

# **STANDARD GRADE**

## **COMPUTING STUDIES**

**REVISION NOTES**

## CONTENTS

<b>Chapter 1</b>	General Purpose Packages
<b>Chapter 2</b>	Word Processing
<b>Chapter 3</b>	Databases
<b>Chapter 4</b>	Spreadsheets
<b>Chapter 5</b>	Graphics
<b>Chapter 6</b>	Automated Systems
<b>Chapter 7</b>	Commercial Data Processing
<b>Chapter 8</b>	Hardware
<b>Chapter 9</b>	System Software
<b>Chapter 10</b>	Operating and Filing Systems
<b>Chapter 11</b>	Low Level Machine

**1 Hardware and Software**

*Hardware* is the physical parts of a computer such as a keyboard, floppy disc, processor chip etc.

*Software* is the programs that the computer can run such as word processing graphics, database, operating system etc.

**2 General Purpose Packages**

*General Purpose Packages* are programs that can be used for lots of different tasks and not for one specific task.

Word processing, Databases, Spreadsheets and Graphics are examples of general purpose packages.

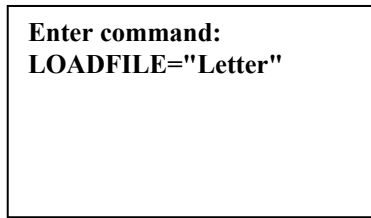
**3 Human Computer Interface (HCI)**

The *Human Computer Interface* is the way in which the user communicates with the computer program.

There are **three** styles of HCI

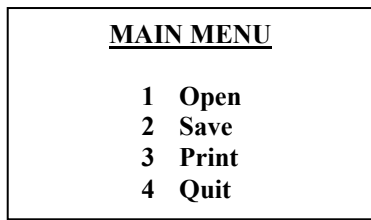
(a) *Command Driven*

The user has to know and type in commands using the keyboard.  
It is difficult and only for expert users.



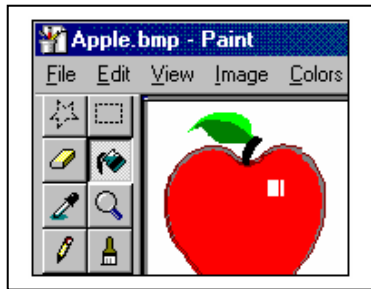
(b) *Menu Driven*

The user selects from a list of choices using the keyboard.  
  
It is easier than command driven interfaces.



(c) *WIMP (Windows, Icons, Mouse, Pull-down menus)*

The mouse is used to select from a list of choices on pull-down menus and small pictures called icons.  
  
It is easy to use and suitable for beginners.  
However an expert user would find it slow and might prefer a command driven interface.



**4 On-Line Help and On-Line Tutorials**

*On-Line Help* is help available within the program on how to do specific task.

*On-Line Tutorial* is a step by step lesson demonstrating the program features.

**5 E-Mail & FAX**

*E-Mail* is the sending of electronic messages from one computer to another.

*Advantages*

Messages are sent instantly.

You can send the same message to a group of people at the same time.

### *Disadvantages*

You can only send E-mails to people who have an E-mail account.

E-mails can be used to send a computer virus.

*FAX* machines scan documents and convert the picture into numbers.

The numbers are then transmitted over the telephone line to another *FAX* machine which converts the numbers back to a picture and prints it out.

## 6 **Networks**

A *Computer Network* is a group of computers connected together by cables.

A *Stand-Alone* computer is one which is not connected to any other computer.

A *LAN (Local Area Network)* connects computers over a small area such as a building.

A *WAN (Wide Area Network)* connects computers over large distances such as different towns or countries.

The computers in a *WAN* are usually joined using the telephone system.

### *Advantages*

Users can share hardware devices such as printers.

Many users can access the same files.

E-mail can be sent between computers.

### *Disadvantages*

If the network gets infected with a virus then all the computers can be infected.

If the central computer (file server) goes down then the network is not operational.

In a *WAN* a *modem* is required to convert the signals from the computer to a form that can be transmitted across the telephone line.

## 7 **Legal Acts Concerning Computing**

The *Computer Misuse Act (1990)* makes the following activities illegal.

- ◆ Sending viruses
- ◆ Hacking into computer systems

The *Data Protection Act (1984)* is concerned with the rights of individuals in society.

A company holding data on people must obey the following rules.

- ◆ Data must be made secure by restricting access with passwords.
- ◆ Data must be up to date and accurate.
- ◆ Individuals have the right to demand a printout of their data. (Except for the Police.)
- ◆ Data must not be held if it is no longer required.
- ◆ A company wishing to hold data must register with a central government agency.

## 8 **Integrated Package**

*Integrated Packages* have two or more general purpose packages combined together in one program.

### *Advantages* of an Integrated package

- ◆ Easy to transfer data from one general purpose package to another.
- ◆ They share a common HCI.  
(The general purpose packages are all operated in a similar way)
- ◆ Cheaper than buying several individual general purpose packages.
- ◆ Can set up dynamic links between the different general purpose packages. (eg. Mail Merge)

### *Disadvantages* of an Integrated package

- ◆ The general purpose packages will not have as many features as a dedicated individual general purpose package.

**1 Word Processing**

*Word Processing* allows you to enter, delete, edit, save, retrieve and print text.

*Enter...*text is typed in.

*Delete...*text is removed altogether.

*Edit...*text is altered

*Save...*text is saved on a backing store. (eg. hard disc)

*Retrieve...*text is loaded back into memory from a backing store.

*Print...*a hard copy is obtained (a printout)

**2 Justification**

*Justification* is the way the text is lined up on the page.

*Left Justified*

Hello there,  
just a short note to let you  
know that the ship is  
sinking and the crew are  
sitting around and  
watching it go down.

Text is lined up with the  
**left** hand margin.

*Centre Justified*

Hello there,  
just a short note to let you  
know that the ship is  
sinking and the crew are  
sitting around and  
watching it go down.

Text is lined up  
symmetrically about the  
**centre** of the page

*Right Justified*

Hello there,  
just a short note to let you  
know that the ship is  
sinking and the crew are  
sitting around and  
watching it go down.

Text is lined up with  
the **right** hand margin.

*Fully Justified*

Hello there,  
just a short note to let you  
know that the ship is  
sinking and the crew are  
sitting around and  
watching it go down.

Text is lined up with  
the **both** the left and  
right hand margin.

**3 Search and Replace**

*Search and Replace* allows you to look for a word or phrase in a document and replace it with another word or phrase.

eg. In a story you could change every occurrence of the name a character from "Harry Sawyer" to "Tom Potter"

**4 Spell Check and Grammar Check**

*Spell checks* look up each word in a dictionary and offer replacements for words that are not found. Peoples names and towns are often not in the dictionary and will be highlighted as a spelling error. The user can add new words to the dictionary.

*Grammar checks* look for errors in grammar such as no capital in a new sentence, the wrong tense, etc.

**5 Standard Paragraphs**

If the same paragraph is used over and over again in different documents then it can be saved onto disc and loaded into a document as required.

This saves a lot of time by removing the need to type in the paragraph each time it is used.

**6 Headers and Footers**

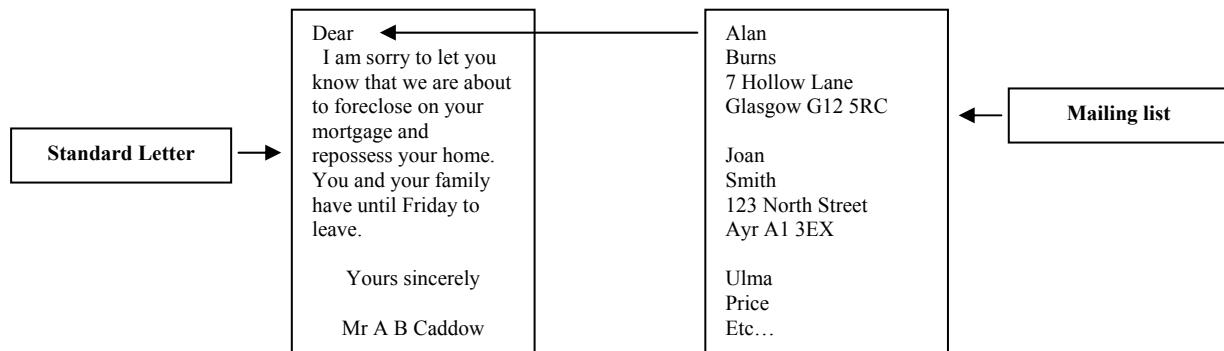
*Headers* and *footers* are used to enter data **once** which will then be shown at the top or bottom of every page in a long document.

The data may be a Title, Page Number, Date, Time etc...

## 7 Standard Letters and Mail Merge

A *standard letter* is one which is sent to many people with only a few details (such as name and address) changed for each person.

*Mail merge* is the process of personalising a standard letter by inserting details contained in a mailing list held on a database.



## 8 Static and Dynamic Links

When the same data is shared between two documents then the link can be either *static* or *dynamic*.

### Spreadsheet document

A	B	C	D
1	January		
2	3	7	5
3	4	5	3
4			
5			
6			
7			
8			
9			

### Word Processing Document

**Report**  
The sales figures for last month are shown in the table below.

**January**

3	7	5
4	5	3

I hope that you are pleased with the improvement.

Source data

Copied data

*Static Link*...If the source data is changed then the copied data **will not** automatically change.

*Dynamic Link*...If the source data is changed then the copied data **will** automatically change.

## 9 Printer Driver

A *Printer Driver* is software which allows the computer to communicate with a printer.

The program translates formatting codes in a document into the correct code for the printer being used.

**1 Database Package**

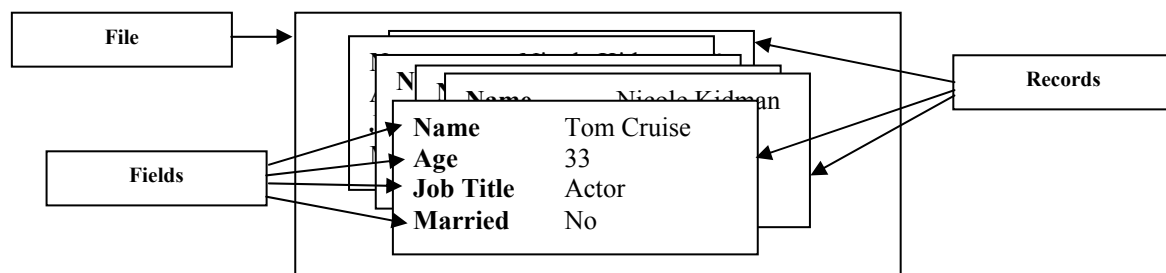
A *Database Package* is a program used to create and organise data.

*Advantages*

- ◆ Saves paper and space compared to a manual system on record cards.
- ◆ Amendments can be made easily to the data without rewriting a record card.
- ◆ The records in the database can be quickly sorted into any order.
- ◆ A search can be made quickly to find certain records.

**2 Database File**

A *database file* is a structured collection of similar data.



A *File*...is data on a particular topic contained in a collection of records.

A *Record*...is data on a single person or thing.

A *Field*...is an item of data on a record.

**3 Field Types**

A *Text field* contains characters. eg. Surname, Address.

A *Numeric field* contains numbers. eg. Exam Mark, Age.

A *Date field* contains a date. eg. Date of birth, Subscription Due Date.

A *Computed field (or Calculation field)* is calculated from data in other fields using a formula.

eg. A Calculation field called Pay could be calculated from the formula

$=[\text{Hours}] * [\text{Pay per Hour}]$

A *Key field* is a field that contains a unique value in each record so that a particular record can be found by searching for the value in this field. eg. Reference number, Account number, etc.

**4 Inserting, Deleting and Amending Records**

*Insertion*...Adding a new record to the database.

*Deletion*...Removing a record from the database.

*Amending*...Updating a record to include any changes.

**5 Input and Output Format**

The layout of the screen for inputting data can be altered to make it easier to enter data. eg. Only show the fields into which data is being entered.

The layout of data to be output can be displayed in different ways.

eg. The records are printed out in columns, only certain fields are displayed, the records are sorted in a certain way, etc.

**6 Expert System**

An *Expert System* is a computer program which has a large number of rules stored in a *Knowledge Base* from which it is able to draw conclusions and make decisions.

Expert Systems are used in medical diagnosis, legal advice, car problems etc.

## 7 Sorting


*Sorting* a database means to arrange the records in a certain order.

The records can be sorted in ascending (increasing) or descending (decreasing) order.

The records can be sorted on one field or on more than one field.

*Simple Sort (Sorting on one field)*

The file below has been sorted in **Ascending** order on the **Age** field.



Name	Address	Age	Pet
Q. Lewinski	2 North Street	13	Parrot
F. Mercury	123 Gaga Drive	19	Dolphin
G. Sparkle	100 Treacle Crescent	22	Budgie
.....	.....	.....	.....
T. Forrests	13 Golf Drive	89	Dingo

*Complex sort (Sorting on two or more fields)*

The records are sorted according to the first field and only if the data in it is the same for two or more records is the second field used.

The file below has been sorted on **two** fields.

**Field1** Form Class field in **Ascending** order.

**Field2** Exam field in **Descending** order.

Form Class	Exam	Date of Birth	Hobbies
3B	87	120688	Sky Diving
3B	72	130988	Archery
3B	56	230488	Jogging
3B	31	091288	Chess
3C	93	290288	Computing
3C	67	301088	Athletics
3C	45	251288	Water Polo
3D	89	010189	Reading
.....	.....	.....	.....

## 8 Searching

*Searching* a database means to find records which meet certain conditions.

The records can be searched on one field or on more than one field.

*Simple Search (Searching on one field)*

eg. Search for records where the **Salary** field = £30,000.

*Complex Search (Searching on two or more fields)*

eg. Search for records where the **Winner** field = "Partick Thistle" AND **Year** field is less than 1970.

## 9 Validation

*Validation* of data means that the program will not accept data that is not possible or sensible.

eg. A range check will only accept a value in a certain range. eg. If a month is entered as a number then it must be in the range 1...12.

## 10 Verification

*Verification* of data means that **two** people enter the same data. The program then compares both versions and highlights any differences which are then corrected.

**1 Spreadsheet**

A *Spreadsheet* is a grid of cells which can contain numbers, text or formula.

	A	B	C	D	E	F
1	Champions League					
2						
3		P	W	D	L	Points
4	Partick Thistle	3	3	0	0	9
5	Juventus	3	2	1	0	7
6	Barcelona	3	0	1	2	1
7	Manchester United	3	0	0	3	0

**2 Formula**

*Formula* are used to perform calculations on the data in the spreadsheet.

The arithmetic operations are Add (+), Subtract (-), Multiply (\*), and Divide (/).

eg.

	A	B	C	D
1	3	4	6	
2	9	7	2	
3	5	1	8	
4				

In the above spreadsheet  
 =A3+B2-C3 gives an answer of 4. (=5+7-8)  
 =A1\*B1/C1 gives an answer of 2. (=3x4/6)  
 =(A1+B2+C3)/3 gives an answer of 6. (=3+7+8)/3)

**3 Functions**

*Functions* are built in formula to calculate highest values, lowest values, totals, averages, etc.

The functions required for this course are MAX, MIN, SUM, AVERAGE and IF.

eg.

	A	B	C	D
1	3	4	6	
2	9	7	2	
3	5	1	8	
4				

In the above spreadsheet

=MAX(A1..A3) gives an answer of 9. (The highest value of 3, 9 and 5.)  
 =MIN(A2..C2) gives an answer of 2. (The lowest value of 9, 7 and 2.)  
 =SUM(B1..C3) gives an answer of 28. (The sum of 4, 6, 7, 2, 1 and 8.)  
 =AVERAGE(B1..B3) gives an answer of 4. (The average of 4, 7 and 1.)

The *IF function* (conditional function) returns one value if a condition is true and another value if a condition is false.

=IF(Condition, True, False)

=IF(A1>10, C1\*2, C1\*3) gives an answer of 18 since the condition A1>10 is false and C1\*3 gives an answer of 18. (=6x3)

#### 4 **Replication**

*Replication* is when a formula is filled down or across.

A *Relative Cell Reference* is when the cell reference changes according to the row or column that it is copied into.

In the example below the formula =A1+B1 has been replicated (A1 and B1 are both relative cell references)

	A	B	C
1			=A1+B1
2			=A2+B2
3			=A3+B3
4			=A4+B4
5			=A5+B5

An *Absolute Cell Reference* is when the cell reference does not change according to the row or column that it is copied into.

Dollar signs are used to make a cell an absolute cell reference. eg. \$A\$1

In the example below the formula =A1+B1 has been replicated (A1 is an absolute cell reference and B1 is a relative cell references)

	A	B	C
1			=\$A\$1+B1
2			=\$A\$1+B2
3			=\$A\$1+B3
4			=\$A\$1+B4
5			=\$A\$1+B5

#### 5 **Cell Attributes**

The *Cell Attributes* of a cell are the features or display options of a cell.

eg. The width of the cell, the type of justification, the number of decimal places, the background colour, etc.

#### 6 **Cell Protection**

*Cell protection* is when the contents of a cell are locked so that the contents can not be changed.

#### 7 **Charting**

*Charting* is when cells are selected and the selected data is used to produce a choice of graph.

The types of graph include a bar chart, a pie chart, a line graph etc.

**1 Graphics Package**

A *Graphics Package* is a program that is used to produce pictures. There are two types of graphic software, **Painting** and **Drawing**.

**2 Pixels**

Graphics are made up of tiny dots called *Pixels*. (The word **pixel** comes from **picture element**)

**3 Resolution**

*High Resolution Graphics* are made up from a large number of small pixels. This gives a good quality graphic with a lot of detail.

*Low Resolution Graphics* are made up from a small number of large pixels. This gives a poor quality graphic with little detail.

**4 Painting**

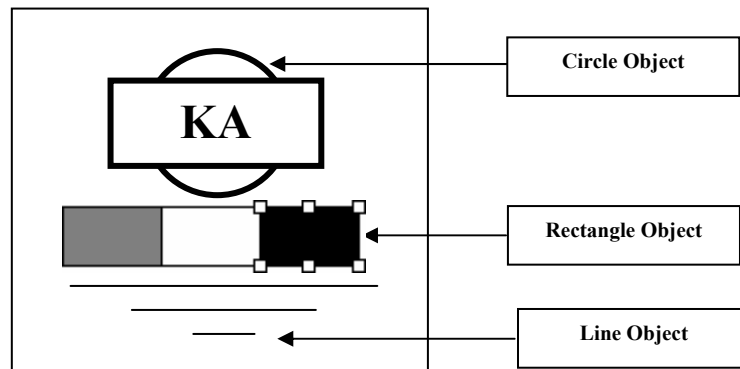
*Painting* graphics store the graphic as the colour of the pixels that make up the graphic.



The tools that a painting package uses allows the individual pixels to be changed. eg. Pen, Rubber, Airbrush, etc.

**5 Drawing**

*Drawing* graphics store the graphic as a list of objects (shapes) that make up the graphic. The objects are shapes such as Rectangles, Circles, Lines, etc.



The tools that a drawing package uses allows the objects to be changed. eg. Line Thickness, Fill Colour, Object Selector, etc.

## 6 Editing Graphics

### Scale

To *Scale* a graphic is to change it's size by enlarging or reducing.  
eg.



### Rotate

To *Rotate* a graphic is to turn it through an angle.  
eg.



### Flip

To *Flip* a graphic is to reflect it in an axis of symmetry.  
eg.



## 7 Animation

*Animation* is moving graphics.

It is used in Games, Screen Savers, Virtual Reality, etc.

## 8 Simulators

A *Simulator* is a computer system that creates an artificial representation of a real life situation.

eg. Pilot Training Simulators, Driving Simulators, Virtual Reality, etc.

### *Advantages*

- ◆ Training can take place in a safe environment.
- ◆ Extreme or rare situations can be created.
- ◆ Saving on costs of materials such as fuel.
- ◆ No damage to expensive equipment.

**1 Robots**

*Stationary Robots* are fixed to a point on the floor.

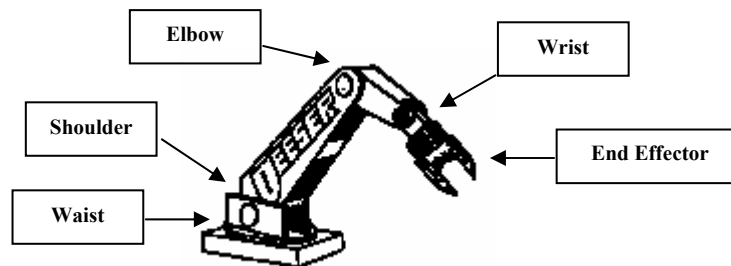
eg. Car assembly plants where the robots weld/paint car parts.

*Mobile Robots* are able to move around the floor.

eg. Warehouses where the robots collect packages from the shelves.

**2 Anatomy of a Robot Arm**

The parts are labelled the same as a human arm.



**3 End Effector**

An *End Effector* is a tool at the end of the wrist.

eg. A *Gripper* is used to move objects from one place to another.

A *Welder* welds objects together.

A *Paintspray Gun* is used to paint objects.

**4 Degrees of Freedom**

The *Degrees of Freedom* of a robot arm is the number of different ways in which it can move.

eg. Typically a robot arm has 7 degrees of freedom.

It can turn at the waist.

It can raise at the shoulder.

It can bend at the elbow.

It can perform four movements at the wrist. (Roll, Pitch, Yaw, and Extend)

*Roll* is when the wrist rotates.

*Pitch* is when the wrist moves up and down.

*Yaw* is when the wrist moves from side to side.

*Extend* is when the wrist reaches out further.

**5 Teaching Robots to Perform Tasks**

*Programming*

A Program can be written with a set of instructions that the robot carries out.

*Lead Through (or Copycat)*

An operator moves the robot arm through the movements that are required to perform the task. The movements are recorded and can be played back over and over again.

**6 Mobile Robots**

There are two main methods of guiding mobile robots.

*Light Sensors*

White lines are painted on the floor.

The robot shines a light on the floor which is reflected best by the white line.

A light sensor on the robot detects if the robot is over the white line or not.

### *Magnetic Field Sensor*

Electrical wires are buried just under the floor.

The current in the wire generates a magnetic field.

A magnetic field sensor on the robot detects if the robot is over the wire or not.

## 7 **Process Control**

### *Sensors*

*Sensors* measure quantities such as heat, pressure, radiation, etc.

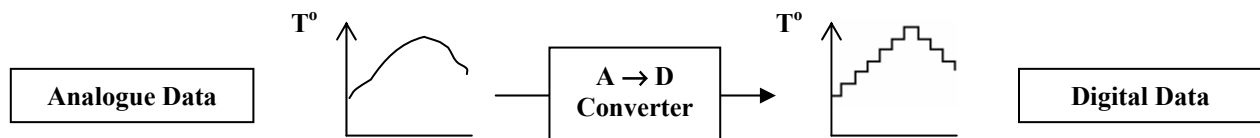
### *Analogue Data*

The data measured by sensors such as temperature and pressure is *Analogue Data* which means that the data changes smoothly.

### *Digital Data*

The data stored in a computer is *Digital Data* which means that the data changes in small steps.

An *Analogue to Digital Converter* is required to change *Analogue* data from sensors into *Digital* data so that it can be entered into a computer.

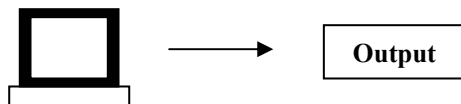


### *Feedback*

*Feedback* is data sent back to the controlling computer from sensors.

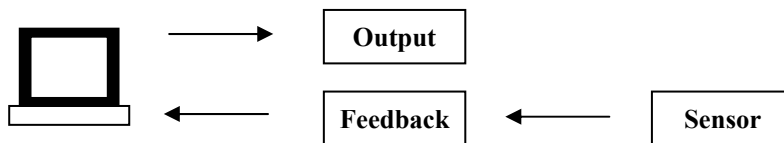
### *Open Loop*

In an *Open Loop* control system there **is no** feedback.



### *Closed Loop*

In a *Closed Loop* control system there **is** feedback from sensors.



## 8 **Advantages/Disadvantages of Automated Systems**

### *Advantages*

- ◆ Machines do not get paid so there is a huge saving on wages.
- ◆ Machines can carry out tasks faster than humans.
- ◆ Machines can do tasks repeatedly without getting bored or tired.
- ◆ Machines can work in dangerous environments.
- ◆ Machines are accurate and do not make careless mistakes.
- ◆ Machines do not need heating, light, toilets, etc.

### *Disadvantages*

- ◆ Humans may lose jobs if tasks are automated.
- ◆ Large initial expenditure of installing automated system.
- ◆ Running the machines generates a high electricity bill.

**1 Commercial Data processing**

Large organisations require to process vast amounts of data every day.

They use computers to process their data because they are **faster** at processing data than humans **and** they are more **accurate** at processing data than humans.

**2 Data and Information**

*Data* is the term for numbers, text, graphics, etc. stored on a computer.

*Information* is the term for data when it is given meaning.

eg. The data item 180901 stored on a computer could mean almost anything.

If you are told that it is a date of birth (18<sup>th</sup> September 2001) then it is given meaning and becomes information.

**3 Collection and Input of Data**

Data can be entered into a computer *Directly* or *Indirectly*.

◆ *Direct Data Entry*

Bar codes

The data is encoded in a pattern of lines which are input into the computer using a bar code scanner or a light pen. Bar codes have a check digit to ensure that the code is read accurately.

eg. Bar codes are used in supermarkets and libraries.

OMR (*Optical Mark Recognition*)

Marks are made on cards (mark sense cards) which are read by an OMR document reader.

eg. OMR is used in the National Lottery and multiple choice exams.

OCR (*Optical Character Recognition*)

Typed or hand-written letters and numbers are read directly by an OCR document reader.

eg. OCR can be used to save retyping documents only available on paper or to enter data from forms.

MICR (*Magnetic Ink Character Recognition*)

Characters written in special magnetic ink which are difficult to forge that are read by a MICR reader.

eg. MICR is used on checks and postal orders.

◆ *Indirect Data Entry*

Key to Disc

The data is entered with a keyboard and saved on a disc. The data is then input from the disc for processing at a later stage.

Kimball Tags

Cards with patterns of holes to encode the data are attached to articles of clothing which are removed when the garment is sold. The data is then entered using a Kimball Tag reader.

**4 Turnaround Document**

A *Turnaround Document* is a form that is produced by a computer, sent out to a customer, filled in and returned for the data to be entered into the computer.

eg. Gas bill, Electricity bill, Mail order forms, etc.

**5 Microfiche**

*Microfiche* is tiny sheets of clear acetate onto which the data in a computer can be printed.

The information is too small to be read by a human but can be read in a microfiche reader which magnifies the information.

## 6 **Hardcopy**

A *hardcopy* is a printout of a document.

## 7 **Processing Modes**

### *Batch Processing*

The data to be processed is collected over a period of time.

It is then input to the computer in a batch and processed without human intervention.

eg. Processing payrolls, electricity bills, etc.

### *Interactive*

The data is input by a human into the running program.

There is a dialogue between the human and the program, which responds to what has been input.

eg. Word processing, playing a game, etc.

### *Real Time*

Any delay in the inputting of the data is not acceptable. The data to be processed is input instantly.

eg. Missile Guidance system, booking system, etc.

## 8 **Master File and Transaction File**

### *Master File*

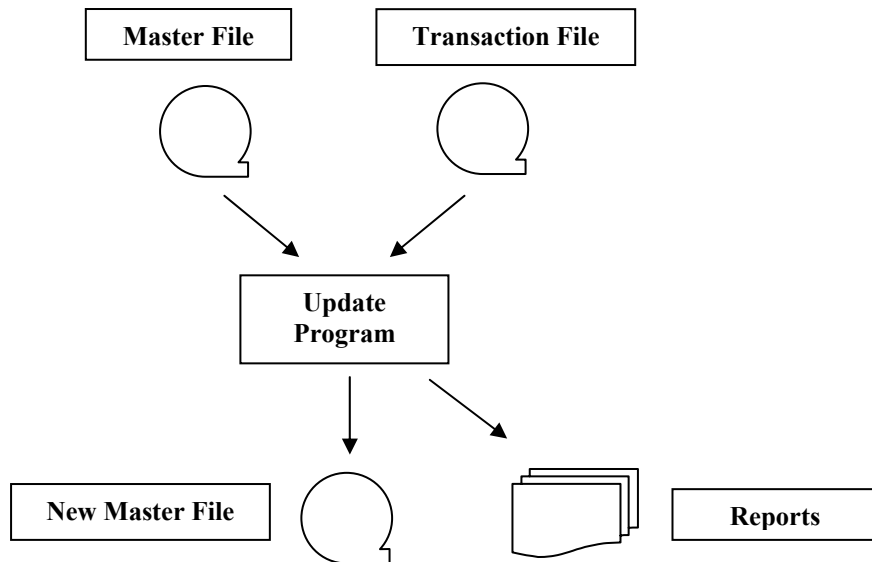
A *Master File* contains the latest version of all the data on customers, stock, employees, etc.

### *Transaction File*

Changes that are going to be made to a master file are kept in a *Transaction File*.

Changes might include inserting a new customer record, deleting an article in a stock record, changing an employee's address, etc.

The changes stored in the *Transaction File* are used to update the *Master File*.



### *Ancestry*

When a *master file* is updated the new master file is called the *Son* and the old master file the *Father*. Usually three generations of files are kept as backups, (Grandfather, Father and Son), so that files which are lost or corrupted can be recovered from the backups.

### *Reports*

When the *master file* update takes place the program can generate *reports*.

eg. A list of items in stock that require re-ordering, customers who place the most orders, etc.

9 **POS**

A *Point of Sale* is the checkout in a shop where the goods are bought.

The details of which goods are bought are entered into the computer using a bar code reader.

10 **EFTPOS**

In *Electronic Funds Transfer at Point of Sale* the customer buys goods with a credit card instead of cash.

The money required for the purchase of the goods is transferred from the customer's bank account into the shop's bank account at the *Point of Sale*.

11 **Jobs**

A *Systems Analyst* observes and analyses a system and advises upon which hardware and software is required to implement a computerised system.

A *Programmer* writes, tests and maintains computer programs.

A *Computer Engineer* installs, maintains, upgrades and repairs the hardware of a computer system.

A *Data Preparation Operator* enters data which has been gathered from source documents usually using a key to disc system.

He verifies data to make sure that it is accurate.

A *Computer Operator* is in charge of the day to day running of the computer system.

eg. Loading and running programs, supplying printers with paper and toners, etc.

12 **Security**

Access to confidential files can be restricted using passwords.

Physical security can involve keeping computers in locked rooms, putting locks on keyboards, etc.

13 **Accuracy**

It is essential that data used in commercial data processing is correct otherwise customers could get the wrong goods, be overcharged, etc.

Mistakes can be made when data is entered into a computer using a keyboard.

These errors can be found using the methods of *validation* and *verification*.

14 **Backup Copy**

The consequences of losing important data in a commercial organisation can be catastrophic.

*Backup copies* are made regularly so that the data can be recovered if it is lost, damaged, etc.

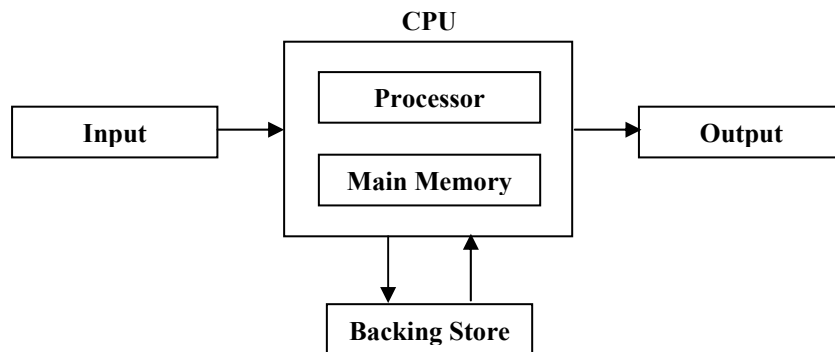
1 **Hardware**

*Hardware* is the physical parts of a computer such as a keyboard, floppy disc, processor chip etc.

*Software* is the programs that the computer can run such as word processing graphics, database, operating system etc.

2 **Computer System**

A computer system is made up of a *Central Processing Unit (CPU)* which executes program, *Input devices* to enter data to be processed, *Output devices* to show the results of processing and *Backing store devices* to permanently store programs and data.



3 **Central Processing Unit (CPU)**

The CPU is made up of a *processor chip* and *main memory*.

*Main Memory* temporarily stores the programs and data that are currently being executed by the processor.

The *processor* fetches and executes the program instructions stored in main memory.

4 **Main Memory**

*Main Memory* is made up of *RAM (Random Access Memory)* and *ROM (Read Only Memory)*.

*RAM* is used to temporarily store the users program and data which are currently being executed.

It **loses** it's contents when the computer is switched off.

It's contents **can** be changed.

*ROM* is used to store programs in a system where the program stays the same. eg. robot control

It does **not lose** it's contents when the computer is switched off.

It's contents **can not** be changed.

5 **Computer Systems**

A *mainframe* is a very expensive large computer used for fast processing of large amounts of data.

A typical *Desktop* computer will have a QWERTY keyboard with a mouse, monitor and disc drives. It is not *portable* since it is too heavy to be easily carried around.

A typical *Laptop* computer will have a QWERTY keyboard with a touchpad, flat screen and disc drives. The screen can be a LCD (Liquid Crystal Display) or a TFT (Thin Film Transistor) display. It is *portable* since it is light enough to be easily carried around.

A typical *Palmtop* computer will have special pen (stylus) to write on a touch sensitive screen.

It is *portable* since it is small enough to be held in the hand.

## 6 Input Devices

eg.

*Keyboard (QWERTY)* used to type in data.

*Mouse* used to move a pointer and select using a button. (Usually on a Desktop computer)

*Touchpad* used to move a pointer and select using a button. (Usually on a Laptop computer)

*Scanner* used to enter graphics and text data.

*Digital Camera* used to enter digital photographs.

*Graphics Tablet* used to enter graphics by writing on a horizontal surface with a special pen.

*Light Pen* is a special pen that can be used to write or select on the screen.

*Touch Sensitive Screen* the user touches an area on the screen to choose from a menu.

*Tracker Ball* is used by rotating a ball which moves a pointer or object. (Like an upside down mouse)

*Joystick* is used to move a pointer or object on the screen.

*Microphone* used with a sound card to enter sound data.

## 7 Output Devices

*Inkjet Printer* forms characters and graphics by squirting tiny droplets of ink onto paper.

*Laser Printer* forms characters and graphics by using a laser to put an electric charge representing the image on a drum and then using a toner powder to transfer the image to paper.

*Monitor (Cathode Ray Tube)* is a bulky monitor that displays a picture made of pixels on a screen.

*LCD (Liquid Crystal Display)* is a low power device that turns pixels on or off to produce a picture on a flat screen.

*TFT (Thin Film Transistor)* turns tiny transistors on or off to produce a picture on a flat screen.

*Flat-Bed Plotter* graphics are produced on a horizontal sheet of paper by a pen which moves around.

*Loudspeaker* used with a sound card to output sound data.

*Microfiche* is small sheets of clear acetate used to hold a microscopic printout of data that can only be read in a special microfiche reader which magnifies the printout.

## 8 Backing Store Devices

*Magnetic Devices* store the data by magnetising a coating of magnetic material.

eg.

*Floppy Disc Drive* stores the data on a small flexible 3.5 inch disc.

*Hard Disc Drive* contains one or more rigid discs to store a large amount of data.

*Magnetic Tape Drive* can use small cassettes with microcomputers or large tapes used with mainframe computers.

*Optical Devices* store the data by creating *pits* (holes) and *lands* (peaks) on the coating of a disc which are read by a laser.

eg.

*CD-ROM (Compact Disc Read Only Memory)* can not be written to. The data on the disc can only be read.

*WORM (Write Once Read Many)* can be written to only **once** but the recorded data can be read as often as required.

*CD-Read/Write* can be read from and written to as often as required.

## 9 Types of Access

*Direct (Random) Access*

Disc storage systems use direct access. This is fast access since the data can be accessed directly from any point on the storage device.

*Sequential Access*

Tape storage systems use sequential access. This is slow access since to access the required data requires reading through other data to get to it.

10 **Capacity**

The *Capacity* of a storage device is how much data it can store.  
eg. Floppy disc-1.4 Megabytes, Hard Disc-60 Gigabytes.

11 **Multimedia**

This is a computer system that displays text, graphics, video and sound in an interactive environment.  
*Multimedia* systems use good quality external speakers, high resolution colour monitors and CD-ROM to store the large amount of data required by the program.

12 **Virtual Reality**

*Virtual Reality* is a method of reproducing the real world in a computer system.

*Input Device*

The movements of the user can be input using a *virtual reality glove* or by walking on a treadmill.

*Output Device*

The movements of the user are processed by the computer and a *virtual reality helmet* can be used to update what the user sees.

**1 Program**

A *program* is a set of instructions that are executed to solve a problem.

**2 Low Level Languages**

*Machine Code* is the computer's own language using binary codes to represent instructions and data. Machine code programs are very difficult for humans to write and to find errors.

eg. 10111001 00110010 01010001  
01000011 00111111 10101011  
11111110 11110000 11000010  
etc.

*Assembly Language*

*Assembly Language* is the same as machine code except that short abbreviations are used instead of binary codes.

Assembly language programs are easier for humans to write and to find errors than machine code programs.

eg. Add N1, N2  
Sub N3, N4  
Prt N5  
etc.

**3 High Level Languages**

*High Level Language* programs are much easier to write and find errors than *Low Level Language* programs for the following reasons:

They use English command words.

Complex arithmetical operations can be performed in one instruction.

One *High Level Language* instruction translates to many *Machine Code* instructions.

They have inbuilt functions to perform mathematical and logical processing of the data.

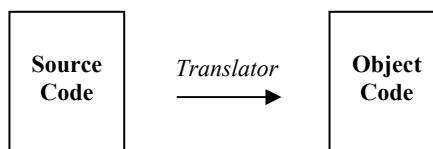
The program can be broken down into procedures.

eg. Let Age = Inputbox("Please enter your age.")  
If Age < 18 Then  
Picture1.Print "Please leave now."  
etc.

**4 Translation**

All *High Level Language* and *Assembly Language* programs must be translated into *Machine Code* before they can be run.

The translator takes the *High Level Language* or *Assembly Language* program (*Source Code*) and translates it into *Machine Code* (*Object Code*).



*High Level Language* programs are translated by a *Compiler* or an *Interpreter*

*Compiler*

A *Compiler* translates the whole of the source code program into machine code before it is run.

The program runs relatively fast since no translation is required when the program is run.

Errors take time to correct since the compiler will give a list of errors in the program and the corrected program must be compiled again before it can be run.

Once the program has been compiled the source code and the programming language are no longer required to run the program.

### *Interpreter*

An *Interpreter* translates the source code program into machine code one instruction at a time when it is run.

The program runs relatively slowly since it takes time to translate the instructions while the program is being run.

Errors are relatively easy to correct since the interpreter will stop at the instruction with the error and the corrected program can be run again immediately.

The source code and the programming language are always required to run the program.

*Assembly Language* programs are translated by an assembler.

An *Assembler* translates a *Low Level Language Program (Assembly Language)* into *Machine code*.

## 5 **General Purpose and Special Purpose Languages**

*General Purpose Languages* are intended to be used to solve a wide range of computing tasks.

They will have a large number of features and command words and are therefore hard to learn.

eg. PL/1, Algol

*Special Purpose Languages* are intended to be used to solve a particular type of computing problem.

They will have features and command words related to the particular area of computing in which they are used.

eg. COBOL (Common Business Oriented Language) used to create business programs.

PROLOG (Programming Logic) used to create artificial intelligence programs.

HTML (Hypertext Markup Language) used to create World Wide Web pages.

PASCAL used in education to teach programming.

FORTRAN (Formula Translator) used to create scientific programs.

## 6 **Utilities**

*Utilities* are programs that are used to maintain the computer system.

eg. Disc repair, Anti-virus, File compression, Screen savers, etc.

## 7 **Portability**

*Portability* is how easy a program can be adapted to run on a different computer system from the one for which it was originally written. eg. from Windows to Apple.

Low Level Language programs are less portable than High Level Language programs since the Low Level Language instructions are specific to one computer system.

## 8 **Robust**

*Robust* means that a program will not crash when unexpected data is entered. eg. a letter instead of a number.

## Revision Sheet      Chapter 10: Operating and Filing Systems

### 1 **Operating System**

The *operating System* is a large program which manages the hardware in the computer system.

### 2 **Functions of an Operating System**

*Command Language Interpreter* is the interface between the user and the *Operating System*.

It interprets the user's commands and passes them on to the appropriate part of the *Operating System*.

*File Management* controls the saving and loading of files on disc. It creates a directory on the disc to hold information on the names and addresses of files stored on the disc.

*Memory Management* controls where program and data files are put in main memory.

*Input/Output* controls the reading of data from input devices and the sending of data to output devices.

*Process Management* controls the allocation of the processor time when it is shared between two or more tasks.

### 3 **Multi-programming**

*Multi-programming* means that two or more programs are running at the same time on a single computer.

### 4 **Multi-access**

*Multi-access* means that many users can access a single computer at the same time.

### 5 **Resource Allocation**

*Resource Allocation* means that the operating system has to decide how to allocate tasks required by the running program to the devices connected to the computer system.

eg. Allocating printing to printers, saving files to disc drives, etc.

### 6 **Foreground/Background Processing**

In interactive computing the processor is idle for a lot of the time while it is waiting for the user to do something. Instead of doing nothing the processor can be used to carry out a task in the background.

eg. *Foreground/Background Printing* is where the processor is shared between the *foreground task* of dealing with input from the user and the *background task* of sending data to the printer.

The user can continue to use the computer while printing goes on in the background.

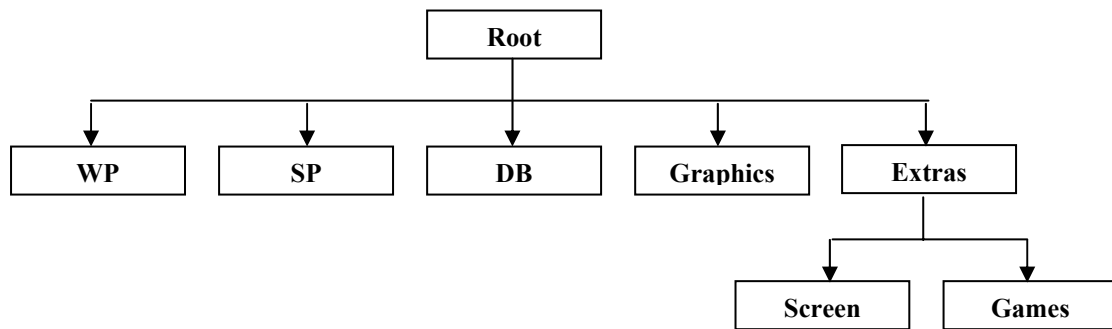
### 7 **Filing Systems**

A *Flat (Single Level)* filing system is where one directory contains all the files stored on the disc.

eg.      Bart.bmp  
          MonicaLetter.doc  
          Students.mdb  
          KingKong.exe  
          Cartoon.bmp  
          Detention.doc  
          Attack.exe  
          Sharks.scr  
          BillLetter.doc  
          CurriculumVitae.doc  
          Budget.xls  
          StaffWages.xls  
          Exam.doc

A *Hierarchical* filing system is where directories can contain sub-directories so that files can be grouped together. The main directory is called the *root* directory.

eg.



#### *Advantages of a Hierarchical Filing System*

- ◆ Files can be grouped together in a logical manner so that it is easy to find files.
- ◆ Files can have the same name provided that they are not in the same directory.
- ◆ In a network different directories can be given different access rights (read/write, read only etc.) to the network users.

**1 Units**

- A *bit* is a binary digit. (1 or 0)
- A *Byte* is a group of 8 bits. (eg. 10001011)
- A *Kilobyte* is 1,024 bytes. ( $2^{10}$  bytes)
- A *Megabyte* is 1,048,576 bytes. ( $2^{20}$  bytes)
- A *Gigabyte* is 1,073,741,824 bytes. ( $2^{30}$  bytes)

**2 Representing Text in a Computer System**

*Text*

Letters, digits, punctuation marks and mathematical operations are represented in 8 bit codes called ASCII codes. (American Standard Code for Information Interchange)

eg. 0 1 0 0 0 0 0 1 = "A"

*Control Characters*

Some of the ASCII codes are not used to print characters but are special control codes.

- eg. Carriage return. (moves the cursor to the start of the next line)
- TAB (moves the cursor to the next tab stop)
- Make a beep

*Character Set*

A *Character Set* is the complete group of characters that a computer system can represent.

**3 Representing Numbers in a Computer System**

*Integers*

*Integers* (positive and negative whole numbers) are stored as binary numbers.

eg.  $\begin{matrix} 128 & 64 & 32 & 16 & 8 & 4 & 2 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \end{matrix} = 64 + 16 + 4 + 2 = 86$

*Floating Point Numbers*

A *Floating Point Number* is stored in a *Mantissa* (fraction part) and an *Exponent*. (power part)

eg. 3,739,202,456,138 =  $\begin{matrix} \text{Mantissa} & \text{Exponent} \\ \mathbf{0.3739} & \times 10^{13} \end{matrix}$

In a computer the numbers are in binary.

eg.  $\begin{matrix} \text{Mantissa} & \text{Exponent} \\ \mathbf{0.1011011} & \times 2^{16} \end{matrix}$

*Advantage of Floating Point Notation*

Very large and very small numbers can be stored.

*Disadvantage of Floating Point Notation*

Accuracy is lost since an approximation of the number is stored using fewer significant figures.

**4 Representing Graphics in a Computer System**

*Graphics*

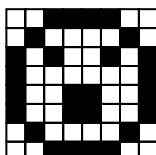
Graphics are made up of tiny dots called *Pixels*.

(The word **pixel** comes from **picture element**)

An image can be stored by using a binary code to represent the colour of each pixel.

In a black and white graphic a black pixel can be stored as a 1 and a white pixel as a 0.

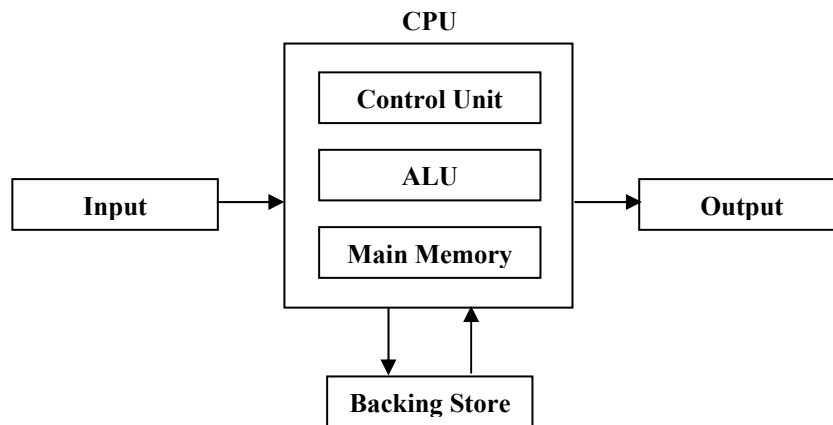
eg.



00111100  
01000010  
10100101  
etc.

## 5 Central Processing Unit (CPU)

The *CPU* has three components-Control Unit, ALU and Main Memory.



### *Control Unit*

The *Control Unit* fetches and executes the program instructions stored in main memory.

### *ALU (Arithmetic Logic Unit)*

The *ALU* performs arithmetic operations such as adding and subtracting and logical operations such as AND and OR.

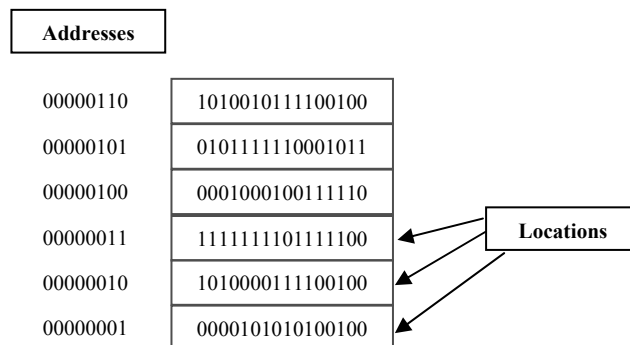
### *Main Memory*

*Main Memory* temporarily stores the programs and data that are currently being executed by the processor. It is made up of *RAM (Random Access Memory)* and *ROM (Read Only Memory)*.

## 6 Addressability

Main memory is made up of a large number (usually millions) of storage locations which hold program instructions and data.

Each location is given a unique address so that the processor can identify it.



## 7 Word

A *word* is a group of bits that is transferred as a single unit by the processor.

Typical word sizes of modern computers are 16 bits, 32 bits and 64 bits.