Definitions and Concepts for CAIE Computer Science IGCSE

Topic 3: Hardware

3.1 Computer architecture

Central Processing Unit (CPU): The hardware component within a computer that carries out the instructions of a computer program.

Microprocessor: A type of integrated circuit that contains the CPU (and sometimes other components) on a single chip.

Arithmetic Logic Unit (ALU): A component within the CPU responsible for performing arithmetic operations (addition, subtraction, etc.) and logical operations (AND, OR, NOT).

Control Unit (CU): A component within the CPU that manages and coordinates the other components of the computer, fetching and decoding instructions.

Register: A small, very fast storage location within the CPU that holds data temporarily during processing.

Program Counter (PC): A register that stores the address of the next instruction to be fetched from memory. It increments during each fetch-execute cycle to point to the next instruction.

Memory Address Register (MAR): A register that stores the address to fetch data from or the address where the data is to be stored.

Memory Data Register (MDR): A register that stores the data that is being fetched from or written to memory. It acts as a buffer between main memory and the CPU.

Accumulator (ACC): A register that stores the results of calculations or operations carried out by the Arithmetic Logic Unit (ALU). Also temporarily holds data being processed.

Fetch-Decode-Execute Cycle: The fundamental process by which the CPU continually retrieves instructions stored in main memory and decodes and executes them.

Clock Speed: The rate at which a CPU executes instructions, measured in Hertz (Hz), which affects CPU performance.

Number of Processor Cores: The number of independent processing units within a single CPU, allowing for parallel execution of tasks and affecting performance.

Cache: A small, fast memory device located on the CPU that stores frequently used data and instructions, providing faster access than main memory.

Cache Size: The amount of fast, temporary memory (cache) available to the CPU, which stores frequently accessed data for quicker retrieval and affects performance.

Embedded System: A computer system with a simple, dedicated function within a larger mechanical or electronic system (e.g., in a washing machine or car).

Instruction Set: A collection of all the commands (instructions) that a processor can understand and execute, written in machine code.

3.2 Input and output devices

Barcode scanner: An input device that reads barcodes and converts them into digital data, allowing quick and unique identification of products.

Digital camera: An input device that captures photographs or videos as digital files, used to input images into a computer system.

Keyboard: An input device with keys that allows text, numbers, and commands to be entered into a computer.

Microphone: An input device that captures analogue sound and converts it into a digital signal for voice or audio input.

Optical mouse: An input device that detects movement and clicks to control a pointer on a screen for navigation and interaction.

QR code scanner: An input device that reads QR codes and converts them into readable digital data, such as URLs or payment information.

Touch screen (resistive): A screen that registers touch through pressure on two layers, allowing input by finger or stylus even with gloves.

Touch screen (capacitive): A screen that registers touch using the electrical properties of the finger for more accurate and responsive input.

Touch screen (infra-red): A screen that uses a grid of infrared beams to detect touch location and can detect any input object.

2D scanner: An input device that captures flat images or documents as digital files, used to digitize physical documents.

3D scanner: An input device that captures the shape and appearance of 3D objects to create digital 3D models. Often achieved by taking several pictures from multiple angles.

Actuator: An output device that produces physical movement, converting digital signals into real-world mechanical actions.

Digital Light Processing (DLP) projector: An output device that projects images onto a surface using tiny mirrors and light, for large visual displays.

Inkjet printer: An output device that sprays tiny drops of ink onto paper to produce colour or black-and-white printed images and text.

Laser printer: An output device that uses lasers and toner to produce high-speed, high-quality printed output efficiently.

Light Emitting Diode (LED) screen: A display that uses LEDs to show images with bright and energy-efficient lighting.

Liquid Crystal Display (LCD) projector: An output device that projects images using a light source and liquid crystal panels for visual presentations.

Liquid Crystal Display (LCD) screen: An output display that uses liquid crystals and a backlight to show images with low power consumption.

Speaker: An output device that converts digital audio signals into analogue sound output like music, voice, or alerts.

3D printer: An output device that builds physical objects layer by layer from digital 3D models using materials like plastic or resin.

Sensor: A device that detects physical inputs from the environment (e.g. temperature, light, motion and pressure) and converts them into electrical signals.

Acoustic sensor: A sensor that detects sound or vibrations and measures sound levels.

Accelerometer: A sensor that measures acceleration, movement, or tilt, capturing motion or orientation data.

Flow sensor: A sensor that measures the flow rate of liquids or gases.

Gas sensor: A sensor that detects the presence or concentration of gases in the environment.

Humidity sensor: A sensor that measures the moisture level in the air.

Infra-red sensor: A sensor that detects infrared radiation to measure heat, motion, or proximity.

Level sensor: A sensor that measures the level of liquids or solids in containers.

Light sensor: A sensor that measures the intensity of light.

Magnetic field sensor: A sensor that detects magnetic fields or changes in magnetism.

Moisture sensor: A sensor that detects moisture content in soil or materials.

pH sensor: A sensor that measures the acidity or alkalinity of a solution.

Pressure sensor: A sensor that detects the force applied by gases or liquids over an area.

Proximity sensor: A sensor that detects the presence or distance of an object without physical contact.

Temperature sensor: A sensor that measures temperature or how hot/cold something is.

3.3 Data storage

Primary Storage: The computer's workspace for actively running programs, providing fast access to data and instructions currently in use by the CPU.

RAM (Random Access Memory): Volatile main memory that can be read from and written to, used for temporary storage of data and programs currently in use by the CPU.

ROM (Read-Only Memory): Non-volatile memory that can only be read from, typically storing essential startup instructions that do not change.

Volatile: A type of memory whose contents are lost when the computer loses power.

Virtual Memory: A memory management technique that allows a computer to run more programs than it has physical RAM (Random Access Memory) by using a portion of the hard drive as if it were RAM.

Secondary Storage: Non-volatile storage mechanisms that are not directly accessible by the CPU, used for long-term, persistent storage of data (e.g., hard drives, SSDs).

Solid State Storage: A type of secondary storage that uses electrical circuits (flash memory, technology, specifically based on NAND or NOR transistors) to persistently store data, with no moving parts.

Optical Storage: A type of secondary storage that uses lasers to read and write data on a rotating disc (e.g., CDs, DVDs, Blu-ray discs).

Magnetic Storage: A type of secondary storage that uses magnetic patterns to store data on a rapidly rotating disk (e.g., Hard Disk Drives - HDDs).

Cloud Storage: A model of data storage where digital data is stored on remote servers, accessed via the internet.

3.4 Network hardware

Network Interface Card (NIC): Hardware inside a device that allows it to connect to a network by sending and receiving data signals.

IP Address: A unique address used to identify a device on a network. IPv4 uses 32-bit addresses; IPv6 uses 128-bit addresses, allowing for a greater number of unique addresses.

MAC Address: A permanent, unique hardware identifier assigned to a device's network interface controller at manufacture, used for communication on local networks. Typically written in hexadecimal to reduce their character length.

Router: A device that connects different networks together and directs data between them - commonly used to connect LANs to the Internet.