CS 286 Computer Architecture & Organization
Fall 2022 (SOLUTIONS)
Quiz #3 on September 7, 2022

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.

![Diagram of number systems](image)

(2) How will “-1\(_{10}\)” be represented using \(n\)-bits two’s complement number?

\[ n \text{ 1's (all } n \text{ bits are '1') } \]

(3) What does “sufficient condition” guarantee?

If a given sufficient condition is met, it is guaranteed that you will achieve the result(s) you want.
(4) What is the difference between “li $a0, 107623” and “la $a0, 107623” instructions? Assume that this computer system is a 32-bit system (i.e., all the registers are 32-bit registers and its ALU can deal with up to 32-bit inputs and outputs).

- **li** instruction binary-encodes a given integer to a register based on the two’s complement integer.
- **la** instruction binary-encodes a given integer to a register based on the unsigned integer.

(5) “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?

In MIPS assembly language, “( )” means a memory address. Li instruction does NOT load a data from memory (i.e., li instruction requires an immediate (a constant) integer for its second argument (it can’t take a memory address for its second argument)). Therefore, instead of “li $t0, (1024)”, we need to use “lw” instruction (“lw $t0, (1024)”).