Hexadecimals (part 1) [Andy Chong Sam]

(I) The hexadecimal number system is one based on powers of 16. As such, the system contains 16 symbols. The first 10 symbols correspond exactly to the Hindu-Arabic numbers used in decimals. Digits 10 through 15 are represented with A, B, C, D, E, F respectively. These are summarized below:

Decimal	Hexadecimal	Binary
0	0	0000
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
10	A	1010
11	B	1011
12	C	1100
13	D	1101
14	E	1110
15	F	1111

(II) We'll denote hexadecimals, binary numbers, and decimals with the subscripts 16, 2, and 10 respectively. So let's figure out what $(F4A)_{16}$ is in decimal. Going from right to left, A is in position 0, 4 is in position 1, and F is in position 2, so:

$$(15)(16)^2 + (4)(16)^1 + (10)(16)^0 = 3,914$$
$$\text{so } ...(F4A)_{16} = (3,914)_{10}$$

(III) We can take a decimal number and transform it into a hexadecimal by continuously dividing by 16 and recording the remainder. Let's convert $(117)_{10}$ into a hexadecimal:

$$\begin{array}{r} 7 \\ 16\overline{)117} \\ \underline{112} \\ 5 \end{array} \qquad \begin{array}{r} 0 \\ 16\overline{)7} \end{array}$$

We get a remainder sequence of 5 followed by 7, the hexadecimal is the reverse of this sequence so $(117)_{10} = (75)_{16}$.

We can always check this result by converting $(75)_{16}$ to decimal:

$$(7)(16)^1 + (5)(16)^0 = 117$$

(IV) Let's try to convert $(17,319)_{10}$ into a hexadecimal:

$$\begin{array}{r} 1082 \\ 16\overline{)17319} \\ \underline{16} \\ 131 \\ \underline{128} \\ 39 \\ \underline{32} \\ 7 \end{array} \qquad \begin{array}{r} 67 \\ 16\overline{)1082} \\ \underline{96} \\ 122 \\ \underline{112} \\ 10 \end{array} \qquad \begin{array}{r} 4 \\ 16\overline{)67} \\ \underline{64} \\ 3 \end{array} \qquad \begin{array}{r} 0 \\ 16\overline{)4} \end{array}$$

The remainder sequence of 7,10,3,4 is reversed (remembering that the symbol for 10 is A) to get 43A7, so:

$$(17,319)_{10} = (43A7)_{16}$$

Just like before we can verify this solution:

$$(4)(16)^3 + (3)(16)^2 + (10)(16)^1 + (7)(16)^0 = 17,319$$