

CHAPTER 1: Information Representation

Binary:

Binary representation is base 2, magnitude of numbers is shown through:

Denary		Binary	
Kilobyte	1000 bytes	Kibibyte	1024 bytes
Megabyte	1000^2 bytes	Mebibyte	1024^2 bytes
Gigabyte	1000^3 bytes	Gibibyte	1024^3 bytes
Terabyte	1000^4 bytes	Tebibyte	1024^4 bytes

Denary			Binary		
Kilo	k	10^3	Kibi	Ki	2^{10}
Mega	M	10^6	Mebi	Mi	2^{20}
Giga	G	10^9	Gibi	Gi	2^{30}
Tera	T	10^{12}	Tebi	Ti	2^{40}

When adding and subtracting binary numbers an overflow error can occur.

Hexadecimal:

Hexadecimal is more convenient to use because one hex digit represents 4 binary digits, it is also easier for humans to remember and work with.

- Error codes - these are in hex to show the programmer the location of the error.
- MAC addresses - this is a unique number that is for every device.
- IP address - a device connected to a specific network has an address.
- HTML colour codes - represents different colours.

Two's Complement:

Use the check flip method, where you keep each bit the same as the positive binary representation then do the opposite when you see a 1.

To convert a binary two's complement into denary, take the MSB as a negative and add up the binary 1s before it.

BCD:

Binary coded decimal is an alternative binary representation that converts each denary integer into a nibble.

Uses of BCD are when needing to display denary integers in calculators or cash registers.

Representing characters:

Ascii is a 7 bit coding scheme to convert characters that humans understand to binary representation.

Extended ASCII is one byte, and **unicode tries to represent every character**

ASCII disadvantages are that it does not represent non western languages, Unicode does this as one character in unicode has 4 bytes and one character in ASCII is 1 byte.

Vectors:

Bitmaps:

Bitmap images have pixels which are binary digits. Each pixel will be a particular colour and each pixel's colour will be stored as a binary number.

Bit depth is the amount of bits per pixel, if there are more bits per pixel then it can represent more colours.

Colour depth is the number of possible colours that can be used
Image resolution is the amount of pixels per image.

The clarity with which the bitmap image is viewed on the monitor screen will depend on image resolution and screen resolution. Image resolution is the amount of pixels in the image, height times width. While the screen resolution is the amount of pixels in the image the screen can display.

$2^{\text{bit depth}} = \text{colour depth}$

$\text{Image resolution} \times \text{colour depth} = \text{file size}$

The file header is a set of bytes at the beginning of a bitmap file which identifies the file and contains information about the coding used.

Sound:

Measuring sound there is amplitude on the y axis and the time on the x axis. The amplitude gets converted into binary and the amount of bits used per sample to convert it is the sample resolution. Sample rates are the amount of samples per second. If you have a bigger sample resolution and rate then you will have more accuracy but the file size will be bigger.

Sample rate × sample resolution × length = file size

Data compression:

Compression:

- Saves space
- Reduces time to stream
- Reduce upload time
- Reduces costs
- Doesn't take up much network bandwidth

Lossy compression loses unneeded data while compressing, so it reduces colour depth, sample rate etc. It also removes sounds that people can't hear and makes different shades of the same colour the same. They are smaller than lossless files; they are MP3, MP4 and JPEG. Lossy compression is permanent.

Lossless compression doesn't get rid of any existing data, it compresses it through RLE by an algorithm, whatever data is repeated by being indexed.

Glossary:

A Network: a network is a collection (2 or more) of devices connected to each other (e.g Lan, Computer) to share data/resources.

LAN: a network which is on a single site or small geographical area (e.g school) (Anything under a Km)

WAN: a WAN is a wide area network which is a collection of LAN, multiple networks connected to each other over a wide distance by using third party communication (e.g The Internet)

Concatenate: to stick things together for example if you add an integer into a string it will concatenate and become a string

PSTN (Public Switched Telephone Network): Traditional global voice communication network, operating via circuit-switched technology over landlines.

DNS (Domain Name System): Translates domain names into IP addresses for easier internet navigation, using a hierarchical and distributed system.

DSL (Digital Subscriber Line): Provides internet access over phone lines, with types like ADSL and SDSL offering asymmetric or symmetric data speeds.

WAPN (Wireless Access Point Network): A device that connects wireless devices to a wired network, extending LAN coverage via Wi-Fi or Bluetooth.

WNIC (Wireless Network Interface Card): A hardware component that enables a device to connect wirelessly to a network using Wi-Fi.

NIC (Network Interface Card): Allows a computer to connect to a network, available in both wired (Ethernet) and wireless (Wi-Fi) forms.

Repeater: A device that amplifies and retransmits signals to extend the range of a network, useful in both wired and wireless setups.