



Binary



Artemis 2016



What Is Binary ?

Binary is a language written with a combination of ones (1) and zeros (0) that computers use to carry out commands, inputs, or functions.

Whatever you write onto a computer, a machine inside processes the input and converts it into binary. It's like using a translator!



Bytes and Bits

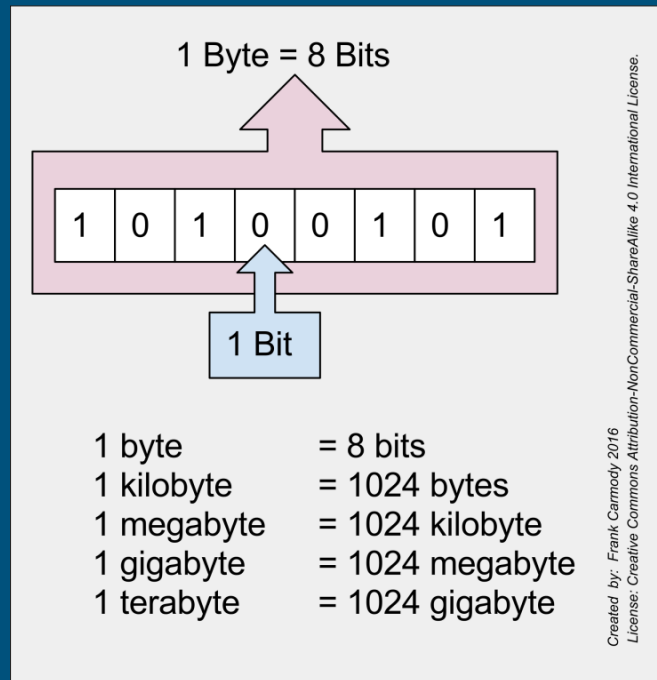
In binary, we have bytes and bits which are major components in writing binary.

Bit: a single 0 or 1 in a binary number

10100000

Byte: eight bits put together

10100000



Converting Binary to decimal

Using a chart like this:

0	0	0	0	0	0	1	1
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	64	32	16	8	4	2	1

compared to one like this:

0	0	0	1	1
10^4	10^3	10^2	10^1	10^0
10000	1000	100	10	1

Everywhere there is a “0” that digit is “off”

Everywhere there is a “1” that digit is “on”

An Example

Every digit in a binary number represents a power of 2. For example if we were working with the binary number ‘00001101’ we could convert it to decimal with that chart:

0	0	0	0	1	1	0	1
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	64	32	16	8	4	2	1
Off	Off	Off	Off	8 +	4 +	Off	1 =13

Converting Decimal to Binary

Say we want to convert 23 to binary

We would start with all digits in “off” position

Next we find the **largest power of two less than 23** and turn that “on”, or put a 1 there

Now we would find the largest power of two less than **23-16** and repeat

Converting 23 to binary:

- Start with all numbers “off”



0 0 0 0 0 0 0 0

- Find the biggest power of two less than 23 turn it on



0 0 0 1 0 0 0 0

128 64 32 16 8 4 2 1

$$23 - 16 = 7$$

- Find the biggest power of two less than 7 turn it on



0 0 0 1 0 1 0 0

128 64 32 16 8 4 2 1

$$7 - 4 = 3$$

- Find the biggest power of two less than 3 turn it on



0 0 0 1 0 1 1 0

128 64 32 16 8 4 2 1

$$3 - 2 = 1$$

- Turn on 1



0 0 0 1 0 1 1 1

128 64 32 16 8 4 2 1

What is Hexadecimal?

- ❖ Similar to binary, but easier to understand.
- ❖ It uses sixteen different symbols, the numbers zero through nine, and the letters A through F. Each symbol represents four bits.

For example: 7FFFD4



Uses of Hexadecimal

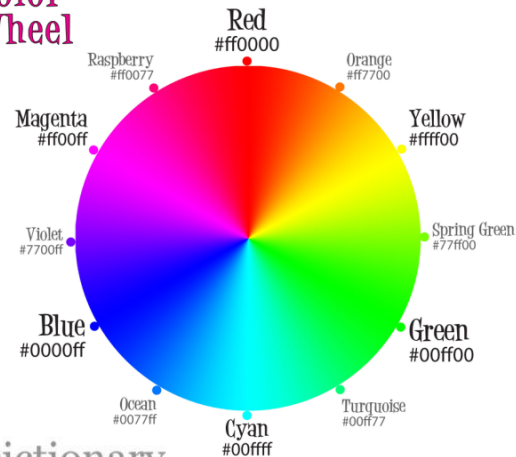
- ❖ Represent colors
- ❖ Saves memory, shorter than binary
- ❖ Describes locations in a computer's memory

Compare: 1010000011100111110 vs. 5073E

roses are `#ff0000`

violets are `#0000ff`

Hexadecimal Color Wheel



Hex Color Code Dictionary

#accde
#beaded
#beefed
#decade
#deface
#efface
#facade

#add
#ace
#bad
#bed
#bee
#cab
#cad
#dad
#ebb
#fab
#dab
#fed
#fee

How to Convert Hexadecimal into Binary

123AE:

1 2 3 A E

Decimal (Base 10)	Binary (Base 2)	Hexadecimal (Base 16)
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

How to Convert Hexadecimal into Binary

123AE:

1	2	3	A	E
0001	0010	0011	1010	1110

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How to Convert Hexadecimal into Binary

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74670

Decimal (Base 10)	Binary (Base 2)	Hexadecimal (Base 16)
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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

Why Binary?

Binary itself was fun because it was quick and easy to learn.

Played Binary Bingo which was very competitive and challenging.

Most of all it was interesting!

Thank You for Listening!

5468616E6B20596F7520666F72204C6973744656E696E6721

01010100 01101000 01100001 01101110 01101011 00100000
01011001 01101111 01110101 00100000 01100110 01101111
01110010 00100000 01001100 01101001 01110011 01110100
01100101 01101110 01101001 01101110 01100111 00100001