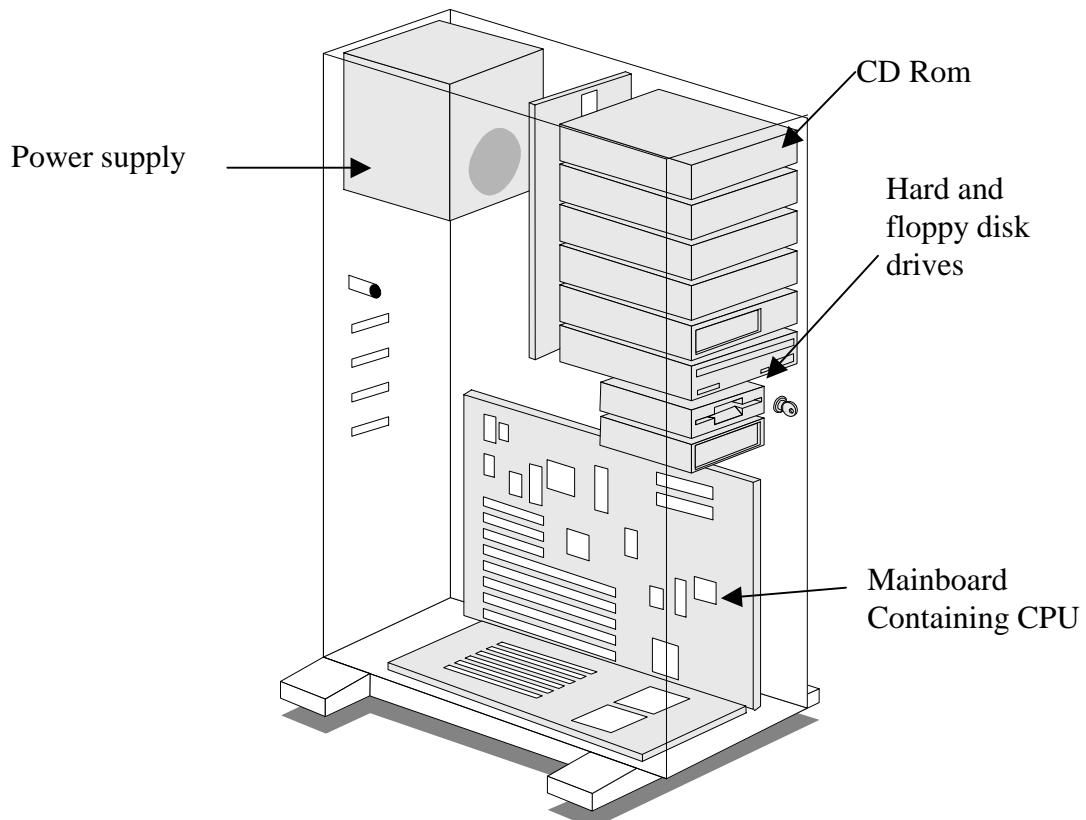
Task 1

Part A

Using the computer you will be doing most of your work on, identify the various components of the computer and list them below:

_____

_____

_____

_____

_____

Part B

Look at the back of the computer. Notice the various leads that are connected to the computer. Identify the leads for the following devices, if they exist on your computer:

    Mouse
    Monitor
    Speakers
    Power

End of Task 1

Classifying the Components of a Computer System

The components of the computer can be classified as either Hardware or Software. The **Hardware** consists of the physical components of the computer, such as the keyboard, monitor, CPU etc. The **Software** consists of the programs that run on the computer. Together the hardware and software form the computer system.

Peripheral Devices

All devices not part of the CPU, but connected to it, are called **Peripheral** devices. The keyboard, mouse, printer, disk drives, CD Rom drive etc are all called peripherals. Most of the peripherals on a computer system can be classified as Input, Output or Secondary Storage devices.

Input Devices

All computers require some form of input. The most common input devices are the keyboard and mouse. The keyboard while widely used is in fact the slowest input device. Most input devices fall into one of four main types:

1.   Paper Devices.

These are the oldest input devices but are actually making a resurgence in recent times. The first input devices consisted of **paper tape** and **punched cards**. Each of these devices was used to represent the bytes of data that are used for storing data in a computer.

The paper tape and punched cards both represented a 1 in the byte by a hole. The following diagram shows how the five bytes 01010000, 11111111, 11001000, 00110001 and 10010000 are represented on punched paper tape. Note each byte is across the paper.

Recently paper devices have been introduced into many forms of gambling. People pick their Tattslotto numbers by marking a paper card that is then read by the computer. Also TAB agencies use paper devices for choosing horses at the races. The main difference between paper devices used when computer were a new device and today is that no longer does the data have to be converted into binary by the user of the computer. It would be very difficult to pick the Tattslotto numbers if they had to be entered on the card using binary.

2. Touch Devices

There are a number of input devices that rely on touch - the **mouse** and **joystick** are probably the most common. Also included in this group are the:

Touch screen - where input comes from touching the screen with the finger
Trackball - where the cursor is moved on the screen by rolling a ball instead of a mouse. Some computers have a Trackball built into the Keyboard.
Light Pen - where the pen senses the light from screen
Graphics tablet used with graphics packages, especially in computer aided design

3. Sensing Devices

Many computers use sensing devices to monitor what is actually happening in the real world. For instance many of the devices used in hospitals to monitor patient's conditions are attached to computers and are constantly recording the patient's vital signs.

Other sensing devices are used to monitor temperature, electrical currents, pressure and even the races at the Olympic and Commonwealth games are timed using computerised sensing devices.

4. Source Data Automation Devices

Many of the input devices in use today are called source data automation devices because the data that is put into the computer is gathered directly at its source with little or no keying of data required. Included in this category are:

Scanners - There are many types of scanners used with computers. Hand-held scanners are relatively cheap and can be used to scan small pictures into the computer. An example scanner is shown below: The scanner is held in the hand and moved over the picture slowly.
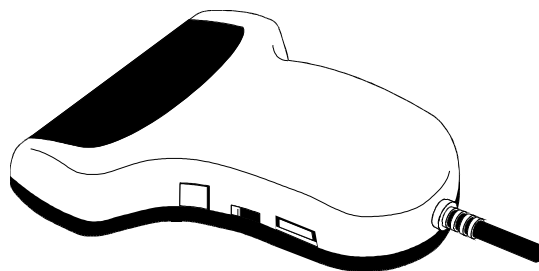
The Flat-bed scanner (shown below) is more expensive but can be used to digitise (convert to binary) pictures and scan text into a Document.
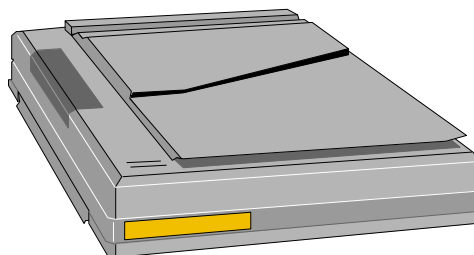
Many businesses also use specialized scanners. Most supermarkets use scanners to scan the bar codes of products rather than keying in the prices to the cash register. Libraries are also mainly computerised and use scanners for scanning the call numbers on books.

MICR- Magnetic Ink Character Readers are used in the banking industry for processing cheques. The magnetic ink characters that are impregnated onto the bottom of cheques are quickly scanned into the computer leaving only the amount of the cheque to be processed by hand.

OCR - Optical Character Readers allow printed characters to be read directly into the computer again using a scanner. In this case special software is needed to identify the different characters being read.

OMR - Optical Mark Readers are used to scan marks on printed sheets such as the marks placed on a Tattslotto coupon or TAB ticket. The reader can quickly tell where the mark is and record the chosen number or horse. Some school examinations are also marked by computer. Multiple choice tests often have computer mark sheets, which use optical marks to select the answer for each question.

Output Devices

Once data has been entered into the computer and processed it must then be made available to the user. The function of the output devices is to provide this processed data in a form useful to the user. There are many different devices used to display the output from the computer. The most common are:

1.   **Monitors**

There are various types of monitors on the market today. Most computers have either a VGA or super VGA screen. The VGA stands for Video Graphics Array. Earlier computers had screens classified as CGA (Colour Graphics Adapter) or EGA (Enhanced Graphics Adapter).

2.   **Printers**

While monitors are said to produce a soft copy of work, printers produce a hard copy printout from the computer. Printers are basically categorised as either Impact or Non-impact.

Impact printers have some hitting mechanism that is used to impart the image from the print head to the paper. They are very noisy printers and often require an acoustic cover to stop the noise from the printer.

The most common example of an impact printer is the dot-matrix type printer. This printer uses a print head that consists of pins - either 9 or 27 pins - that forms the matrix for each letter of the alphabet. The pins are moved forward and then hit against the printer ribbon, which then places the letter onto the paper. The letters are generally of a poor quality although the printers were originally relatively fast and inexpensive. For example the letter E and T may have been made with the following dot patterns:
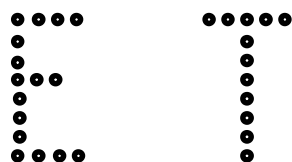
Note the nine pins are down each line of the character. The ninth pin is used for letters such as y.

Non-impact printers use heat, jets of ink or lasers to produce an image on the paper. Thermal printers use heat sensitive paper, ink jet printers spray the ink onto the paper and laser printers use lasers to adhere toner to the paper. Non-impact printers are very quiet and also give an excellent quality output. They are however, relatively more expensive than non-impact printers. In recent times however, non-impact printers have fallen in price and it is now quite feasible for a home computer system to include either a colour ink-jet printer or a black and white laser printer. The following picture shows a heavy duty type laser printer designed more for commercial rather than private use.
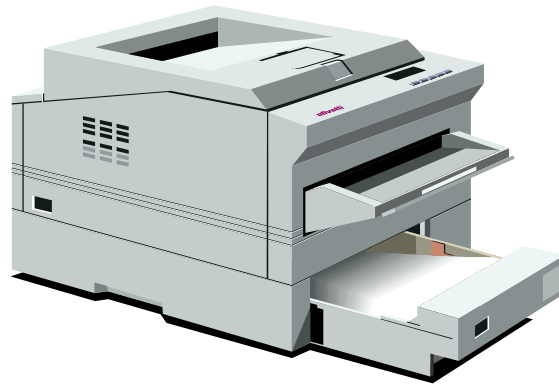
3. Plotters

Plotters also produce hard-copy output but unlike printers, that are text oriented, plotters produce drawings. To draw on the paper the plotter determines the starting co-ordinates for the page and then draws from position to position rather than typing text line by line down the page, as does a printer. Plotters use a carousel of pens that allows different coloured objects to be drawn on the paper.

4. Sound Devices

Software has now been developed to produce reasonable sound output from computers. For example, when Telstra gives the phone number for an enquiry, the computer is actually producing the sound for each digit in the number. Similarly many of the pay-by-phone billing systems use computers to prompt the user for data input such as the account number. Output of this nature may be using either voice synthesis or a digitally recorded voice.

Secondary Storage Devices

The data placed into a computer is stored in main memory. Main memory however, is not a permanent form of storage and therefore in order to save data permanently it must be placed on some form of secondary storage device. These devices allow both permanent storage of material and also provide the ability to transport data from one computer to another. All software is purchased on secondary storage media. There are again a number of secondary storage devices available for computers. They include:

1. **Magnetic Tape**

    Magnetic tape is the oldest form of secondary storage and is rarely used in its original form now. Magnetic tape originally came on large reels and required a large tape drive to read it. All magnetic tape has data stored as magnetic spots representing the bits of each byte. North and South magnetisation represent the 1's and 0's.

    Magnetic tape must be read **sequentially**, in other words the tape has to be read from start to finish reading each section as it goes. This makes it a very slow medium for reading.

    Today the main use for magnetic tape is in the form of **streaming tapes**. Streaming tape comes in a small cassette similar to those used in Walkman players. The tape is very dense and can hold vast amounts of data. It is used for making backup copies of hard disks. A small streaming tape drive is installed into the computer and the tape used to copy all data from the hard disk.

    Backing up is essential for all computers in case the hard disk fails (sometimes called a "crash") or the computer fails. It is important both for business and personal computers that a regular system of backing up be devised. Many businesses make a backup of the files used in their business each day, while other may only backup once a week. The frequency of backing up is really determined by the amount of work done on the computer each day. The most important point about backing up is that it is done regularly.

2. **Hard Disks**

    Originally hard disks came in the form of removable disk platters. Each platter had its own read/write head that hovered over the disk. These platters were very heavy and cumbersome and were prone to changes in environmental conditions such as heat and dust.

    Hard disks also store data using magnetic spots, the data is however organised in sectors and tracks as shown in the diagram below. This disk is divided into sectors and tracks:
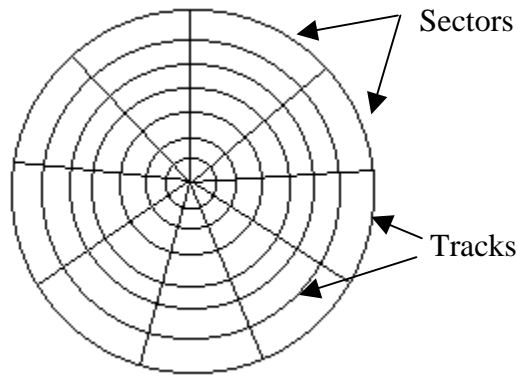
Data is stored in a certain sector and track and usually is placed in the first available place on the disk. The read/write head can move in and out to access each track on the disk and the disk spins so that each sector can be accessed.

Today's hard disks come enclosed in a metal box that seals them from dust, smoke etc. They are sometimes called Winchester Hard disks and have become very compact. Hard disks can hold vast amounts of data and new machines today have hard disks that can contain many billions of bytes of data and are measured in **gigabytes** of storage.

3.   Floppy Disks

Floppy disks basically come in two main sizes - 5 ¼ inch and 3 ½ inch. There are also two types of density with each disk - high and low density. The following table gives the capacity of each of these four disks:

Disk Size	Capacity
5 ¼ inch double density	360 Kb
5 ¼ inch high density	1.2 Meg
3 ½ inch double density	720 Kb
3 ½ inch high density	1.44 Meg

5 ¼ inch floppy disk
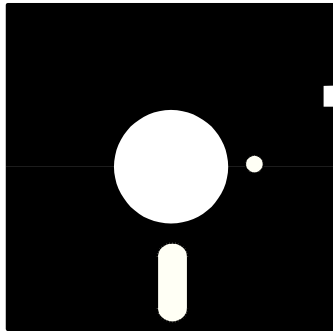
3 ½ inch floppy disk
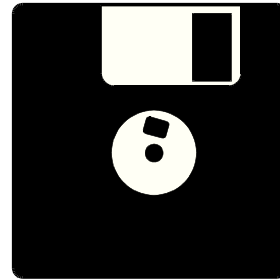
Most 5 ¼ inch drives have disappeared from computer systems and been replaced by a CD Rom drive.

4.   CD Roms

CD Roms are fast becoming the media to use for long term storage of data and distribution of software packages. At this stage most CD Roms are read only but read/write disks and players are quickly dropping in price and in a short time it is expected that most Computer Systems will have a CD read/write unit.

CD Roms use very dense recording techniques and can store up to 650 Mb of data. They are very durable and easy to transport and it is envisaged they will soon become the main secondary storage device.


5.   DVD

Digital Versatile Disks are starting to be used in computers. They can store several Gigabytes of data. The main use of these so far is for multimedia files which are very large.

Communication Devices

One computer cannot communicate with another through the phone line, without the addition of a **MODEM**. A Modem, which stands for **Mo**dulation **Dem**odulation is used to translate the data going from the computer, which is in bits, into the signal that must be sent down the phone line. For two computers to communicate through the phone system the following is required:
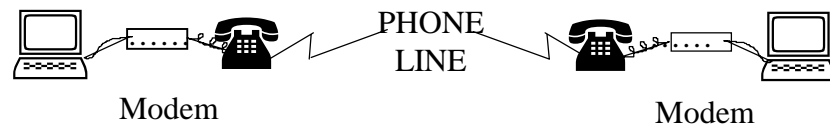
Each computer is connected to a modem. The modem can be external as shown below or be on an interface card that is placed into the expansion slots on the motherboard inside the System Unit.
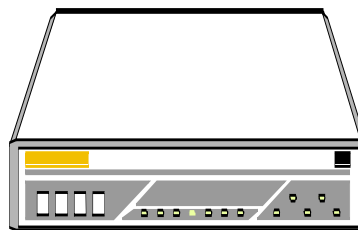

Each modem is then connected to the phone line through the phone plug connected to the phone. The bits are then sent to the modem from the computer, translated into a phone signal and sent down the phone line to the other phone, which sends it to the modem to be translated back into bits and bytes for the computer. This is the system required to use the Internet from home.

Below is a list of peripheral devices. Categorise each device as Input, Output, Secondary Storage or Communication device:

Device	Category
Compact Disk	
Temperature sensor	
Games Joystick	
Speakers	
Deskjet 690C Deskjet Printer	
Special characters on the bottom of cheques	
Touch ball	
Plotter	

Identify the following pictures – write their name and category beside each picture.
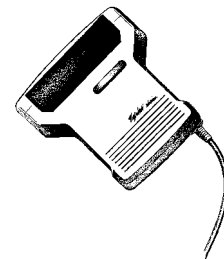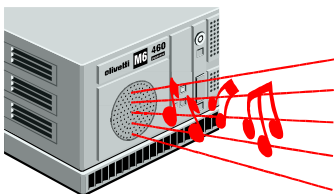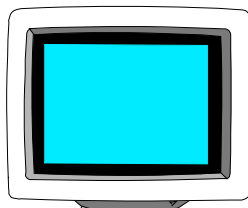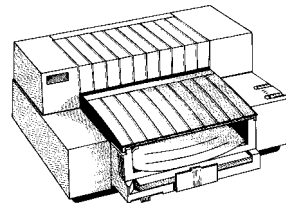
End of Task 2

Operating the Mouse

The Mouse is the primary way that the User interacts with the Computer and its Software. Actually the Mouse is one kind of Pointing Device. With most programs now using a Graphical User Interface (GUI) the User constantly needs to "point" at locations on the screen.

Two typical Mouse devices are shown below. The one on the right also has a small wheel located between the two buttons.

For the User, the main parts of the Mouse are, the body which can be moved around on the desk and which is sensed by the Mouse and the two buttons at the front.

When using the Mouse it is important to watch the screen and the on-screen Mouse Pointer. The shape of the Mouse Pointer changes depending on which program and what operation within the program, but is commonly seen as an outlined arrow similar to that shown below.

Use of the Buttons

The two buttons are used to make choices within the program being used. In general terms the use of each button can be categorized as follows,

Left Button   To make a Selection. That is, to actually choose and expect that choice to happen.

Right Button   To bring up a Menu on the screen that is appropriate for where on the screen the right button was pressed. Usually this would then be followed by using the Left Button to choose one of the Menu items.

Click and Double-Click

Each button can be used in two ways, Single-Click (or just Click) and Double-Click. Single-Click means press and release the button. Double-Click means press and release the button twice with only a short time interval in between. Double-Click is rarely used with the Right Button.

An important point about clicking the buttons is that between the Press and Release, the Mouse must not move. Also, if an instruction says Click or Double-Click but not which button, then use the Left Button.

Drag

Another operation that is commonly performed throughout Windows is the Drag. A Drag operation means to relocate some particular item on the screen. In this operation the Mouse is deliberately moved between pressing the left button down and releasing.

A typical operation would be to move an Icon on the Desktop. For example, the Mouse Pointer would be located over the Icon, the left button pressed, the Mouse Pointer moved to the required new location and then the left button would be released. During the Drag, the Icon would change appearance in some way.

The Wheel

If the Mouse has a Wheel this can be used to Scroll the view on the screen and may also operate as another button. Not all programs will recognise these functions and the exact use of the Wheel will depend on the setting of Mouse Parameters, see below.

Adjusting Mouse Parameters

For a basic Mouse there are a number of parameters that can be adjusted through software. For instance, the time between clicks for a Double-Click and for preference, if required, the role of the left and right buttons can be swapped.
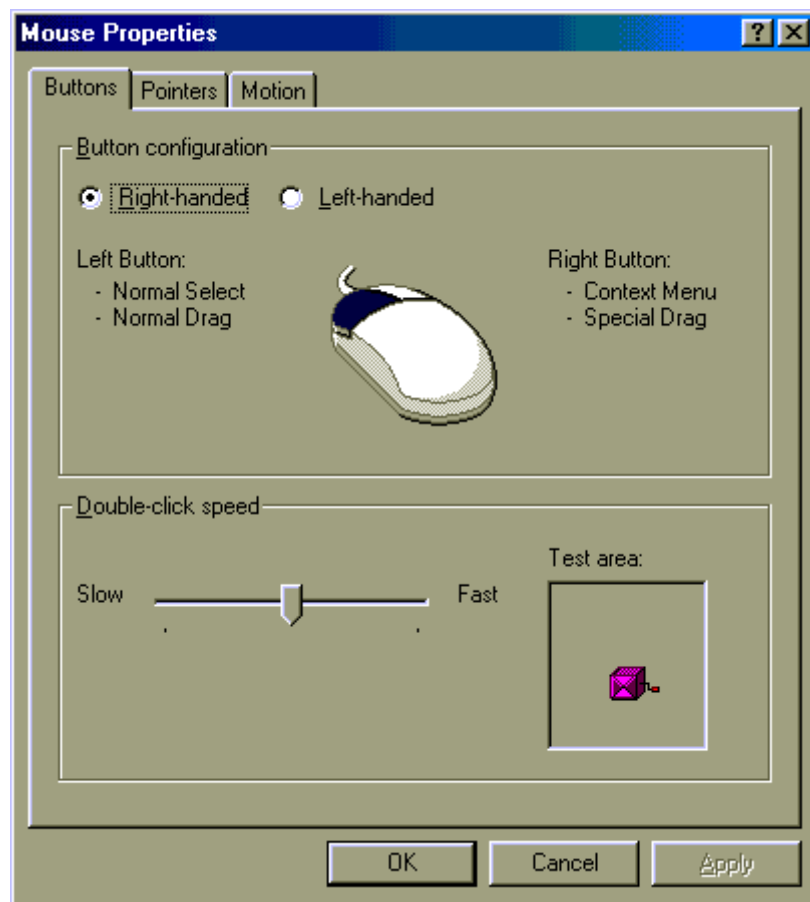
To adjust Mouse parameters choose,

Start | Settings | Control Panel
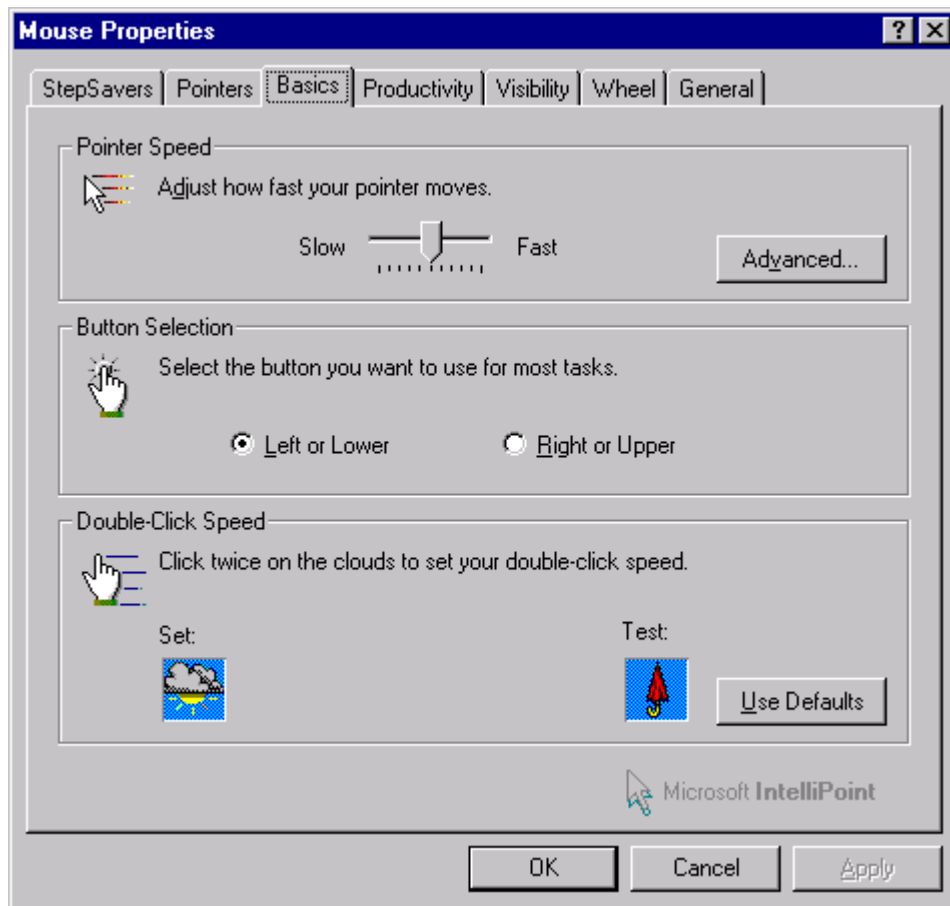
Then Double-Click on the Mouse Icon.

The **Mouse Properties** Dialog box should appear.

Various parameters can be set with this dialog by choosing the different Tabs at the top and then the appropriate parameter.

If a more advanced mouse is used such as the Wheel Mouse then the Mouse Properties Dialog will look more like that shown below.

Note the larger range of items that can be set, including a special Tab for the Wheel.

Mouse Maintenance

Depending on the type of Mouse, a certain amount of maintenance is required. Most Mouse devices use a ball underneath to detect movement of the Mouse. The ball can collect a lot of dust and fluff, which can then transfer inside the Mouse. A periodic clean is required, or erratic movement of the Mouse Pointer will occur.

Some Mouse devices do not have a ball, they are known as an Optical Mouse. These do not have the same problems but still need to be regularly checked for any contamination of the optical system.

To clean the Mouse

Underneath the Mouse the ball can be seen. Usually the disk surrounding the ball can be rotated to release the ball.
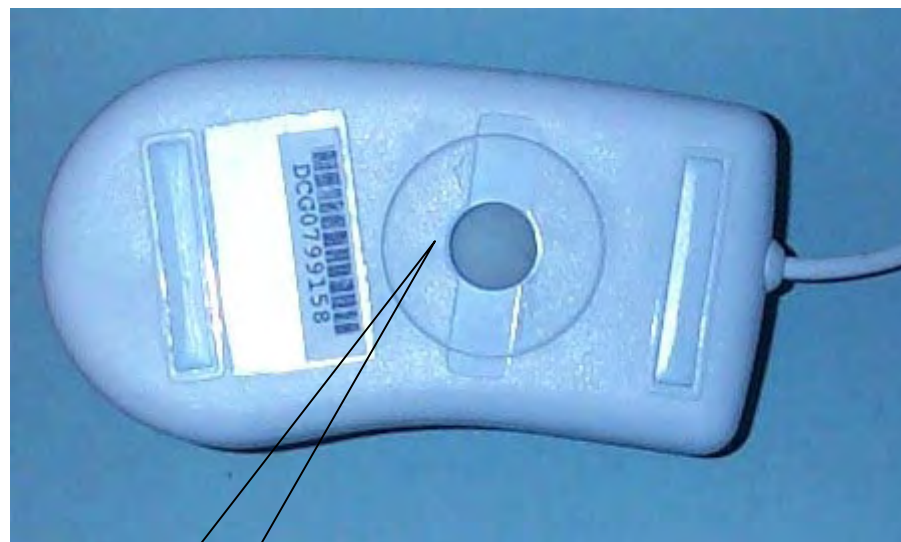

Rotate this Disk

Once open, inside can be seen three small rollers, one is spring loaded to keep pressure on the ball when in use. These rollers should be cleaned with a cotton bud or similar, dampened with a little water, or, for stubborn bits use some Methylated Spirits.

Operating the Mouse

1.   At the Windows Desktop, **Click** the Left Mouse Button on the Start Button, which is usually located at the bottom left of the screen. You should see a menu similar to the following appear.
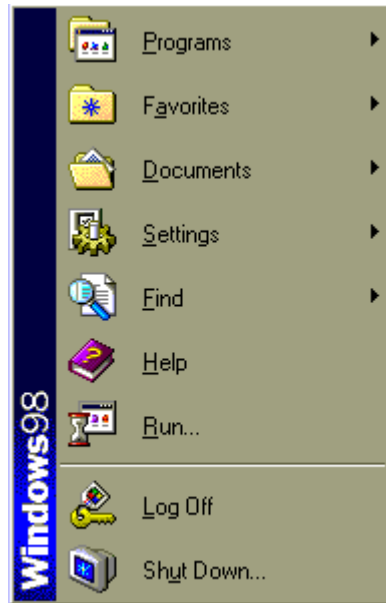
Now **Click** (the Left Mouse Button) somewhere in the blank area of the Desktop and the Menu should disappear.

2.   **Click** (the Left Mouse Button) on the My Computer Icon on the Desktop, its background should turn darker, usually Blue.

3.   **Drag** the My Computer Icon to a different location on the Desktop

4.   **Click** the Right Mouse Button somewhere in the blank area of the Desktop and a menu similar to the following should appear.

5.	Use the Mouse Properties to adjust and practice Double-Click operations.

6.	Use the Mouse Properties to set Pointer Trails

7.	Remove the Mouse Ball and check for contamination, clean if necessary.

8.	Play a game of Hearts, FreeCell or similar to practice Mouse usage. Games are located under Start | Programs | Accessories | Games

End of Task 3

Operating the CD-ROM

CD-ROMs in a computer have a twofold purpose, to load software and data or they can be used to play Audio CDs. To be able to play audio CDs, the computer does need to have a sound device installed, however these are very common in most modern PCs.

A typical CD installation with the controls labeled is shown below.
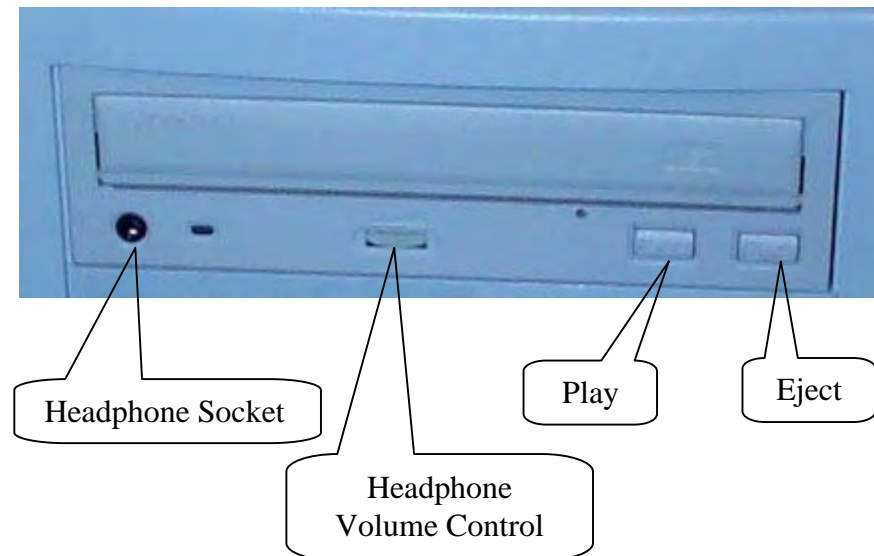
To insert a CD, simply press the Eject button and the CD should open as shown below (with CD inserted).

Software / Data CDs

If the CD is a Software/Data CD it may well Auto Start. This is a feature to make it easier to install new software. If the CD does not Auto Start it can still be accessed through either the Windows Explorer or the Start | Run command.

In the Windows Explorer the CD-ROM drive will appear as a separate Secondary Storage device with its own drive letter, commonly D:. Once a CD is inserted, the Volume Title of the CD will also appear in the Windows Explorer, see the diagrams below.
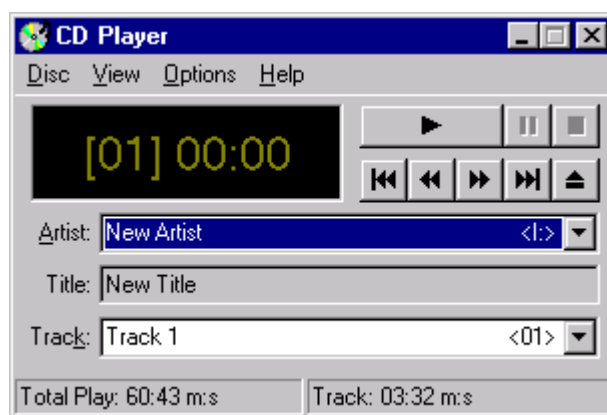

No CD present
CD is Drive I:

CD present with Title - Nov2000

Audio CDs

To play an Audio CD requires the use of a program built into Windows called the CD Player, however there are also many other third party CD Player program available. The Windows CD Player is shown below.


### Adjusting the Volume of Playback

The speakers attached to the computer system will have a Volume Control (if they are the amplified type). Also there are several software Volume Controls. The easiest of these to use is that located in the Taskbar. At the bottom right corner of the screen display there should be a small speaker icon.

A single click on this icon will bring up the simple Volume Control.
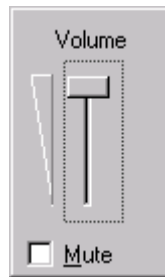
A double click will bring up the full Play Control which has controls for sound input as well as output.
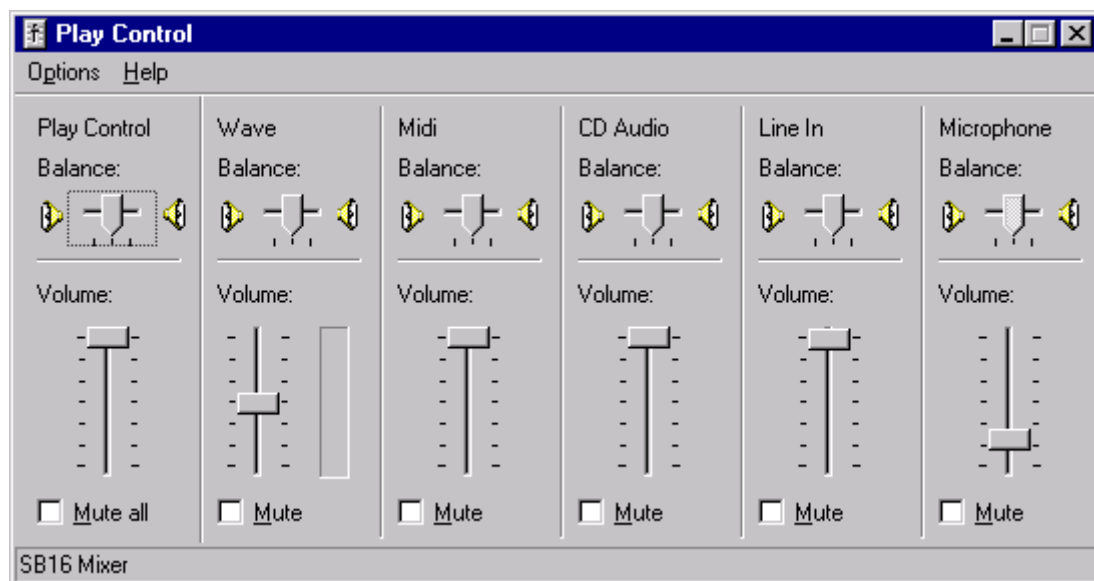
Furthermore, by clicking the right button over the icon and then selecting **Adjust Audio Properties** even more sound properties will be displayed which **may** include another Volume Control.

Depending on the CD Player program this also may have a Volume Control, programs such as WinAmp do offer a full range of controls.

Task 4

Operating the CD-ROM

1.   What drive letter is your CD-ROM?

2.   Obtain a CD from the cover of one of the many PC magazines such as PC
      User or PC Authority. Insert the CD into the CD-ROM drive, wait a few
      seconds and the Web Browser should display the start-up screen for the CD-
      ROM. Now Browse the CD and then Exit.

3.   Another way to browse the CD is to use the Run command.

      Go to Start | Run then type in the drive letter of your CD-ROM, D: for
      instance and then click on OK or press Enter.

      This should start a new Window displaying the contents of the CD-ROM.
      Use the Mouse to Scroll through the contents of the CD-ROM. You can also
      use the Mouse to Double-Click on the Folder Icons to examine further
      contents.

4.   Insert an Audio CD into the CD-ROM drive. The Windows CD Player may
      automatically start to play the CD, if not, choose

      Start | Programs | Accessories | Entertainment | CD Player

      Now adjust the Play Volume using both the Speaker Controls (if any) as well
      as the Windows software Volume Control.

End of Task 4

Operating a Printer

There are many types of printers, each looking quite different but with some similar features. The two most common types of printers in use are, Laser and Ink Jet. Both are available with a range of options including Colour, Speed and paper types accepted.

A typical laser printer is shown below on the left and an Inkjet on the right.

Controls

All printers have at least a Power switch and an On-Line / Off-Line control. The Power switch should be reasonably obvious, however some smaller printers use a Plug Pack rather than direct mains connection.

The On-Line/Off-Line control is used to pause the printer during a job. This may be necessary if something has gone wrong. Normally this is a toggle switch, that is, pressing the first time places the printer Off-Line, pressing again places the printer On-Line.

Many printers also have a control to cancel a job. However, in operation this may not always appear to work since it often only removes that part of the printing job actually in the printer. Some of the print job may still be within the computer and after canceling, that part will then proceed.

Adding Paper

Of course all printers have slightly different ways to add paper, but two of the most common are shown below. Laser printers usually have one or more paper trays that can be removed to add paper. Also they often have a front opening door where special paper can be placed, including Envelopes, thick Card and clear PVC sheets.

Inkjets usually have a built in receptacle for the paper, which may have adjustable slides for different sizes and types such as envelopes.

Typical Laser Printer Paper Tray and Envelope Feed

Typical Inkjet Paper Tray


Changing Consumables

Toner Cartridges

Laser printers use a consumable known as Toner, this is the black component used to create the characters and images. Colour lasers would use three or four different toners. Toner is supplied in a Toner Cartridge.

Although there are many different types of Toner Cartridges, a typical installation sequence is shown below. The steps involved are,

1.   Removing Toner from lightproof container

2.   Shaking Toner cartridge

3.   Withdrawing cover strip, which is often quite tight

4.   Placing Toner cartridge into printer

Note. Used Toner Cartridges may be able to be refilled, but ultimately should be disposed of by recycling.
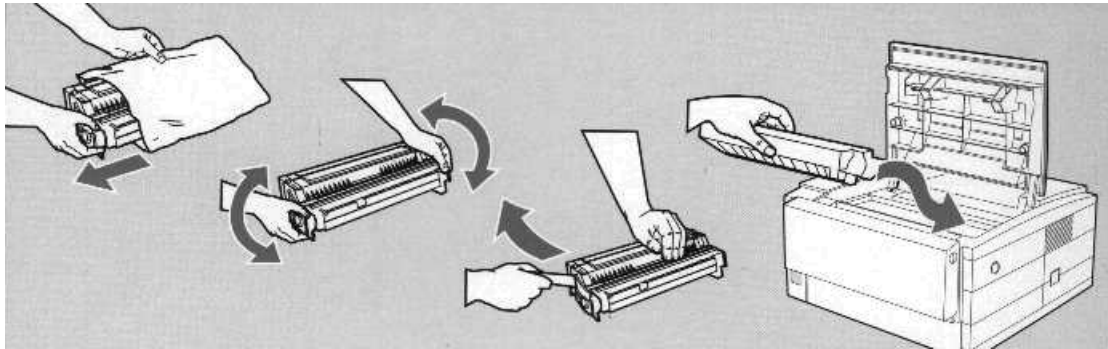
Inkjet Cartridges

Inkjet printers are typically used for colour reproduction as they are much cheaper than laser printers. Usually there are two cartridges, one for Black and one for Colour (which actually contains three colours for mixing).

A typical Inkjet cartridge installation sequence is shown below.
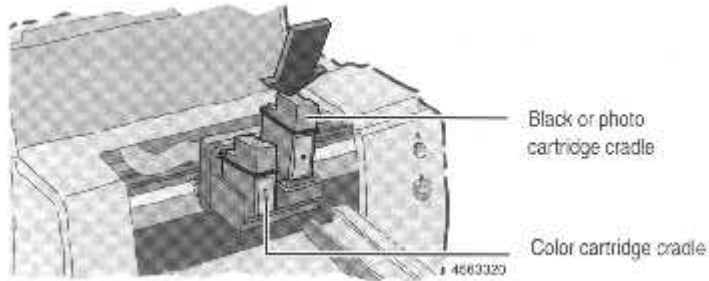
The steps shown are,

1.   Opening the cover and locating the cartridge cradle
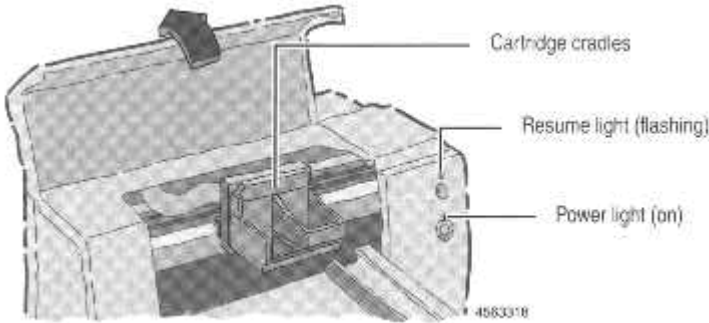
2.   Removing the cover strip from the cartridges

3.   Inserting the cartridges into the cradle

Operating the Printer

1   Can the printer accept more than one size of paper, including envelopes and
         if so, what changes (if any) must be made (at the printer) to change paper
         size.

2   How is the printer placed Offline?

3   What is the printing mechanism, Ink, Laser, Mechanical or other?

4   Read the manufacturers data for replacement of the printer's consumable. If
         appropriate, select the correct consumable (Ink, Toner, etc) and then change
         or practice removal and installation of the printing consumable. After, print
         some test data.

5.   Check and add paper to the printer if necessary.

End of Task 5

Operate Computer Hardware