1.2 Part C - Data Representation

Keywords & Definitions

Binary: Numbering system which uses base 2 (0s & 1s) – the only language that computers truly understand. 0 means off, 1 means on.

Denary: Numbering system which uses base 10 (0-9) – these are our normal numbers that we use every day. (Otherwise known as decimal)

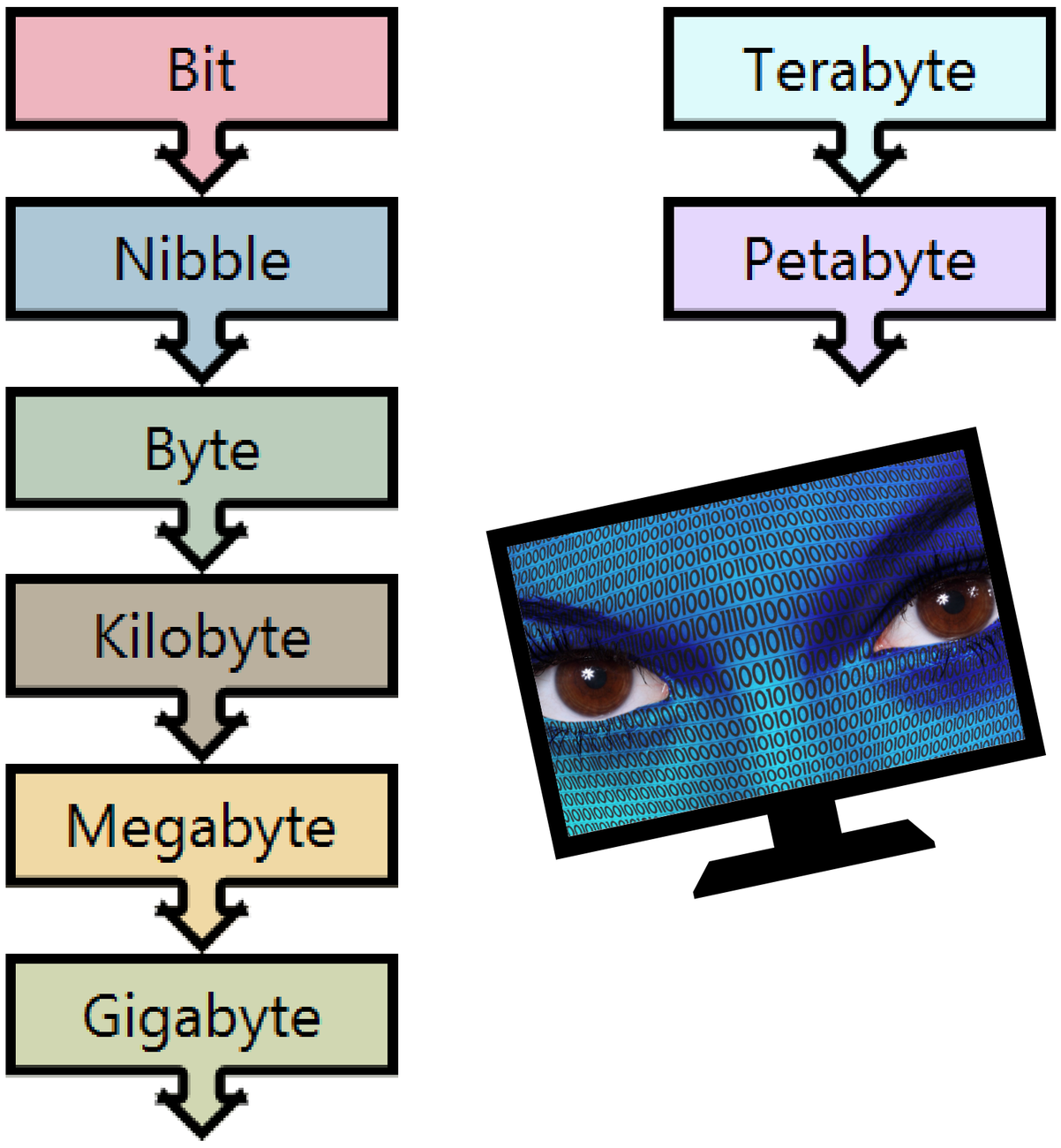
Hexadecimal: Numbering system which uses base 16 (0-9 and A-F).

Character: A single letter, number or symbol.

Character Set: A set of characters used in a language, which are each represented using a unique binary number.

Compression: Reducing the file size

Units of data



Binary to Denary

128	64	32	16	8	4	2	1
1	0	1	1	0	1	1	1

= 183

Denary to Binary

128	64	32	16	8	4	2	1
1	0	1	1	0	1	1	1

- Start from the left hand side
- Does 128 go into 183 - yes
- 183 - 128 = 55
- Does 64 go into 55 - No
- Continue

Hexadecimal

1. Split into two nibbles – 1011 0011
2. Convert each nibble into decimal – 1011 = 1 + 2 + 8 = 11 (B)
   0011 = 1 + 2 = 3
3. Therefore 10110011 in Hex is B3

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F

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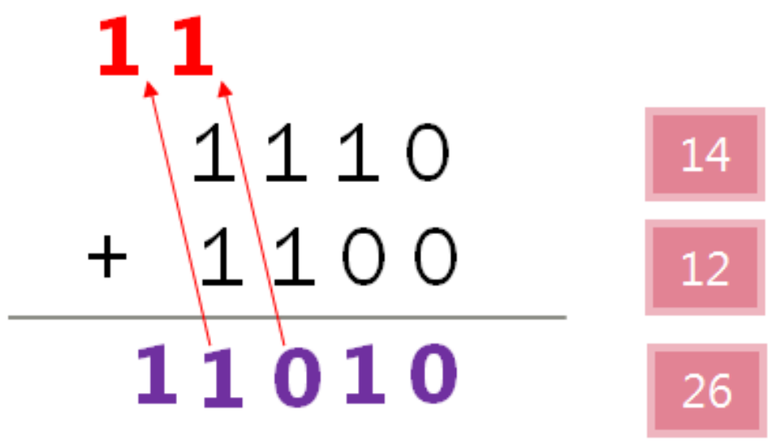
Binary Addition

Work right to left following the rules:

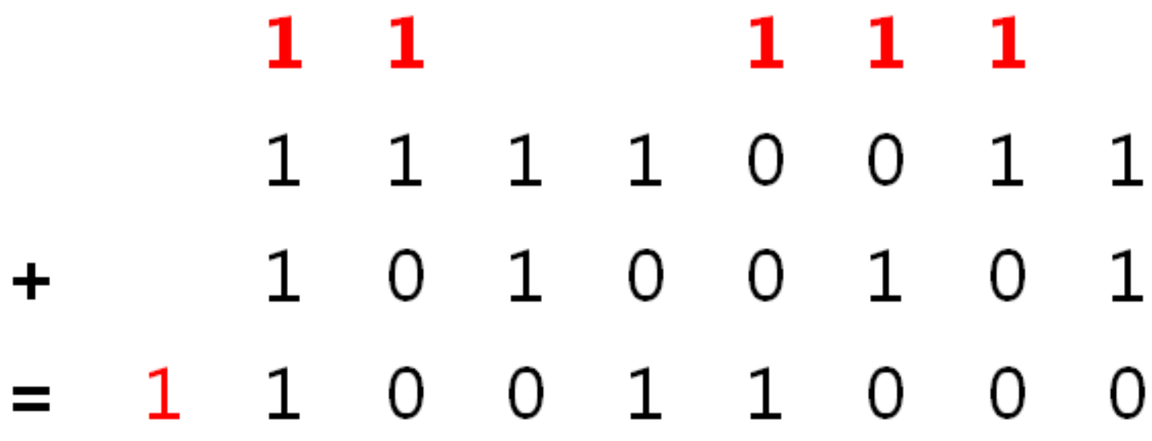
- 0 + 0 = 0
- 0 + 1 = 1
- 1 + 0 = 1
- 1 + 1 = 0 *Carry 1*
- 1 + 1 + 1 = 1 *Carry 1*

Example:



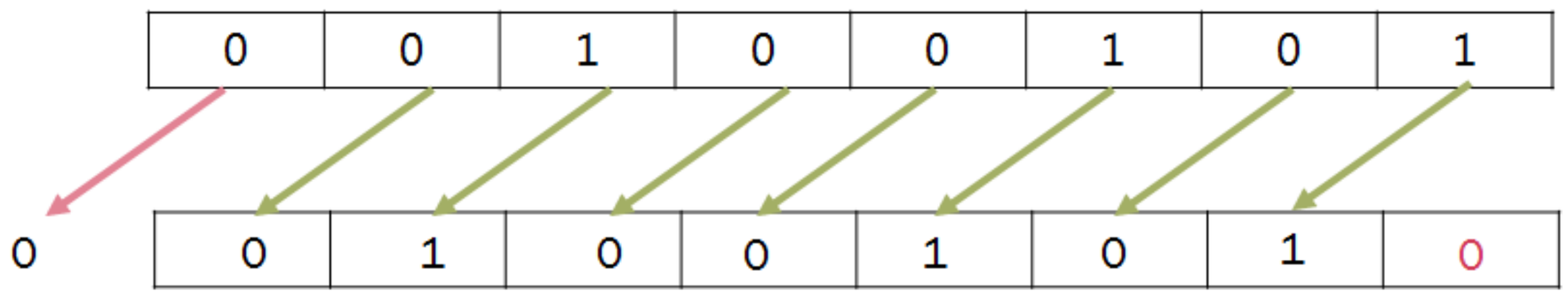
What is an overflow error?

An overflow error occurs where an additional bit is required to store a result greater than the maximum that 8 bits will allow (255).



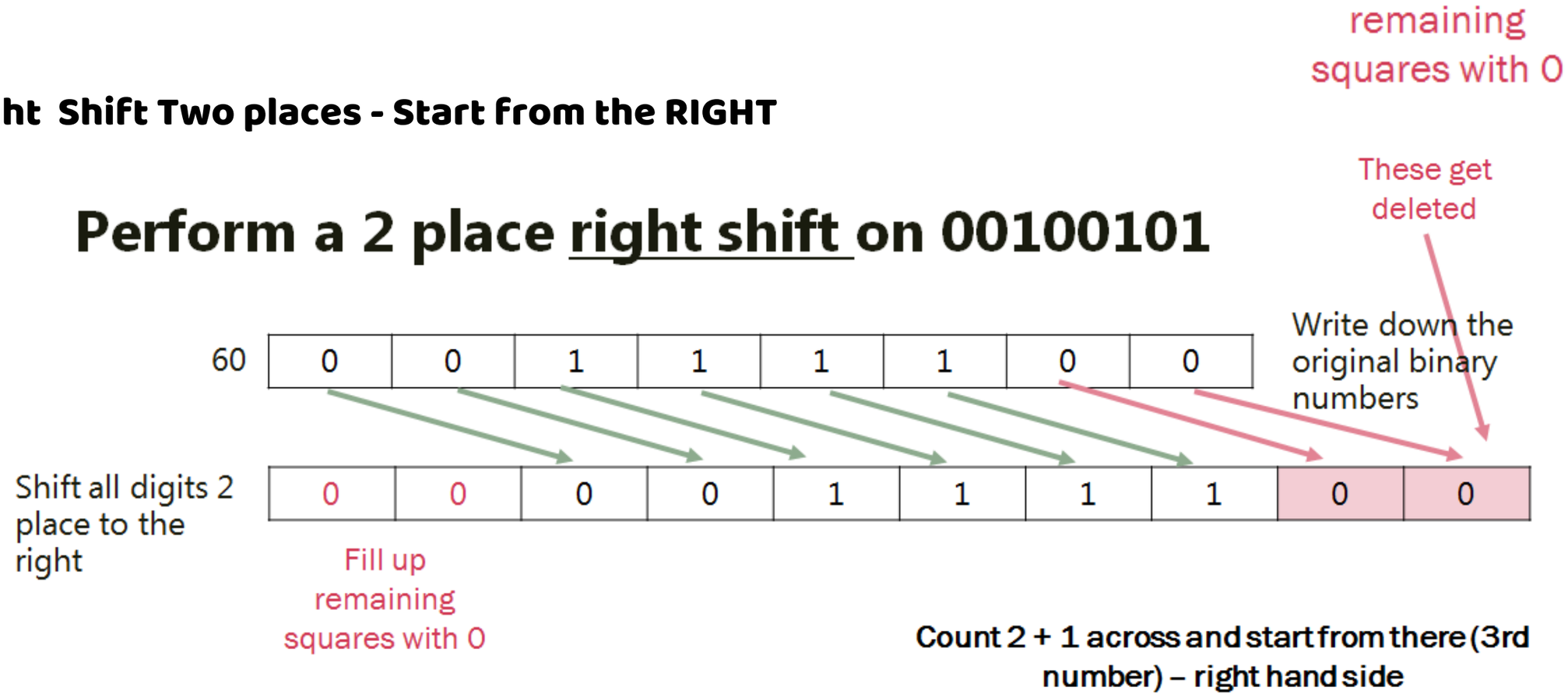
Binary Shift

Left Shift One Place- Start from the LEFT



Fill up remaining squares with 0

Right Shift Two places - Start from the RIGHT



1.2 Part C - Data Representation

Characters

ASCII

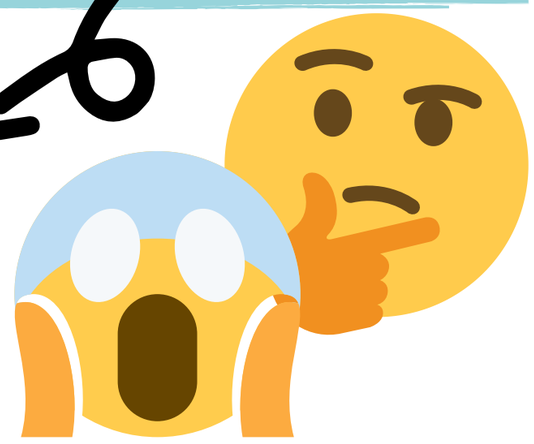
- 7 bits
- represents 128 different characters
- includes the English alphabet - letters, numbers, symbols and commands

Extended ASCII

- 8 bits
- represents 256 characters
- useful for European languages (French, German etc)

Unicode

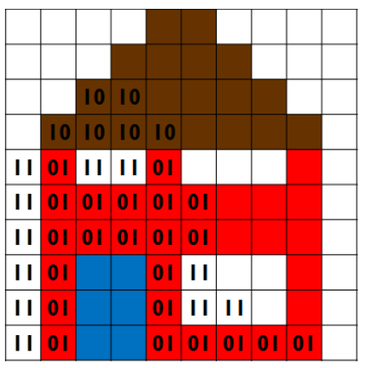
- 16 bits and 32 bits
- EVERY possible character
- all major languages including emoji



Images

	Image Resolution	Colour depth	Number of colours	File size in bits	File size in Bytes
Image 1	30 x 30	2	4	30x30x2 = 1800	225
Image 2	20 x 10	3	8	20 x 10 x 3 = 600	75

Divide the file size (bits) by 8 – 8 bits in a byte



1 bit = 2 Colours [2_1]

2 bits = 4 Colours [2_2]

3 bits = 8 Colours [2_3]

4 bits = 16 Colours [2_4]

width x height x colour depth

Colour Depth

the number of bits per pixel

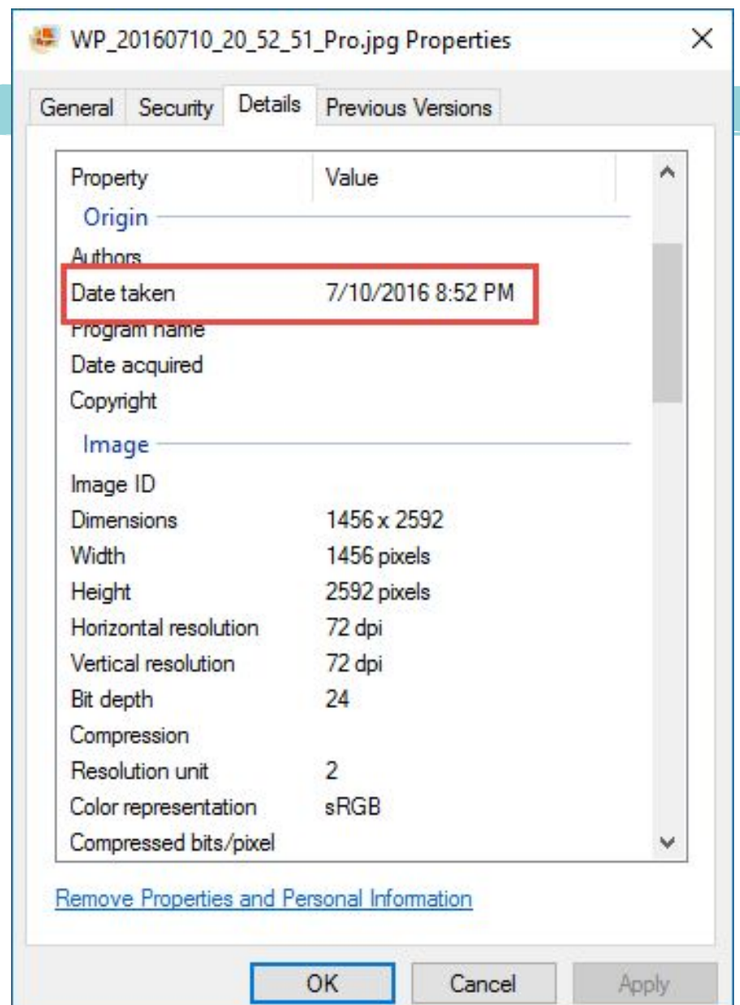
Resolution

how many pixels are within a certain area (dpi)

Increasing any of these would increase the colour but also the file size

Metadata

information stored with the file (format, height, width, colour depth, resolution)



1.2 Part C - Data Representation

Compression

Lossy Compression:

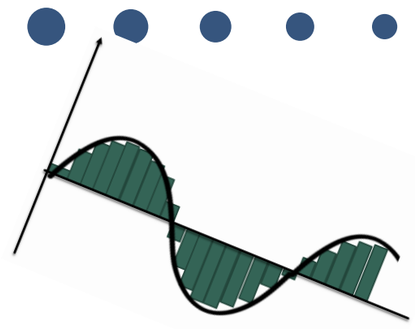
loses data permanently - the file cannot be restored to its original state

Lossless Compression:

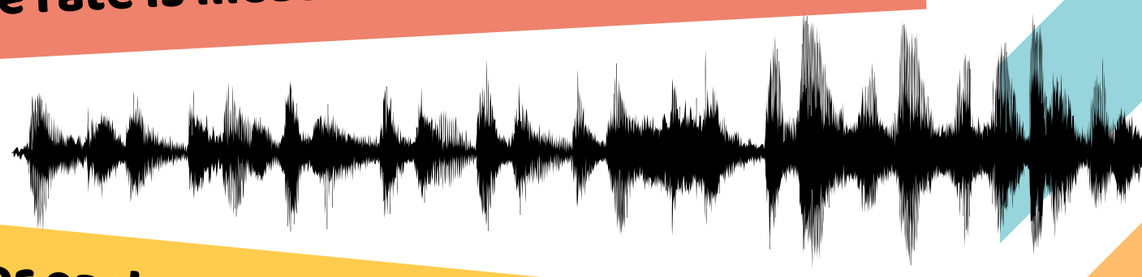
loses data temporarily - the file can be restored back to its original

Sound

Sampling - recording snippets of sound at set intervals.



Sample Rate - This is the number of samples recorded in any given period of time. The higher the sample rate, the closer the recorded signal is to the original. Sample rate is measured in hertz.



Bit depth/sample size - The number of bits available for each sample (similar to colour depth) just as with images, the higher the bit depth, the more accurately a sound can be recorded, but the larger the file size.

Bit Rate - The number of bits used per second of audio (Kbit/s). Will record more detail of the sound

The higher the sample rate and bit rate, the large the file size but the quality will be high - closer to the original

World of work links

Programmer, IT Technician, Software Engineer, Teacher, Systems Architecture, Data Engineer, Software Developer