

1.1 Systems Architecture

- Mhz – Megahertz
- Ghz – Gigahertz
- Cores (Single, Dual, Quad, 8)
- Processor Speed (Speed x Cores)
- Fetch Decode Cycle:
Fetch instructions from memory
Decode into binary for the computer to understand
Execute the instructions
Repeat the process
- Cache - Cache is very fast, and usually a very small amount of memory on the processor chip. It acts as an intermediary between the processor and the Main Memory. As programs are executing – the Cache holds commonly used instructions. Faster to get instructions from than RAM.
- Embedded Systems – Computer system within a bigger hardware device
Kitchen appliances are good examples of embedded systems.
- General rule is the greater amount of something the faster the computer will process.

1.2 Memory

- RAM – Volatile
Memory contents are erased once power is lost.
- ROM – Non-Volatile
Holds the memory contents even when power is turned off.
- **Virtual Memory:**
Virtual memory is simply an area of secondary storage that is used like RAM. It is temporary storage that is located on the hard disk.
Advantages:
You can run more applications at once.
You can run larger applications with less real RAM.
You don't have to buy more memory RAM.
Disadvantages:
Causes disk thrashing, and it's slow.
Takes longer to switch between applications and there is no longer as much space on the Hard Drive.

1.3 Storage

- **Optical** (CDs, Blue Ray, DVDs)
- **Magnetic** (Hard disk drive, tape drive, floppy disk)
- **Solid State** (Solid State Drive, Memory Sticks)
- Characteristics of Storage: Capacity, durability, portability, cost, read/write speed, reliability.
- Capacity Smallest to Largest: Bit, Nibble, Byte, Kilobyte, Megabyte, Gigabyte, Terabyte, Petabyte.
- Secondary Storage Definition: Long term storage of files and data. It is needed to store files/operating system.

1.4 Wired and Wireless Networks

- **LAN** - Computers are connected together over a small geographical area such as a single building or a single site.
Home network, School network, Network in a shop
- **WAN** - Computers are connected over a large geographical area. This could be several buildings/sites, town wide, county wide or even country wide. The biggest WAN would be a global collection of networks (known as The Internet).
- **Client Server** - The network relies on a central server. All clients (devices) request services from the server (e.g. print services / file services)
Additional hardware would be needed e.g. high end powerful servers.
- **Peer to Peer** - All computers have equal status. Each device can act as a client and a server. All devices can request and provide network services. No additional hardware / software needed to set up this type of network.
- **Cloud** (Advantages and disadvantages)
- **Hardware** (Network interface cards, router, switch)
- **DNS** - When you type that URL into the web browser the computer will query a DNS Server (Domain Name Server) The DNS has a list of all domain names and their associated IP addresses. All packets are transmitted as IP addresses – therefore to access the server that holds the OCR website – we would need to know the IP address.

1.5 Network Topologies, Protocols and Layers

- **Mesh Network**
A Mesh Network is where some or all of the workstations or other devices are connected directly to each of other. Most are usually connected to the node that they exchange the most data with.
- **Star network**
In a star network, each device is connected by an individual cable directly to the server. Star networks are usually the layout of choice in schools and offices because they tend to be the most reliable of the topologies.
- **Ethernet:**
Dedicated connection. More secure.
- **Wi-Fi:**
Cheap but easier to hack. Signal quality can be up and down. Not tied down to a specific location.
- **Encryption:**
Encryption is a method of scrambling data with a key code which makes no sense. On an open or public WiFi network anyone can join and sniff out packets of data from other users. Therefore encryption is used. If intercepted the data will have no meaning. In order to read the data the user is required to decrypt the data using the key.

1.6 Systems Security

- **Threats to a system:**
Worms, Viruses, Trojan Horse, Phishing, Social Engineering, Brute force, Distributed denial of service and SQL Injections.
- **How to Overcome Threats:**
Network forensic, penetration testing, firewall, anti-virus software, network policies, user access levels, passwords, encryption.

1.7 Systems Software

- Operating systems and what it provides for a user.
 - User interface
 - Multi task
 - Memory management
 - File management
 - Peripheral management
- Utility Programs – things that help a computer perform better.
 - File Compression
 - Disk Defragmentation
 - File Repair
 - Disk Copying
 - Disk Formatting
 - Disk Backup / Restore
 - Anti-Virus
- 2 Types of backup
(FULL AND INCREMENTAL)
Full back is quicker to restore from but slower to carry out.
Incremental takes longer to restore from but quicker to carry out.
- Defragmentation:
When a hard disk drive is new – files get added onto the disk in order – very much like starting with a blank piece of paper and adding to it. As files are deleted – this leaves gaps. When new files are saved – the files fill the gaps and become fragmented. Defragmentation software groups fragmented files back together.

1.8 Ethical, Legal, Cultural, and Environmental Concerns

- Computer Misuse Act, Copyright, Data Protection, Freedom of Information Act, Creative Commons License.
- Stakeholders – Anyone or anything who has an interest in a business etc..
- Ethical / Cultural / Environmental.
- When it comes to environmental there's 1 go to answer – recycling of electronic devices.
- Whatever the question asks about from the above talk about those things.
- Marked on the quality of writing, including organisation and SPAG.

2.1 Algorithms

- Linear Search and Binary Search.
Binary search – Find the mid-point, split it based on what you are searching for.
Continue this process until you have found what you are looking for.
- Bubble Sort, Merge Sort, Insertion Sort.
Bubble is 2x2 and switch if required until it is in order.
Merge Sort is split into individual elements. Then pair them up and sort the pairs. Then put them in groups of 4 and sort those groups of 4. Then show the final sorted list.
Insertion sort is where it is placed from the front element into the position it should be.
- Pseudo code:
Find out the inputs.
Does it need selection? IF/ELSE
Does it require a loop?
What are the outputs from the program.
- Flowchart – parallelogram for input and output, rectangle for a process, diamond for selection and loops and an oval for start and end.

2.2 Programming Techniques

- Sequence – Line by line of code.
- Selection – If and else statements.
- Iteration – While and for loops.
- Arrays – a collection of multiple data that is the same type.
- Variable – A piece of data in a program that can change whilst it is running.
- Constant - A piece of data in a program that does not change whilst it is running.
- Sub programs (Functions and procedure) - Function returns a value... a procedure doesn't.
Advantages – Makes code easier to read, errors only need fixing once, easier to maintain/update and use less memory.

2.3 Robust Programs

- How to make a program more robust and work more efficiently. Main ways are:
Validation - Check digit, Format check, Length check, Lookup table, Presence check, Range check, Spell check
- Authentication – Only allowing authentic users to use a system.
- Input sanitisation – Cleaning the data that is input.
- Maintainability - If a program is to be defensive against attacks then it has to be maintained and up to date. API and code changes, which means that programs will need to adapt to complement new requirements.
- Indentation
- Comments
- Syntax and logic errors.

2.4 Computational Logic

- Logic gates.
- AND OR NOT logic gates – How to draw, what they look like and what they do.
- AND GATE – All inputs on for a output of on.
- OR GATE – 1 or the other or both to be on for an output of on.
- NOT GATE – Does the opposite.
- Truth Table – How to fill them in.

2.5 Translators and Facilities of Languages

- **ASSEMBLERS**
Translate Assembly Language code into Machine Code. Used for Device Drivers. Used when fast execution is required or limited memory/file size. Difficult to write in (easier than Machine code).
- **COMPILERS**
Translate entire source code all in one go into Machine Code Optimise code. Used at the end of development (ready for shipping). Error Reports created along with Object Code.
- **INTERPRETERS**
Translate and execute source code. Line by Line, Statement by Statement. Source code is checked for syntax – if correct, code is executed. If incorrect interpreting is stopped. Used for development (aide debugging)
- **IDE (Integrated Development Environment) Editor (for writing the code) Error Diagnostics (such as de-bug facilities). Run-Time Environment. Translators. Colour coding. Auto indentation.**
- **High Level Code:**
Similar to Standard English. Written by programmers, before translation takes place. Understood by humans.
- **Machine Code:**
Binary instructions, ready for the CPU to execute. Not understood by humans easily.

2.6 Data Representation

- How to convert from denary to binary and binary to denary.
- How to convert from hexadecimal to denary and denary to hexadecimal. (Slow method and fast method)
- ASCII and Unicode. What are they, which one is better and why. Unicode is better because it can represent more languages.
- **Compression Lossy:**
Lossy compression compresses data files but does lose some of the information. It is acceptable if some loss of accuracy is acceptable e.g. video, audio.
- **Compression Lossless:**
Lossless compression can compress data files without losing any of the information. MP3 files and JPEG images. Lossless compression schemes are reversible so that the original data can be reconstructed. However not all data files can be compressed using Lossless compression.
- **Sample rate for representing audio - This refers to the amount of samples taken. The higher the sample frequency the more accurate it represents the true sound wave, ALTHOUGH it increases the size of the file.**