

HW #1
CSc 137, Fall 2020, Harvey
Total (12 pts)

Problems 1.3, 1.4, 1.5, 1.14 (3 pts each)

Reading assignment: Section 1.1 to 1.4 (all sub-sections).

Advance reading assignment: Section 2.1 through 2.4 (all subsections)

1.3. What is the 16-bit FP number representation of -5.375 in hex with 1-bit sign, 4-bit biased exponent, and 11-bit fraction, where bias offset = 7?

Convert Integer: 5
* Successive division by 2 *
 $5_{(10)} = 101_{(2)}$

Convert Fractional: 0.375
* Successive multiplication of remaining products *
 $0.375 \times 2 = 0 + 0.75$
 $0.75 \times 2 = 1 + 0.5$
 $0.5 \times 2 = 1 + 0.0 \leftarrow \text{Reached Zero}$
 $0.375_{(10)} = 0.11_{(2)}$

Together...
 $5.375 = 101.11_{(2)}$

Converting Binary to Scientific Notation

$$5.375_{(10)} = 101.11_{(2)}$$

Convert $101.11_{(2)}$ to Scientific Notation

$$101.11_{(2)} \xrightarrow{\text{Scientific Notation}} 1.0111_{(2)} \times 2^2$$

Biased Offset = 4

$$\text{Biased Exponent} = 1.01011 \times 2^2$$

$$2 + 4 = 6_{(10)} \xrightarrow{\text{Convert to Binary}} 6_{(10)} = 0110_{(2)}$$

Fusion of Floating Point

Biased Component

$$-1.01011 \times 2^6 = 0110_{(2)}$$

Signed Component Fractional Component



Signed Bit

- * When Signed component is positive set to 0 (zero)
- * When Signed component is negative set to 1

Mantissa/Fraction

Convert to Hex - Final Step

Number	0	1	2	3	4	5	6	7
Binary	0000	0001	0010	0011	0100	0101	0110	0111
Hexadecimal	0	1	2	3	4	5	6	7

Number	8	9	10	11	12	13	14	15
Binary	1000	1001	1010	1011	1100	1101	1110	1111
Hexadecimal	8	9	A	B	C	D	E	F

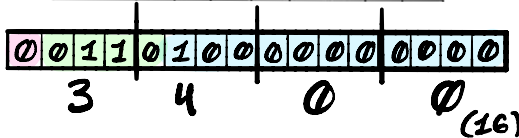
$0xB0x20xC0x0$

ANSWER

1.4. What is the real number equivalent to FP number $0x3400$ with 1-bit sign, 4-bit biased exponent, 11-bit fraction, and bias offset = 7?

Number	0	1	2	3	4	5	6	7
Binary	0000	0001	0010	0011	0100	0101	0110	0111
Hexadecimal	0	1	2	3	4	5	6	7

Number	8	9	10	11	12	13	14	15
Binary	1000	1001	1010	1011	1100	1101	1110	1111
Hexadecimal	8	9	A	B	C	D	E	F



$$(3 \cdot 16^3) + (4 \cdot 16^2) + (0 \cdot 16^1) + (0 \cdot 16^0)$$

$$12288 + 1024 + 0 + 0$$

1.5. What is the real number equivalent to FP number $0x3400$ with 1-bit sign, 4-bit biased exponent, 11-bit fraction, and bias offset = 8?

1.14 What is a Von Neumann architecture bottleneck?

The bottleneck in Von Neumann's architecture is that the processor is idle for a certain amount of time while memory is accessed.