

# Working towards ECDL

## Concepts of Information Technology Module

This is an information section part of the ECDL. There are no exercises. Practice tests will follow after reading this document.

### Introduction

#### **An overview of the computer system**

A computer is a machine that processes data following a set of instructions. The computer system consists of hardware and software. Computer equipment that you can touch and handle is called hardware. It is the name given to all the physical devices that make up the computer system. These devices include the input devices (how we get the information into the computer), such as a keyboard or mouse. It also includes the central processing unit - the 'brain' of the system that carries out all the instructions received from the operator or the program - and the memory devices that store information. Finally, it includes the output devices (how we get the information out of the computer), such as monitors and printers. Input and output devices are known as peripherals.

Software is the name given to the programs, each made up of a series of instructions that tell the computer what to do, allowing the hardware to do a useful job. Without software, hardware is useless. Applications packages such as word processing, spreadsheet, database and drawing programs are all examples of software. Microsoft Office XP is software.

#### **Types of computers**

Computers vary in size and cost. Computers are often categorised into different types, typically: Mainframe, Mini and PC.

#### **Mainframe**

A mainframe (now often referred to as a 'large server') offers the ultimate in processing power and storage capabilities. A mainframe is any powerful general-purpose expensive computer system. It typically has many dumb terminals connected to it although these are increasingly being replaced by PCs. Dumb terminals consist of only a keyboard and display unit usually with no disk drives or their own processor so that they cannot work when not connected to the mainframe. Mainframes are used by large commercial organisations such as banks and insurance companies. Mainframes used to fill whole rooms and require specialised staff and air-conditioned clean environments, but these days they are more robust and take up much less space. They have vast storage capacity (hundreds of megabytes of main memory and terabytes (trillions of bytes) of disk storage). It is interesting to note that the computing power of an average home computer now exceeds that of the typical 1970s mainframe.

**Minicomputer**

As technology grew, smaller and cheaper computers called minicomputers were introduced. The term 'minicomputer' is not used very often nowadays and they have evolved into mid-range servers' that are part of a network. Originally they were typically installed in smaller businesses and research establishments. The processing and storage capacity of the minicomputer is midway between the mainframe and the PC (see below).

**Network Computer**

Computer systems can be stand-alone (not connected to any other computer) or they can be connected together to form a network for data transfer, communications and backups. When computers are connected together, they are known as networked computers. Networked computers do not have to be in the same building. Using telecommunications, a computer can be linked to another computer anywhere in the world. PCs (see below) can be connected to a network for the process of sharing information but they also operate when not connected to the network. There are advantages and savings in that they can share peripherals such as printers.

**Personal Computer**

This is a computer that is small enough to fit on a desktop and inexpensive enough to be bought by an individual for personal use. There are two commonly used personal computers. The most widespread of the two is the computer based on the original IBM PC, and all clones of this machine are referred to as PCs. Personal computers can vary in price, performance and storage capacity and can be chosen to suit your requirements. The price reflects on the performance and storage capacity.

**Laptops**

The laptop computer is a small -sized PC that can use battery power and be carried around. It is used by people on the move, such as sales representatives and business travelers. Laptops are more expensive than desktop PCs with the same specification due to their components needing to be light, small and able to operate on low power consumption.

## Hardware

### Central Processing Unit (CPU)

The Central Processing Unit (CPU) or processor is the processing part of the computer. It carries out all arithmetical and logical operations. It is made up of the Arithmetic Logic Unit (ALU) that carries out high-speed data manipulation - calculating and comparing. It also contains the control unit that controls the passage of data to and from the ALU by locating, analysing and carrying out instructions and sending information to be temporarily stored in high speed memory. In a PC the CPU is a single microchip that looks like a thin wafer with legs. In a minicomputer, the CPU is usually contained on a printed circuit board. A mainframe CPU may take up several circuit boards. The speed of the CPU is called the clock speed or clock rate and is measured in megahertz (MHz). It is one of the crucial factors when determining a computer's overall performance.

### Input devices

There are many ways of feeding information into the computer and this is done using input devices. There are many different input devices including the following:

Keyboard	A keyboard consists of input keys. Computer keyboards are based on the standard typewriter layout QWERTY. They have additional keys, such as functions keys programmed to perform frequently used task, arrow keys, the Control (CTRL) key used in conjunction with other keys to perform specific tasks, and often keys used for power saving.
Mouse	The mouse is a pointing device that enables you to interact with (eg select and move) items on the screen. The mouse's movements are tracked by a rotating ball and sensors in its base. When you move the mouse on your desk, the mouse pointer moves on the screen in the same direction.
Trackball	A trackball operates in a similar way to a mouse but is a stationary unit. Unlike a mouse, it has the rotating ball on top instead of underneath. Track balls are usually found in laptop computers and are operated by using fingers or the palm of the hand.
Touchpad	A touchpad is another alternative to a mouse in that it is a device for interacting with a computer screen. A touchpad is also common on laptop computers for the same reasons as the trackball. It is a flat pad that works by sensing finger movements and downward pressure.
Scanner	A scanner can convert physical printed text or images into electrical signals that the computer can understand.
Digital Camera	This works exactly like a standard camera, except that it does not use a photographic film - the images are recorded digitally in the camera's memory. You can then transfer these to the computer to print, edit, archive or email to others.
Light Pen	This is a light-sensitive detector in the shape of a pen. It enables the user to draw, and change pictures by moving the pen across the screen. It is normally only used in specialised applications.

Joystick/ games controller	These fulfil the same function as the mouse or trackball, but are designed specially for games and simulations.
Graphics tablets	These are flat surfaces that detect the movement of a plastic stylus (pen) across them. They are typically used for art and design applications, but smaller versions are becoming common in 'pocket', 'hand-held' or 'palmtop' computers. These devices (known as Personal Digital Assistants, or PDAs) are too small to allow typing.

### Output devices

There are many ways of getting information out of the computer. Some common output devices include the following:

Screen/Monitor/ VDU	Also called the monitor (because you use it to monitor what is going on in the computer) or the visual display unit (VDU), the screen looks somewhat like a television. Most programs are designed in such a way that you appear to enter input directly from the keyboard onto the screen. In fact, the information is passed to the CPU, and the CPU shows you what it has received by displaying it on the screen.
Printers	A printer provides printed (hard copy) output. The two most common are Laser and Inkjet printers (non-impact printers) <u>Laser</u> printers use laser beams reflected from a mirror to attract ink (called toner) to selected paper areas as the paper is fed over a drum. Laser printers are generally quicker and produce the highest quality output. Most printers have a built-in local memory in order to speed up the print process. The <u>inkjet</u> printers sprays ink on to the paper from an ink cartridge. Other printers that you may come across are the impact printers. These work like typewriters: they hammer out the required characters onto the page through an ink-impregnated (or carbon-covered) ribbon. There are several kinds, using slightly different techniques for making the marks on the paper eg. dot matrix, daisy wheel and line printers.
Plotters	A plotter uses pens to produce drawings. The computer gives the instructions so that the plotter knows which pen to use and where to draw. Plotters are normally used in engineering applications.
Speakers	Speakers produce output in audio format. They are used in music, games and speech.
Speech Synthesizers	Speech synthesizers turn text into spoken words and vice versa. They can be used by the visually impaired.

## Storage

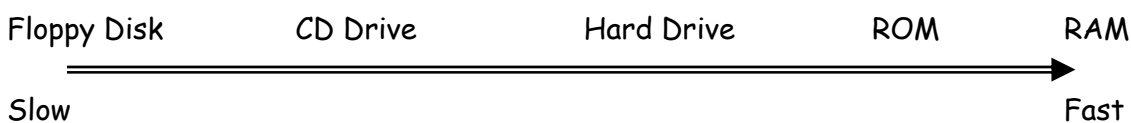
### Types of memory

Computer memory is the place where instructions and data are stored. A computer has two types of memory RAM (Random Access Memory) and ROM (Read Only Memory).

RAM is the computer's temporary storage area. Where the computer holds the instructions and data that it is currently working on. It needs electricity to retain information and anything stored in RAM will be lost when the power is turned off. When the computer is running, the greater capacity it has to temporarily store instructions and data, the quicker larger programs will function. The amount of RAM in a computer is the second factor that affects its overall speed of operation.

ROM permanently stores instructions and data. Its contents are stored when the computer is made and cannot be altered. RAM is faster than ROM and both are faster than disk. Access time to RAM is usually measured in nanoseconds (billionths of a second) whereas access time to a hard disk (see below) or CD-ROM is usually measured in milliseconds (thousandths of a second).

Below shows the speed at which the central processing unit (cpu) can access data:



### Measuring memory

#### Binary System - bit

The binary system is the principle behind digital computers. Binary means two and data is represented by the two digits 0 and 1 (0 is the off state and 1 the on state of the computer's memory cells). As you can imagine, very little information can be stored in a single bit.

Lets explore the idea of computer bits by relating them to the numbers of colours that can be displayed on a computer's screen. Your screen is made up of about 480,000 little squares called pixels, each one of which can show a different colour. Behind each of these individual pixels is an amount of information storage, measured in bits.

1 bit colour - 2 colours can be stored in a single bit. When the bit is on (1), the dot on your screen looks white. When it's off (0), the dot looks black. A black and white screen, therefore, can get by with a single bit of information behind each screen pixel.

2 bit colour - doubling the bit by 2 would give the following 00, 01, 10, 11.

There are four possible combinations. Each pixel can now display one of four colours at a single time, for example, white, light grey, dark grey, black.

4 bit colour - increasing the bits per screen pixel to four would give the following

0000	0001	0010	0011
0100	0101	0110	0111
1000	1001	1010	1011
1100	1101	1110	1111

4 bits of information storage for each screen pixel make it possible for your screen to show any of 16 different colours.

Therefore, the more bits that are available to each pixel, the greater the range of colours that the pixel can display.

### **Bit, bites, kilobytes, megabytes and gigabytes**

A bit is rather a small unit. When computer people talk about information, they say the term bytes, where eight bits add up to one byte. A byte holds the equivalent of a single character eg a letter A or a full stop.

In the metric system, we place the prefix kilo or mega before a unit when we mean a thousand times or a million times eg. a kilometre or a megahertz.

A kilobyte (KB) is a thousand bytes

A megabyte (MB) is a million bytes

A gigabyte (GB) is a billion bytes

A terabyte (TB) is a trillion bytes

Whenever you see the term megabytes, just think of eight million little boxes of information, each one holding a 0 or 1. The table below shows estimated computer file sizes.

Computer file	File size
A short email	15 KB
A one page word processed letter	30KB
A colour image	500KB
A typical hard drive on a PC	120GB
A database of 1,000 names and addresses	800KB
A 3 minute song	4.5MB
A 60 minute video with sound on a DVD RW	2.5GB

### **Memory storage devices**

If you want to store information so that you can re-use it at a later date or just keep it safe, you would need to store it on one of the following non-volatile storage devices.

Hard disk	Most computers have hard disks installed. A hard disk is a fixed disk consisting of magnetic storage plates encased in a drive unit positioned inside the computer. A hard disk is used as the main permanent store of programs that have been loaded on to the computer so that they are always available. If connected to a network, the computer is sometimes able to access other hard disks on other computers. External hard disks are also available. Hard disks provide fast retrieval of information compared with floppy disks. Because hard disk capacity is large, it is measured in MB or GB.
Floppy disk (diskette)	A floppy disk is a removable storage medium used in drive A. The 3' 1/2" floppy disk has become the norm. It provides a cheap way of backing up small amounts of data. It has a hard plastic case (protecting its floppy interior) with a metal cover which slides back when the disk is placed in the disk drive. The amount that can be stored on a floppy disk depends on whether it is single or double sided and whether it is single, double or high density. A double density floppy disk stores approximately 720KB and a high density disk approximately 1.44MB. The majority of the disks are already formatted. Floppy disks have a notch, called the write-protect notch, which will stop you deleting or altering a disk's contents. To ensure floppy disks are not damaged, you should do the following: <ul style="list-style-type: none"> <li>• always store disks carefully</li> <li>• keep the disks away from anything magnetic</li> <li>• keep the disks away from direct heat - e.g. radiators or sunlight</li> <li>• do not touch the exposed recording surface.</li> </ul>
Zip disk	A zip disk is a removable disk similar to a floppy disk but can store large amounts of information and is much faster. As with other disk drives, zip drives can be internal or external. Zip disks are useful for storing unusually large files or putting your system on to another computer - e.g. a laptop
CD's	A <u>CD-ROM</u> (Compact Disc Read Only Memory) disk is a round and flat optical device (uses a narrow laser beam to read the data, which has been etched on to the surface to form minute patterns). It can hold in excess of 650MB, equivalent to about 250,000 pages of text or 500 floppy disks. It has fast data retrieval. As the size of software has increased, it is now usually distributed on CD-ROMs instead of floppy disks. A <u>CD-R</u> is a recordable CD that can be recorded on once only. A <u>CD-RW</u> is recordable and can be used many times. A <u>CD-WORM</u> (Write-Once Read-Many) is an optical disk that allows the user to write data onto it once only.
DVD	CD-ROMS are now being overtaken by DVD (Digital Versatile Disks) which look similar, but have a great deal more of storage capacity.
Magnetic Tape (Data	Magnetic tape - usually in cassettes not unlike music cassettes is

cartridges)	commonly used for keeping backup copies of large volumes of data. It is less useful in normal everyday use, because it cannot be accessed randomly; the computer has to read it through from the beginning to the part of interest.
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### Computer performance

Computer performance can be determined by the following factors.

Speed of the CPU	The speed at which they perform is measured in megahertz (MHz). The greater the number of MHz, the better the performance.
Amount of RAM	Most desktop and notebook computers sold today include at least 32MB of RAM and can normally be upgraded to 128MB. The more RAM you have, the less frequently the computer has to access instructions and data from the more slowly accessed hard disk.
Hard disk speed and capacity	Hard disk speeds vary. It is always a good idea to buy a large hard disk so that you will not run out of storage space and have to rely on using slower floppy disks or have to delete items stored on the hard disk to make room.

## Software

### Types of software

There are two main categories of software, systems software and applications software. Systems software includes the control programs, such as the operating system. Application software is any program that processes information for the user - e.g. word processor, spreadsheet, payroll.

### Operating system software

The operating system (OS) is the software that controls the hardware and runs the programs. It is the first program run when the computer is turned on. Common operating systems include MS-DOS, Windows, Linux, Mac OS and UNIX. Windows is an example of a Graphical User Interface (GUI) because it uses icons (small pictures), menus and a mouse. These make the software more user-friendly since it is intuitive and you don't have to remember complicated commands.

**Applications software**

Common applications software includes:

Word Processing	Multimedia
Spreadsheets	Presentation
Databases	Desktop Publishing
Payroll	

**Freeware**

Freeware is software that you can use free of charge. It is given away with computer magazines or it can be downloaded from the Internet.

**Shareware**

Shareware software can also be downloaded from the Internet and is distributed with computer magazines. The idea is that software can be tried out and if you wanted to continue using it you would then have to register and pay for it.

**Systems development**

Computer systems development employs a number of specialised staff - e.g. systems analysts, programmers - that work together at different stages. It has a life cycle as follows:

Research, analysis and design	This includes a feasibility study, the overall general design, prototyping, the detail design and the functionality requirement specifications.
Programming	This includes the design and coding of the system.
Testing	The system then needs to be tested to ensure that it will perform correctly.
Implementation	This includes training of staff, converting from the old system and installation of the new one.
User acceptance	The user will accept the system once it has been fully implemented and tested.

## Network systems

A computer network is the result of joining two or more computers together. There are many advantages in working on a network. It is easy to share files and resources and to group-work on specific tasks because of this. It is easy to communicate via e-mail. Software programs can be installed centrally from one powerful server computer. Resources such as printers and scanners can be shared, thus keeping equipment costs down.

On the other side there are also disadvantages aswell. You have to take your turn in the queue for printers and other devices that are shared over the network. You might feel less in control when you are sharing documents, databases and information with other users of your network. Networks can be technically complex. Not every company has the required expertise in-house to keep things running smoothly and fix them when they go wrong and bringing in outside help can be expensive.

### LAN, WAN and client-server networks.

Networks can be categorised by their size. For example:

- **LAN** (Local Area Network). This is a network that connects computers within a local confined geographical area - e.g. a single office, building or across a site.
- **WAN** (Wide Area Network). This connects computers over a wide area and across countries.

Another way of looking at a network is in terms of the roles played by different computers attached to it. One of the more widely used is the client-server architecture, in which some computers act as clients and a smaller number act as servers. A server is part of a computer that contains files or applications that it 'serves up' to the clients on request. Servers tend to be large, powerful, permanently switched-on computers. A client computer is an ordinary desktop or mobile PC that relies on a server to complete particular tasks. It might request some information from the server, for example, or even use a software application that is installed on the server machine. The Internet is an example of a client server network.

### The telephone network in computing

LANs usually have cables that connect the computers on the network. However WANs often use the national and international telephone systems that rely on the Public Switched Data Network (PSDN), the Integrated Service Digital Network (ISDN) and satellite communications. The purpose of these is to ensure that people and computers can communicate over standardised connection facilities using common protocols.

Asymmetric digital subscriber line (ADSL), a new technology that allows data to be sent over existing copper telephone lines. ADSL supports data rates of from 1.5 to 9 Mbps when receiving data (known as the downstream rate) and from 16 to 640 Kbps when sending data (known as upstream rate).

ADSL requires a special ADSL modem. ADSL is growing popularity as more areas around the world gain access.

When a computer needs to send information to another computer using the telephone system it must have a means of converting the digital signals (that have two distinct states) from the computer, into analogue signals (not absolute values but ones that constantly change - e.g. audio tones) used by the phone line, and vice versa for incoming information. (It must modulate and demodulate.) The hardware that enables this is called a modem. The rate of signal changes when transmitting/receiving data is known as the baud. At very low speeds the baud rate is equal to bits per second (bps) - e.g. 300 baud is the same as 300bps. Beyond this one baud can be made to represent more than one bit. Currently the maximum rate over the public telephone network is 56 Baud.

Fax and telex machines also use the phone system. Fax machines communicate a printed page between remote locations. A stand-alone fax machine is made up of a scanner, printer and modem with fax signalling, but electronic fax/modems are available that can be attached to a computer either internally or externally. Telex machines were the first worldwide real time data communications service to use terminals for transmitting and receiving messages. Telex messaging is now in decline.

### **Electronic mail**

Electronic mail (e-mail) is a method of sending messages from one computer to another. You can send and receive the electronic equivalent of letters, faxes, pictures and sound. Some organisations have their own internal e-mail systems. Others are connected to the Internet in order to send and receive e-mail locally and internationally. It is a quick and efficient means of communication. It has the advantage that you can send and receive your messages when you choose (unlike telephone communication) and is cheaper because calls are charged at local rate (and sometimes even free!). In addition, you will usually be informed if your message has failed to reach its destination. E-mail messages (and any files transmitted with them) can be saved and edited by the recipient, whether text or graphics.

In order to send/receive e-mail over the Internet you will need:

- a telephone system to connect to, either dial-up (temporary) or a leased line (permanent) connection
- a modem
- communications software
- an account with an Internet Service Provider (ISP) who will register your unique e-mail address

## **The Internet**

The Internet is made up of interconnected networks all over the world that send, receive and store information. Originally developed by the military; it became widely used for research work in academia and commerce. It is now widely used throughout all walks of life for work and leisure pursuits. Access is provided, (for individuals) through ISPs. The World Wide Web (WWW) is a part of this network. It contains millions of pages of words, pictures, sounds and graphics, stored on computers connected to the Internet. It has been called an 'information superhighway'. It provides information on almost every subject. Each document on the WWW is written in HTML (Hypertext Markup Language). This commonality of language makes it easy for a web browser (software that lets you select and view web pages) to display web pages. The two most common web browsers are Internet Explorer and Netscape Navigator. The web uses the Hypertext Transfer Protocol (HTTP) to download web pages to the browser and TCP/IP (Transmission Control Protocol/Internet Protocol) allowing information to travel between networks. Web pages can contain hyperlinks - addresses, known as URLs (Uniform Resource Locators) - to other web pages so that users can plot their own routes through the web pages depending on their area of interest. The WWW is now used for business, commerce and education as well as recreational pursuits.

When looking for specific information on the web, if you do not know an address where you can find it, you can use a search engine. A search engine will look through its database of sites that contain the 'Key word(s)' that you are looking for and will return a list of possible suitable sites. There are also search directories that set out information in subject categories.

## **Keeping your information safe - Security, copyright and the law**

### **Security**

For security reasons it is always a good idea to produce a backup (exact copies) of your data (data is the information that you put into the computer) on a regular basis. Then if anything goes wrong with your computer or the data becomes corrupted (damaged), you will be able to revert to the safely stored version. Various backup programs are available which use removable disks or tapes. It is best to store the backups in a safe and separate place away from your computer.

If there is a power cut when you are using your computer, the documents and information that you have not saved to disk will be lost. It is important that you save your work regularly so that you will minimise the amount of effort required to re-do the work in such situations. Sometimes the computer may just crash - i.e. cease to function - either because there is a program error or a more serious system problem. If it is a program problem, restart the program. If it is a system problem, restart the computer by pressing the keys Ctrl, Alt and Delete at the same time. If this doesn't have any effect, turn the computer off and then restart it.

Computers can be password protected so that only the user can access the data on them. In some organisations several passwords are needed to access strictly confidential data giving added security. Document files can also be password protected. It is always good practice to use a password that is not easy for anyone to guess and it must not be divulged to anyone.

Data can also be encrypted - i.e. turned into a special sort of code. A key to this code is required to make the data readable again.

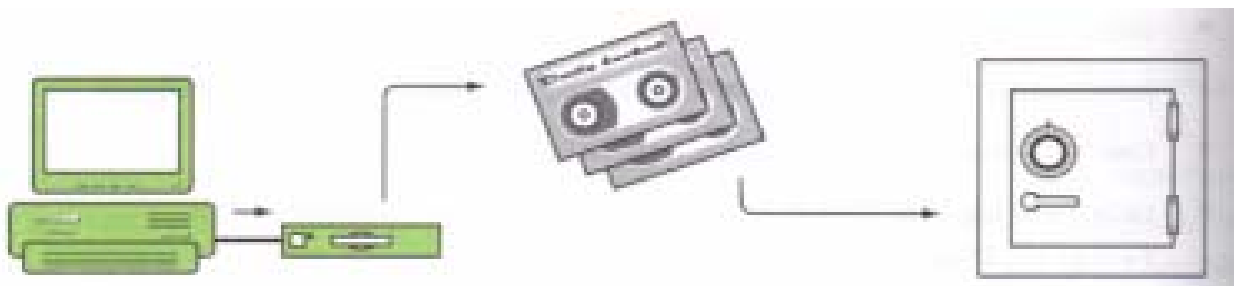
### Computer viruses

A computer virus is a destructive program that is buried within an existing program. They are written by people with programming skills who want to cause widespread problems for computer users. Once the infected program is run, the virus coding is activated and then attaches copies of itself to other programs within your PC. This can quickly spread causing severe damage to computers and networks. A virus cannot attach itself to data. To protect against viruses, always know the source of your software. When downloading software from the Internet always save it and virus check it before running it. Antivirus utilities are available and are a good 'insurance' investment. If you do have a virus on your computer - close down the computer and restart it using a write-protected floppy boot disk and then run a virus utility. There are many products on the market, therefore shop around or even search for further information on the internet. Some of these are:

- Norton Anti Virus - [www.symantec.com](http://www.symantec.com)
- McAfee - [www.mcafee.com](http://www.mcafee.com)
- AVG - [www.grisoft.com](http://www.grisoft.com)

### Back-ups

Taking a back-up of the data from the hard disk drive of a computer or from hard disk of a server running a network is vital. One certain fact is that a hard disk drive will not run forever. If a back-up is taken at the end of each day, then the most that can be lost is one day's work. Often special tape streamer units are used which saves the data onto magnetic tape cassettes. These cassette tapes can typically hold up to 26 GB of data allowing all the data on the server's hard drives to be backed up. A number of tapes should be used in rotation so that a back-up copy can always be kept away from the premises.



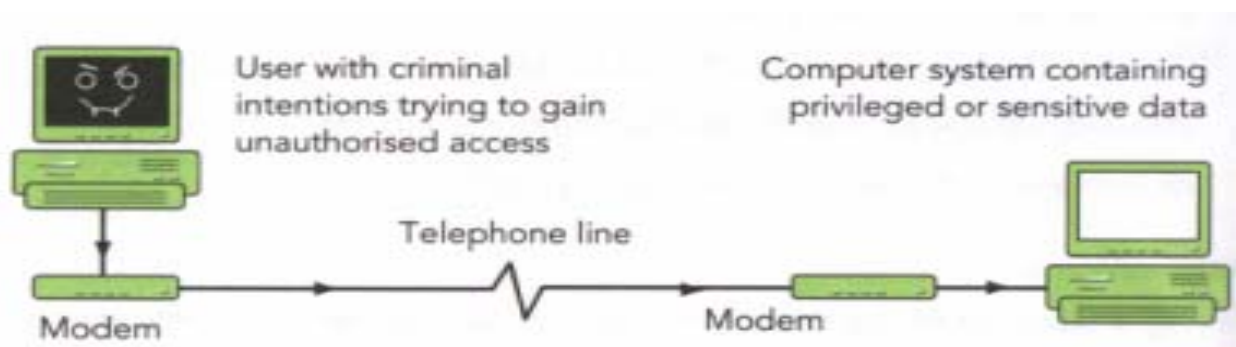
Data is backed up onto tape and then put in a safe place

These tape back-ups should be kept away from the original data, in another building or on another site. Businesses may encourage office staff to take back-up tapes home with them so that data will not be lost through theft from the offices. Tapes kept on-site should be deposited safely each evening in a fireproof safe.

## Hackers

A hacker is a person who breaks codes and passwords to gain unauthorised entry to computer systems. Some hackers can do an enormous amount of damage if they break into a computer system. For some people, the challenge of breaking the codes is irresistible and so precautions have to be taken. Stand-alone computers are usually safe as there is no connection for the hackers to break into. Computers which form part of networks or those with external links, such as attached modems, are in danger from hackers. It is necessary to use passwords to log on to the computer system and it is important to change these passwords at regular intervals.

Computers connected to networks or modems are at risk from hacking



Not all hackers cause harm, ethical hackers help to highlight gaps in security and alert organisations to possible security risks.

## Computer Fraud

Computer fraud is a criminal activity where computer operators use the computer to their own advantage. It is thought that only one in ten cases of computer fraud are reported. There are a number of reasons for this:

- it is very hard to track down and the people committing the crime are often very clever
- offenders are often young, with no previous criminal records
- when fraud is discovered in a company, it is often not publicised as news of the fraud may damage the image of the company.

One example of computer fraud involved a computer operator who found a blank payroll form. He completed the form, making up the details for an imaginary person working in the

company. Each month, as the pay cheques were produced from the company computer, he was able to slip the cheque into his pocket without anyone realising.

### **The Computer Misuse Act, 1990**

Hacking, computer fraud and computer viruses are all relatively new crimes that established English laws were not designed to deal with. For example, under existing laws, a hacker could only be prosecuted for the theft of electricity. To deal with these new crimes, a law was introduced in 1990 called The Computer Misuse Act. Under this law, the following offences could be dealt with:

- Hacking - unauthorised access to any program or data held in a computer. Penalty is a maximum fine of £2000 and a six month prison sentence.
- Computer fraud and blackmail. Penalty is an unlimited fine and a maximum five-year prison sentence.
- Viruses - unauthorised modification of the contents of a computer, impairing the operation of any program or reliability of data. Penalty is an unlimited fine and a maximum five-year prison sentence.

### **The Copyright, Designs and Patents Act, 1989**

Copying computer software, or software piracy, is now a criminal offence under this 1989 Act. The Act covers stealing software, using illegally copies: software and manuals, and running purchased software on two or more machines at the same time without a suitable licence. Quite often, organisations will purchase software licences to cover the number of workstations on their network. They then neglect to purchase additional software licences as they buy more workstations.

The legal penalties for breaking the copyright law include unlimited fines and up to two years in prison.

It has been estimated that half the software used is copied illegally and in some countries pirated software accounts for 90% of the total. Two organisations fight to stop software being copied:

FAST (Federation Against Software Theft), founded in 1984, is a non-profit Organisation to promote the legal use of software.

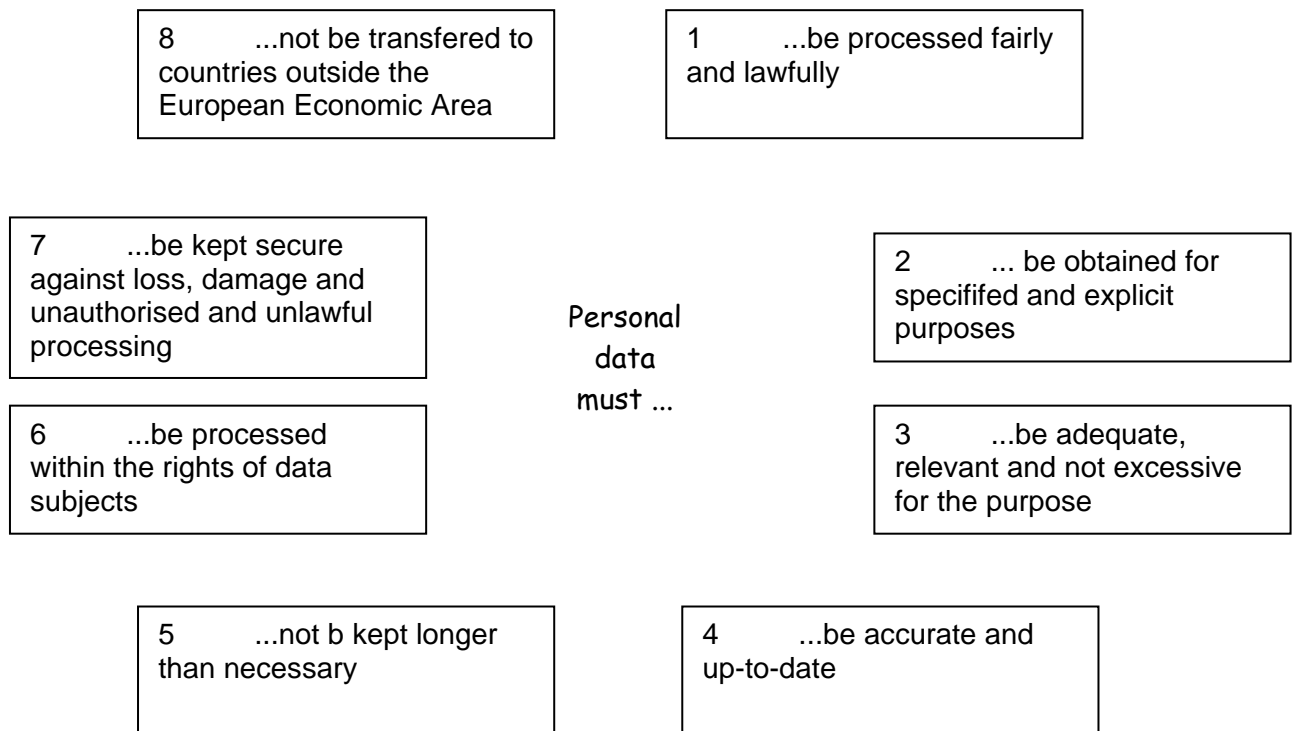
BSA (Business Software Alliance) exists to make organisations and their employees aware of the law and encourage its implementation.

## The Data Protection Act

The 'right to privacy' is a right we all expect. We do not expect personal details such as our age, medical records, personal family details, political and religious beliefs to be freely available to everybody. With the growth of Information and Communication Technology, large databases are able to hold huge quantities of information and global networks are able to share and distribute this information a round the world in seconds. In order to control this development and to protect people's right to privacy, the Data Protection Act was introduced. The first Act became law in 1984 and was updated in March 2000.

If any person, organisation, company or business wishes to hold personal information about people, they must register with the Office of the Data Protection Commissioner.

The Data Protection Act contains eight basic principles. A summary of these is shown below:



### Personal data

What is actually meant by personal data? It is data that can identify a living person and allow an opinion to be expressed about that person. For example, just a name and address is not considered personal data. However, if the data also includes their date of birth and earnings, then this is personal data as the data allows opinions to be expressed about the person. The data can be further classified as 'sensitive' personal data. This includes details of:

- racial or ethnic origins
- political opinions

- religious beliefs
- whether members of trade unions
- their physical or mental health or condition
- sexual life.

### **Rights of data subjects**

In the sixth of the eight principles shown, the rights of the data subject were mentioned. The rights of individuals have increased substantially in the 1998 Act. The following offers a summary.

The individual can:

- be given a copy of the data held
- prevent processing of the data if it is likely to cause damage or distress
- prevent the data being used for direct marketing
- prevent automated decisions being made on the basis of data held
- receive compensation for damage and distress caused by use of the data
- have data corrected, blocked and erased if inaccurate
- make a request to the Data Protection Commissioner if they feel the Act has been contravened.

### **Exemptions**

There are certain exemptions to the Act and the rules governing the need to register data. A summary of the main exemptions to the Act include data that is:

- related to national security
- associated with crime and taxation
- involved in health, education and social work
- used in regulatory activities by public 'watch dogs,
- processed for special (journalistic, literary and artistic) purposes
- used in research, history and statistics
- required by law and in connection with legal proceedings being disclosed
- held for domestic purposes, e.g. household, personal and family affairs.

### **Looking after computer data**

In business, the data stored in a computer can be hundreds of times more valuable than the actual computer equipment. This data may include all the company's financial records, all its customers' details, records of the stock held, etc. Losing this data could, in some cases, put companies out of business.

Data can be damaged or destroyed in the following ways:

- breakdown of hardware, particularly disk drives

- mistakes by office staff, e.g. deleting files
- poor office practice, e.g. not taking a regular back-up of data files and
- not checking for viruses
- hackers gaining access to systems and changing/deleting data
- computer fraud where data is changed to benefit individuals
- theft of computer equipment
- fire, floods, hurricanes, earthquakes, etc, destroying equipment
- infection of systems and data by computer viruses
- deliberate and malicious damage by staff.

## **Computers in everyday life**

### **Use of computers**

With the advent of microchip technology, computers have become smaller, faster, more reliable, easier to use and cheaper. Since the late 70s when personal computers first became available, there has been an ever-increasing growth in their popularity.

### **Computers in the home**

The majority of homes now have a computer with multimedia systems, many with Internet access, CD Rom and sound systems.. It is used for various activities by all family members including:

- working from home (tele-working)
- sending e-mails
- accessing the internet to find information for various activities - e.g. homework, projects. hobbies
- keeping household account
- shopping, banking
- playing games

### **Computers at work or in education**

Business, industry and educational establishments all have computers to deal with large amounts of data that needs calculating and analysing. Some may need special systems such as IMS (Information Management Systems) or DMS (Database Management Systems). Computer uses can include:

- keeping databases of names and addresses (database application,)
- account information (spreadsheet and database applications)
- stock control and sales analysis (spreadsheet and database applications)
- marketing, including advertising and selling via websites (using e-mail and the Internet and web browser software)

- payroll (using spreadsheets or customized software)
- student grades and project work (using database and spreadsheet applications and other specialized software)
- designing products (computer aided design (CAD))
- automating industrial processes (specialised software), robotics
- traffic lights, which have sensors to detect traffic and send messages to a controlling computer, which maintains regulated traffic flow.
- Computer based training (CBT) specialized software enable people to learn at their own pace and at a time that suits them.

## Computers in daily life

Computers can now be found everywhere. Common places are:

Supermarkets. Barcodes are scanned to find produce information that is stored within this. This is known as Electronic Point of Sale (EPOS). Using such methods stock levels can be managed easily.

Libraries. Books are tracked by using a database. Books are scanned when taken and returned.

Doctors' surgeries. Patients' files are now computerized.

Bank/building society. Cash machines (known as Automated Teller machines or ATMs) where cards are used to identify the customer by reading the magnetic strip and checking the user's PIN (Personal Identification Number).

## A changing world

The society that we live in relies on computers to enable us to gather and disseminate information quickly and easily. Because of this it has become known as the 'Information Society'. Some people feel threatened or empowered by it, but everyone as their own views. In situations where you see computers being used it is worth asking 'Is this a job for a computer or would a human interface be better?' Sometimes there are no clear-cut answers and much depends upon your general values.

### Information superhighway

This is another name given to the Internet - the telecommunications infrastructure that allows access to a never-ending source of information across the world. It is changing the way we live and work at an every increasing rate.

## Electronic commerce

This means doing business online. If you advertise a service i.e. Book, groceries, holiday using the internet, you are marketing in e-commerce.

## Health and Safety

There are many health and safety issues that people should be aware of when working within a computer environment.

### Posture

- try not to slouch
- adjust the chair's backrest to support lower back
- remove obstructions from beneath the desk
- organise the workstation to sit upright
- use a document holder
- place document holder close to the screen and at same height
- adjust the seat height so that forearms are horizontal
- use a footrest if the seat is too high
- keep feet flat on the floor or on a footrest
- do not sit with legs crossed for long periods
- do not maintain the same posture for long periods
- avoid leaning and stretching

### Reading the screen

- adjust the screen angle to avoid reflections
- use window blinds
- clean the screen regularly
- adjust the brightness and contrast to suit

### Seating

- Sitting in front of a computer for long periods of time may cause back pain, tenseness and stiffness of muscles, varicose veins, poor circulation and Work Related Upper Limb Disorders. Suitable seating can contribute to good health and efficiency at home and at work.

## **Workstation Design**

The workstation needs to be designed so that the worker is at a comfortable height and position in relation to their work.

All equipment in frequent use should be kept within easy reach so that repeated twisting or stretching movements is eliminated.

Lighting should be adequate for the task and correctly positioned, so that you do not strain or take up uncomfortable positions in order to see properly.

## **Chair Design**

The basic requirements for seating are:

- the chair should support the persons back in a position which allows work to be done comfortably and efficiently.
- the chair should permit the person to change position easily
- the chair should cater for any special needs for particular person, for example very tall or short people or those with disabilities
- the chair should be matched to the dimensions of the workstation
- all adjustments should be easy to make from the seated position
- the chair should be stable - five star bases are recommended
- armrests can be useful, but should not prevent the person from drawing close to the desk
- if feet do not rest firmly on the floor once the chair is adjusted to a suitable sitting height, a footrest should be provided.

## **Gas lift chairs**

Many pedestal chairs are operated by a gas cylinder. These are very popular because of their easy adjustability. Gas lift chairs should not be examined or tampered with by untrained people.

## **Safe working environment**

Electrical safety. Don't be tempted to add too many extension cables or double socket adapters to your existing electrical sockets - if you are in any doubt at all call in an electrician to check the safety of your system and always replace damaged plugs or leads.

Do uncoil leads but don't leave them trailing on the floor.

It is important to remember that your computer is connected to electricity. If you have an Internet connection, that also means that your computer is connected to a telephone line or cable connection. These are also conductive connections. That means that lightning could be conducted to your computer through any of these connections. For safety reasons, you should never use your computer during a storm.

Many computer users purchase surge protectors to safeguard their systems. The user plugs computer components into the surge protector, then plugs the surge protector into the wall. Surge protectors are designed to protect computers against electrical surges or lightning.

Remember electricity and liquids don't mix - keep water and other liquids away from the computer system. This includes drinks, fish bowls and cleaning fluids.

Remember - computer equipment which uses mains electricity must be treated with caution.