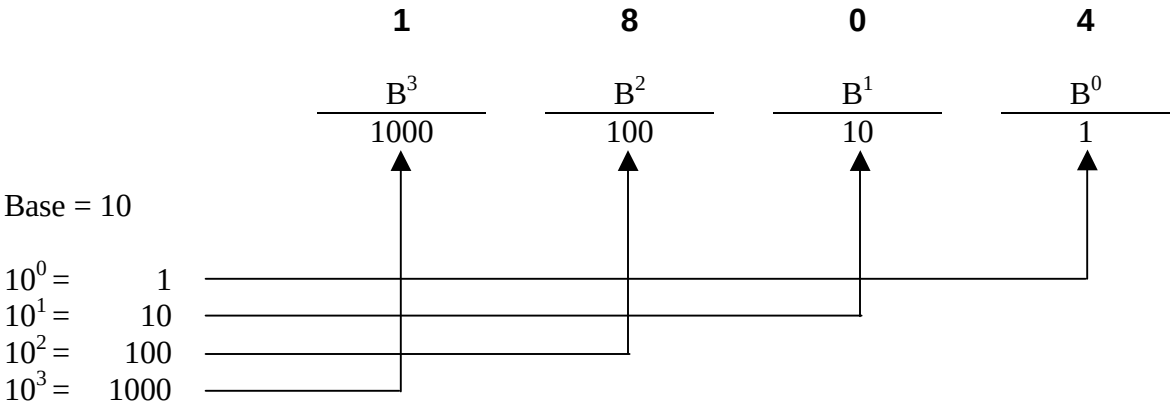
Place Valued Numbering Systems

Decimal – Base 10

How Decimal Numbers Work:
Example: **1804** Decimal

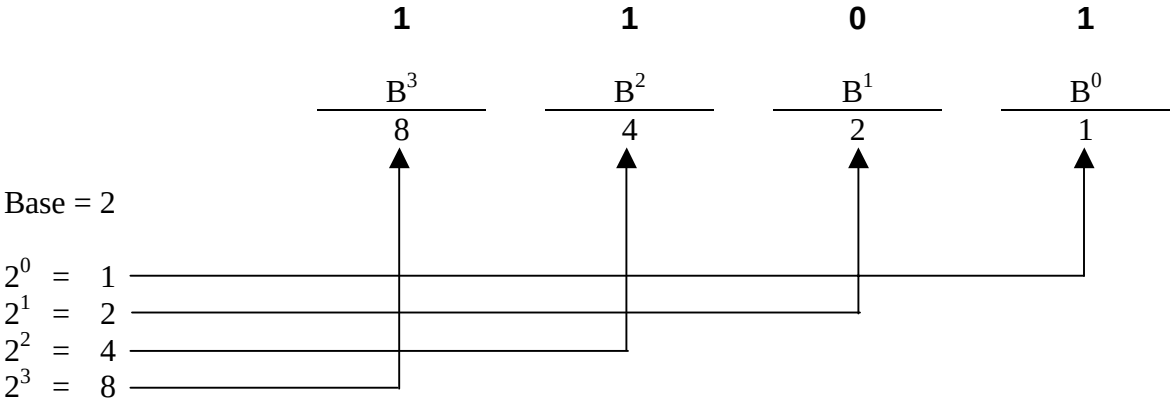


10^0 x 4 = 1 x **4** = 4
10^1 x 0 = 10 x **0** = 0
10^2 x 8 = 100 x **8** = 800
10^3 x 1 = 1000 x **1** = 1000

Add **1804** Decimal

Binary – Base 2

Convert Binary numbers to Decimal numbers:
Example: **1101** Binary



2^0 x 1 = 1 x **1** = 1
2^1 x 0 = 2 x **0** = 0
2^2 x 1 = 4 x **1** = 4
2^3 x 1 = 8 x **1** = 8

Add 13 Decimal

Hex – Base 16

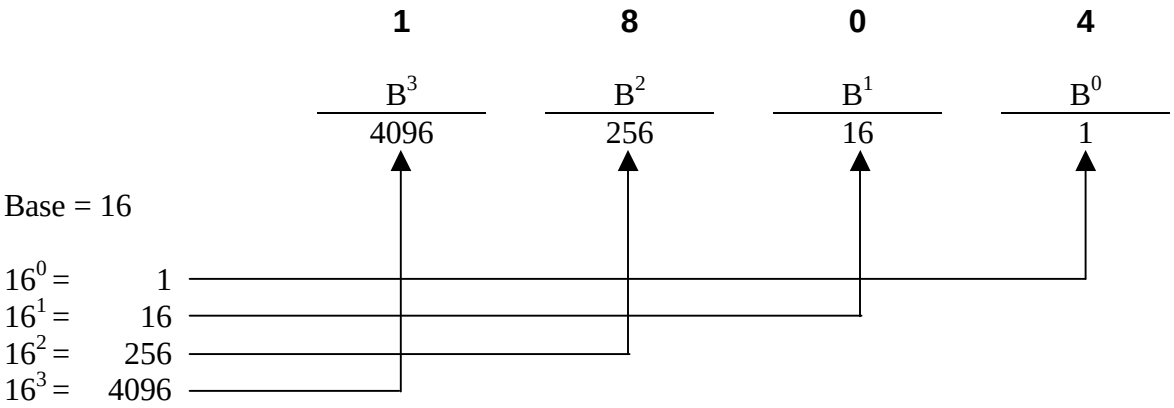
Hex is a base 16 numbering system.

Since a base 16 numbering system needs 16 different symbols, it uses the normal ten from the decimal numbering system (0 – 9) and then the first six letters of the alphabet (A, B, C, D, E, F).

Decimal	Binary	Hex
00	0000	00
01	0001	01
02	0010	02
03	0011	03
04	0100	04
05	0101	05
06	0110	06
07	0111	07
08	1000	08
09	1001	09
10	1010	0A
11	1011	0B
12	1100	0C
13	1101	0D
14	1110	0E
15	1111	0F

Convert Hex numbers to Decimal numbers

Example: **1804** Hex



16^0 x 4 = 1 x **4** = 4
16^1 x 0 = 16 x **0** = 0
16^2 x 8 = 256 x **8** = 2048
16^3 x 1 = 4096 x **1** = 4096

Add 6148 Decimal

Why use Hex to represent binary numbers?

Long strings of binary numbers are too hard to read, they will make you go cross eyed!! It's much easier to read groups of hex numbers.

Convert Binary to Hex

Example: **1011101101010**

= **1 0111 0110 1010**

0 0 0 **1**	**0 1 1 1**	**0 1 1 0**	**1 0 1 0**
8 4 2 1	8 4 2 1	8 4 2 1	8 4 2 1
__ __ __ **1**	__ **1 1 1**	__ **1 1** __	**1** __ **1** __
8 4 2 1	8 4 2 1	8 4 2 1	8 4 2 1
1	4+2+1=7	4+2=6	8+2=10 Dec =A Hex

Final Hex number = 176A Hex

Convert Hex to Binary

The conversion from a hex digit to binary and back is so simple it can be done manually with little chance for error.

Example: **6B35** Hex

6	**B**	**3**	**5**
__ __ __ __	__ __ __ __	__ __ __ __	__ __ __ __
8 4 2 1	8 4 2 1	8 4 2 1	8 4 2 1
4+2=6	8+2+1=11 Dec = B Hex	2+1=3	4+1=5
__ 1 1 __	1 __ 1 1	__ __ 1 1	__ 1 __ 1
8 4 2 1	8 4 2 1	8 4 2 1	8 4 2 1
0 1 1 0	1 0 1 1	0 0 1 1	0 1 0 1

Final Binary number = 0110 1011 0011 0101 = 110101100110101 Binary

How to write Hex numbers

Either put an "h" after the number, or put "ox" in front of the number

0x52 = 52h