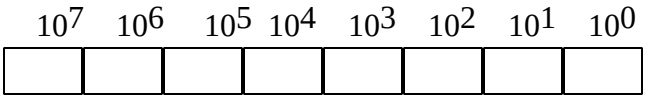
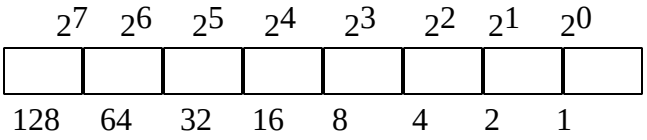
Number Systems

Decimal Number Set: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9



Example: $1024 = 4\times1 + 2\times10 + 0\times100 + 1\times1000$

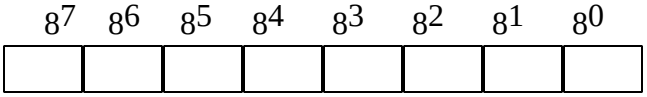
Binary Number Set: 0, 1



Example: $1010 = 0\times1 + 1\times2 + 0\times4 + 1\times8 = 10$ in decimal

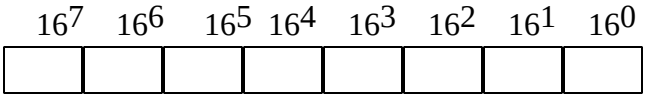
11111111= 255 in decimal

Octal Number Set: 0, 1, 2, 3, 4, 5, 6, 7



Example: $121_8 = 1\times1 + 2\times8 + 1\times64 = 81$ in decimal

Hexadecimal or HEX Number Set: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F



Example: $FF = 15\times1 + 15\times16 = 255$ in decimal

An easy way to convert an eight digit binary number to a two digit hexadecimal number is to treat the 8 digit binary as two hexadecimal numbers consisting of 4 binary numbers. See table below:

Binary	*Hex*
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

.

So, the 8 digit binary number

$$0011\ 1011 \Rightarrow 3B$$

since 0011 in hexadecimal is 3 and 1011 in hexadecimal is B.

Converting Decimal to Binary

Example: Convert 52_{10} to binary.

52/2 rem = 0 = a_0
26/2 rem = 0 = a_1
13/2 rem = 1 = a_2
6/2 rem = 0 = a_3
3/2 rem = 1 = a_4
1/2 rem = 1 = a_5

So 52_{10} in binary is = $a_5\ a_4\ a_3\ a_2\ a_1\ a_0$ = 110100

Binary Arithmetic

Addition table for binary numbers:

0 + 0 = 0
0 + 1 = 1
1 + 0 = 1
1 + 1 = 0 and carry 1 to the next column

Subtraction table for binary numbers:

0 – 0 = 0
0 – 1 = 1 and borrow 1 from the next column
1 – 0 = 1
1 – 1 = 0

Multiplication table for binary numbers:

$0 \times 0 = 0$
$0 \times 1 = 0$
$1 \times 0 = 0$
$1 \times 1 = 1$