

SYSTEMS I

LAB 4

Detecting a sequence

This assignment is due Thursday, Oct-08, 11:59 pm.

1 A sequence detector

We want to build a circuit that can detect whether a particular sequence of input values is being given to a sequential circuit. Specifically, for this project, we want to detect the following sequence of 1-bit values:

0, 0, 1, 1, 0, 1

For this circuit, a single switch will control the input value A , a button to provide the clock signal that determines when A is “entered” as the next value in the sequence, and a button that allows you to *reset* the register’s bit values to 0. There should be a one-bit output Y that is 1 if the last six clocked values match the sequence above, and 0 otherwise. When the final state is reached the circuit should ignore additional input values; only resetting the circuit escapes the terminal success state.

Recommended approach: We suggest that you develop your solution in this sequence...

1. Draw the *finite state machine* that represents this problem.
2. Convert that FSM to a truth table representing the sequential logic.
3. Determine, from the truth table, the transitional logic required to advance from one state to the next.
4. Build the circuit that implements the sequential logic and its functions.

Making it debuggable: To see how the inputs affect the state, you should number the states of your FSM *in order of the progression through the sequence*. That is, the initially, the circuit should start in state 0; as each correct digit is entered, the state number should increment until the terminal state—state number 6—is reached. By numbering them in this way, you can connect the state number being emitted by the register to LED's, thus allowing yourself to see the current state number that your circuit is in.

2 Submitting your work

Once you have a detector working, demonstrate the working circuit:

1. **Take a video** of the circuit by resetting to the initial state 0, and then moving through the following sequence of values as a test of it, resetting the circuit to state 0 before each sequence:

INPUT SEQUENCE	STATE NUMBER SEQUENCE
1	0, 0
0, 1	0, 1, 0
0, 0, 0	0, 1, 2, 2
0, 0, 1, 0	0, 1, 2, 3, 1
0, 0, 1, 1, 1	0, 1, 2, 3, 4, 0
0, 0, 1, 1, 0, 0	0, 1, 2, 3, 4, 5, 2
0, 0, 1, 1, 0, 1	0, 1, 2, 3, 4, 5, 6
0, 0, 1, 1, 0, 1, 0, 1	0, 1, 2, 3, 4, 5, 6, 6, 6

2. **Upload the video** to the lab-4 subfolder within your shared Google Drive folder for this class.
3. **Upload a PDF** of your state machine, truth table, and logic functions.