CS 286-002 Computer Architecture & Organization  
Fall 2023  
Quiz #3 on September 11, 2023 (SOLUTIONS)

Your Last Three Digits: ________________  
(please do NOT write all of your student ID or your name)

Grade: ______

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(1) Complete the following figure by specifying number systems we discussed in the classroom.

(2) Transform the following decimal number to the two’s complement binary number (using the 16-bit format; your processor is a 16-bit architecture processor): -95(10).  Show all your work.

Construct the bit pattern for positive 95: \(95_{(10)} = 1011111_{(2)}\)

Translate the pattern to a 16-bit pattern: \(95_{(10)} = 0000\ 0000\ 0101\ 1111_{(2)}\)

Invert the bit pattern: \(1111\ 1111\ 1010\ 0000\)

Add binary 1: \(1111\ 1111\ 1010\ 0001\)
(3) “li $t1, $t0” is an illegal instruction (if you try to assemble that instruction using PC-SPIM simulator, that instruction will cause a syntax error). What’s wrong?

“li $t1, $t0” is an illegal instruction because “li” instruction **requires a constant number for its second argument (it can not take another register).**

(4) “li $t0, (1024)” is an illegal instruction (if you try to assemble that instruction using PC-Spim simulator, that instruction will cause a syntax error). What’s wrong?

“li $t1, $t0” is an illegal instruction because “li” instruction **requires a constant number for its second argument, while (1024) indicates a memory address to be accessed (li does not access a memory address).**

(5) Translate the “if-then-else” program structure using MIPS instructions (in the following MIPS assembly program structure (by showing all the necessary missing instructions there).