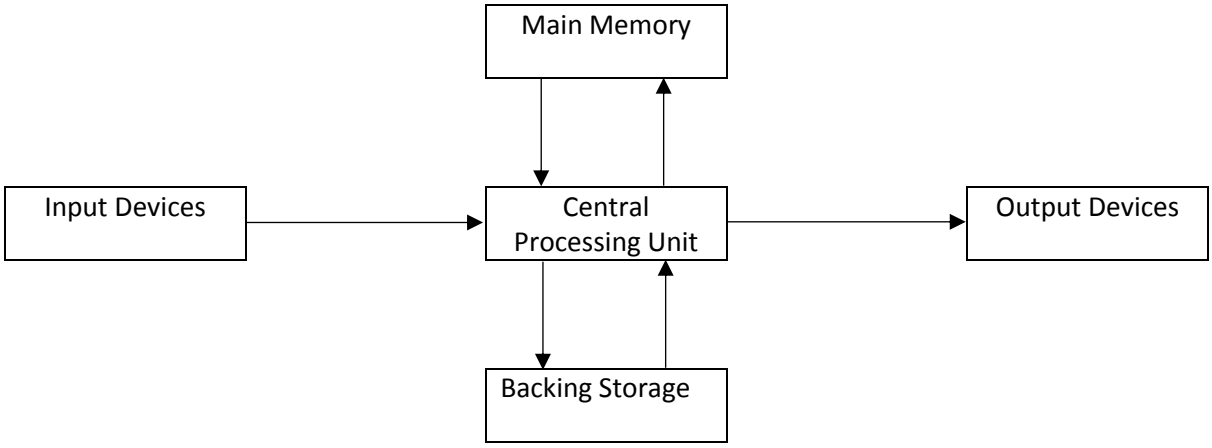
Computer Science
S3 Exam Revision Notes

Computer Structure

5 box diagram



Central Processing Unit (CPU)

This is the brain of the computer system and carries out all instructions. It consists of three different parts:

Arithmetic & Logic Unit – carries out all calculations and makes decisions based on comparisons

Registers – temporarily stores any data that the processor is working on

Control Unit – in charge of the CPU; makes sure that instructions are run in the correct order

Main Memory

This is the area where a computer stores data until it is needed by the processor. It consists of two different parts:

Random Access Memory (RAM) – data is held here temporarily; when the PC is switched off any data is lost

Read Only Memory (ROM) – data is held here permanently; when the PC is switched off any data will be saved

Backing Storage

Backing storage is the name given to devices that allow data to be stored permanently. There are three different types:

Optical – makes use of lasers to read and write data

Magnetic – makes use of electromagnets to read and write data

Solid-state – makes use of microchips to read and write data; has no moving parts

Types of Devices

Input – sends data to a computer system e.g. keyboard sends text, camera sends an image, microphone sends sound

Output – display information from a computer system to the user e.g. monitor allows user to see information, speakers allow a user to hear information

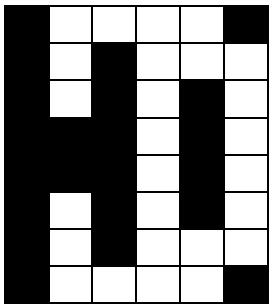
Data Representation

Binary

This is the only language that a computer system can understand. It is made up of 1s and 0s.

Bitmap Images

Every pixel in a bitmap image is stored using a certain number of bits. A black pixel is represented by a 1. A white pixel is represented by a 0.



Bitmap graphic ←

Represented as →

1	0	0	0	0	1
1	0	1	0	0	0
1	0	1	0	1	0
1	1	1	0	1	0
1	1	1	0	1	0
1	0	1	0	1	0
1	0	1	0	0	0
1	0	0	0	0	1

Binary Numbers

These consist of a certain combination of bits that can represent denary numbers (fancy name for numbers that humans can understand). They are represented in the following way:

128	64	32	16	8	4	2	1
1	0	0	0	0	1	0	0

To convert a **binary** number into denary, you need to make sure you add the numbers above the 1s:

128 + 4 = 132

To convert a **denary** number into binary, you work in the following way: Example – 57

Does 128 fit into 57? No -	0	
Does 64 fit into 57? No -	0	
Does 32 fit into 57? Yes -	1	Now subtract 32 from 57 and continue with 25
Does 16 fit into 25? Yes -	1	Now subtract 16 from 25 and continue with 9
Does 8 fit into 9? Yes -	1	Now subtract 8 from 9 and continue with 1
Does 4 fit into 1? No -	0	
Does 2 fit into 1? No -	0	
Does 1 fit into 1? Yes -	1	

Double check that it adds up to 57 to ensure you have the correct answer.

128	64	32	16	8	4	2	1
0	0	1	1	1	0	0	1

Add
57

Storage Units

8 bits = 1 **byte**
1024 bytes = 1 **kilobyte**
1024 kilobytes = 1 **megabyte**
1024 megabytes = 1 **gigabyte**
1024 gigabytes = 1 **terabyte**

File Sizes

To convert a file size from **gigabytes** to bits, you need to complete the following steps:

1. Multiply the number of gigabytes by 1024 to get the number of megabytes
2. Multiply the number of megabytes by 1024 to get the number of kilobytes
3. Multiply the number of kilobytes by 1024 to get the number of bytes
4. Multiply the number of bytes by 8 to get the number of bits

Example: 2 gigabytes

1. 2 x 1024 = 2048 megabytes
2. 2048 x 1024 = 2097152 kilobytes
3. 2097152 x 1024 = 2147483648 bytes
4. 2147483648 x 8 = 17179869184 bits

To convert a file size from **bits** to gigabytes, you need to complete the following steps:

1. Divide the number of bits by 8 to get the number of bytes
2. Divide the number of bytes by 1024 to get the number of kilobytes
3. Divide the number of kilobytes by 1024 to get the number of megabytes
4. Divide the number of megabytes by 2014 to get the number of gigabytes

Example: 25769803776 bits

1. 25769803776 ÷ 8 = 3221225472 bytes
2. 3221225472 ÷ 1024 = 3145728 kilobytes
3. 3145728 ÷ 1024 = 3072 megabytes
4. 3072 ÷ 1024 = 3 gigabytes

File Types

Different types of files are used to store different types of media. The table below shows the file types you need to know about.

Type of media	File format	Stands for
Text	RTF	Rich Text Format
	TXT	Text
Image	JPEG	Joint Photographic Experts Group
	PNG	Portable Network Graphics
	GIF	Graphic Interchange Format
Video	AVI	Audio Video Interleave
	MP4	MPEG – Video Layer 4
Sound	MP3	MPEG – Audio Layer 3
	WAV	Waveform Audio File

Databases

Manual

A manual database is one that is paper-based. Examples include Yellow Pages, Argos catalogue etc.

Electronic

An electronic database is stored on a computer. It has many advantages over a paper-based database including:

- Takes up less storage space
- Quicker to search for information
- Quicker to sort information in a given order
- Easier to change/edit data that is stored
- Easier to move data eg send via email or storage device instead of carrying a filing cabinet

Flat File

A flat file database stores all data in one table.

Field

A field is one piece of information within a table. These can be identified by the different **headings** at the top of each column. There are different types of fields:

- Text – stores words
- Number – stores digits
- Boolean – stores yes/no values
- Date – stores date formats e.g. DD/MM/YYYY
- Time – stores time formats e.g. HH/MM/SS, 00.00.00

Record

A record is one completed set of fields within a table. These can be identified by the number of **completed rows** in a table.

Searching

A **query** is used to find information within a database. It is made up of the **fields** you want to search and the **criteria** (the specific information you want to find).

Sorting

Database tables can be sorted by fields in two different orders: ascending or descending.

Ascending – lowest to highest, A – Z, 0 – 9.

Descending – highest to lowest, Z – A, 9 – 0.

Relational

A relational database stores data in **two or more** linked tables. The have several advantages over using a flat file database:

- Data only needs to be entered once
- Data is easier to edit – one change is automatically updated everywhere else it appears where as a flat file requires you to change it yourself
- Saves time

A **primary key** is used to ensure that every record is unique.

A **foreign key** is used to link two tables together.

Example

Club ID	Club Name	Location	Price (£)	Indoors?	Teacher
C011	Table Tennis	Building	10	Yes	A. O'Neil
C012	Table Tennis	Hall	10	Yes	B. Weston
C003	Football	Arena	15	No	D. Carson
C004	Basketball	Hall	12	Yes	A. O'Neil

In the table above, there are **6** fields and **4** records.

The field types would be as follows:

- Club ID – Text
- Club Name – Text
- Location – Text
- Price (£) – Number
- Indoors? – Boolean
- Teacher – Text

It is sorted by the field **Club Name** in a **descending** order (every other field changes order).

The primary key would be **Club ID** because it is a different value (unique) for every row. It is possible that:

- two or more clubs share the same name
- two or more clubs have the same location
- two or more clubs cost the same price
- two or more clubs are indoors
- two or more clubs are taught by the same person

If you designed a query to search for all clubs that are in indoors it would be:

Field Name	Club Name	Indoors?
Criteria		"Yes"