CS220: Assignment#5

1.[40 marks] Implement the finite state machine the next state function of which is shown in Table 1. The machine takes a two-bit input (Y[1:0]). The output function is not specified and can be ignored for this assignment. Suppose

Table 1. Next state function

Current state	Input (Y[1:0])	Next state
S_0	2'bxx	S_1
S_1	2'bxx	S_2
S_2	2'bxx	S_3
S_3	2'b00	S_4
S_3	2'b01	S_5
S_3	2'b1x	S_6
S_4	2'bxx	S_7
S_5	2'bxx	S_7
S_6	2'bxx	S_7
S_7	2'bxx	S_8
S_8	2'bxx	S_9
S_9	2'bxx	S_{10}
S_{10}	2'b00	S_{11}
S_{10}	2'b01, 2'b1x	S_{12}
S_{11}	2'bxx	S_0
S_{12}	2'bxx	S_0

a state incrementer can be used to compute the next state along with dispatch ROMs, a microcode ROM, and a state selection multiplexer. The microcode ROM takes only the current state as input to look up a row and outputs the branch control for computing the next state (note that Y cannot be used as an input to the microcode ROM).

The ROMs should be implemented as arrays and initialized within an initial block. The current state should be displayed on each rising clock edge in your top module. Two time units before each rising clock edge a new input is sent to the FSM (note that the input is two bits), but the state change occurs on rising edges only. Model a propagation delay of two time units in the state registers. The clock should have a cycle time of ten time units with 50% duty. Simulate for ten clock cycles.

2.[60 marks] Construct a module that takes as input four three-bit values treated as unsigned numbers and computes the index of the smallest value. For example, if the inputs are 110, 010, 001, and 111, the output is 2 indicating that the input at position two is the smallest (input index starts at zero on the left hand side and ends at three on the right hand side). Display the output index in your top module. Simulate for ten different input sets. Keep a delay of one time unit between two consecutive input sets.

Submission: Submit your verilog files named clearly. Prefix the file names for Q1 using A5Q1_ and those for Q2 using A5Q2_. Email the files as attachment to cs220spring2021submit@gmail.com. The subject line of the email MUST be the following (replace N by your group number): Assignment#5 submission for Group#N