CSU0049 Analog and Digital Computing Elements, Homework 4

Department of Computer Science and Information Engineering

National Taiwan Normal University

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100 regular points plus 20 bonus points (the one labeled *Bonus Task*).

Problem 1 (100 points)

Complete Project 2 on the nand2tetris website: `https://www.nand2tetris.org/course`. Download your work for the target ALU. Zip both your code and your answer to the bonus task (if you did it) into one single zip file. Name the zip file using your student ID and upload it to Moodle. You may try to complete Project 1 first, to get yourself familiar with that online environment and its HDL. No need to submit your work for Project 1.

The answer to this ALU implementatioin is not unique, and you should code it yourself. We will use code plagiarism checker to compare your code with one another, and it will detect copy-pasting, paraphrasing, cosmetic code changes, and more. For those who cheated and those who helped cheating, both will receive zero point for this homework assignment.

Bonus Task (20 points)

Ten points for each of the following problems:

(1) Assuming two's complement representation for integers, compute the following summation: $(11001100)_2 + (00011110)_2 = (?)_{10}$.

(2) Suppose we use n bits to encode decimal integer i into its two's complement representation $code(i)$. Given two decimal integers x and y and that both $code(x)$ and $code(y)$ are valid encodings, prove the following property: if the decimal integer $z = x + y$ can also be represented by an n-bit binary number using two's complement, then $code(z)$ must equal $code(x) + code(y)$.

Required Readings

You must read through the second textbook's Chapters 1, 2, and 3. If you want to master this course, textbook reading is necessary. The PDFs of the second textbook are available at `https://www.nand2tetris.org/course`.