Definitions and Concepts for CAIE Computer Science IGCSE

Topic 1: Data Representation

1.1 Number systems

Denary (Base 10): A number base using ten unique digits (0-9).

Binary (Base 2): A number base using two unique digits (0 and 1), which computers use to represent all data and instructions.

Hexadecimal (Base 16): A number base using sixteen unique symbols (0-9 and A-F), often used by programmers for its compact representation of binary data.

Most Significant Bit (MSB): The bit with the highest value, which is the leftmost 1 in a binary number.

Least Significant Bit (MSB): The bit with the lowest value, which is the rightmost bit, whether it is a 0 or 1, in a binary number.

Logical Binary Shift: A process that moves bits left (equivalent to multiplying the number by 2 for each place shifted) or right (equivalent to dividing the number by 2 for each place shifted), losing the bits that shift out and adding 0s on the opposite side.

Overflow Error: An error that occurs when a number or result is too large to be stored in the available number of bits.

Two's Complement: A method of representing signed binary numbers where the MSB is negative. It allows both positive and negative numbers in binary.

1.2 Text, sound and images

Character Set: A defined list of characters that a computer can recognise and use, each mapped to a unique, numerical binary code.

ASCII: An early character encoding method, primarily used for English text.

Unicode: A character encoding standard designed to represent text in all of the world's languages, including non-English alphabets and emojis (more bits per character than ASCII).

Pixel: Short for "picture element," a single point in an image.

Resolution: The number of pixels in an image (width x height).

Colour Depth: The number of bits used to represent the colour of each pixel in an image.

Metadata (Images): Data about an image such as: file format, resolution, colour depth, and sometimes details like the device used to capture the image.

Analogue Sound: Sound that is continuous and varying in amplitude and frequency, found in the real world.

Sample (Sound): A measure of the amplitude of an analogue sound wave taken at a specific point in time during the digital conversion process.

Sampling Rate (Sound): The number of samples taken per second when converting analogue sound to digital, measured in hertz (Hz).

Sample Resolution (Sound): The number of bits used to store the amplitude of each sample when converting analogue sound to digital.

1.3 Data storage and compression

Bit: The fundamental unit of information, representing either a 0 or a 1.

Nibble: A group of 4 bits or half a byte

Byte: A group of 8 bits.

Kibibyte (KiB): 1024 bytes.

Mebibyte (MiB): 1024 KiB.

Gibibyte (GiB): 1024 MiB.

Tebibyte (TiB): 1024 GiB.

Pebibyte (PiB): 1024 TiB.

Exbibyte (EiB): 1024 PiB.

Data Compression: The process of encoding information using fewer bits than the original representation, to save storage space or reduce transmission time.

Lossy Compression: A form of compression where some information is lost in the process of reducing the file's size.

Lossless Compression: A form of compression where all original information is retained.

Run Length Encoding (RLE): A form of data compression that reduces the physical size of a repeating string of characters, by storing the character and the number of times it repeats.