HW #2

Saturday, September 14, 2019 11:22 AM

1) Integers are represented as 16-bit words

negative numbers → 2's complementary method

Hexadecimal to decimal numbers

a) OXCAFE

C-12, A-10, F-15, E-14

⇒ 1100 1010 1111 1110
12 10 15 14

Binary : 1100101011111110 [2's complement]

↳ Signed bit : 1 [NEGATIVE]

Complement of 100 1010 1111 1110

= 011 0101 0000 0001

Value = 011 0101 0000 0001 + 1

= 011 0101 0000 0010
14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

$= -\left(2^1 \times 1 + 2^8 \times 1 + 2^{10} \times 1 + 2^{12} \times 1 + 2^{13} \times 1\right)$

$= \boxed{-13570_{(10)}}$

2 2
8192
4096
1024
256
2
13570

b) 0x4DAD

↳ 4 13 10 13 → Binary: 0100 1101 1010 1101

Signed bit: 0 → (Positive)

Decimal value: 100 1101 1010 1101
[14 13 12 11 10 9 8 7 6 5 4 3 2 1 0]

$= 2^0 \times 1 + 2^2 \times 1 + 2^3 + 2^5 + 2^7 + 2^8 + 2^{10} + 2^{11} + 2^{14}$

→ $\underbrace{1 + 4 + 8 + 32}_{45} + \underbrace{128 + 256 + 1024}_{1408} + 2048 + 16384$

$= \boxed{+19885}$

12
16384
2048
1408
45
19885

c) 0xFACE

↳ 15 10 12 14, Binary: 1111 1010 1100 1110

Signed bit: 1 → Negative

Value: Complement of (111 1010 1100 1110) +1

$= 000\ 0101\ 0011\ 0010$
[14 13 12 11 10 9 8 7 6 5 4 3 2 1 0]

$= -(2^1 + 2^4 + 2^5 + 2^8 + 2^{10}) = -(2 + 16 + 32 + 256 + 1024)$

$= \boxed{-1330}$

2) Integers → 32-bit words, Negative numbers → 2's complimentary

Decimal to Hexadecimal.

a) -1814 ↷ $1024 + 256 + 32 + 2$

↳ Binary: 0000 0000 0000 0000 0000 0101 0001 0010

1's complement: 1111 1111 1111 1111 1111 1010 1101 1101 ↷ +1

2's complement: 1111 1111 1111 1111 1111 1010 1101 1110 ↶

HEXA: 0XFFFFFADE

b) 2020 ↷ $1024 + 512 + 256 + 128 + 64 + 32 + 4$ (10, 9, 8, 7, 6, 5, 2)

↳ Binary: 0000 0000 0000 0000 0000 0111 1110 0100

HEXA: 0X000007E4

3) Floating point numbers → (single-precision 32-bit format)

a) -0.1875 → (32-bit) → $\begin{bmatrix} S & Expo & Fraction \\ 1 & 8 & 23 \end{bmatrix}$

↳ $= (0.0625) = -3 \times 2^{-4}$

$= -11 \times 2^{-4} = -1.1 \times 2^{-3}$

$S = 1$, $E = -3 + 127$, Fraction $= 1000\ldots0_{(2)}$

$= 124 - (64 + 32 + 16 + 4 + 8)$

⇒ 1 0111 1100 1000 0000 0000 0000 000 (a)

b) $0.46875 = 15 \times 2^{-5}$

↳ $1111 \times 2^{-5} = 1.111 \times 2^{-2}$

$S = 0$, $E = -2 + 127$, $F = 1110\ldots0_{(2)}$

$= 125 = [0111\ 1101]$

$\therefore$ 0 0111 1101 1110 0000 0000 0000 0000 000$_{(2)}$

4) Decimal value of

a) 3F400000

= 0011 1111 0100 0000 0000 0000 0000 0000

↑ Positive, Exponent: 0111 1110 = 126, Fraction = 100 000$\ldots0_{(2)}$

Actual = −1,

$= 1.10 \times 2^{-1} = 3/4 = 0.75$

b) BE000000

= 1011 1110 0000 0000 0000 0000 0000 0000

↑ Signed bit: 1 Exponent: 0111 1100, Fraction: 0000...

Negative, $= (124) = (-3)$

$\therefore -(1.0 \times 2^{-3})_{(2)} = (-1/8)_{(10)} = -0.125$

5) Representation of string:

"Comets are awesome!"

43(h)	6f(h)	6d(h)	65(h)	74(h)	73(h)	20(h)	61(h)	72(h)	65(h)	20(h)
C	o	m	e	t	s	—	a	r	e	—

61(h)	77(h)	65(h)	73(h)	6f(h)	6d(h)	65(h)	21(h)	00(h)
a	w	e	s	o	m	e	!	

43(h)	6f(h)	6d(h)	65(h)	74(h)	73(h)	20(h)	61(h)	72(h)	65(h)	20(h)
C	o	m	e	t	s	—	a	r	e	—

61(h)	77(h)	65(h)	73(h)	6f(h)	6d(h)	65(h)	21(h)	00(h)
a	w	e	s	o	m	e	!	

0x 43 6f 6d 65 74 73 20 61 72 65 20 61 77 65 73 6f 6d 65 21 00

Binary : 0100 0011 0110 1111 0110 1101 0110 0101

4 3 6 f 6 d 6 5

0111 0100 0111 0011 0010 0000 0110 0001 0111 0010

7 4 7 3 2 0 6 1 7 2

0110 0101 0010 0000 0110 0001 0111 0111 0110 0101 0111

6 5 2 0 6 1 7 7 6 5 7

0011 0110 1111 0110 1101 0110 0101 0010 0001 0000 0000

3 6 f 6 d 6 5 2 1 0 0

in MIPS memory ↑