

## Binary Numbers

How do we count in binary?

0 = 0000

1 = 0001

2 = 0010

3 = 0011

4 = 0100

5 = 0101

...

### Adding in Binary

It's the same as in decimal:

9

+1

----

10 (zero, carry the one)

Carry the one in binary as well

0001    1

+0001   + 1

-----

00010   2

### Converting Binary to Decimal

First let's look at decimal representation.

Decimal uses base 10, so values are based on multiples of 10.

4096 =

$4*1000 + 0*100 + 9*10 + 6*1$

In binary we use base 2.

So a binary number can be represented as:

1011 =

$1*2^3 + 0*2^2 + 1*2^1 + 1*2^0$

$= 1*8 + 0*4 + 1*2 + 1*1$

$= 8 + 0 + 2 + 1$

$= 11$

### Converting Decimal to Binary

Here we use division for the conversion:

Do division the "old school" way, showing the hierarchy and remainder after each division

## Binary Numbers Practice Problems

The nice thing about these problems, is that you can check your answers yourself.

1. Convert the binary number 1010010 to decimal:
2. Convert the binary number 1111110 to decimal:
3. How can you tell right away whether a binary number is even or odd?
4. Convert the decimal number 42 to binary:
5. Convert the decimal number 4096 to binary:
6. How many bits are required to represent 9 items?
7. How many bits are required to represent the alphabet?