Lecture 1 - Number Systems

CONVERTING HEXADECIMAL TO DECIMAL

Steps:

1. Get the last digit of the hex number, call this digit the **currentDigit**.
2. Make a variable, let's call it **power**. Set the value to 0.
3. Multiply the **current digit** with (16^**power**), store the result.
4. Increment **power** by 1.
5. Set the the **currentDigit** to the previous digit of the hex number**.**
6. Repeat from step 3 until all digits have been multiplied.
7. Sum the result of step 3 to get the answer number.

Example 1

Convert the number **1128** HEXADECIMAL to DECIMAL

MULTIPLICATION	RESULT	NOTES
8 x (16^0)	8	Start from the last digit of the number. In this case, the number is 112**8**. The last digit of that number is **8**. Note that any number the power of 0 is always 1 Also note the notation **(16^0)**means 16^0, and **(16^1)** means 16^1, and **(16^2)** means 16^2, and so on.
2 x (16^1)	32	Process the previous, which is **2**. Multiply that number with an increasing power of 16.
1 x (16^2)	256	Process the previous digit, which is **1**, note that **16^2**means 16^2 or **16 x 16**
1 x (16^3)	4096	Process the previous digit, which is **1**, note that 16^3 means 16 x 16 x 16
		Here, we stop because there's no more digit to process

ANSWER	4392	This number comes from the **sum** of the RESULTS (8+32+256+4096)=4392

Once discerned, notice that the above process is essentially performing this calculation:

1x(16^3) + 1x(16^2) + 2x(16^1) + 8x(16^0)

When doing this by hand, it is easier to start backward is because:

- Counting the number of digits takes extra time, and you might count wrongly.
- If you don't remember what a particular value of 16 to the power of n, it's easier to calculate it from the previous power of n value. For instance, if you don't remember what the value of 16^3 is, then just multiply the value of 16^2 (which you'll likely already have if you started backward) with 16.

Example 2

Convert the number **589** HEXADECIMAL to DECIMAL

MULTIPLICATION	RESULT
9 x (16^0)	9
8 x (16^1)	128
5 x (16^2)	1280
ANSWER	1417

If you want to be a speed counter, it's beneficial to memorize the values of the smaller power of 16s, such as in this table

POWER OF 16s	RESULT
16^0	1
16^1 = 16	16
16^2 = 16x16	256
16^3 = 16x16x16	4096
16^4 = 16x16x16x16	65536

Example 3

Convert the number **1531** HEXADECIMAL to DECIMAL
(This time, let's use the table of the power-of-16s above.)

MULTIPLICATION	RESULT
1 x 1	1
3 x 16	48
5 x 256	1280

1 x 4096	4096
ANSWER	5425

Example 4

Convert the number **FA8** HEXADECIMAL to HEXADECIMAL

MULTIPLICATION	RESULT
8 x 1	8
A x 16 (remember that hex A=decimal 10)	160
F x 256 (remember that hex F=decimal 15)	3840
ANSWER	4008

Example 5

Convert the number **8F** HEXADECIMAL to DECIMAL

DIVISION	RESULT
F x 1	15
8 x 16	128
ANSWER	143

Example 6

Convert the number **A0** HEXADECIMAL to DECIMAL

DIVISION	RESULT
0 x 1	0
A x 16	160
ANSWER	160

Example 7

Convert the number **12** HEXADECIMAL to DECIMAL

DIVISION	RESULT
2 x 1	2
1 x 16	16

1 x 16	16
ANSWER	18

Example 8

Convert the number **35432** HEXADECIMAL to DECIMAL

2x(16^0) + 3x(16^1) + 4x(16^2) + 5x(16^3) + 3x(16^4) =
2 + 3x16 + 4*256 + 5*4096 + 3*65536 =
2 + 48 + 1024 + 20480 + 196608 =
218162