

Binary to Decimal:

- Each digit in binary represents a power of 2
- Starting from the right: 2^0 , 2^1 , 2^2 ...
- The decimal answer is the sum of all the powers of 2 that have a 1 in its corresponding slot (skip it if it has a 0)
- Example:
 - **1011 0101**
 - From right to left: $2^0 + 2^2 + 2^4 + 2^5 + 2^7 = 181$

Decimal to Binary:

- Every decimal number can be expressed as a sum of binary numbers (use binary-decimal conversions as proof); every number can be represented in another base
- Basic algorithm:
 - Given a decimal number, find the biggest power of 2 that can fit inside that number
 - Subtract that power of 2 from that number
 - Repeat the process until you get 0 (remember that 1 is a power of 2; $2^0 = 1$)
 - The resulting binary number is the result of all those powers of 2 (put a 1 for each corresponding binary digit used, 0 if it's not used)
 - (Optional): Split into groups of 4 and add 0's to make it even
- Example:
 - **300**
 - $300 = 256 + 32 + 8 + 4$
 - $2^8 + 2^5 + 2^3 + 2^2$
 - **0001 0010 1100**

Hexadecimal to Decimal:

- Hex numbers go from 0-9, A-F
- Easy way is to first convert to binary
- Convert each hexadecimal digit into a set of 4 binary numbers
- Convert that binary number to decimal
- Example:
 - **A9**
 - $A = 10 = 1010$
 - $9 = 1001$
 - 1010 1001
 - $1010\ 1001 = 2^0 + 2^3 + 2^5 + 2^7 = 169$

Decimal to Hexadecimal:

- Easier (in my opinion) to convert the decimal into its binary equivalent
- Split the binary numbers into groups of 4
- Convert each set of 4 binary numbers into its corresponding hexadecimal digit
- Example:
 - **72**
 - $72 = 0100\ 1000 = 48$ (NOTE THAT 48 IN HEX IS NOT THE SAME AS 48 IN DECIMAL)