# 1 Computers (Theory)

# INTRODUCTION

Computers are so common today that it is surprising to learn that the first computer was not produced until 1944. This computer was produced by a team of IBM engineers and measured 15 m long and 8 m high. The power of this computer was much less than the smallest pocket calculator of today. The first commercial computer was produced for a bakery in 1951, and this computer was 10 m long, 2.5 m high and 1.2 m wide.

The first appearance of the modern personal computer (PC) was not until 1971, due to the development of the modern microprocessor by Intel. This chip, the Intel 4004, had a complete processor on a single chip. The power of this chip was totally inadequate by modern standards, but it did set the pattern for future development.

# DEFINITION

The simplest definition of a computer is, 'A computer is a machine for processing data.'

A slightly more accurate definition would be, 'A computer is a general-purpose machine that processes data according to a set of instructions that are stored internally, either temporarily or permanently.'

A computer can process numeric and nonnumeric data, for example:

- It can take a list of names and sort them into alphabetical order.
- It can take information about workers' rates of pay, hours worked, tax and social welfare deductions and produce a weekly or monthly payroll.
- Computers are also used to play music, produce drawings, play games, guide aircraft, keep records, produce invoices and numerous other tasks.

Of course, the computer cannot do these things on its own. People must supply the data, give exact instructions as to how it is to be processed and specify what results are required. Instructions are given to a computer by a program.

# **TYPES OF COMPUTERS**

Computers can be divided into three basic groups:

- Mainframe.
- Mini.
- Micro.

# Mainframe

Mainframe computers are used by very large corporations and have large computing power and storage space. Modern mainframe computers tend to be about the size of a large storage cabinet. These computers would be stored in a special room with a large number of terminals (referred to as **dumb terminals** because the processing is done by the mainframe) connected to them. These computers are very powerful and process data extremely quickly. Mainframes are very expensive and are therefore only used by large corporations.



Figure 1.1

### Mini

Mini computers have a similar arrangement to mainframe computers but are smaller – typically the size of a small filing cabinet. These would be used in situations where the large power and storage of a mainframe was not required. This type of computer is not nearly as expensive as a mainframe but still retains a lot of the mainframe features. Mini computers are typically found in sizable companies.

### Micro

Micro computers are by far the most common today. They are commonly referred to as a PC (personal computer). The modern micro computer (PC) is as powerful as a mainframe was a number of years ago, they are relatively cheap and have a vast number of programs available for them. They are fast and have large storage (but still small in comparison to mini and mainframe) and are used in a wide variety of businesses. There is a PC in most homes today.







PCs are often networked together. PC networks have taken over from the mini computer in some business situations. In a network situation each computer does its own processing and is therefore referred to as an **intelligent terminal**. Each computer is connected to a server for central storage and printing. Network users can also have access to other facilities connected to the network, such as scanners and the Internet.

The mainframe, mini and networking setups greatly facilitate group working, especially where a number of people are working on a common project. These arrangements allow all members of the group to work on the same files, thus eliminating duplicate files. The arrangement also means that all members are using the same programs, printers, etc.

#### Laptop

A variation of the PC is a laptop computer. This has all the features of a desktop PC but the components are much smaller and therefore fit into a small case.



Figure 1.3

The monitor is a liquid crystal display (LCD) type and is an integral part of the computer. Laptops may be connected to a standard keyboard, mouse and monitor and in this case operate as a standard desktop PC.

### Personal Digital Assistant

Another variation of the modern micro computer is the development of the personal organiser or the personal digital assistant (PDA). These are small computers which fit in a person's hand and receive input by means of a small keyboard or pointer which selects items on the screen. These have become quite powerful and some of the more expensive ones allow the user to edit Word and Excel documents, view PowerPoint files, connect to the Internet, surf the World Wide Web (WWW) and send and receive e-mail.



Figure 1.4

### Multimedia

A large number of PCs, including laptops, are equipped with the necessary components in order to connect to the Internet, whether individually or as part of a network. Most computers are also equipped with components such as sound cards, cameras, microphones and DVD (digital versatile disc) drives. These features give them the ability to play music, produce graphics, play motion pictures, play games, record sound, etc. These features are commonly referred to as **multimedia**.

### Task 1.1

Answer the questions in Task 1A-1 on the CD.



# **BASIC PARTS OF A COMPUTER**

The computer itself consists of the central processing unit (CPU) together with random access memory (RAM), read only memory (ROM) and the connections to the various other devices such as keyboard, screen, disk drives, printers, etc. These items, which are connected to the basic computer, are collectively referred to as peripheral devices or peripherals.

# CPU

The central processing unit (**CPU**), commonly known as the microprocessor or the central processor is, in effect, the brain of the computer. It performs the task of organising the work of all the other components and also carries out arithmetic, sorting and other functions. The CPU contains two units, which are used in all its work. These units are the arithmetic logic unit (**ALU**) and an amount of immediate access memory. The ALU performs all the arithmetic and sorting functions and uses its immediate access memory while performing these functions.



Figure 1.5

The most common CPU in PCs today is the Intel Core 2 or the Intel Core 2 Quattro processor. The six core processor is on the way. This has been developed over the last few years, has continuously increased the operating speed, and is now running at clock speeds up to 3 GHz. This means that the CPU is performing up to 3,000,000,000 instructions per second. The amount of data that can be processed in one instruction has also increased.

Processors are developing at a rapid rate and the next generation where the processor and memory will be completely self contained is already in development.

### RAM

The random access memory (**RAM**) is the computer's workspace, where the program instructions and the data being worked on will reside. The CPU can read from, and write to, RAM very quickly (much faster than to a hard disk). In most computers anything stored in RAM will be lost when the computer is switched off or in the event of a power failure – for this reason it is referred to as **volatile memory**.

# 6 Step by Step Computer Applications





### ROM

The read only memory (**ROM**) contains certain program instructions that are required by the CPU for its own internal use and these do not change. The CPU can read the instructions stored in ROM, but it cannot write anything into ROM and is therefore referred to as **non-volatile memory**.

### **Task 1.2**

Answer the questions in Task 1A-2 on the CD.

# PERFORMANCE

A computer's performance is dictated by a number of factors, such as clock speed, CPU, RAM, hard disk, bus size, bus speed and the number of applications in use at the same time.

- As mentioned above, the clock speeds are continually increasing and are obviously increasing the performance of the computer.
- The number of operations performed by the CPU during each clock cycle varies the greater the number of operations, the greater the performance.
- The CPU accesses RAM much faster than the hard disk. Therefore, if a computer has a large amount of RAM it will have very fast access to a large amount of data. If a computer has a small amount of memory then it uses the hard disk as temporary memory, but it takes longer to access this and therefore degrades the performance of the computer.

- The speed at which data can be read from, and written to, a hard disk varies. Again, the faster the read/write operation, the better the performance of the computer. Working from a CD, memory stick or floppy disk will be quite slow, as the read/write operation on these drives is very slow in comparison to the hard disk.
- A **bus** is a channel along which data flows in the computer. This may be compared to a motorway along which traffic passes. The wider the bus, the more data it can accommodate at a time, like a highway having four lanes instead of two. The faster the speed at which the data flows along the bus the better the performance compare a highway speed of 130 km/hr instead of 70 km/hr.
- Computers are capable of running a number of application programs at the same time. However, each program requires an amount of RAM when it is in use and therefore if a number of application programs are in use at the same time it will slow down the computer's performance.

# **INPUT DEVICES**

In order to give instructions to (or feed data into) a computer we must have some way of communicating with it. The most common method is by using a keyboard. Since the instructions given to a computer must be exact, the accuracy of keying is more important than speed.

Other methods of input include:

- Mouse.
- Joystick.
- Disk drive (hard, floppy and zip).
- Memory stick.
- CD-ROM/DVD.
- Touch pads (laptops).
- Touch-sensitive screen.
- Trackball.
- Scanner.
- Digital camera.
- Microphone.
- Light pen.
- Video.

# **OUTPUT DEVICES**

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These allow us to receive output from the computer. The screen (or monitor) is the most common output device. The way in which the output is displayed is controlled by the program instructions that are given to the computer.

When output is required on paper, it is normally produced on a printer. There is currently a large variety of printers available. The most common types are laser and inkjet. The laser printer is suitable for large quantities and good quality but tends to be expensive. The inkjet printers are suitable for low-quantity colour printing. These printers are relatively cheap but the cost of ink is high. The quality of the inkjet printer, in some cases, is now nearly as good as the laser printer.

Other methods of receiving output from a computer include:

- Disk drive.
- Memory stick.
- Speakers.
- Plotter.
- Robots.
- CNC (computer numeric control) machines.

### **Task 1.3**

Answer the questions in Task 1A-3 on the CD.

# HARDWARE

This is the term used to describe all the electronic and mechanical elements of the computer. Hardware is basically something that has size and shape, and can be seen and touched. Examples of hardware are a computer, screen, printer, disk drive, disks (hard or floppy), mouse, cables, etc.

# **PROGRAMS**

The computer cannot do anything on its own. It must be given exact instructions, which it will follow. These instructions are given to the computer by people and they are contained in what is known as a program. The activity of producing a program is called programming.

A program may be only a few lines long or it may contain several thousand lines, depending on what it is required to do. Most programs in common use are written by specialists who are employed by software houses. Most people who use computers today have little or no knowledge of programming – this is not necessary in order to operate a computer.



# SOFTWARE

This is the general term used to describe the various programs used on a computer. Software is something that has no size and it cannot be touched, but a computer can do nothing without it. Software is generally supplied on a CD and for this reason the CD, which is a piece of hardware, is often mistaken for the programs that are optically stored on the CD disk. It is in fact the programs stored on the disk which constitute software. Software is continuously being developed and updated versions of software are released regularly. The updated version may have been developed to correct some faults with a previous version or, more frequently, to introduce new features into the software.

Software may be divided into two categories, namely:

- Systems software.
- Applications software.

# Systems Software

Systems software is the programs that are produced in order to manage and control the computer's operation. Systems software is normally referred to as the operating system (OS). The operating system transforms the various pieces of hardware into a working computer by allowing all the different components to operate together and perform the function for which they were designed.

The OS accepts instructions from the **application software** and carries them out. It organises the flow of data to and from the various parts of the computer, such as the CPU, memory and hard disk. The OS also controls the various devices attached to the computer, such as the keyboard, mouse, monitor and printer. Without the OS the computer would simply be a collection of parts that would not be able to do anything.

There are a number of operating systems in use today but by far the most common is Windows. Windows is an extensive **systems software** (operating system) program that is designed to be user friendly. There are a number of versions of Windows in common use (Windows 2000, XP and Vista), but they are all so similar that most people would not see a difference when using a computer with any of these versions.

Modern OSs use icons (small pictures or words) and a mouse to perform many tasks. The use of icons and a mouse is referred to as a graphic user interface (GUI). The use of a GUI has become so common that it is difficult to comprehend how the computer was operated before they were invented. The use of a GUI makes operating a computer very simple. The icons used in various application programs are standard and once the user learns how to perform an operation in one program, it is the same in all other programs. Commands are executed by simply pointing to a particular icon and clicking a mouse button. The use of a GUI also allows easy manipulation of text and graphics and the user can immediately see the result of a command.

Even though the icons are part of each program it is the OS that allows the use of the GUI and responds to many of the commands given in the application program.

### **Applications Software**

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This term refers to the various programs that are used to perform specific user tasks. Examples of these programs are Word, Excel, Internet Explorer and games. There are literally hundreds of thousands of application programs.

Application programs are designed to perform very specific tasks, such as producing a letter, spreadsheet, payroll or playing a game. The application program works in close association with the OS. Instructions are passed between the two programs as they work hand in hand to perform the various tasks.

Each **application** program used with Windows must be specially matched to the Windows environment. Care should be taken when purchasing software to ensure that it is suitable for the particular version of the OS that is on the particular computer which will be used.

#### **Task 1.4**

Answer the questions in Task 1A-4 on the CD.

# DATA REPRESENTATION

When a letter or number is typed on the keyboard it is stored in the computer's RAM. The computer's memory is not capable of storing letters or numbers as we see them. The memory consists of chips with millions of tiny magnetic cells which can either be charged or uncharged. If a cell is charged we refer to it as containing a **1**, and if it is uncharged we refer to it as containing a **0**.

In order to store anything in a computer's memory, each character must be converted into a **binary** code, i.e. a code consisting of a series of 1s and 0s. The most common code used is called the ASCII code (American Standard Code for Information Interchange). Each of these 1s and 0s are referred to as Blnary digiTS, which is abbreviated to bits. This ASCII code represents each character as a series of eight bits, which is referred to as a byte.

Number	Code	Letter	Code
1	10110001	А	11000001
2	10110010	В	11000010
3	10110011	С	11000011
4	10110100	а	11100001
5	10110101	b	11100010
6	10110110	С	11100011

The read/write operation to and from the various storage devices, such as disks and CDs, is normally measured in bits per second (bps), also referred to as **baud**.



# **MEMORY SIZE**

Computer memory and disk space is measured by the number of bytes or characters it is capable of holding. Since these numbers are very large the terms kilobyte (KB), megabyte (MB) and gigabyte (GB) are used:

- 1 KB = approximately 1,000 bytes (1,024 exactly).
- 1 MB = approximately 1,000,000 bytes (1,048,576 exactly).
- 1 GB = approximately 1,000,000,000 bytes (1,073,741,824 exactly).

# **STORAGE DEVICES**

The normal method of storing programs and information for a computer is on a magnetic disk or optical disk. The six most common types of storage devices are:

- Floppy disk.
- Zip disk.
- Hard disk.
- Compact disk.
- Magnetic tape.
- Memory card/stick.

All types of units have certain things in common but there are some distinct differences between them. The following is a brief synopsis of the storage devices.

# **Floppy Disk**

This consists of a disk drive unit into which a floppy disk is placed. The disk has magnetic surfaces and a read/write head is positioned on both sides of the disk. The disks in this case are removable and can therefore be transported. Software for a computer may be supplied on floppy disk. This disk size is standardised at 3.5" and the speed of this device is very slow (less than 1 Mbps).



Figure 1.7

### **Zip Disk**

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These are similar to floppy disks but have a much larger storage capacity (usually 100 MB to 750 MB). They are much faster than floppy disks (up to 2.5 Mbps) but not nearly as fast as hard disks. They are most suitable for transporting large files and for backup storage.



Figure 1.8

### Hard Disk

This consists of a number of rigid magnetic disks mounted on a common spindle with read/write heads between each disk. The disks rotate at very high speed and the read/write operation is very fast (normally 3 to 30 Gbps). The complete unit is mounted in a sealed container and is therefore not susceptible to dust.



Figure 1.9

Every computer will have at least one hard disk in the machine. Hard disks are also available that are separate from the machine but may be connected to it by means of a cable. Another type of hard disk is capable of being plugged in and out of a socket in the computer, called hot swap disks.

# **Optical Disk**

These are normally referred to as compact disks (CDs) and consist of an optical surface onto which the data is burned using a laser beam. The data is read from the disk using a laser. A variation of the CD is a DVD. This is also a laser disk but is used to store motion pictures. Disks are now available that may be reused and these are referred to as rewritable (RW) disks. CDs normally hold about 650 MB. The read/write speed of these devices is normally less than 10 Mbps.



Figure 1.10

# **Magnetic Tape**

The data in this device is stored on a magnetic tape in the same way as an audio tape, i.e. sequentially. In order to retrieve data from the tape it is necessary to go to the exact point on the tape where that piece of data is stored. The technology associated with tape storage has developed and write speeds up to 15 Mbps are being achieved. However, the read speed is greatly affected by the time taken to find the data required. Therefore, this storage device is usually only used for archival storage. Data cartridges, which fit into the tape unit, are available with storage capacities of 8 GB. Some systems have multiple tape units, which hold up to 640 GB.



### Memory Cards/Sticks

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This is a small memory device that is used in a range of digital equipment, such as PDAs, digital cameras, laptops, mobile phones, etc. These devices are simply an amount of RAM which may be plugged into and out of the appliance. These devices are also referred to as flash cards or memory sticks. Read/write speed is usually less than 20 Mbps. The USB memory stick has virtually replaced floppy disks as a means of transporting data.

Many printers are now accepting memory cards to make it possible to print photos from the camera without the use of a computer.





# **MAGNETIC DISKS**

The disk surface in the floppy, zip and hard disk is magnetic – it must be magnetically divided (formatted) into a number of tracks and sectors. Each storage location can then be located by the disk number, disk side, track number and sector number. Data that is stored on the disk is transferred (in a stream of bits) from the computer's memory and stored in one or more of these storage locations. The amount of data that can be stored on a disk depends on the size and density of the disk. Hard disks normally hold from 120 GB to 1,000 GB. Zip disks hold 100 MB to 750 MB. Floppy disks normally hold 1.44 MB.





Figure 1.13

# Formatting

In order to use a magnetic disk (hard, floppy, zip) it must be formatted. When a disk is produced it is simply a plain magnetic surface that has no method of storing data on it. Formatting the disk is the process of magnetically producing the tracks and sectors on the disk.

# Backup

Computers are man-made machines and do break down from time to time. One of the most severe problems which may occur, however unlikely, is the loss of data stored on a disk. In order to recover from such an occurrence it is necessary to keep copies of all data that is stored on the computer's hard disk. The process of copying data to another location or device is often referred to as **systems backup** and would be performed on a regular basis. The frequency of a systems backup may vary from several times per day to once per week, depending on the importance of the data.

Depending on the amount of data to be backed up and the likelihood of having to restore the data, a variety of media may be used, including:

- Memory sticks.
- Zip disks.
- CDs or DVDs.
- Other hard disks.
- Backup tape.

The normal procedure is to have three copies of data that are updated (backed up) at regular intervals. At least one of these copies should be stored outside the building that houses the computer.

In some cases large amounts of data need to be backed up for archival storage. This would require a very large number of zip disks or CDs and the procedure would be relatively slow and labour intensive. In this case the data would normally be stored on magnetic tape, which is capable of holding up to 8 GB on a very small tape.

### Task 1.5

Answer the questions in Task 1A-5 on the CD.

# SOFTWARE DEVELOPMENT

Software development may be broadly divided into four stages:

- Analysis.
- Design.
- Programming.
- Implementation.

### Analysis

This task involves a careful examination of the business, what it does and how it does it. Usually, a systems analyst examines the operation of the client's business and determines how the business may be improved by the use of computer software. The outcome of this analysis may be to use off-the-shelf software, in which case the software may be purchased, installed and the personnel trained in its usage.

In other cases the result of the analysis may be the recommendation that the business have their own software developed. This solution would be much more expensive, but in the long term it may be more advantageous to the business to have programs tailored exactly to their needs.

### Design

The systems analyst will usually progress from the analysis to the design of the new software, where this is considered necessary. This step involves clearly identifying **what** the software should do, but not **how** it should do it. This is similar to an architect designing a building and producing a blueprint, with full specifications for every aspect of the construction. At the end of the design phase the systems analyst produces a very detailed specification of **what** the software is to do.

### Programming

This stage involves a computer programmer translating the detailed specification into a computer program – usually a number of programs. Each program contains the instructions needed by the computer in order to perform tasks identified in the design phase. This is similar to a builder who takes the blueprints and specifications and constructs the building. The programming phase will also include testing the programs before installing them for the client.



### Implementation

The implementation phase involves installing the new software on computers and ensuring that the software meets the client's needs. This stage may become quite extended, depending on the detail and accuracy of the previous stages. Training personnel to operate the new software is also part of this phase.

# COMPUTER-BASED TRAINING (CBT)

CBT takes advantage of the multimedia capability of modern computers and uses interactive programs to train people, namely communicating knowledge and enabling people to perform certain tasks on the computer. The most popular of these programs are ones that teach people **to keyboard**. The more sophisticated of these programs are able to detect the user's ability and adjust the exercises to their standard. Of course, these programs cannot determine if the person is using the correct finger for each key or whether they are looking at the keys as they type, but nevertheless they are very useful and if used properly will enable a student to acquire the skill of keyboarding.

Most CBT programs will use text, sound and video clips, which allow the student to acquire skills without risk to the person or the use of expensive equipment.

The use of CBT allows students to work at their own pace and will usually accelerate the training time and reduce costs. Students may work at home or even over the Internet – therefore there is no need to attend classes and have the presence of a teacher.

There are a number of disadvantages to CBT. The learning tends to be a solitary process and therefore there is little interaction with other students. There may be no teacher involved in the process and therefore no way of obtaining assistance if it is needed. The lack of contact with other students or teachers may lead to a lack of motivation and the student may just give up.

# **COMPUTER NETWORKS**

There are a number of advantages by connecting computers to one another. The configuration of connecting computers together is referred to as a **network**. Networks may be divided into two broad categories:

- LAN (local area network).
- WAN (wide area network).

# LAN

This arrangement typically applies to a room or a building where a number of computers are connected together by means of network cables. The arrangement is sometimes referred to as an **intranet** (not to be confused with Internet). The arrangement usually consists of a computer called a server, which is used to control the network and store shared resources such as files, programs, printers, scanners and Internet connections. Computers that are connected to the server are referred to as terminals. These terminals are actual PCs and therefore perform all processing locally.



#### Figure 1.14

This arrangement has some security attached to it, as users have to use a username and password in order to gain access to the network. A major advantage of this arrangement is that different users may work on a single set of files, such as accounts or payroll, while still having other applications that are specific to their computer. This can be advantageous when purchasing licences, as it is only necessary to purchase licences for the number of users of each individual program.

A less popular type of LAN is a **pier-to-pier** arrangement where individual computers are connected together without a server. In this arrangement individual computers may share data directly with other computers.

Intranets may connect to the Internet and thus allow users to access the Internet. The type of connection used would generally be ADSL (broadband). However, there is usually no connection to the network from outside the network. In some cases intranets may be arranged so that authorised people may gain access to the network via the telephone line. This type of network is referred to as an **extranet**. In this arrangement a user may dial up the network and, provided they have proper authorisation, use the network. A firewall is commonly installed on the server in order to control access to the data on the network.

### WAN

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In this arrangement individual computers and LANs are connected over a large area, e.g. a single country or even worldwide. Typically banks, insurance companies, national governments or lotteries would have their own WAN. Computers in different locations communicate via the use of telephone lines on the **PSTN** (public switched telephone network) or in some cases, satellites.





Figure 1.15

The most popular WAN in use today is the Internet. This arrangement allows computers all over the world to communicate either directly or via a LAN.

In order to connect networks on a country or worldwide basis it is necessary to have excellent communication networks. The networks used for computer communications are high-speed digital networks such as **ISDN** (integrated services digital network), **ADSL** (asymmetric digital subscriber line) and satellite communications. These types of networks are commonly referred to as **information superhighways**. The Internet operates on such a network. Individual users normally connect to the Internet via the PSTN using a router.

### **Task 1.6**

Answer the questions in Task 1A-6 on the CD.

# THE INTERNET

The term **Internet** is short for internetworking. The Internet is a collection of worldwide computer networks connected together using the **PSTN**. The information on all these networks may be shared by anyone connected to this worldwide network.

Modern developments have increased the access to the Internet by means of mobile phones and satellite communications.

# **CONNECTING TO THE INTERNET**

In order for an individual computer to connect to the Internet it must be equipped with a network connection. This is a device that is fitted in the computer and allows it to connect to the telephone network via a router. Alternatively, a computer may be part of a LAN that is connected to the Internet. There are a number of different types of connections to the PSTN. The most common is an ADSL (broadband) connection using a standard router.



Figure 1.16

#### ADSL

The most common type of connection to the Internet is the asymmetric digital subscriber line (ADSL) or broadband. This type of connection makes use of existing telephone lines but transmits at much higher frequencies, therefore not interfering with existing telephone traffic. The connection is always on and because of the higher frequencies used, transmission rates of up to 10 Mbps (10,000,000 bps) are available. The term **asymmetric** means that the information flowing into a computer (download) is much faster than the traffic flowing out of it (upload). This is advantageous as the amount of download traffic is much greater than the upload traffic.

An account with an Internet service provider (ISP), such as Eircom, Smart,  $O_2$  and BT, is also required in order to gain access to the Internet. Some of these accounts are free.

#### Modem

In areas where broadband is not available it is possible to connect to the Internet using a modem. The word **modem** comes from two words which describe what a modem does – Modulator and Demodulator. It is a device that accepts serial data (a string of bits) from a computer and converts it into an analogue signal. The analogue signal is suitable for transmission over a PSTN. The analogue signal is receiving by another modem, which translates the analogue signal back into digital data. The reason we need modems for data communication is because the telephone network is designed for analogue communication.

This is a relatively slow arrangement with maximum download speeds of 56,000 bits per second (bps or baud). However, these speeds are rarely achieved and very often the speed will be closer to 28,000 bps.



### THE WORLD WIDE WEB (WWW)

The WWW is a global network of computers that uses the Internet to connect and transfer data, pictures, sound and video worldwide. In order to allow this to happen there has to be a standard protocol for connecting computers together and transferring information. The development and adoption of **http** (HyperText Transfer Protocol) facilitated the development of the WWW.

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Along with having a connection to the Internet, the computer must also have a program (software) that will allow the computer to interact with the World Wide Web. This program is called a **web browser**, and the most common web browser programs in use are Microsoft Internet Explorer and Mozilla Firefox.

The uses of the WWW are vast and varied. New uses are being found every day and it is impossible to devise any sort of a list of uses. The main uses can be broadly divided into communication, training, research, commerce and marketing.

### E-mail

This term stands for electronic mail. Everyone who has an account on the Internet usually has an e-mail address. Even if you do not have an account you may have an e-mail address in your place of work. Alternatively, you may sign on to a number of free e-mail services such as Gmail, Hotmail and Yahoo.

Once you have an e-mail account you may send and receive e-mail from anywhere in the world, provided you have access to a computer. The most popular programs used for e-mail are Microsoft Outlook, Microsoft Outlook Express and Webmail.

The use of e-mail has revolutionised the way in which people communicate. E-mail allows instant delivery of messages at a greatly reduced cost. An e-mail may be sent to a number of people at the same time, and messages may be replied to, or forwarded to, other people very quickly.

E-mail messages may also have files attached to them and in this way any file(s) may be sent from one computer to another almost instantly and at a very low cost. The file may contain data, pictures and programs.

The only drawback is that the messages must be typed, and unless people have good keyboarding skills, this process can be very slow.

#### **Task 1.7**

Answer the questions in Task 1A-7 on the CD.

# **USES OF COMPUTERS**

Use of computers has become so common today that it is difficult to imagine a world without them. Their use has revolutionised every aspect of life, from the home to space travel. Computers are generally used to take the drudgery out of repetitive tasks and increase the efficiency of businesses in general. The vast majority of homes now have

a computer, which is used for both work and leisure. However, it should be remembered that computers are not the answer to every problem. There are many tasks that still need human interaction.

The era we are living in now is sometimes referred to as the **Information Society** or **Information Age**, in the same way as we once had an Industrial Age. Many countries rely heavily on the production and use of information technology (IT) to generate wealth. Today, it would be difficult to comprehend how our lives and society in general would change if computers disappeared tomorrow.

### In the Home

A home computer would normally be a multimedia machine with sound, DVD, network connection, scanner and printer.

The software on such a machine would normally be off the shelf and typically include a word processor, spreadsheet program, Internet and e-mail programs, graphics programs (for use with a digital camera), DVD player, web browser and numerous games.

The use of the Internet and e-mail have become as common as making a phone call was a number of years ago. Children are using the computer to produce colourful school projects as well as using the Internet to source material.

Using computers to work from home is also becoming more common.

# In Education

The use of computers in schools has grown at a similar rate to the increase in general use. Initially computers in schools were single, stand-alone units but now computer networks have become increasingly common. Computers are used for both administration and teaching purposes. In the teaching area they are used to teach the use of applications software, such as word processing and spreadsheets. However, there is a vast range of software available to enhance the teaching of all subjects – this area is becoming increasingly popular as teachers gain confidence in using computers.

The use of computers in other education-related areas include:

- Student registration.
- Timetabling.
- Distance learning (e.g. Open University).
- Project and homework research.
- Computer-based training (CBT).



# At Work

Most workplaces now have a computer network (LAN), which is used to carry out a large number of tasks required to run the business. Computers in workplaces generally do not have full multimedia capability and are selected to only perform the business functions.

In general, computers in the workplace will have specialised software that has been written specifically for that particular business or a more general program for that type of business. Computers in the workplace will normally have some off-the-shelf software, such as word processing and spreadsheet programs.

The list of work areas where computers are used is endless but here are some examples:

Banks	New customer applications, account details, transaction records.	
Insurance Companies	Applications, claims processing, renewals, quotations.	
Manufacturing	Computer-controlled machines, robot assembly, stock ordering.	
Government Departments	Tax records and collection, vehicle registration, public records, electronic voting.	
Health	Patient records, ambulance control, diagnostic instruments (monitors), specialist surgical equipment.	
Supermarkets	Point-of-sale terminals, stock reordering, credit/Laser card payments.	
Communications	Automatic telephone systems, mobile phone systems.	
Reservations	Cinema, theatre, airlines, hotels, car rental, holidays.	
Cars	Electronic management systems, navigation systems.	
Aircraft	Autopilot, computer navigation systems, fly by wire.	

# E-commerce

The term 'e-commerce' stands for electronic commerce. The use of computers combined with high-speed digital networks is allowing more companies to carry out business without face-to-face contact. Video conferencing and electronic document transfer mean that business can be transacted very quickly without the need to travel or wait for the mail.

Shopping online for all sorts of goods and services, from the weekly groceries to a house in the sun, is now possible. The user simply logs on to the Internet and selects the site from which they wish to purchase. The user can then view the items and select

what they want as they browse. There are a number of advantages to shopping on the WWW, some of which include:

• Large selection of suppliers.

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- Large selection of goods (may cause difficulty in making a choice).
- Shop when it suits you (available twenty-four hours a day).
- Easy to make price comparisons (be sure to check cost of delivery).

Payment for goods purchased over the WWW is normally made by credit card and the items are delivered to your door. When giving details, either personal or financial, care should be taken to ensure that the website is secure (usually indicated by the letter s after the http (https://) at the start of the website address). Some websites display secure certification, indicating the level of security associated with their website. Personal details should be limited to those necessary in order to carry out the transaction. Be wary of websites that collect additional personal information, as this is often used in marketing.

The consumer rights for goods purchased over the Internet are the same as for any other goods purchased. However, returning goods and receiving a refund may be quite difficult. These rights may be summarised as follows.

Under the **Sale of Goods and Supply of Services Act 1980**, anything bought from a retailer must be:

- Of merchantable quality.
- Fit for its normal purpose and reasonably durable.
- As described, whether the description is part of the advertising or wrapping, on a label, or something said by the salesperson.

### Teleworking

The increased use of the PSTN and the Internet to communicate has led to a growth in teleworking. This may be divided into two categories, namely:

- Working from home.
- Telecentre.

### Working from Home

This has the great advantage of not having to commute to and from work. It also saves the employer having to provide workspace with all the accompanying overheads. There are usually less distractions when working at home, which can result in greater productivity. There is also greater flexibility in work scheduling and work can be scheduled to fit around family commitments.

There are also drawbacks to working from home. Work becomes a solitary occupation with little human contact. This can lead to stress, which is normally



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alleviated by simply being able to share problems with colleagues. It is also very difficult to engage in teamwork from home.

### Telecentres

There has been a large growth in the use of telecentres in Ireland over the past number of years. This has come about due to the advances in the PSTN and the availability of computer-literate personnel. A telecentre typically has operatives using a computer while talking to clients on the telephone. Telecentres are used for such activities as making reservations, offering customer support and telephone banking.

### **Task 1.8**

Answer the questions in Task 1A-8 on the CD.

# **USING COMPUTERS**

As with the use of any machinery there are good and bad practices associated with their use. Firstly, the computer should be started correctly. This usually involves simply switching on the machine (and possibly the monitor) and then waiting for the operating system to load. During the start-up cycle the keyboard or mouse should not be touched. The computer should also be shut down correctly, which is much more important than starting. All programs should be shut down (exited) correctly and then the operating system shut down.

The room or office where the computer is installed should be well ventilated and have good lighting. Lighting should be such that it does not cause glare on the screen. The computer should be positioned so that natural light does not interfere with viewing the screen.

# **Health and Safety**

The most common problem associated with the constant use of computers is RSI (repetitive strain injury). This is caused by constant use of the same muscles over a prolonged period of time. Poor posture or incorrect positioning of keyboard, mouse or monitor normally cause injuries.

Eye fatigue is another problem that is usually associated with constant use of computers. This is often attributed to poor monitors, poor lighting, incorrect lighting, reflections on the monitor or being too close to the monitor. Frequent breaks are required if a person is using a computer all day.

The person's position while working at the computer is important. People should sit properly in an appropriate chair with the monitor slightly below the eye line. The keyboard and mouse should be at the correct height and comfortably positioned. The user should be able to sit with their arms by their sides while using the keyboard.

The chair is also of great importance. It should be comfortable and the height should be adjustable.

### Licensing

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All software, including the operating system, is copyrighted and should be licensed. Most computers are sold with the operating system (usually Windows) already installed. However, if the operating system is upgraded then a further licence fee has to be paid.

All application software is licensed separately and a licence must be purchased for the use of each piece of software on **each** machine. When a new program is purchased it automatically comes with a licence. This licence is usually a single licence, which licences the software to be used on one machine only. As in the case of the OS, if the application software is updated then a separate licence fee must be paid.

It is sometimes possible to buy multiple licences for software at a reduced price. Some vendors offer site licences that allow the software to be used on one site (one company, business or school). Site licensing is common in some applications, particularly in the case of accounts, bookkeeping and payroll programs. This is often a better option. Even though the cost is greater than a single licence, the overall cost for a number of machines is much less.

The growth in the use of the Internet has led to many producers offering their software over the WWW. Some of these programs may be freeware, which do not require a licence to use them under the conditions specified. A large number may be shareware, which generally require a licence. Standard commercial programs may also be downloaded directly from the supplier's website. However, it must be remembered that most of these programs require a licence, and while some offer a free trial period, they are only legal when paid for and then usually only on one computer.

Every program will have a product ID number that must match the licence for that product. The product ID may be checked by accessing the Help menu for that program.

Programs may be copied onto storage media such as a memory stick or CD but it is not legal to sell these or even to give copies to other people.

### The Environment

Respect for the environment is becoming a very important issue. In this Information Age the proper use of technology may help to reduce its impact on the environment. Printer toner and ink cartridges, and the paper generated by printing should be recycled. The use of electronic documents, without the need for printing, should be used wherever possible. The use of low-power computers, monitors and peripherals should be encouraged together with automatic power management help to reduce overall power consumption.

# **COMPUTER SECURITY**

There are a number of measures which should be taken in order to secure the integrity and privacy of data stored on a computer. The first measure which should be taken is to ensure that the machine itself is not stolen. This can be a particular problem with



laptops, mobile phones and PDAs. If the item is stolen then all the data stored on it can be accessed, even if it is protected with IDs and passwords. The loss of a personal mobile phone may mean the loss of contact phone numbers unless they are also recorded somewhere else.

# **Backing Up**

Computers today are generally very reliable, but like any machine they can break down. The most important part of a computer is the data stored on the hard disk. If this data is lost then it may be very expensive or impossible to generate it again. All data stored on a computer should be copied onto backup storage at regular intervals. These intervals may be weekly, daily or even a number of times each day. Some businesses have a system of live updating where the data is backed up as it is written to the hard disk.

# **Privacy**

It is vitally important to ensure that computers are protected from unauthorised use. In the case of computer networks, users are forced to log on to the network. In order to do this they must have a recognised username or ID and at least one password. Computer users usually retain their username or ID (generally their name) but passwords should be changed regularly and old passwords deleted where necessary. Stand-alone computers may also be protected in the same way, but very often this is not enabled on the computer.

Many programs, such as accounts, payroll and employee records, may be separately protected by having their own username and passwords. This means that even though a user may have access to a computer or computer network, they may not have access rights to certain programs or even certain elements within a program. The right to make changes in certain data, such as personal details, may be restricted to a supervisor or manager.

Many companies have information security policies that make personnel aware of their responsibilities with respect to information security. These policies also detail procedures for dealing with sensitive information and for reporting breaches in security.

# **Physical**

It may seem obvious, but computers should be stored on a solid table or on the ground. Monitors should be positioned in front of the user and slightly below the eyeline, and therefore it is not a good idea to have the monitor sitting on the computer.

As already mentioned, computers should be shut down properly. In the case of a power cut this will not happen and the computer may be damaged as a result. Some files may be corrupted, or data lost, if the power is suddenly cut off. In cases where computers hold sensitive information, they should be protected by using a UPS (uninterruptible power supply). This device contains a battery that keeps the computer running for a period of time in the event of a power cut. This gives the operator sufficient time to shut down the computer properly and disconnect it from the mains.

Some of the more powerful UPSs allow the user to continue using the computer for a period of time.

Another problem that sometimes occurs with mains power, particularly after a power cut, is a power surge. This is where the voltage suddenly surges, just for a brief moment, but it can cause damage to data. This may be prevented by using a surge suppressor. Surge suppressors are often an integral part of a UPS.

The computer equipment should be kept clean and free from spills. Cables should be tidy and away from traffic. Computers should be in a well-ventilated area and at normal room temperatures. Overheating can be a problem if the computer is stored in a small space with lots of other equipment.

### Viruses

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Today the term **virus** is more associated with computers than humans. Computer viruses are programs that are written with the deliberate intention of disrupting the operation of a computer, sometimes preventing the operation of the computer altogether and corrupting or deleting the contents of the hard disk. Where a computer is part of a network the problem is even greater – a virus can spread to the whole network very rapidly.

There are many different types of viruses, the more common ones being the following.

#### **Boot Viruses**

These viruses infect boot records and may prevent the computer from working altogether.

### **Program Viruses**

These programs are loaded in memory during the execution of a program, taking the virus with them.

#### **Multipartite Viruses**

A hybrid of boot and program viruses.

#### **Stealth Viruses**

These viruses use certain techniques to avoid detection. They may either redirect the disk head to read another sector instead of the one in which they reside, or they may alter the reading of the infected file's size shown in the directory listing.

#### **Polymorphic Viruses**

This is a virus that can encrypt its code in different ways so that it appears differently in each infection. These viruses are more difficult to detect.



### Macro Viruses

A macro virus infects the macros within a document or template. When a macro virus is activated it infects the normal template (Normal.dot).

### ActiveX

ActiveX and Java controls have introduced great flexibility and dynamism into Internet activity but may soon be the scourge of computing, as they provide an ideal opening for this type of virus.

Viruses are spread by being carried on files that are moved from one computer to another. This can be done using floppy disks, CDs, on e-mail or even over the Internet.

Most computer users invest in antivirus software in order to prevent infection. In order for the antivirus program to be effective it must be updated regularly (at least every week). Once the program has been purchased it may be updated by downloading the latest update over the Internet.

The following are some simple measures that may help to prevent infection by a virus:

- Check the computer regularly for viruses.
- Clean/disinfect or delete infected files immediately.
- Never use a memory stick that has not been checked for viruses.
- Never open e-mail from unknown sources.
- Only use reputable software (be wary of free software).
- Back up data regularly.

# DATA PROTECTION LEGISLATION

There is a vast amount of information collected and stored on computers every day. Many people would be shocked if they knew how many databases contained their personal details and the uses to which this information is put. Database creators include banks, building societies, local government, supermarkets, credit card companies, doctors, hospitals, insurance companies and employers. Effectively, every form filled out is stored in a database. In the past, these databases were often shared or sold to other parties. In order to try and control this situation the government has introduced data protection legislation.

The Data Protection Act 1988 gives certain rights to individuals and imposes certain responsibilities on controllers relating to data stored on computer. The Act gives every individual the right to establish the existence of personal data, to access such data and to have inaccurate data rectified or erased.

The following are some of the main points of the data protection legislation:

- Data shall be kept only for one or more specified and lawful purposes.
- Data shall be adequate, relevant and not excessive.
- Data shall not be kept for longer than necessary for the purpose for which it was collected.
- Data shall not be used or disclosed in any manner incompatible with the purpose for which it was collected.
- Data shall be adequately secured against unauthorised access, alteration, disclosure or disruption.
- Every individual has the right to:
  - view data stored about her/him.
  - have inaccuracies rectified or erased.
  - have personal data taken off a direct mailing list.
  - complain to the Data Protection Commissioner.

### Task 1.9

Answer the questions in Task 1A-9 on the CD.