

Hw 4: Num Representation, Arithmetic, Floating point representation

Part 1:

1) The difference between unsigned numbers and signed in binary is that unsigned binary numbers do not have a sign bit. Unsigned numbers don't have a sign and can represent larger positive integers.

2's complement numbers are signed integers that represent their negative numbers by taking the 1's complement (binary inverse) and adding a bit.

$$\text{ex. } 2 = 011 \rightarrow 1\text{'s complement: } 100 \rightarrow 2\text{'s complement} = 101$$

2's complement has advantages, 1 representation 0, contains arithmetic valid

$$2) (1301)_{10} = (10100010101)_2 = (515)_{10} = (2425)_8$$

$$11 \text{ total bits } 1301_{10} = 8R5, 8111_2 = 5R1 \quad 1301_8 = R5 \quad 20/8 = 4$$

$$\text{minimum for each } (1301)_{10} = 8(2 \text{ bits}), H(2), 0(12 \text{ bits}) \quad 162/8 = R2 \quad 2$$

$$16 \text{ bit rep } (1301)_{10} = (0000010100010101)_2$$

Binary 12 digits

Hex = 3 digit, Octal = 4 digit

3) Show $(-1301)_{10}$ as a 2's complement signed num

$$\text{a) binary} = (101011101011)_2 \quad 16 \text{ bit} = -3278 - 3277$$

$$01011101010 \quad 16 \text{ bit} \rightarrow$$

$$15 \text{ bit} = -16384 - 16383$$

$$\bullet \text{ b) } x = -x_{n-1}2^{n-1} + x_{n-2}2^{n-2} + \dots + x_12^1 + x_02^0$$

$$01011101010$$

$$\text{Sum: } -2^8 + 2^9 + 2^6 + 2^5 + 2^3 + 2^0 = 1301$$

4) Represent $(-1301)_{10}$ in sign-magnitude format 16 bit.

$$(-1301)_{10} = (1000010100010101)_2$$

$$5) \text{ a) } -30 + 12$$

$$\text{b. } -20 + 64$$

$$\begin{array}{r}
 + \quad -30 \ 111111111100010 \\
 + \quad 12 \ 0000000000001100 \\
 \hline
 -18 \ 11111111101110
 \end{array}
 \quad
 \begin{array}{r}
 \xrightarrow{-20} 11111111111101100 \\
 \xrightarrow{64} 0000000000100000 \\
 \hline
 44 \ 00000000000101100
 \end{array}$$

No overflow 16 bit $-30 + 12$

No Overflow on 16-bit $-20 + 64$ (of 1)