Base Conversion

David Greenstein
Monta Vista High School

DECIMAL/OCTAL/BINARY

- On and off can be thought of as 0 and 1.
- 0 and 1 are known as bits or BInary digiT.

Decimal (base 10)	Octal (base 8)	Binary (base 2)
0	0	0
1	1	1
2	2	10
3	3	11
4	4	100
5	5	101
6	6	110
7	7	111
8	10	1000
9	11	1001
10	12	1010

LARGE NUMBERS IN BINARY

Break down binary "word" into powers of 2.

Decimal	Binary 2^3	2^2	2^1	2^0
2	0	0	1	0
5	0	1	0	1
15	1	1	1	1

What about 35?

Octal & Hexadecimal

- Octal has a base of 8 or 3 bits
- Hexadecimal has a base of 16 or 4 bits
- Both are useful for very long numbers or data with a large range (like color and addresses in memory)

Octal	Hexadecimal
0	0
1	1
2	2
3	3
4	4
11	9
12	A
13	B
14	C
15	D
16	E
17	F
20	10

OCTAL CONVERSION

$127_8 = ?_2$

Binary	Octal
000	0
001	1
010	2
011	3
100	4
101	5
110	6
111	7

Create a Conversion Chart

Decimal	Binary	Octal	Hex
0			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

Converting Binary to Hexadecimal

$1101011010110_2 = ?_{16}$

1) Group the binary number into sets of 4 digits from right to left.

$1\ \ 1010\ \ 1101\ \ 0110_2 = ?_{16}$

Converting Binary to Hexadecimal

$1101011010110_2 = ?_{16}$

1) Group the binary number into sets of 4 digits from right to left.

2) Pad zero digits to the left of your number to make the number of digits a multiple of 4.

0001 1010 1101 $0110_2 = ?_{16}$

Converting Binary to Hexadecimal

$1101011010110_2 = ?_{16}$

1) Group the binary number into sets of 4 digits from right to left.

2) Pad zero digits to the left of your number to make the number of digits a multiple of 4.

3) Using your conversion chart, convert each 4 digit group to a hexadecimal number.

$0001\ \ 1010\ \ 1101\ \ 0110_2 = \mathbf{1AD6}_{16}$

Converting Binary to Hexadecimal

Convert this binary into hexadecimal.

$$10100101110000110101110_2$$

Convert this into decimal.