1. $n = \sum(d_i \times base^i)$

a. 0x BABE $\xrightarrow{\text{binary}}$ 1011 1010 1011 1110 $\xrightarrow{\text{invert all bits +1}}$

negative integer

→ 0100 0101 0100 0010

$= 1\times2^{14} + 1\times2^{10} + 1\times2^{8} + 1\times2^{6} + 1\times2^{1}$

$= (1\times16384)+(1\times1024)+(1\times256)+(1\times64)+(1\times2)$

$= 17730$ ∴ answer = -17730

b. 0x DADE $\xrightarrow{\text{binary}}$ 1101 1010 1101 1110 $\xrightarrow{\text{invert all bits +1}}$

negative integer

→ 0010 0101 0010 0010

$= 1\times2^{13} + 1\times2^{10} + 1\times2^{8} + 1\times2^{5} + 1\times2^{1}$

$= (1\times8192)+(1\times1024)+(1\times256)+(1\times32)+(1\times2)$

$= 9506$ ∴ answer = -9506

c. 0x 4ACE $\xrightarrow{\text{binary}}$ 0100 1010 1100 1110

$= 1\times2^{14} + 1\times2^{11} + 1\times2^{9} + 1\times2^{7} + 1\times2^{6} + 1\times2^{3} + 1\times2^{2} + 1\times2^{1}$

$= (1\times16384)+(1\times2048)+(1\times512)+(1\times128)+(1\times64)+(1\times8)+(1\times4)+(1\times2)$

$= 19150$ #

2. Using Horner's nest form

a. -2011, try to calculate 2011 first, in binary, minus 1 and invert all bits

2011		remainder
	2011/2	1
	1005/2	1
	502/2	0
	251/2	1
	125/2	1
	62/2	0
	31/2	1
	15/2	1
	7/2	1
	3/2	1
	1/2	1

2011 result = 1111 1011 111, extension to 32 bits

0000 0000 0000 0000 0000 0111 1101 1011

1111 1111 1111 1111 1111 1000 0010 0101

$\xrightarrow{\text{hex}}$ 0x FFFFF825 #

b. 9804

	remainder
9804/2	0
4902/2	0
2451/2	1
1225/2	1
612/2	0
306/2	0
153/2	1
76/2	0
38/2	0
19/2	1
9/2	1
4/2	0
2/2	0
1/2	1

9804 in binary

= 1001 1001 0011 00 , extension to 32 bits

0000 0000 0000 0000 0010 0110 0100 1100

$\xrightarrow{hex}$ 0x 0000 264C

3. a. -0.1875

$S = 1$

$-0.1875 = \left(-\frac{1}{8}\right) + \left(-\frac{1}{16}\right) = \left(-\frac{3}{16}\right) = -1 \times 11_2 \times 2^{-4}$

$= -1 \times 1.1_2 \times 2^{-3}$

Fraction = $100\ldots00_2$

Exponent = $-3 + \text{bias} = -3 + 127 = 124 = 01111100_2$

answer = 1 01111100 10000000000000000000000

b. 0.46875

$S = 0$

$0.46875 = \left(\frac{1}{4}\right) + \left(\frac{1}{8}\right) + \left(\frac{1}{16}\right) + \left(\frac{1}{32}\right) = \left(\frac{15}{32}\right) = 1 \times 1111_2 \times 2^{5}$

$= 1 \times 1.111_2 \times 2^{2}$

Fraction = $1110..00_2$

Exponent = $2 + 127 = 129 = 10000001_2$

answer = 0 10000001 11100000000000000000000

4. a. 3F000000 $\xrightarrow{\text{binary}}$ $\underset{S}{0}\ \underbrace{0111111\,0}_{\text{exponent}}\ \underbrace{000\ 0000\ 0000\ \ldots\ 0000}_{\text{Fraction}}$

$$\text{exponent} = 2^6 + 2^5 + 2^4 + 2^3 + 2^2 + 2^1 = 126$$

$$\text{Fraction} = 0$$

$$\text{decimal} = (-1)^0 \times (1 + 0.0_2) \times 2^{(126-127)}$$

$$= 1 \times 1 \times 2^{-1} = 0.5 \ \#$$

b. BE000000 $\xrightarrow{\text{binary}}$ $\underset{S}{1}\ \underbrace{0111110\,0}_{\text{exponent}}\ \underbrace{000\ 0000\ \ldots\ 0000}_{\text{Fraction}}$

$$\text{exponent} = 2^6 + 2^5 + 2^4 + 2^3 + 2^2 = 124$$

$$\text{Fraction} = 0$$

$$\text{decimal} = (-1)^1 \times (1 + 0.0_2) \times 2^{(124-127)}$$

$$= -0.125$$

5. "Comets are awesome!"

in memory, a char is 8 bits = 1 byte

in mips, we use big endian

Msb start from lowest bit

byte address →

memory a a+1 ....

...			C	o	m	e	t	s		a	r	e		a	w	e	s	o	m	e	!	\0	...