GCSE Computer Science
Topic 1.2 Memory and Storage (3)

Each 1 or 0 is a bit. Short for **bi**nary digi**t.**

1. Bit
2. Nibble
3. Byte
4. Kilobyte
5. Megabyte
6. Gigabyte
7. Terabyte
8. Petabyte

There are **8** bits in a **byte**
Then **1000** of each smaller unit in each bigger unit.

128	64	32	16	8	4	2	1

1 Byte	1 Kilobyte (KB) = 1000 Bytes	1 Megabyte (MB) = 1000 Kilobytes	1 Gigabyte (GB) = 1000 Megabytes	1 Terabyte (TB) = 1000 Gigabytes	1 Petabyte (PB) = 1000 Terabytes

Sometimes when doing binary **addition** you get a result that requires **more bits** than the CPU is expecting. This is called an **overflow error**

Overflow errors result in **loss of data** and the results are **inaccurate**

Left shifts MULTIPLY a binary number.
For every place shifted left, the number is doubled.

Right shifts DIVIDE a binary number.
For every place shifted right, the number is halved.

A binary shift (or logical shift) moves every bit in a binary number either left or right a certain number of places.
Gaps at the beginning or end of a number, after a shift are filled with 0s.
Left shifts can cause overflow errors and right shifts can cause digits to 'drop off' the end.
Bits dropping off or overflowing can cause loss of accuracy or loss of data.

Character set: A collection of characters that a computer recognises from their binary representation.

ASCII - Uses 7 bits – this means it can represent 128 characters. (2^7 = 128)
EXT ASCII: Uses 8 bits – allowing 256 characters to be represented (2^8 = 256).
Unicode uses 16-32 bits -2^16 bit (65, 536) 2^32 bit (4,294, 967,296) ***Unicode covers ALL major languages.***

Check digits are a way of checking that data has been **entered** and **read** correctly.
They are digits added to the **end** of numbers.
If the check digit is correct when the data is read, it is **likely** the data has been entered/read correctly.
For binary data, the check digit is called a **parity** bit.

- You can have **odd** and **even** parity bits.
- An **even** parity bit is added to make the binary string have an **even number of 1s**.
- An **odd** parity bit is added to make a binary string have an **odd number of 1s**.

Number 1	0	0	0	1	1	1	0	1
Number 2	1	0	0	1	1	0	1	1
Answer	1	0	1	1	1	0	0	0
Carry	0	0	1	1	1	1	1	

1 + 1 = 0 *CARRY* 1

1 + 1 + 1 = 1 *CARRY* 1

DEN	BINARY	HEX
0	0	0
1	1	1
2	10	2
3	11	3
4	100	4
5	101	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

EXAMPLES: 1. Convert the hexadecimal number 87 into denary.

1) First, draw this table, then write in your hex number.

16	1
8	7

2) Multiply the numbers in each column. 8 × 16 = 128 7 × 1 = 7

3) Add up the results 128 + 7 = 135 So the hex number 87 is 135 in denary.

- ✓ Its easier to remember large numbers in HEX.
- ✓ Because HEX is shorter there are less chance of typing errors.
- ✓ Its easier to convert between binary&hex than binary and denary.

Analogue signals are converted to digital signals so that they can be processed by a computer.
This process is called sampling.

Sample intervals	Sample frequency	Sample size/depth	Bit rate
The time gap between taking a sample. e.g. sound may be sampled every 5 milliseconds. Sample interval 5ms.	How many samples are taken in a second. e.g. 44.1khz means 44,100 samples are taken per second.	How many bits are available to store each sample.	Number of bits used per second of audio. Bit rate = sampling frequency * sample size.

Increasing any of the above means better quality but larger file size.

Bitmap images are made up of tiny little dots called pixels.
The colour of each pixel is represented by a binary code.
More colours = more bits (longer binary code)
Colour depth: the number of bits used for each pixel.
MORE COLOURS = BETTER QUALITY BUT LARGER FILE.
Resolution - how many pixels are in an area of the image – measured in dpi (dots per inch)
MORE DOTS, MORE BINARY = LARGER FILE.
Metadata is the data stored in an image file which helps the computer recreate the image on screen. *File format, height, width, colour-depth and resolution, time/date/location image was taken.*
WITHOUT METADATA, DEVICES WOULD NOT BE ABLE TO DISPLAY IMAGES.

GCSE Computer Science - Topic 1.2 Data representation (3)

What I need to know:

Define the term bit.			
How many bits are in a byte?			
Order the binary units from smallest to largest.			
Explain, with an example how to convert a number from denary into binary.			
Explain, with an example, how to convert a number from binary to denary.			
Define the terms check digit / parity bit.			
Explain with examples how odd and even parity bits are used.			
Demonstrate how to perform binary addition.			
Explain with examples, how to convert binary into hexadecimal.			
Explain with examples how to convert hexadecimal into binary then to denary.			
Define the term overflow error.			
Explain with examples, how to perform binary shifts.			
What are the benefits of using the hexadecimal number system.			
Explain the process of sampling.			
Explain the factors that affect the size and quality of a digital sound file.			
Define the term character set.			
Explain the key differences between ASCII, extended ASCII and Unicode.			
Explain how images are represented on a computer system using the terms colour depth and resolution.			
Define the term metadata.			