Numerical Conversion:

Understanding Bits----------------------------------------------------

Look at C++ Review for this information regard how many bits each data type can hold: <https://docs.google.com/document/d/1eJj4oXB9IiNQ2gDJMOQTHeFICFuZPy-glFcpXBP0f40/edit?usp=sharing>

Unsigned numbers bits (add one it will become 0 again (wraps around)):

0 = 0000

1 = 0001

2 = 0010

3 = 0011

4 = 0100

5 = 0101

6 = 0110

7 = 0111

8 = 1000

9 = 1001

10 = 1010

1 1 1 1 1 1 1 1 1 1

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2^8 2^7 2^6 2^5 2^4 2^3 2^3 2^2 2^1 2^0

Signed (After 3 the numbers become negative):

000 = 0

001 = 1

010 = 2

011 = 3 (biggest possible number)

100 = -4

101 = -3

110 = -2

111 = -1

Decimal <-> Binary----------------------------------------------------

Decimal Binary Decimal Binary

0 0000 8 1000

1 0001 9 1001

2 0010 10 1010

3 0011 11 1011

4 0100 12 1100

5 0101 13 1101

6 0110 14 1110

7 0111 15 1111

How to Binary to Decimal

1. Organize a series of starting from 0 going left to right

Ex: ...

1. Multiply 1 or 0 to its corresponding value

Ex: 1 1 0 1 =

1. Sum of all the multiplied values

Ex:

How to Decimal to Binary

1. Organize a series of starting from 0 going left to right

Ex: ...

1. Find largest value that is ≤ to the decimal value

Ex: Decimal = 13 -> -> (is too big)

1. Place a 1 where will help add up to decimal value (else place a 0)

Ex: 1 1 0 1 =

1. Check if sum all the multiplied values = decimal value

Ex:

Decimal <-> Hexadecimal-------------------------------------------

Decimal Hexadecimal Decimal Hexadecimal

0 0 8 8

1 1 9 9

2 2 10 A

3 3 11 B

4 4 12 C

5 5 13 D  
6 6 14 E

7 7 15 F

How to Hexadecimal to Decimal

1. Organize a series of starting from 0 going left to right

Ex: ...

1. Convert Letter values into decimal equivalent

Ex: Hex = 4 -> Dec = 4 Hex = B -> Dec = 11

1. Multiply values to its corresponding value

Ex: 0 4 0 10 =

1. Sum of all the multiplied values

Ex:

How to Decimal to Hexadecimal

1. Organize a series of starting from 0 going left to right

Ex: ...

1. Find largest value that is ≤ to the decimal value

Ex: Decimal = 17 -> ->

1. Place a value x = {0 ,...,15} where will help add up to decimal value (else place a 0)

Ex: 0 4 0 10 =

1. Check if sum all the multiplied values = decimal value

Ex:

1. Replace values of x greater than 9 with corresponding letters from A to F

Ex: D = 4 -> X = 4 D = 11 -> X = B

//The 0x is for formatting, do not consider it for the conversion

Binary <-> Hexadecimal----------------------------------------------

Binary Hexadecimal Binary Hexadecimal

0000 0 1000 8

0001 1 1001 9

0010 2 1010 A

0011 3 1011 B

0100 4 1100 C

0101 5 1101 D  
0110 6 1110 E

0111 7 1111 F

How to Binary to Hexadecimal

1. Organize a series of starting from 0 going left to right

Ex: ...

1. Multiply 1 or 0 to its corresponding value

Ex: 1 1 0 1 =

1. Sum of all the multiplied values

Ex:

1. Convert Decimal Value to corresponding Hexadecimal

Ex: D = 13 -> X = D

How to Hexadecimal to Binary

1. Convert Hexadecimal Value to corresponding Decimal
2. Convert Decimal to Binary Equivalent