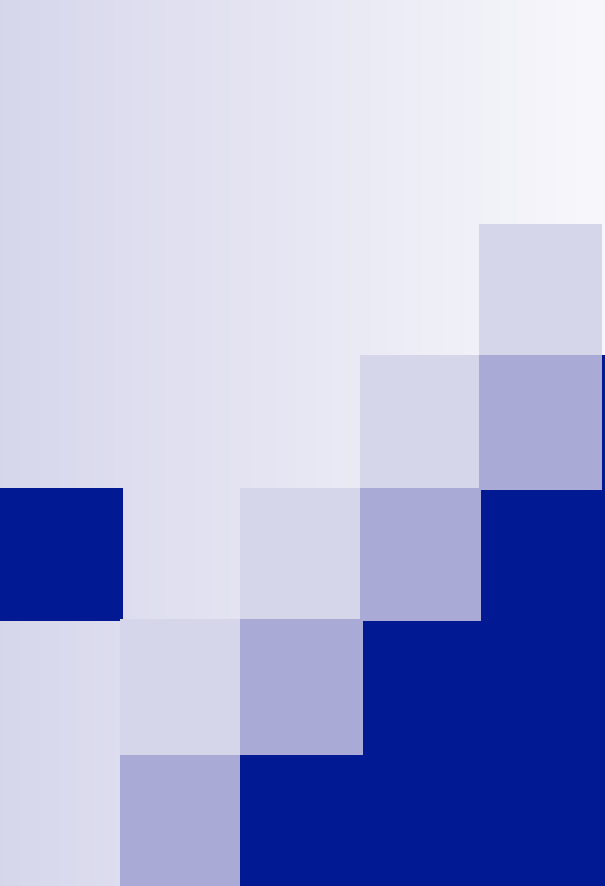




Numbers and Computers (practice)

ICS312 Machine-Level and Systems Programming

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(q13) Yes/No Questions

- Is 1-byte value 01000101_2 odd?
- Is 2-byte value $5FA2_{16}$ positive?
- Is 1-byte value 1010000_2 positive?
- Does the 1-byte addition $FF + FF = FE$ make sense mathematically for unsigned numbers?

(q13) Yes/No Questions

- Is 1-byte value 01000101_2 odd?

YES

- Is 2-byte value $5FA2_{16}$ positive?

YES (regardless of signed or unsigned)

- Is 1-byte value 1010000_2 positive?

CANNOT TELL (no if signed, yes if unsigned)

- Does the 1-byte addition $FF + FF = FE$ make sense mathematically for unsigned numbers?

NO

(q14) Two's complement

- What is the **2-byte** representation of signed integer -153_{10} in hexadecimal?

(q14) Solution

- What is the 2-byte representation of signed integer -153_{10} in hexadecimal?
 - $153_{10} = 0099_{16}$
 - complement: FF66
 - add 1 to get the answer: **FF67**

(q15) Two's complement

- What is the 2-byte representation of signed integer 96_{10} in hexadecimal?

(q15) Solution

- What is the 2-byte representation of signed integer 96_{10} in hexadecimal?
 - $96_{10} = 60_{16}$
 - It's a positive number, so its 2's complement representation is simply its 2-byte binary representation
 - answer: **0060**

(q16) Two's complement

- What is the decimal value of $FF4A_{16}$, which we know to be a 2-byte signed number?

(q16) Solution

- What is the decimal value of FF4A_{16} , which we know to be a 2-byte signed number?
 - $\text{FF4A} = 1\dots_2$
 - Therefore it represents a negative number, let's invert it
 - Invert: 00B5
 - Add 1: $00\text{B6} = \text{B6}$
 - $\text{B6}_{16} = 11 \cdot 16 + 6 = 176 + 6 = 182_{10}$
 - Therefore, in 2's complement representation, FF4A is -182_{10}

(q17) Two's complement

- What is the 1-byte representation of signed number -81_{10} in hexadecimal?

(q17) Solution

- What is the 1-byte representation of signed number -81_{10} in hexadecimal?
 - $81_{10} = 51_{16}$
 - complement: AE
 - add 1: AF

(q18) Two's complement

- What is the decimal value of 76_{16} , a 1-byte signed number?

(q18) Solution

- What is the decimal value of 76_{16} , a 1-byte signed number?
 - It's a positive number, so 76 is simply the hex value of the integer
 - Answer: $7 \cdot 16^1 + 6 \cdot 16^0 = 118_{10}$

(q19) Ranges of numbers

- What is the largest **unsigned** decimal number that can be encoded with 8 bits?
- What is the smallest **unsigned** decimal number that can be encoded with 8 bits?
- What is the largest **signed** decimal number that can be encoded with 8 bits?
- What is the smallest **signed** decimal number that can be encoded with 8 bits?
- What is the 2's complement representation of -1_{10} with 32 bits?

(q19) Solutions

- What is the largest **unsigned** decimal number that can be encoded with 8 bits?
 - 255 (i.e., FF in 2's complement representation)
- What is the smallest **unsigned** decimal number that can be encoded with 8 bits?
 - 0 (i.e., 00 in 2's complement representation)
- What is the largest **signed** decimal number that can be encoded with 8 bits?
 - Largest that isn't negative: 7F in 2's complement representation = 127_{10}
- What is the smallest **signed** decimal number that can be encoded with 8 bits?
 - Smallest that isn't positive: 80 in 2's complement representation = -128_{10}
- What is the 2's complement representation of -1_{10} with 32 bits?
 - $1 = 00000001$; complement: FFFFFFFE; add one: FFFFFFFF



More Practice?

- This module contains a sample homework assignment with more practice, if you need it
- As stated in the screencast, we'll have a quiz on this next Monday