CS2130 - COMPUTER SYSTEMS AND ORGANIZATION 1 - FALL 2022

DUE MONDAY, SEPT 19, 2022 AT 11:00P VIA GRADESCOPE

HOMEWORK 2

Name: **Computing ID**: _____

Collaborators:

Collaboration Policy: You may collaborate with other students in this class. As an exception to the usual collaboration policy, you do not need to tell us about casual interactions of the "I got X, what did you get?" variety. But do cite any close collaboration or major corrections; for example if the answer to the above hypothetical was "I think X is wrong, here's why" and then you change your answer, add a note like "mst3k suggested this answer" next to your answer. However, we expect that everyone will work on the assignment to better understand circuits, so you may not directly copy another student's answer.

PROBLEM 1 *4-input adder*

We have discussed both a 2-input and 3-input adders for single-bit values as we were building our ripple carry adder. Draw a 4-input adder for single-bit values: that is, a set of logic gates with 4 input wires (no need to name them) each representing a number between 0 and 1 and a multi-bit output z, composed of wires z_0 through $z_{...}$ (where z_0 is the low-order bit, z_1 the next, etc., up to the number of wires needed for this task). The gates should ensure that $z =$ the sum of all four inputs.

PROBLEM 2 *4-bit decrement*

In class we considered an increment circuit that adds 1 to its input value. Now we want a circuit that subtracts 1 (i.e., $z = x - 1$). Draw a 4-bit decrement circuit that does **not** use not gates.

PROBLEM 3 *4-bit subtractor*

Draw a 4-bit subtractor that computes $z = x - y$. *Hint: how can we modify our ripple-carry adder to subtract instead?*