

CS 135 Fall 2010: Homework 3

Answer all questions. You may want to work out the team homework problems first before you solve this homework.

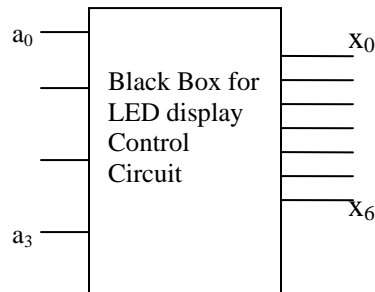
Ques.1: Do question 3.12 from textbook.

Ques.2: Do question 3.30 from textbook.

Ques.3: Do question 3.24 from textbook.

Ques.4: Draw a partial finite state diagram (show at least 10 states, with a path of length at least 3 in the graph) for the game of tic-tac-toe. How many states will the full finite state machine have ? Why. How many storage elements will be required to build a sequential circuit to implement this finite state machine ? Why.

Ques.5: In this question you are required to build a simple counter – the device will count from 0 to 8 (and reset to 0 after 8) at each clock cycle. Therefore, the output of the circuit will be 0,1,2,3,4,5,6,7,8,0,1,2,... (repeated as long as the clock is on). The output will be displayed using the LED display and the control circuit you designed in the previous teamwork. To simplify the answer, assume that the design (for the LED display control circuit) from Team Homework 3 is available to you as a black box where the inputs are the 4-bit input (a_3, a_2, a_1, a_0) and the output is the 7-bit control signals $(x_0, x_1, x_2, x_3, x_4, x_5, x_6)$ - i.e., you have to design the circuit that will generate the values of (a_3, a_2, a_1, a_0) at each clock cycle (and connect it to this black box). Assume that the initial state of the counter is 0 (i.e., 0 is displayed on the LED, and the 4-bit input to the Display control circuit is 0000).



- First, draw the state diagram of the finite state machine for this circuit.
- How many states does the FSM have? How many flip-flops (or storage devices) would you need to implement these states ?
- Implement the complete circuit required for the state diagram – you should implement both the sequential circuit and the combinational logic. (Note that you can assume that the output of the sequential machine will feed into the LED Control circuit ‘black box’ shown in the figure above.)