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We have considered the binary number system (base 2):

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

The above represents decimal 22.

Other bases are possible, we are also familiar with base 10 (or decimal) numbers. Consider:

Base	Symbols	Examples	Decimal equivalents
2	0, 1	1, 10, 1010, 10000	1, 2, 10, 16
3	0, 1, 2	1, 2, 101, 121,	1, 2, 10, 16
8	0, 1, 2, 3, 4, 5, 6, 7	1, 2, 12, 20	1, 2, 10, 16
10	0, 1, 2, 3, 4, 5, 6, 7, 8, 9	1, 2, 10, 16	1, 2, 10, 16
16	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D , E, F	1, 2, A, 10	1, 2, 10, 16

In the IB Computer Science program we are only interested in binary, decimal and hexadecimal (base 16). Hexadecimal is interesting because it can be used as a shorthand form of binary, as follows:

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

Any binary byte can be represented as 2 hexadecimal digits by substituting in the above table. Our old buddy 22 – 00010110 – becomes 16 in hexadecimal.

Try these:

	binary	hexadecimal	decimal
a.	01110010	…….	……..
b.	10010110	…….	……..
c.	11111111	…….	……..

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As we mentioned in the first worksheet, 24-bit colour is often used to represent colours in a modern system. That is 3 binary bytes, each byte stands for **red** component, **green** component, **blue** component (RGB colour).
Graphically:

red	green	blue	
11111111	11111111	11111111	binary
FF	FF	FF	hex

So, each colour can be described in 6 hex digits. FFFFFF is white. What colours do you think these hex numbers represent?

a. FF0000 …….

b. 00FF00 …….

c. 000000 …….

What might be the code for cyan (an equal mixture of blue and green)?.....

The ASCII code for a space is 20 in hexadecimal; what is it in decimal?.....

The ASCII code for the letter A is 65 in decimal. What is it in binary?.....

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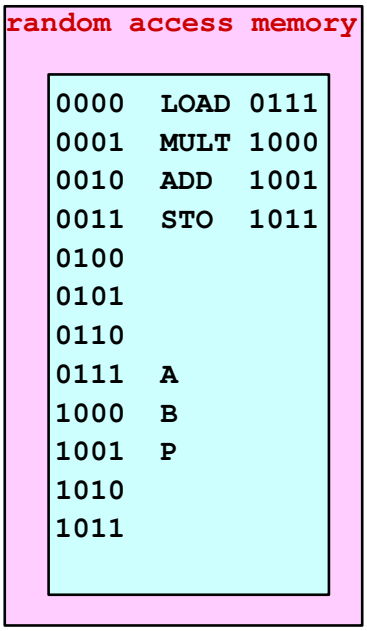
Introduction to Architecture

A simplified diagram of computer memory might be:



The first 4 numbers might represent memory locations

The second column could be program insructions (these would, of course, be in binary form too).

The third column represents data locations.

Notice that oth data and program instructions can be held in RAM.

How many different address locations can this computer have?

…….

Data and instructions are sent from the RAM (primary memory) to the CPU (central processing unit) to be processed. Each bit is sent along a wire/circuit so 4 sets of wires would be needed in this computer. The group of wires/circuits is called a **bus**.

Buses carry data and addresses.

Computers typically have 32, 64 or 128 bit buses. How many different addresses can a computer with a 32-bit bus have?

……

How much is that in Megabytes (MB)?

……

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