

2.6 DATA REPRESENTATION

DENARY

Denary is the decimal number system that we are used to. It uses the numbers 0-9 and the column headings go up in powers of 10.

100 (Hundreds)	10 (Tens)	1 (Units)
2	3	8
2 lots of 100	3 lots of 10	8 lots of 1

BINARY

Binary uses the numbers 0 and 2. The column headings go up in power of 2:

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

$$64 + 4 + 2 + 1 = 71$$

HEXADECIMAL

Hexadecimal uses 0- F (A=10, B=11, C=12, D=13, E=14, F=15). The headings go up in powers of 16.

16	1
3	D
3 lots of 16	D (13) lots of 1

$$3 * 16 = 48$$

$$D (13) * 1 = 13$$

$$48 + 13 = 61$$

To convert a binary number to Hexadecimal, split into 2:

8	4	2	1
0	0	1	1

$$= 3$$

8	4	2	1
1	1	0	1

$$= D$$

BINARY ADDITION

$$\begin{array}{r}
 1\ 0\ 0\ 1\ 0\ 1\ 0\ 1 \\
 +\ 1\ 1\ 0\ 1\ 1\ 0\ 1\ 1 \\
 \hline
 1\ 1\ 1\ 1\ 1\ 0\ 0\ 0\ 0 \\
 1\ \qquad\quad 1\ 1\ 1\ 1\ 1
 \end{array}$$

This binary addition gives an overflow error as the total does not fit in 8 bits (a byte).

BINARY SHIFT

A binary shift to the left multiplies the number by 2. A binary shift to the right divides it by 2. Below is an 8 bit binary number which has been shifted 2 places to the right.

Original number	1	1	0	0	1	1	0	1
Shifted number	0	0	1	1	0	0	1	1

CHARACTERS

Character sets = the characters that are recognised or represented by a computer system

ASCII = Each character is represented by a 7 bit number with a 0 in front to make it up to a byte.

Extended ASCII = Each character is represented by an 8 bit binary number. This gives 256 different possibilities.

Unicode = Each letter is represented by a 16-bit or 32-bit binary number. This gives at least twice as many character options as ASCII and allows the character set to represent characters and symbols from all languages.