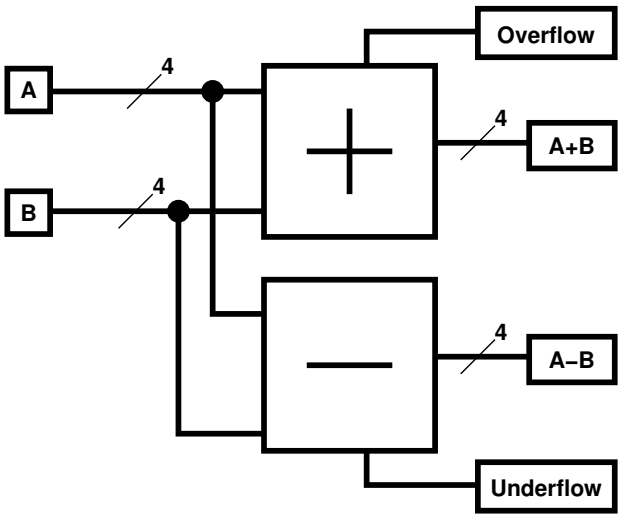
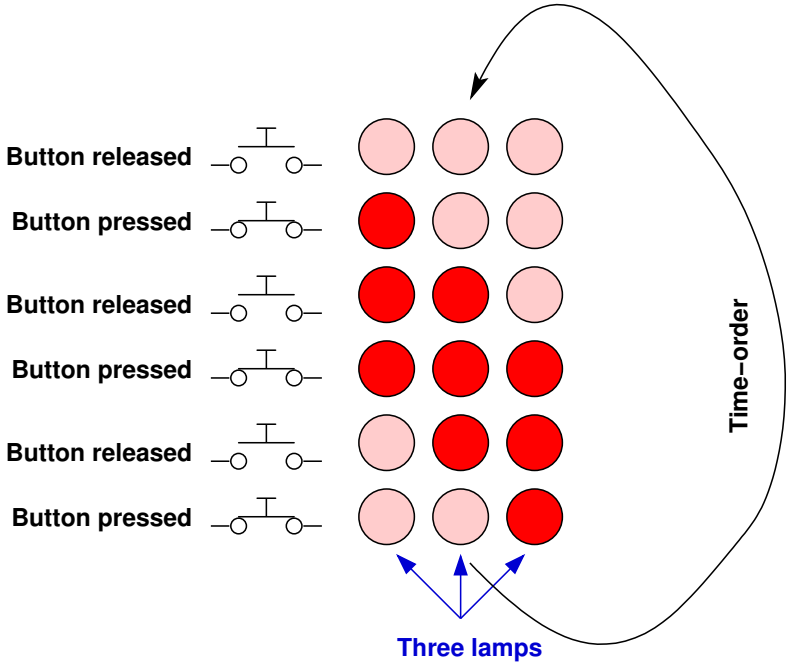


You are given an 8-input, 10-output circuit. `A` and `B` are numbers encoded in natural binary, using 4 bits: A_3, A_2, A_1, A_0 *and* B_3, B_2, B_1, B_0.
The outputs are also encoded in natural binary and defined as follows:
A+B= (P_3,P_2,P_1,P_0) *and* **A-B=** (M_3,M_2,M_1,M_0).
Finally, the overflow **O** and the underflow **U** outputs indicate that the result can not be described in 4 bits (capacity of the adder/subtractor is exceeded).
Your task is to design a gate-level schematic of the circuit.

Questions:

1. Draw a truth table of the adder.
2. Using Logisim, design and verify a gate-level schematic of the adder.
3. Draw a truth table of the subtractor.
4. Using Logisim, design and verify a gate-level schematic of the subtractor.

The purpose of this exercise is to design a controller circuit for a three-light-system,. The state of the three lights changes on each press or release of the button, according to the scheme below:



Tasks to complete:

5. Implement a system with the described functionality in Logisim. You are only allowed to use simple logic gates, SR-latches, LEDs, and buttons.

6. Download your design to the GECKO4Education board. What do you observe?