1. Introductory Practice

The set of digits in the base-10 (decimal) number system is {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}

a) Write out the set of digits in the octal (base-8) number system (__/1)

b) Write out the set of digits in the binary (base-2) number system (__/1)

c) Write out the set of digits in the hexadecimal (base-16) number system (__/1)

2. Digits

For the decimal number 2,368, we can extend this as:

Thousands 10^3	**Hundreds** 10^2	**Tens** 10^1	**Ones** 10^0
2	3	6	8

And then as the mathematical equation $2 \cdot 10^3 + 3 \cdot 10^2 + 6 \cdot 10^1 + 8 \cdot 10^0$

For the binary number 0100 0001, we can write it as:

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

And then as: $1 \cdot 2^6 + 1 \cdot 2^0$

a) Write out the number $(19)_{10}$ *(19 base-10)* as a mathematical equation (__/1)

10^1	10^0

b) Write out the number $(0101101)_2$ *(binary)* as a mathematical equation (__/1)

2^5	2^4	2^3	2^2	2^1	2^0

c) Write out the number $(FFAA66)_{16}$ *(hexadecimal)* as a mathematical equation (__/1)

16^5	16^4	16^3	16^2	16^1	16^0

3. Converting

Algorithm for converting a decimal number to ***base b***:

1. Input a natural number *n*
2. While n > 0, do the following:
    1. Divide *n* by *b* and get a quotient *q* and remainder *r*.
    2. Write *r* as the next (right-to-left) digit.
    3. Replace the value of *n* with *q*, and repeat.

a) Convert $(35)_{10}$ to binary (__/1)

b) Convert $(125)_{10}$ to binary (__/1)

c) Convert $(123)_{10}$ to base-5 (__/1)

Hexadecimal to Binary

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

Example: Convert 11001 from binary to hex
1. Write out in chunks of four: 0001 1001
2. Swap out each “nibble” with hex: 1 9

$$(11001)_2 = (19)_{16}$$

Example: Convert DAD from hex to binary
1. Convert each digit to binary: D = 1101 A = 1010 D = 1101

$$(DAD)_{16} = (1101\ \ 1010\ \ 1101)_2$$

a) Convert $(1F0B)_{16}$ to binary

b) Convert $(01000110)_2$ to hexadecimal