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Introduction iv

## Part 1

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What the book covers

This book supports the Cambridge IGCSE Information and Communication Technology syllabus. It has been written by an experienced author to ensure the content and features make learning as interesting and effective as possible. On the accompanying CD you will find interactive and revision tests, glossary and further past paper questions taken from the previous syllabus.

How you will be assessed

The assessment for the IGCSE consists of the following three papers:

Paper 1
This is a written paper of 2 hours’ duration which tests the content of Sections 1 to 21 of the syllabus content. The questions are all compulsory and many of them consist of multiple choice or short answer questions. There are others which require longer answers.

The marks for paper 1 are 40% of the total.

Paper 2
This is a practical test that tests the practical skills to use the applications in Sections 17, 18 and 19 of the syllabus content.

The marks for paper 2 are 30% of the total.

Paper 3
This is a practical test that tests the practical skills to use the applications in Sections 20 and 21 of the syllabus content.

The marks for paper 2 are 30% of the total. Throughout this book, you will find exam-style questions. Some of these are taken from past examination papers; these have been taken from the previous syllabus so may be different to what you encounter in your examination.

Sections for the content of the syllabus content

The content is divided into the following interrelated sections:

1 Types and components of computer systems
2 Input and output devices
3 Storage devices and media
4 Networks and the effects of using them
5 The effects of using IT
6 ICT applications
7 The systems lifecycle
8 Safety and security
9 Audience
10 Communication

The practical tests

For the practical tests you will also need to show knowledge and understanding of Sections 1-10, and demonstrate the practical skills relevant to Sections 11-21.

Practical tests assess the practical skills developed for applications in the following list:

11 File management
12 Images
13 Layout
14 Styles
15 Proofing
16 Graphs and charts
17 Document production
18 Data manipulation
19 Presentations
20 Data analysis
21 Website authoring

When your work is marked you will have to meet a series of learning outcomes in each of the sections outlined above.

For access to all the files used in the activities go to www.oxfordsecondary.co.uk/completeict, or the Complete ICT for IGCSE Teacher Kit CD-ROM.
Computer systems consist of two parts: hardware and software, and both are essential for computers to carry out tasks. This chapter looks at different types of computer and the hardware and software needed for them to do a useful job.

The key concepts covered in this chapter are:
- Hardware and software
- The main components of computer systems
- Operating systems
- Types of computer
- Impact of emerging technologies

### Hardware and software

All computer systems consist of two main parts: hardware and software. Here are the definitions of hardware and software.

**Hardware** are the physical components of a computer system such as motherboards, memory, sound cards, screens/monitors, keyboards, printers, etc.

**Software** are the programs for controlling the operation of a computer or for the processing of electronic data.

#### Internal hardware devices

These are situated inside the computer casing and include:

- **Motherboard** – the main printed circuit board found in computers and contains electrical components such as the central processing unit and memory and also connectors for connecting external hardware devices such as keyboards, mice, speakers, etc.
- **Random access memory (RAM)** – these are the memory chips which lose their contents when the power is removed.
- **Read-only memory (ROM)** – memory chips where the contents can be read but not written to and where the contents are retained when the power is removed.
- **Video card** – an expansion card that generates the signals so that a video output device can display computer data such as text and graphics.
- **Sound card** – an expansion card that allows a computer to send audio signals to audio devices such as speakers and headphones. Most computers now have the sound card integrated into the motherboard.
- **Internal hard disk drive** – a rigid magnetic material coated disk onto which programs and data can be stored and situated inside the casing of the computer.

#### External hardware devices

These are outside the computer casing and include:

- Monitors/screens
- Keyboards and mice
- External storage devices (e.g. external hard disk drive, memory sticks/pen drives)
- Printers
- Scanners
- Speakers and microphones

### KEY WORDS

**Hardware** the physical components of a computer system such as motherboards, memory, sound cards, screens/monitors, keyboards, printers, etc.

**Software** programs for controlling the operation of a computer or for the processing of electronic data.
Software

Software are programs for controlling the operation of a computer or for processing electronic data.

Software consists of sets of instructions that tell the computer hardware what to do. Software is written in a computer language and there are quite a few different ones. Computer hardware is useless without software. Software is of two main types: applications software and system software.

Applications software

Applications software are programs that are designed to carry out certain operations for a particular application. The formatting of text and the organisation of page layout can be performed using word-processing software, which is an example of applications software.

Applications software cannot run on its own as it is dependent on system software, which is the other type of software.

Applications software includes:

- Word processing – software that allows the composition, editing, re-formatting, storing and printing of documents.
- Spreadsheets – software that stores data in cells formed by the intersection of rows and columns that can be used to help sort data, arrange data and calculate numerical values. It can calculate values using mathematical formulae and the data contained in the cells.
- Database management system – software that provides facilities for the organisation and management of a body of information required for a particular application.
- Control software – software used to supply instructions in order to tell devices such as washing machines, automatic cookers how to operate.
- Measuring software – software used to issue instructions to sensors to take measurements of physical quantities such as temperature, pressure etc. and input the readings into the computer for processing.
- Applets and apps – are little programs (i.e. applications) which range from games to social applications and are usually run using smartphones or tablets.
- Photo-editing software – used to improve/enhance photographs using a computer. This would include re-sizing, cropping (i.e. using only part of the photo) and colour/brightness/contrast adjustment.
- Video-editing software – allows a user to take sections of video recordings called clips and trim, splice, cut or arrange them across a timeline. Special visual effects can be included.
- Graphics manipulation software – used to alter the appearance of images. This typically involves altering size, altering orientation, cropping, adjusting colours etc.

System software

System software are programs that control the computer hardware directly by giving the step-by-step instructions that tell the computer hardware what to do. System software therefore operates and controls the computer hardware.

System software includes:

- Operating systems
- Device drivers
- Compilers
- Linkers
- Utilities

Operating systems

An operating system is a program or a suite of programs that controls the system resources and the processes using these resources on a computer. You will learn about the different tasks performed by an operating system later in this chapter.

Compilers

Compilers are programs that change the instructions written in programming languages, such as BASIC, into binary numbers (0’s and 1’s). A compiler converts the whole of a program written in the programming language into binary in one go. The program is then stored in binary and when it is run it runs much faster because it is now in binary so no time is wasted translating it.

Device drivers

Device drivers are software used to supply instructions to the hardware on how to operate equipment that may be connected to the computer such as printers, scanners, keyboards, mice, external hard disk drives, etc.

Most operating systems are able to recognise when hardware such as a pen drive/memory stick, camera, external hard disk drive, printer, scanner, etc., has been attached to the computer and automatically load the driver software needed to control it. Sometimes, when a new device is attached to a computer, you need to install device driver software included with the device on the computer so that the computer is able to recognise and operate the device.

Linkers

Linkers are programs that are usually part of the compiler. Linkers take care of the linking between the code that the programmer writes and other resources and libraries that make up the whole program file that can be executed (run).

Utilities

Utility programs are provided as part of the system software and they help the user with everyday tasks such as:

- File maintenance tasks such as creating new folders, copying files, renaming files, deleting files
- Compressing files so that they take up less storage space or can be transferred quickly over the internet
- Installing and uninstalling software
- Compacting files on the hard drive so they can be found faster
- Checking for and removing viruses
- Formatting a disk ready for use
- Burning CDs and DVDs (saving data onto them)
The main components of computer systems

- **Input devices**
- **Processor and internal memory**
- **Output devices**
- **Backing / secondary storage devices**

**Device driver**
A short, specially written program that understands the operation of the device it controls/operates. For example, driver software can operate/control a printer or scanner. Driver software is needed to allow the systems or applications software to control the device properly.

**Operating system**
Software that controls the hardware of a computer and is used to run the applications software. Operating systems control the handling of input, output, interrupts, etc.

**System software**
Any computer software that manages and controls the hardware thus allowing the applications software to do a useful job. System software consists of a group of programs.

**Utility software**
Part of the system software that performs a specific task such as creating a new folder, copying files, etc.

**QUESTIONS A**

1. a Explain the main difference between computer hardware and software. (2 marks)
   
b Give two examples of computer hardware and two examples of computer software. (4 marks)

2. System software includes the following:
   Operating system
   Device drivers
   Utilities

   Write down the piece of software from the list above that performs each of the following tasks.
   
a Switches the printer on/off and sends data to the printer for printing. (1 mark)
   
b Compresses files so that they can be sent in less time over the internet. (1 mark)
   
c Provides a user interface so that users can easily create folders, copy files, move files, etc. (1 mark)
   
d Keeps track of where to store data on the hard disk drive. (1 mark)
   
e Detects and removes viruses. (1 mark)
   
f Used to supply instructions as to how to operate hardware attached to the computer such as printers and scanners. (1 mark)

3. a Hardware devices can be either internal hardware devices or external hardware devices. Explain the difference between the two. (2 marks)
   
b From the following list, identify which are internal hardware devices and which are external hardware devices.
   
   Mouse Video card
   Motherboard Internal hard disk drive
   Processor RAM
   ROM Printer
   Keyboard Sound card (10 marks)

4. System software is a suite of programs that includes the operating system, device drivers and utilities.
   
a Explain why all computers need an operating system. (2 marks)
   
b i Is a device driver hardware or software? (1 mark)
   
   ii When a printer is attached or linked to a computer system, a device driver is loaded. Explain what the purpose of a device driver is. (1 mark)
   
c Give two tasks that are performed by utility software. (2 marks)

The main components of a computer are:
- Input devices (keyboard, mouse, etc.)
- Processor and internal memory
- Output devices (printer, monitor, speakers, etc.)
- Backing / secondary storage devices (DVD-R/W drive, internal hard disk drive, etc.)

The processor and internal memory include the central processing unit (CPU), read only memory (ROM), random access memory (RAM) and the internal hard disk drive.

**The central processing unit and its role**
The central processing unit (CPU), often called the processor, is the brain of the computer and it consists of millions of tiny circuits on a silicon chip. The central processing unit does a number of tasks: it controls the step-by-step running of the computer system, it performs all the calculations and the logical operations, and deals with the storage of data and programs in memory.
Internal memory: read only memory (ROM) and random access memory (RAM)

There are two types of memory called ROM and RAM. Both of these two types of memory are stored on chips and are available immediately to the central processing unit.

Computers also have a hard disk drive as internal memory and it is here that the application software is stored along with the user’s files.

<table>
<thead>
<tr>
<th>ROM (read only memory)</th>
<th>RAM (random access memory)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data and program instructions are stored permanently.</td>
<td>Data and program instructions are stored temporarily.</td>
</tr>
<tr>
<td>The computer can only read the contents.</td>
<td>Can read contents as well as write new contents.</td>
</tr>
<tr>
<td>Non-volatile, meaning the contents of memory are retained when there is no power.</td>
<td>Volatile, meaning the contents are lost when there is no power.</td>
</tr>
<tr>
<td>Used to store the BIOS program used to boot the computer up when the power is turned on.</td>
<td></td>
</tr>
</tbody>
</table>

**BIOS** (basic input/output system) stored in ROM and holds instructions used to ‘boot’ [start] the computer up when first switched on.

**RAM** random access memory – fast temporary memory which loses its contents when the power is turned off.

**ROM** read only memory – memory stored on a chip which does not lose data when the power is turned off.

**KEY WORDS**

**Input devices**

These are used to get raw data into the computer ready for processing by the CPU. Some input devices, such as a mouse, keyboard, touch screen, microphone, etc., are manual and need to be operated by a human. Others are automatic and once they are set up they can be left to input the data on their own. These include optical mark readers, optical character readers, etc.

**Output devices**

Once the raw data has been processed it becomes information and this information needs to be output from the computer using an output device. Output devices include monitors/screens, printers, speakers, plotters, etc.

**Secondary/backing storage**

Secondary/backing storage is used for the storage of programs and data that are not needed instantly by the computer. It is also used for long-term storage of programs and data as well as for copies in case the original data is lost.

Secondary/backing storage media includes internal hard disks, memory sticks, flash memory cards, optical disks (such as CDs and DVDs) and magnetic tape.

See Chapter 2 for more information on input, output and storage devices.

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**QUESTIONS B**

1. The diagram represents a computer’s main components:

   For each of these components, match it with a letter in the diagram above.

   - Processor and internal memory devices
   - Secondary storage devices
   - Output devices
   - Input devices

   (4 marks)

2. ROM and RAM are both types of internal computer memory.
   a. i. What do the letters ROM stand for? (1 mark)
   b. ii. What do the letters RAM stand for? (1 mark)

   b. Tick one box next to each item below to show which statements apply to ROM and which to RAM. (4 marks)

   | Contents are lost when the computer is turned off | Contents are not lost when the computer is turned off |
   | Stores the programs needed to start up the computer | Stores application programs and data currently being used |

3. a. Explain why it is important that a computer has a large amount of RAM and ROM. (2 marks)
   b. Computers contain RAM and ROM.
   Explain what ROM would be used for in a computer.
   Explain what RAM would be used for in a computer. (4 marks)

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**Operating systems**

Operating systems are programs that control the hardware directly by giving the step-by-step instructions that tell the computer hardware what to do. An operating system performs the following tasks:

- Handles inputs and outputs – selects and controls the operation of hardware devices such as keyboards, mice, scanners, printers, etc.
- Recognises hardware – the operating system will recognise that a hardware device such as a pen drive, camera, portable hard drive, etc., has been attached to the computer. The operating system loads the software it needs to control the device automatically.
Supervises the running of other programs – it provides a way for applications software (i.e. the software that is used to complete a task such as word-processing, spreadsheet, stock control, etc.) to work with the hardware.

Handles the storage of data – it keeps track of all the files and directories/folders on the disk.

Maximises the use of computer memory – the operating system decides where in the memory the program instructions are placed. For example, some instructions are needed over and over again, whereas others are needed only now and again. It ensures that the parts of the program needed frequently are put in the fastest part of the memory.

Handles interrupts and decides what action to take – when something happens such as the printer cannot print because the paper is jammed or it has run out of paper, it will stop the printer and alert the user.

The types of interface used with operating systems

An operating system needs a way of interacting with the user. The way the operating system communicates with a user is called the interface and there are two common interfaces in use and these are:

- Graphical user interface (GUI) – these are very easy to use and have features such as windows, icons, menus, pointers, etc. Examples of operating systems which make use of a GUI are:
  - Windows
  - Mac OS
  - Ubuntu

- Command line/driven interface (CLI) – here you have to type in a series of commands which must be precisely worded, and it can be hard to remember how to do this, so this type of interface is harder to use. An example of an operating system making use of a command line/driven interface is MSDOS (Microsoft Disk Operating System).

Graphical user interface

Graphical user interfaces (GUIs) are very popular because they are easy to use. Instead of typing in commands, you enter them by pointing at and clicking objects on the screen. Microsoft Windows and Macintosh operating systems use graphical user interfaces. The main features of a GUI include:

- Windows – the screen is divided into areas called windows. Windows are useful if you need to work on several tasks.
- Icons – these are small pictures used to represent commands, files or windows. By moving the pointer and clicking, you can carry out a command or open a window. You can also position any icon anywhere on your desktop.
- Menus – these allow a user to make selections from a list. Menus can be pop-up or drop-down and this means they do not clutter the desktop while not in use.
- Pointer – this is the little arrow that appears when using Windows. The pointer changes shape in different applications – it changes to an ‘I’ shape when using word-processing software. A mouse can be used to move the pointer around the screen.

Notice that the first letter of each feature in the above list spells out the term WIMP (i.e. Windows, Icons, Menus, Pointers).

The benefits and drawbacks between an operating system which uses a GUI and those which use a CLI

Benefits and drawbacks of a GUI

Benefits

- A GUI is considered by most people to be more user friendly. It is more obvious to new users how to do simple tasks such as printing by clicking on a printer icon.
- There are no commands to remember. You simply click on icons or drop-down menus using the mouse to make selections.
- It is much easier to find programs that are running using a GUI. For example, you can have one window open displaying a spreadsheet while using word-processing software in a different window.
- They enable data to be passed easily from one software package to another using drag and drop or cut and paste.

Drawbacks

- A GUI takes up more hard disk space when being stored.
- A GUI requires more memory (ROM and RAM) when being used.
- A more experienced user might find that typing in commands is quicker than moving the mouse or clicking.
- A powerful processor is needed to run the latest version of a GUI.
Benefits and drawbacks of a CLI

Benefits

- If the user is experienced in using the CLI it can be faster to type commands rather than move the mouse and click on drop-down menus and icons to issue the same commands.
- A CLI does not use as much hard disk space when being stored.
- A CLI does not need as much memory (ROM and RAM) when being run.
- You do not need a powerful processor to run a CLI.

Drawbacks

- You need to learn and remember lots of commands.
- Commands must be issued in a specific order otherwise the commands will be rejected.

Important note

Windows is an interface which allows easy user interaction with a multitasking graphical user interface (GUI) operating system as well as other software. MS Windows is a branded operating system owned by the company Microsoft.

Questions C

1. Graphical user interfaces are very popular interfaces that are used with computers, mobile phones, and other portable devices.
   a. Give three features of a graphical user interface. (3 marks)
   b. Other than a graphical user interface (GUI) give the name of one other type of user interface. (1 mark)

2. All computers need an operating system.
   a. Explain what an operating system is. (2 marks)
   b. List three different functions of an operating system. (3 marks)

3. Users need a way of interacting with an operating system.
   a. Give the names of the two different types of user interface used with computers. (Note that the use of brand names will gain you no marks in an examination.) (2 marks)
   b. Give a benefit and a drawback for each type of interface. (2 marks)

Types of computer

The type of computer you choose to use depends on the tasks you intend to do with the computer and where you intend using the computer. If a computer is to be used away from a desk then it needs to be small and light but there are some tasks such as desktop publishing where it becomes difficult to perform using a small screen.

Personal computers (PCs) or desktop computers

A personal computer is the type of computer that you are most likely to encounter at home or at school.

Computers can be classed as stand alone or networked:

- Stand alone computers are not connected to a network so they do not share resources or files with other computers. They are used when all the programs/data/files needed for the application, are stored locally (i.e. on one of the drives or memory in the computer itself).
- Networked computers are linked to a network so they are able to share files, an internet connection and devices such as printers and scanners with other computers connected to the network. Many programs are stored on the internet (i.e. cloud storage) rather than locally on the computer and can therefore only be accessed using networked computers.

Laptops

Laptop computers are designed to be portable and used while on the move. A touch pad is typically used instead of a mouse to move the cursor and make selections. Laptops are often used in public places so there is a greater likelihood of them being stolen.

Laptops make use of LCD (liquid crystal displays) which use less power and are light in weight. This is important because laptops use rechargeable batteries when used away from a power supply. If a laptop is not connected to a network then it is a stand alone laptop and all the programs and files needed for the application used are stored on the computer itself. Once the computer is connected to a network then it is able to share files and resources and it becomes a networked laptop.

Tablet computers

Tablet computers, called tablets for short, are mobile computers with a display, electronic circuitry and battery in a single thin unit. They are designed to be portable yet have a screen size that makes them easy to use for accessing content on the internet, playing games, listening to music, as well as using all the other applications for which you would use a computer. Tablets usually feature an on-screen keyboard which pops up on the screen to enable text to be input.

Tablet computers are usually equipped with some or all of the following:

- A camera which enables still or video images to be recorded and saved as well as photo-editing software.
- Speakers to output music, sound from video recordings, instructions from GPS (global positioning systems), etc.
- A microphone to record voice for the phone facility, the web cam, and for voice recognition to enable commands to be issued verbally and to enable speech to be converted to text for documents and emails.
Handwriting recognition enables a user to write on the touchscreen using a stylus and then convert it to text which can be used in email, documents, etc.

Bluetooth which allows communication between the tablet and peripherals such as external speakers and other devices.

Ability to use Wi-Fi which allows access to the internet wherever there is a wireless access point (e.g. in homes, coffee shops, libraries etc.).

The ability to use 3G/4G telephony to access the internet when Wi-Fi is not available, provided you have a mobile signal.

Smartphones

Smartphones have most of the features of a tablet computer but their small size limits their use for certain applications.

The following diagram shows some of the features of a smartphone.

<table>
<thead>
<tr>
<th>Features of a smartphone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clock, alarm, calendar &amp; calculator</td>
</tr>
<tr>
<td>3G/4G telephony</td>
</tr>
<tr>
<td>WiFi access to the internet</td>
</tr>
<tr>
<td>Phone calls</td>
</tr>
<tr>
<td>SMS messaging</td>
</tr>
<tr>
<td>Voice messages</td>
</tr>
<tr>
<td>MP3 player</td>
</tr>
<tr>
<td>GPS</td>
</tr>
<tr>
<td>Video</td>
</tr>
<tr>
<td>Camera &amp; photo-editing</td>
</tr>
<tr>
<td>Communicating with nearby devices using Bluetooth</td>
</tr>
<tr>
<td>Ability to run small programs called apps</td>
</tr>
</tbody>
</table>

Handwriting recognition enables a user to write on the touchscreen using a stylus and then convert it to text which can be used in email, documents, etc.

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The ability to use 3G/4G telephony to access the internet when Wi-Fi is not available, provided you have a mobile signal.

**Impact of emerging technologies**

Emerging technologies are those that are likely to make a great impact on our everyday lives in the future and these are outlined here.

**Artificial intelligence**

Artificial intelligence is the science of getting computers to learn in a similar way to the way the human brain learns new things. The aim of this is to make computers more intelligent and make them able to work things out for themselves.

Artificial intelligence is a reasoning process performed by computers that allow the computer to:

- Draw deductions
- Produce new information
- Modify rules or write new rules.

**KEY WORD**

**Artificial intelligence (AI)** creating computer programs or computer systems that behave in a similar way to the human brain by learning from experience, etc. The computer, just like a human, is able to learn as it stores more and more data.

**Biometrics**

Biometrics uses a property of the human body to identify people. The three main properties used to identify a person using ICT are:

- Fingerprints
- The pattern on their retina (the pattern of blood vessels at the back of the eye).
- The pattern on their iris (the coloured, circular area around the pupil in the eye).
These have the following uses.

Fingerprint scanning:
- Used for recording attendance in school/college
- Used for access to buildings and rooms
- Used to restrict access to computers/smartphones
- Used to restrict access to countries at border control at airports, ports, etc.

Retinal scanning:
- Used for passport control.
- Used for access to buildings and rooms.

Retinal scanning makes use of the unique pattern of blood vessels in the retina to identify people.

There are some new developments in biometrics:
- Face recognition systems – where a person can be identified by their face. Faces are stored on a database and the image from a CCTV camera is used to find a match. Face recognition systems are used at passport/border control where a face is identified using a camera and a check is made to confirm it matches the photograph in the passport.
- Walk recognition systems – people have a unique way of walking and this can be used to identify people from behind. This is used by the security and police forces.

Computer-assisted translation
Computer-assisted translation is a type of translation from one language into another where the person doing the translation uses computer software to aid them with the translation.

All you need to do is enter text into a window in one language and then select the language you want it translating into and then all the text will appear in another window translated in the new language. There is even the option of hearing the spoken words in each language. In some cases it is not necessary to tell the computer the language being translated as it can recognise it automatically. One popular computer-assisted translation service is provided by Google Translate.

Uses for computer-assisted translation
- Changing the language on websites – many websites are used internationally and it is possible for you change the language used by the website to the language you use.
- Translation of documents – documents such as contracts, letters, brochures, notes etc may need to be translated into different languages. There is no need for translators to perform the translation as computer software can do it saving both time and money.

Quantum cryptography
Quantum cryptography uses a special branch of physics called quantum mechanics to produce a very secure method of encryption. It allows a sender and receiver to communicate in private using a special key. If someone is trying to eavesdrop on the communication, the system is able to detect this and the system stops the communication. This method is used by the military to send orders to troops and also for sending financial and banking details over networks.

Uses for quantum cryptography
- Used for the sending of credit/debit card or banking details – these are sent over the Internet without hackers being able to view and understand the data.
- Provides a completely secure method of sending secret information – (e.g. details of informants and spies) which improves the security of a country.
- Used for securely performing elections using the Internet – in the past, paper votes or even electronic votes could be tampered with.

Vision enhancement
Vision enhancement uses special sensors (which are usually special cameras) that detect information from images outside the visible spectrum. This information is then put together with the ordinary image to make it clearer.

Vision enhancement is used in some luxury cars to provide a screen at which a driver can glance when driving in poor visibility (e.g. fog, spray, lights from oncoming cars, rain, and at night). It can also be used by the military to enable troops to see when it is almost dark.

People who have low vision (i.e. they are almost blind) can use vision enhancement to enable them to see using their remaining sight. The system takes their remaining sight and magnifies objects up to 50 times allowing them to change the brightness and contrast of the image to enable them to see much more clearly.

Uses for vision enhancement
- Improving vision – pilots/drivers in poor light conditions can have their vision improved making it safer.
- Improves the vision of partially sighted people – thus improving their quality of life.

3D and holographic imaging
3D imaging is a technique that gives the illusion of depth in an image. It works by using two slightly offset images with one image sent to the right eye and the other image sent to the left eye. The brain then uses the 2D images on the screen to give the impression of depth.
Holographic imaging uses laser light to form an image of an object that is almost indistinguishable from the object itself. Research is currently taking place to use computer-generated holograms with special holographic displays to produce holographic television. The main problem at the moment is that producing a holographic image requires huge numbers of calculations to be performed very quickly and current processors are not fast enough. There is also the problem of transmitting holographic images, because the bandwidth needed is much higher than that currently available. As soon as these technical problems are solved, we will have true 3D images.

**Virtual reality**
Virtual reality is a simulation of the real world, or an imaginary world that is created using computers. Sometimes the image is displayed on a computer screen and sometimes it is displayed on a specially designed headset that you wear. In some cases users are able to interact with the virtual environment using a keyboard and mouse or by using a specially wired glove.

**Robotics**
Robots have been widely used in manufacturing for years, especially for painting and welding in car factories. Robots are also used for picking and packing goods in large warehouses. Robots have been developed that will do some of the tasks humans hate to do, such as mowing the lawn or vacuuming floors.

There are robots available for the home that will wash floors, clean gutters, and clean swimming pools. The robots that are available at the moment in the home are usually capable of performing one task. In the future you will probably buy a single multifunctional robot capable of carrying out a range of different tasks.

**Advantages and disadvantages of robots**
Compared to manual control, computer-based control systems or robots have the following advantages and disadvantages.

**Advantages:**
- Can operate continuously, 24 hours per day and 7 days per week.
- Less expensive to run as you don’t have to pay wages.
- Can work in dangerous places (e.g. a robot to remove a bomb).
- Can easily change the way the device works by re-programming it.
- More accurate than humans.
- Can react quickly to changes in conditions.

**Disadvantages:**
- Initial cost of equipment is high.
- Equipment can go wrong.
- Fewer people needed so leads to unemployment.
- Need specialist to program, which is expensive.
**REVISION QUESTIONS**

1. Explain the difference between hardware and software. [2]

2. Desktop computers consist of a number of components.
   Explain the purpose of each of the following components.
   a. Central processing unit (CPU) [1]
   b. Main memory [1]
   c. Backing storage [1]

3. Give the names of:
   a. Two input devices [2]
   b. Two output devices [2]
   c. Two backing storage devices [2]

4. Computers come in all sizes and can be used in different situations.
   a. Describe what is meant by a desktop computer and explain how it differs from a laptop computer. [3]
   b. Tablet computers are very popular. Give two ways in which a tablet computer differs from a laptop computer. [1]

5. A salesperson travels to newsagents taking orders for sweets using a tablet.
   Give one advantage of using a tablet rather than a laptop computer. [1]

   a. Give one difference between memory and backing storage. [1]
   b. Give one example of what would be stored in memory. [1]
   c. Give one example of what would be stored in backing storage. [1]

7. a. Explain how you could distinguish between an internal and an external hardware device. [1]
    b. Give two examples of internal hardware devices and two examples of external hardware devices. [4]

8. a. Describe the meanings of the abbreviations RAM and ROM. [2]
    b. Describe the differences between RAM and ROM. [4]

9. There are many emerging technologies that are set to change peoples’ lives.
   Give the name of one emerging technology and explain what the technology is and how it is likely to change peoples’ lives. [5]

10. Many computer systems make use of biometrics.
    a. Explain the meaning of the term biometrics. [1]
    b. Give the names of two biometric measurements that are likely to be used by a computer system. [2]
    c. For one of the measurements in your answer to part b explain an application for the measurement. [2]

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**Test yourself**

The following notes summarise this chapter, but they have missing words. Using the words below, copy out and complete sentences A to M. Each word may be used more than once.

software ROM information hardware desktop output CPU input RAM backing applications

A. Computer systems consist of two main parts, hardware and _____.

B. The physical components of a computer system are called _____.

C. The _____ is a piece of hardware that is the brains of the computer and it turns data into _____.

D. Computer hardware is useless without the _____ which is used to give it instructions as to what to do.

E. There are two types of software called system software and _____ software.

F. A computer which has a full-sized keyboard and full-sized screen and is normally used in one place is called a _____ computer.

G. _____ devices such as the keyboard and mouse are used to input data into the computer for processing.

H. After data has been processed, the results of processing are passed to a(n) _____ device.

I. Storage which is not memory is called _____ storage.

J. _____ is fast temporary memory where programs and data are stored only when the power is supplied.

K. _____ is fast permanent memory used for holding instructions needed to start up the computer.

L. _____ is held on a computer chip and is called non-volatile memory because it does not lose its contents when the power is turned off.

M. _____ is held on a computer chip and is called volatile memory because the contents disappear when the power is turned off.
EXAM-STYLE QUESTIONS

1 Choose three tasks from the list below that are carried out by system software:
   - Renaming a file
   - Deciding where to store data on a hard disk drive
   - Underlining text in a word-processing package
   - Cropping a picture
   - Loading a file from the disk drive

2 a Give three tasks (other than those in Q1) performed by system software. [3]
   b Some printers come with device driver software. Give one purpose of device driver software. [1]

3 Write down the name of the piece of system software that carries out each of the following by matching the name to the correct description.
   Utility
   Device driver
   Operating system

<table>
<thead>
<tr>
<th>Description</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Deals with errors that occur when the computer is working on tasks</td>
<td></td>
</tr>
<tr>
<td>(B) Software needed when a new piece of hardware is attached to the computer</td>
<td></td>
</tr>
<tr>
<td>(C) Scans the hard disk drive to detect and remove viruses</td>
<td></td>
</tr>
</tbody>
</table>

4 Tick True or False next to each of these statements.

   Computer programs are examples of software. True False
   Creating a new folder would be performed by a device driver. True False
   A compiler is an example of an operating system. True False
   Word-processing software is an example of applications software. True False

5 Which three of the following tasks are carried out by all operating systems?
   a Transferring data to a printer
   b Allocating storage space on a disk
   c Positioning text in a word-processing document
   d Finding a database record
   e Accepting keyboard input
   f Adding colour to a drawing on screen

6 Give three functions of an operating system. [3]

7 There are two types of internal memory called ROM and RAM. Describe the differences between ROM and RAM. [4]

8 Complete each sentence using one item from the list:
   Processor Output Communication Software
   Router Microphone ROM RAM Input
   a ................. means the programs that supply the instructions to the hardware to tell it what to do.
   b ................. devices such as keyboards, mice, and scanners are used to supply data to the computer.
   c ................. devices are hardware such as printers, speakers, and screens.
   d ................. is memory which is used to hold the boot program needed to start the computer up when first switched on.
   e ................. is memory held on a chip that can have its contents changed by the user. [5]

9 Graphical user interfaces are very popular particularly with tablets and smartphones.
   a Give two advantages of a tablet compared to a laptop computer. [2]
   b Give two disadvantages of a tablet compared to a laptop computer. [2]
   c Give three features of a graphical user interface. [3]

10 Give two examples of tasks that are completed by robots. [2]

11 Washing machines are assembled by robots in a factory.
   Tick three advantages in using robots rather than humans to assemble washing machines.

   - Robots are more intelligent than humans.
   - Robots are cheap to buy and maintain.
   - Robots can work 24 hours a day.
   - Robots always assemble the parts correctly.
   - Robots need to be programmed to perform a task.
   - It is cheaper as robots are not paid wages. [3]

12 Describe the differences between a CLI (Command Line Interface) and a GUI (Graphical User Interface). [4]

13 Describe the differences between a stand-alone computer and a networked computer. [4]