Octal and Hexadecimal

Aka: Base 8 & Base 16

Octal - Base 8

Works the same!

Base 8 has 8 digits

{ 0, 1, 2, 3, 4, 5, 6, 7 }

Counting...

0
1
2
3
4
5
6
7
10
11
...

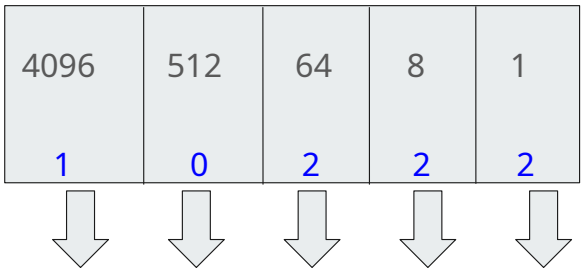
Columns

Base 8! Columns are:

8^4	8^3	8^2	8^1	8^0
4096	512	64	8	1

Conversion from Octal to Decimal

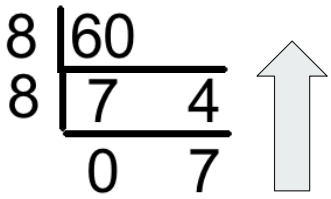
Ex: Convert 10222_8 to Decimal



4096 + 0 + 128 + 16 + 2

= 4242

Converting from Decimal to Octal



$=74_8$

Something New!

Ever wondered how addition works?

$$\begin{array}{r} 35_8 \\ +\ 27_8 \\ \hline 64_8 \end{array}$$

Again!

$$\begin{array}{r} 7425_8 \\ +\ 1261_8 \\ \hline 10706_8 \end{array}$$

And now... from Octal to Binary?

First, how many binary bits to represent a single value from 0-7?

Three! So, simply replace each Octal value

with 3 corresponding bits

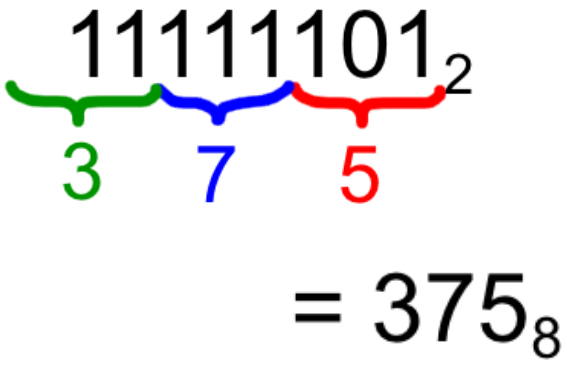
$$375_8$$

$$011\ \ 111\ \ 101$$

$$=11111101_2$$

And back again?

Reverse the process - remember to start from the RIGHT!



Hexadecimal - Base 16

Works the same!

Base 16 has 16 digits

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

0	C	18
1	D	19
2	E	1A
3	F	1B
4	10	1C
5	11	1D
6	12	1E
7	13	1F
8	14	20
9	15	...
A	16	
B	17	

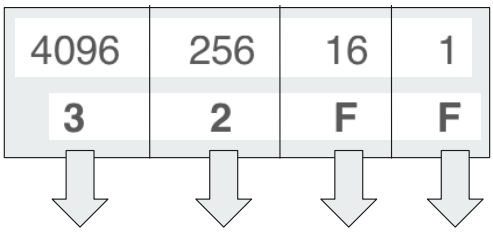
Columns

Base 16! Columns are:

16^3	16^2	16^1	16^0
4096	256	16	1

Conversion from Hex to Decimal

Ex: Convert $32FF_{16}$ to Decimal



12288 + 512 + 240 + 15

= 13055

F → 15
16 * 15 = 240

Converting from Decimal to Hex

16	2227		
16	139	3	
16	8	11 ->	B
16	0	8	

$$= 8B3_{16}$$

More Addition

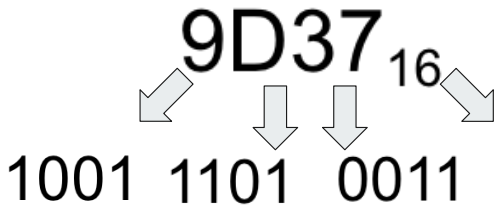
$$\begin{array}{r} 1A4 \\ +\ 2E \\ \hline 1D2 \end{array}$$

And now... from Hex to Binary?

First, how many binary bits to represent a single value from 0-15?

FOUR! So, simply replace each Hex value

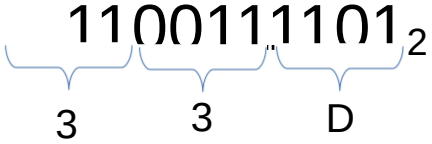
with 4 corresponding bits



$$= 1001110100110111_2$$

And back again?

Reverse the process - **remember to start from the RIGHT!**



$$= 33D_{16}$$

Practice

1. Convert each of the following:
   a) 11001101101111_2 to octal
   b) 1011101010011_2 to hexadecimal
2. Convert each of the following:
   a) 123_8 to binary
   b) $FACE_{16}$ to binary
3. Convert each of the following:
   a) BEE_{16} to octal
   b) 765_8 to hexadecimal
4. Convert each of the following:
   a) 246_8 to decimal
   b) $7EE_{16}$ to decimal

Practice

1. Convert each of the following:
   a) 11001101101111_2 to octal
   $= 31557_8$
   b) 1011101010011_2 to hexadecimal
   1 7 5 3 $= 1753_{16}$
2. Convert each of the following:
   a) 123_8 to binary
   $= 1010011_2$
   b) $FACE_{16}$ to binary
   $= 1111\ 1010\ 1100\ 1110_2$
3. Convert each of the following:
   a) BEE_{16} to octal
   $= 5756_8$
   b) 765_8 to hexadecimal
   $= 1F5_{16}$
4. Convert each of the following:
   a) 246_8 to decimal
   $= 166_{10}$
   b) $7EE_{16}$ to decimal
   $= 2030_{10}$