



Digital storage of characters, graphics, and sound

Characters: letters, digits, spaces, punctuation and symbols stored as binary numbers.

Standardised character sets:

ASCII: 7-bit code used to represent characters (for example, 1100001 = 'a').

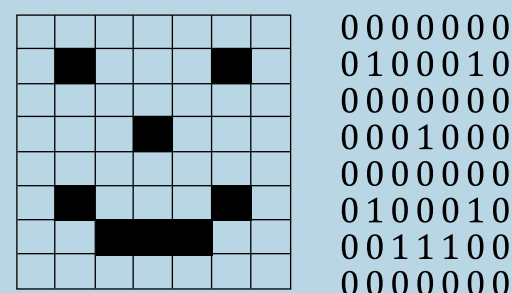
Unicode: uses 8 to 32 bits for a wider range of characters but requires more memory.

Character set	Advantages	Disadvantages
ASCII	Simple, uses less memory, widely supported.	Limited to 128 characters, not suitable for all languages.
Unicode	Supports a vast range of characters and languages.	Requires more memory due to longer bit representations.

Digital storage of characters, graphics and sound

- **Bit:** the smallest unit of data in computing, representing a binary value of 0 or 1.
- **Nibble:** a group of 4 bits, often used to represent a single hexadecimal digit.
- **Byte:** a group of 8 bits, which can represent 256 different values (2^8).
- **Kilobyte (KB):** 1,024 bytes (2^{10}).
- **Megabyte (MB):** 1,024 kilobytes or 1,048,576 bytes (2^{20}).
- **Gigabyte (GB):** 1,024 megabytes or 1,073,741,824 bytes (2^{30}).
- **Terabyte (TB):** 1,024 gigabytes or 1,099,511,627,776 bytes (2^{40}).
- **Petabyte (PB):** 1,024 terabytes or 1,125,899,906,842,624 bytes (2^{50}).

The digital storage and representation of graphics raster graphics: made up of pixels in a grid (dot matrix structure). Cannot be enlarged without losing quality.



Colour depth: refers to the number of bits used to represent the colour of each pixel. Higher colour depth allows for more colours.

Image size calculation:

to calculate the storage requirement of a raster image, use the formula:

Image size: Width $\times$ Height $\times$ Colour depth.

Size of above image: $7 \times 8 \times 1 = 56$ bits

$56 \div 8 = 7$ bytes.

Vector graphics: made of points, lines and curves based on mathematical equations, not pixels. Can be resized without losing quality or causing distortion.

Digital storage and sampling of sound

Sampling: the process of converting sound into a digital signal. A microphone measures the sound level multiple times per second and records it as binary data.

Sampling frequency (rate): the number of times sound is sampled per second, measured in Hertz (Hz). Higher sampling rates provide better sound quality.

Bit depth: the number of bits used to store each sample. Higher bit depth increases the sound quality by allowing more detailed sound levels.

File size = Sampling rate $\times$ Bit depth $\times$ Duration seconds.

Example: an audio file with a sampling rate of **10 Hz**, **16-bit depth**, and a duration of **100 seconds**:

$10 \times 16 \times 100 = 16,000$ bits

$16,000/8 = 2000$ bytes

$2000/1024 = 1.95$ Mb

Compression

Data compression reduces the size of files to save storage space and make transmission faster. There are two main types of compression – lossy and lossless

Lossy compression uses algorithms that compress the file size by discarding some of the data. This might mean reducing the number of colours in an image or reducing the number of samples in a sound file. This can result in a small loss of quality of an image or sound file. Examples include **JPEG**, **MP3**, **MPEG**, **MOV** and **WMV**.

Lossless compression uses an algorithm that compresses data into a form that may be decompressed without any loss of data, returning the file to its exact original form. It is preferred to lossy compression, when the loss of any detail, for example in a computer program or a word-processed document, could have a detrimental effect. Examples include **ZIP files** and **PDF documents**.