Data Representation - Part 1

Name	Abbreviation	Multiple of...
Bit	b	-
Nibble	N	4 bits
Byte	B	8 bits
Kilobytes	kB	1000 bytes
Megabytes	MB	1000 kilobytes
Gigabytes	GB	1000 megabytes
Terabytes	TB	1000 gigabytes
Petabytes	PB	1000 terabytes

ALL data must be translated into binary to be processed by a computer.

CONVERTING BINARY INTO DENARY

01101001 =

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

64 + 32 + 8 + 1 = 105

CONVERTING DENARY INTO BINARY

Step 1: Decide on the column to start with. This should be lower than or equal to the value you are looking for so if we wanted to convert 50 to binary we would start with the column 32. Enter a 1 in that column.

Step 2: Find out the remainder (50 – 32 = 18)

Step 3: Repeat steps 1 and 2 until there is no more remainder (in this case we would also put a 1 in the 16 and the 2 columns.

Step 4: Fill in the other columns with 0's. Please note: you do not need to add 0s before your first 1 as these are unnecessary. Using the example of 50 our binary number would be 110010 (32 + 16 + 2).

Adding with binary

Description	Example
Take the first column on the right and add together the individual 1's. In this case 0 + 1 = 1	1 0 1 0 + 1 1 1 1
Next take the next column and add together the 1's. In this case 1 + 1 = 10. Don't forget we are adding in binary so the answer should also be in binary. Put the 0 in the same column and carry the 1. This is usually shown below the bottom line.	1 0 1 0 + 1 1 1 0 1 1
In the next column don't forget to include the 1 that has been carried forward. In this example the calculation is 0 + 1 + 1 which is 10. Again, put the 0 in the column and carry the 1.	1 0 1 0 + 1 1 1 0 0 1 1 1
In the final column add together the digits, including the carried digit. In this case 1 + 1 = 10. As there are no other columns instead of putting the 1 that is being carried below the line, move it up to the main answer row.	1 0 1 0 + 1 1 1 1 0 0 0 1 1 1

CHECK DIGITS

When data is transferred across networks it can easily become corrupted by outside interference. This can cause problems if, for example, a credit card number was sent incorrectly causing the wrong person's account to be debited.

For instance, on a UPC bar code the check digit is the last digit shown (in this case a 3). The other numbers are used in the calculation to generate the final check digit.

ASCII, Extended ASCII and Unicode

ASCII uses 7-bits to represent characters allowing 127 characters to be represented. **Extended ASCII** code is an 8-bit character set that represents 256 different characters making it possible to use characters such as ö or é. Extended ASCII is useful for most European languages. **Unicode** contains 136,755 characters covering 139 modern and historic languages, as well as lots of symbols which are used in maths and other specialist areas.

BINARY SHIFT

Moving a pattern of binary digits to the left or right will multiply or divide the denary value.

128	64	32	16	8	4	2	1	
0	0	0	1	0	1	0	0	20
0	0	1	0	1	0	0	0	40
0	1	0	1	0	0	0	0	80
1	0	1	0	0	0	0	0	160

Left = Multiply by 2

Right = Divide by 2

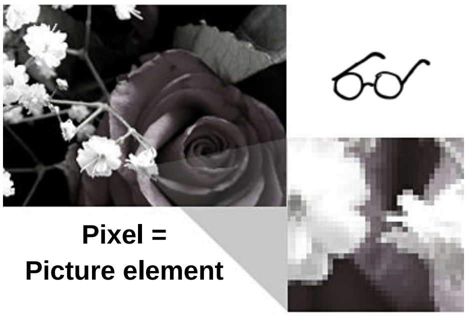
CONVERTING BINARY INTO HEXADECIMAL

Denary	Binary	Hexadecimal
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7
8	1000	8
9	1001	9
10	1010	A
11	1011	B
12	1100	C
13	1101	D
14	1110	E
15	1111	F

0100 1110 = 4E

Data Representation - Part 2

Bitmaps



Pixel =
Picture element

A **pixelated** image is one where the individual pixels are clearly visible. The **image size** is described in pixels (width x height). The higher the image **resolution** the better quality the image will be. This is measured in DPI (dot's per inch). The **colour depth** is how many different colours each pixel can be represented by.

Metadata

As well as storing each pixel as binary an image file will also store metadata. That is data that is saved before and after the image to tell the computer how to decode the image. It includes:

- The file dimensions (pixels wide x pixels tall)
- The colour depth
- The resolution etc.

This meta data is mainly stored at the beginning of the file and at the end of the file is another piece of meta data telling the computer that the image has finished, a bit like a full stop at the end of a sentence.

Calculating file size of images

To work out the file size you will need to know the following:

W = image width
H= image height
D = colour depth (in bits)

As long as you know these things you can make an approximate calculation of the file size.

W x H x D = File size

Sound files

To store an analogue sound wave into digital sound wave that computers require a recording is must be taken of the sound wave at set intervals.

Sample rate = number of samples taken in a second, measured in hertz (Hz)

Bit rate = the number of bits per sample, also known as the resolution

Calculating sound file sizes

To work out the file size of a sound clip you will need to know the following:

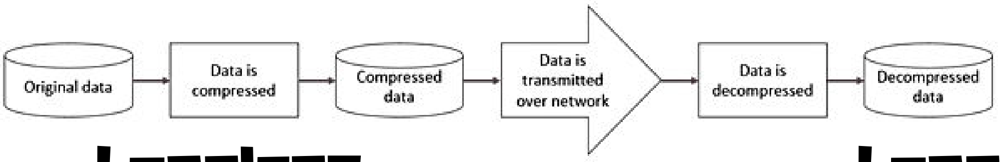
rate = sampling rate
res = sample resolution
secs = number of seconds

As long as you know these things you can make an approximate calculation of the file size.

rate x res x secs = File size

Compression

Compressing a file is when a file is encoded so it uses fewer bits than the original file format



Lossless

Lossless data compression gets rid of unnecessary data to represent data without losing any information. This process is reversible.

Lossy

Lossy gets rid of the least essential data. For instance, some colour variants will be dropped reducing This is an irreversible process as once they have been lost, those colours cannot be brought back to the image.

Data Representation

Revise it

Read through the handout and then select a revision technique from those described in this section, you can even do more than one if you want!

Highlight

Highlight key words (maximum of 2 per sentence) and then cover the page and try to write down all the key words you can remember. Go back and fill in all the ones you have missed.

Mind map

Using the handout, draw a mind map and include as many colours, images and diagrams as you can to illustrate it

BULLET POINTS

Write the main headings (leaving space between each) and then write bullet points of the main key points you need to remember under each heading. Re-read the handout and add any missed points to your list.

Post-it notes

Write a key word and the definition on a post-it note and stick them around your study area as a reminder of the terminology.

Record your notes

Re-write the handout in your own words and record yourself using your phone as you read your notes aloud.

TEST YOURSELF

Cover your notes and the answer before you attempt to answer this practice exam question.

State and explain your reasons for the type of compression you should use in the following two scenarios: [4 marks]

a) uploading your images to your social media account

b) uploading photographs for a fashion magazine

Mark your answer

Give one mark for selecting the correct type of compression in each scenario and one mark for explaining why that compression type is the most appropriate. Maximum four marks.

Part a:

- Lossy compression type
- Uploading is quicker as the file size is reduced
- The images do not need to be of such high quality

Part b:

- Lossless compression type
- The detail is maintained and it can be printed without loosing resolution or colour depth