Instructions

Your second Logisim project tasks you with creating a two-digit base-10 decimal adder/subtracter with seven-segment displays and 8-4-2-1 BCD input. You must use:

- Four two-state binary inputs, $2^3 2^2 2^1 2^0$ of the left operand,
- One seven-segment display for the left operand,
- Four two-state binary inputs, $2^3 2^2 2^1 2^0$ of the right operand,
- One seven-segment display for the right operand,
- One two-state binary input for selection between addition and subtraction,
  - 0 for Addition and
  - 1 for Subtraction
- One seven-segment display for the 10^1 digit, and
- One seven-segment display for the 10^0 digit.

Several possible illustrations are presented below.

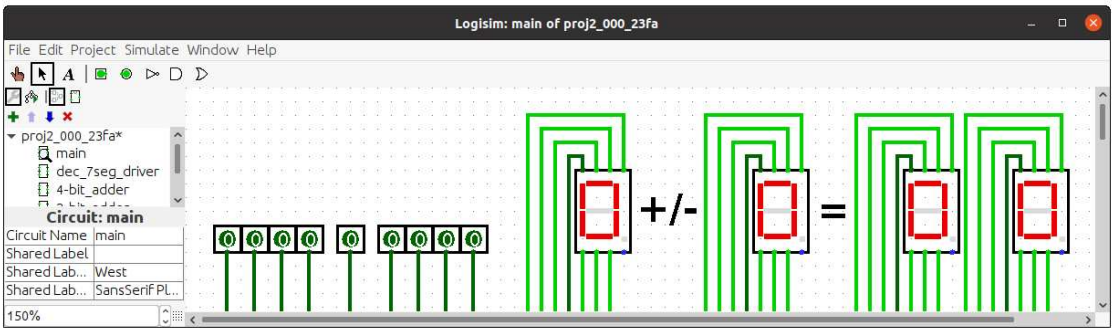

Figure 1: 0 + 0 = 00.

You must provide eight one-bit, two-state, binary inputs grouped into the two four-bit operands. Each four-bit group must accept values in [0000, 1001], representing decimals in [0, 9]. Each four-bit group must use a seven-segment display to represent its value as a decimal integer. The sum or difference of the two 4-bit inputs should be displayed in a pair of seven-segment display showing sums in [00, 18].

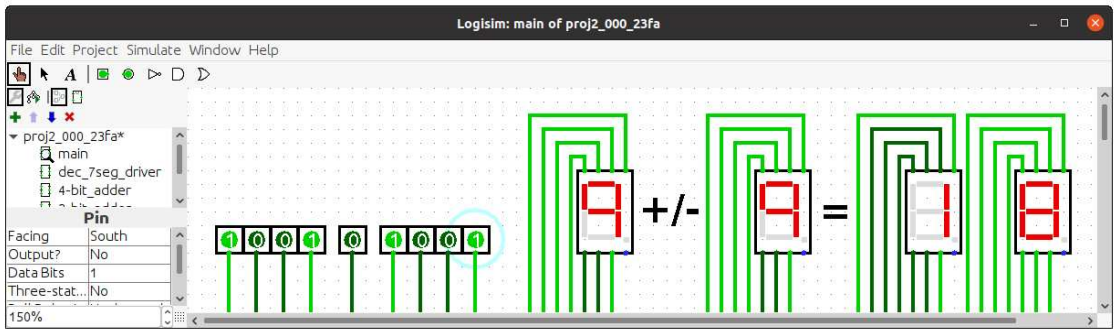

Figure 2: 9 + 9 = 18.

You are not allowed to use the arithmetic library. The point of this exercise is to test your ability to build circuits. If circuits from the arithmetic library are found in your project, you will receive zero points for this assignment and will be submitted to Academic Integrity for **interfering with a grader's ability to assess submissions**. Lastly, you must have the circuit you want graded set as "main." Right-click on the circuit and set it to main.

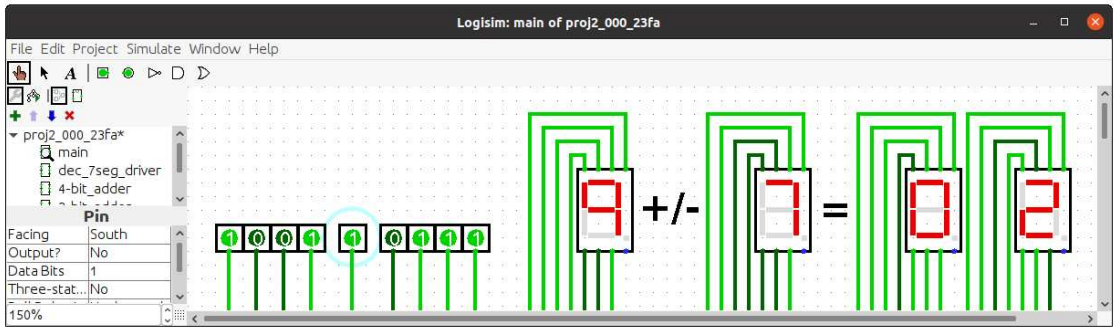

Figure 3: 9 - 7 = 02.

Submission

Submit a single file: **proj_2.circ** for your group using the Blackboard assignment upload site. I would recommend beginning by renaming **proj_1.circ** to **proj_2.circ**. You will need the 8421 BCD seven-segment display driver from that program.

Points

This project is worth 2.5 points. Each of the following is worth 1 point with partial credit being awarded for wholly completed parts as described below.

1. Correctly implement the two(2) 4-bit ($2^3 2^2 2^1 2^0$) inputs and corresponding seven-segment displays for each: $[0, 9] \times [0, 9]$.
2. Correctly add all pairs from $[0, 9] \times [0, 9]$, producing sums in the set $\{0, \ldots, 18\}$.
3. Correctly subtract all pairs $a - b$ with $a \geq b$ (where $a, b \in [0, 9]$), producing differences in the set $\{0, \ldots, 9\}$.

The End.