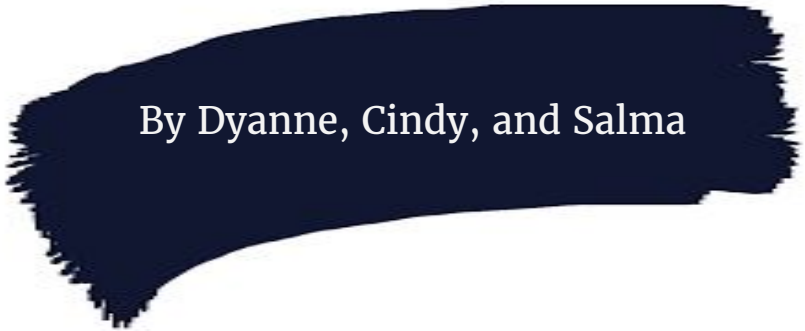
Binary



What is binary?

- Language that computers speak
- Base Two (which means it uses two digits)
- Consists of 1s and 0s
  - To computers, the 1s and 0s are switches
    - ‘1’ means ON
    - ‘0’ means OFF
  - The only way we can understand binary is if we translate the string into other numeral systems like hexadecimal and decimal

Terms

Bit - a 1 or 0 in a binary form

Byte - eight *bits*

Giga**byte**? (GB)

- Unit of storage
- Base 2 (2^30)
  - 1073741824 bytes
  - 8589934592 bits

Translating

- Binary is written in **strings**
  - A sequence of characters (in this case, bits)
- The strings can be translated into decimal and hexadecimal
  - Easier for humans to understand

Decimal

What is decimal?

- The number system we use
  - Most widely used number system
- Can be called “Base 10”
  - Based on the number 10
  - Only ten digits
    - 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
  - To the left of the decimal point: units, tens, hundreds, thousands……

Converting from Decimal to Binary:

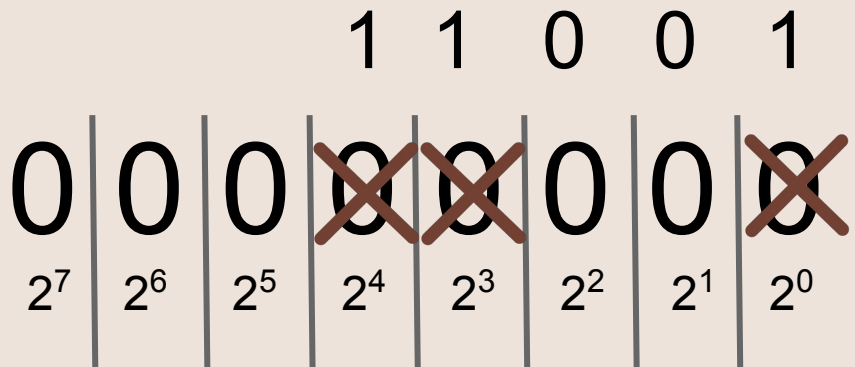
Method 1

Let's try converting 25 to binary!

25 $\xrightarrow{16(2^4)}$ 9

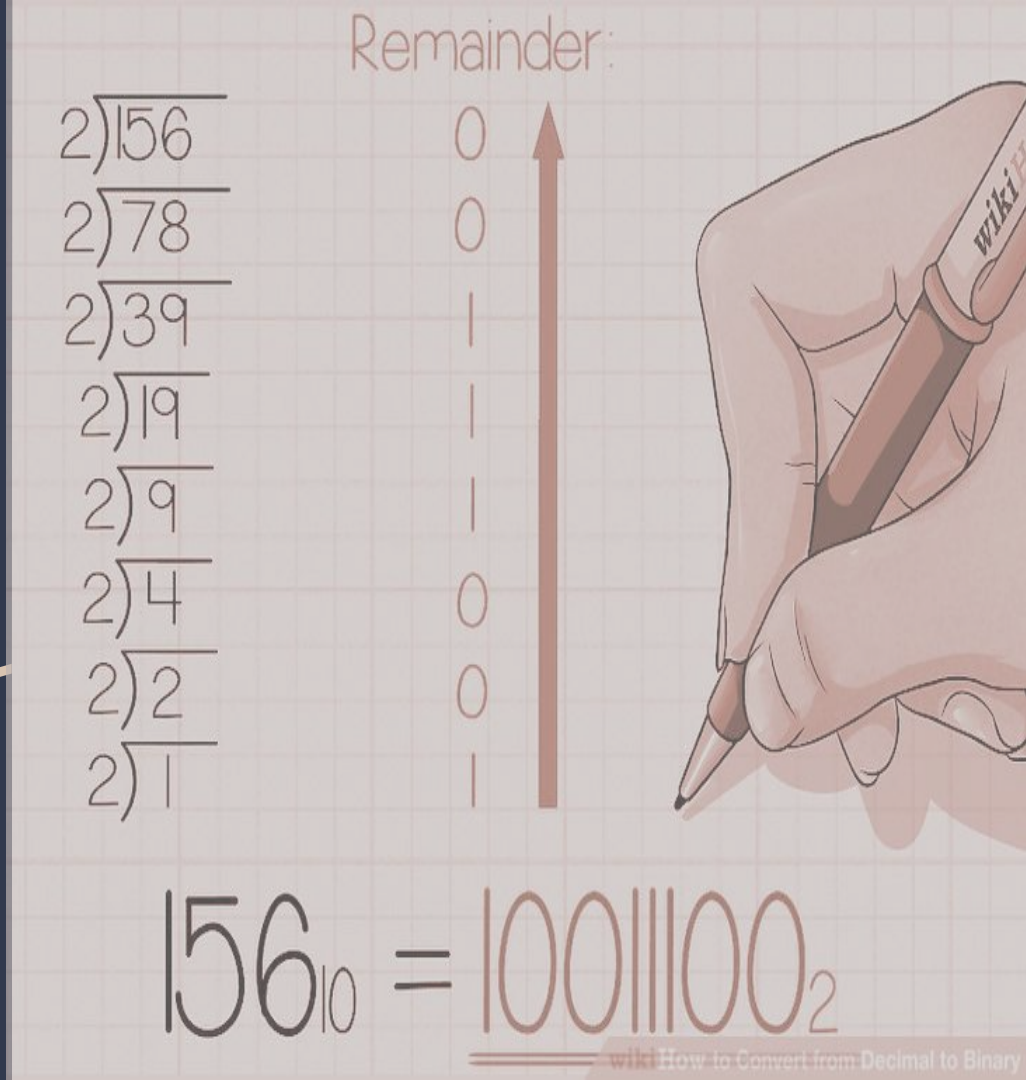
9 $\xrightarrow{8(2^3)}$ 1

1 $\xrightarrow{1(2^0)}$ 0

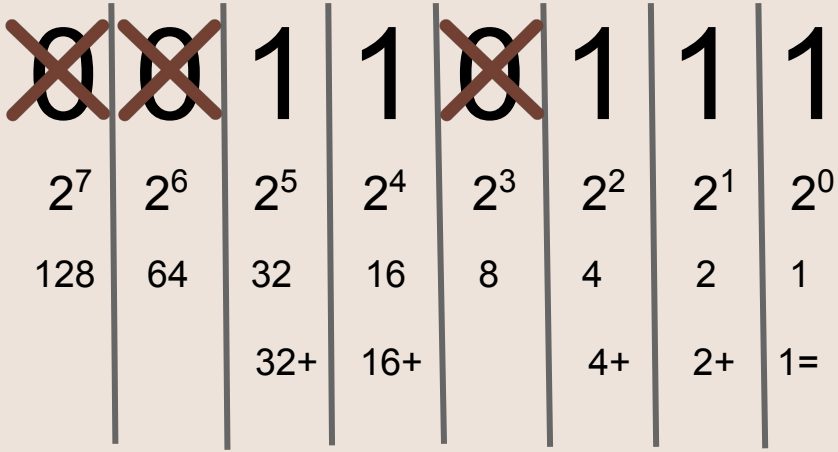


Converting Decimal to Binary:

Method 2



Converting Binary to Decimal



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Hexadecimal

What is hexadecimal?

- Hexadecimal is useful for representing large numbers as fewer digits
  - Hex uses 0-9 to represent the values of zero to nine and A, B, C, D, E, and F to represent 10-15
- Hexadecimal is a more human-friendly representation of binary

Converting Hexadecimal to Binary

decimal	hexadecimal	binary
0	0	0000
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
10	A	1010
11	B	1011
12	C	1100
13	D	1101
14	E	1110
15	F	1111

We will convert **4B9F1** into binary

Hex	4	B	9	F	1
Decimal	4	11	9	15	1
Binary	0100	1011	1001	1111	0001

4B9F1=01001011100111110001

Converting Binary to Hexadecimal

decimal	hexadecimal	binary
0	0	0000
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
10	A	1010
11	B	1011
12	C	1100
13	D	1101
14	E	1110
15	F	1111

We will convert **0001110000110111110**

Binary	0001	1100	0001	1011	1110
Decimal	1	12	1	11	14
Hex	1	C	1	B	E

0001110000110111110= 1C1BE

Sources

- Information:
  - https://en.wikipedia.org/wiki/Binary_code#Other_forms_of_binary_code
  - https://en.wikipedia.org/wiki/Hexadecimal
  - https://en.wikipedia.org/wiki/Decimal
  - Lesson Notes
- Images:
  - http://www.toscana-notizie.it/-/irpet-rapporto-economia-toscana-2015-l-uscita-dalla-crisi
  - http://www.wikihow.com/Convert-from-Decimal-to-Binary
  - http://www.wikihow.com/Convert-from-Binary-to-Decimal
  - https://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&ved=0ahUKEwiT7Pyju8rVAhXi7IMKHY9oBiAQjxwIAw&url=http%3A%2F%2Fwww.sparcpoint.com%2FBlog%2FPost%2Fhex-is-not-hard&psig=AFQjCNEzJ7o9ollMZhGmzXaS9wFrEGXWjw&ust=1502378790553997
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