



BINARY

Bit = binary digit
Number base = the number of unique digits used to represent values.

You are probably most familiar with the decimal number system, where numbers are represented with base-10.

There are 10 unique numerals used to represent values. Each digit is 10 times more significant than the previous digit.

0 1 2 3 4 5 6 7 8 9 ≈ 10 digits

The hexadecimal system is base-16.

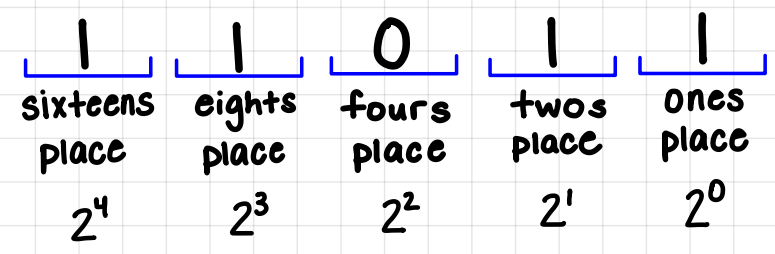
0 1 2 3 4 5 6 7 8 9 A B C D E F

The octal number system is base-8.

0 1 2 3 4 5 6 7

The binary number system is base-2.

0 1



We can denote the number system we are using by including the base as a subscript.

100_2

100_{10}

100_8

Convert Binary to Decimal

01010101

Start from the right.

- 1 • $2^0 = 1$
- 0 • $2^1 = 0$
- 1 • $2^2 = 4$
- 0 • $2^3 = 0$
- 1 • $2^4 = 16$
- 0 • $2^5 = 0$
- 1 • $2^6 = 64$
- 0 • $2^7 = 0$

The result is the sum of these products.

$1 + 0 + 4 + 0 + 16 + 0 + 64 + 0 =$

85

Convert Decimal to Binary

85

- ① Divide by 2.
- ② Write down the remainder.
- ③ Divide the result by 2 and repeat.

Record the remainders from right to left.

$85 \div 2 = 42$	Remainder = 1
$42 \div 2 = 21$	Remainder = 0
$21 \div 2 = 10$	Remainder = 1
$10 \div 2 = 5$	Remainder = 0
$5 \div 2 = 2$	Remainder = 1
$2 \div 2 = 1$	Remainder = 0
$1 \div 2 = 0$	Remainder = 1

1010101