

A High Level Overview of Binary

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What is binary?

Humans (mostly) use **decimal**, a base 10 numeral system

- this means we use 10 digits: 0 through to 9
- this is thought to be because we naturally have 10 fingers

Computer processors use **binary**, a base 2 numeral system

- this means it uses only two digits: 0 and 1

Both systems are able to produce *any number*, however binary usually requires more individual digits to achieve the same result

- this makes binary a poor system for everyday arithmetic by humans

27 in decimal	27 in binary
27	11011

How binary works

The decimal system place values begin from the left at the highest value and move to the right lowering in value

- These values are to the power of ten (1, 10, 100, 1000, 10000 etc)

ten thousands	thousands	hundreds	tens	ones
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Similarly the binary system places the most significant bit to the left

- These values are to the power of two (1, 2, 4, 8, 16 etc)

16	8	4	2	1
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- Like the decimal system more columns are added as necessary

How binary works

When using the decimal system you apply either a digit from 0 to 9 in each column

- these digits represent how many of that unit there are

millions	ten thousands	thousands	hundreds	tens	ones
0	0	0	1	3	4

In binary, each column can contain either a 0 or a 1

- a 0 represents the unit as 'dead', a 1 that it is 'alive'

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

Both of these tables represent the number 134

Counting in binary

Units that are 'alive' (contain 1) are added together

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

$$128+4+2 = 134$$

With this in mind, counting is simple

1	2	3	4	5
0001	0010	0011	0100	0101

- Leading 0's can be discarded, 000101 is the same number as 101 (5)

Binary numbers sometimes begin with '0b' to inform the computer it is to be treated as a binary number (0b0101)