**ELEN 21, COEN 21: Logic Design Winter 2021**

**Homework 8**

**due Wednesday, March 3**

1. (15 points) Design a Moore-type FSM circuit that will have an output of whenever the most recent three values of input are 1 0 1. Use a minimum number of flip-flops.
   1. Draw the state transition diagram using states labeled alphabetically starting with A. Specify the meaning of each state. (For example, one state should indicate that the most recent three inputs were 1, 0, 1 and it should have an output of 1.) Indicate which state is the initial state after a reset,
   2. Make a next state table in the style of Figure 6.4.
   3. How many states are needed? What is the minimum number of flip-flops needed?
   4. Assign binary state variable values to the states.
   5. Using D-type flip-flops, write the logic equations for the D inputs to each flip-flop.
   6. Write the logic equation for the output .
2. (15 points) Design a Moore-type FSM circuit that will have an output of for 1 clock cycle whenever an X input of 0 is followed by an X input of 1. Use a minimum number of flip-flops.
   1. Draw the state transition diagram using states labeled alphabetically starting with A. Indicate which state is the initial state after a reset,
   2. Make a next state table in the style of Figure 6.4.
   3. How many states are needed? What is the minimum number of flip-flops needed?
   4. Assign state variable values to the states.
   5. Using D-type flip-flops, write the logic equations for the D inputs to each flip-flop.
   6. Write the logic equation for the output .
3. (15 points) Modify the circuit in the previous problem to have a second output of Y=1 whenever an X input of 1 is followed by an X input of 0.
4. (10 points) For the FSM described in Verilog in Figure 6.29 (as discussed in class), the state assignment was A = 00, B=01, and C=10.
   1. Briefly describe what would need to be changed for a one-hot implementation.
   2. Specifically list each statement that would need to be changed. State why it would need to be changed and write the replacement statement(s). Do not write the full module – only show where changes are needed.
5. (15 points) Design a circuit which will read 6-bit temperature values in degrees Celsius from a temperature sensor at regular intervals of and will always have the most recent four measurements available to compute circuit output values. The 6-bit temperature value from the sensor is available as a parallel input to your circuit. Use six serial-input parallel-output shift registers in your design. Assume a clock with a period of is available. Show your circuit and label all inputs and outputs.
6. (15 points) Design the temperature monitoring circuit of the previous problem using four 6-bit data storage registers which have a synchronous Load enable input. Each register will be loaded with every fourth measurement. For example register 0 will have the initial temperature measurement made at and then the fourth measurement made at and then the eighth measurement made at etc. The first value loaded into register 1 will be the measurement made at .
   1. Determine what other components such as counters, decoders, and multiplexers might be needed for your circuit and list them.
   2. Draw the circuit and clearly label all inputs and outputs.

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