code decoded

# 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

| 1 | 1 | 0 | 1 | 1 |
|---|---|---|---|---|
| sixteens place | eights place | fours place | twos place | ones place |
| $2^4$ | $2^3$ | $2^2$ | $2^1$ | $2^0$ |

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.

$1 \cdot 2^0 = 1$
$0 \cdot 2^1 = 0$
$1 \cdot 2^2 = 4$
$0 \cdot 2^3 = 0$
$1 \cdot 2^4 = 16$
$0 \cdot 2^5 = 0$
$1 \cdot 2^6 = 64$
$0 \cdot 2^7 = 0$

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.

| | |
|---|---|
| $85 / 2 = 42$ | Remainder = 1 |
| $42 / 2 = 21$ | Remainder = 0 |
| $21 / 2 = 10$ | Remainder = 1 |
| $10 / 2 = 5$ | Remainder = 0 |
| $5 / 2 = 2$ | Remainder = 1 |
| $2 / 2 = 1$ | Remainder = 0 |
| $1 / 2 = 0$ | Remainder = 1 |

1010101