

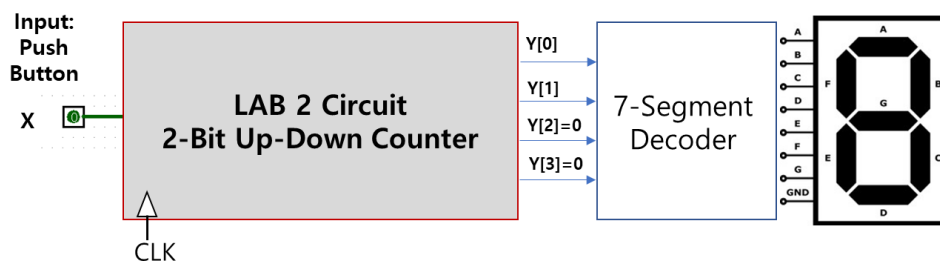
Digital Logic Circuit: Design Problem #2

Sequential Circuits

Warning: DO NOT draw circuit, truth table, Karnaugh map by HAND!!!

Problem 1

Design and make a circuit for 2-bit up-down counter and display the output with a 7-segment display.



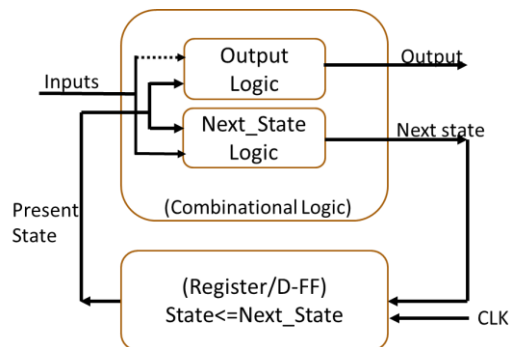
- The clock period is 1 second. Use Arduino to generate the clock.
- There are 2 modes for the counter:
 - Up-counting mode, Down-counting mode
- Use one push button to control the counter mode. See Table 1
- Display the output decimal number '0'~'3' with a 7-Segment Display
- Use 7-segment decoder chip(SN74LS47N) to control 7-Segment Display
- Design the circuit and check the results in the simulation program.
- Implement the circuit on a breadboard and demonstrate the result.

Table 1. Counter Mode

Input X	Counter mode
X = 0	UP_Counting
X=1	DOWN_Counting

Procedure

- Search for the specification sheet for all electrical components for this lab.
- You can choose either Mealy or Moore Circuit.
- Design the necessary states. Use 2x D-FF for the states.
- Draw the State Table & State Graph
- Draw the truth table and derive the boolean expression for each output ($Y[0] \sim Y[1]$) and Next State.
- Draw the counter circuit in the form of



- Design the circuit on the simulation program.
- Make the circuit on breadboard and show the output with a short demo video.
 - Need to display Input with a LED ($X=0$, LED=OFF / $X=1$, LED=ON)
 - Need to display Output number with 7-segment
- Write a concise report

Components

- Breadboard, Jumper wire
- Input: Arduino for 5V/0V source, 4-pin tactile switch(with Pull-down)
 2*LEDs for Input Indication
- Output: 7-Segment
- Logic chip: D-FFs (74LS74), 4-to-1 MUX(74HC4052N), 7-segment
 decoder(SN74LS47N), XOR gate (74HC86), NOT gate(74HC04)