Cpr E 281 RC10
WEEK 14
ELECTRICAL AND COMPUTER ENGINEERING
IOWA STATE UNIVERSITY

Recitation Material for Week 14
Tasks to do in the recitation section
Assigned Date: Thirteenth Week

T1. Review HW10 problems and solve any problems that the students point out they had difficulties with.

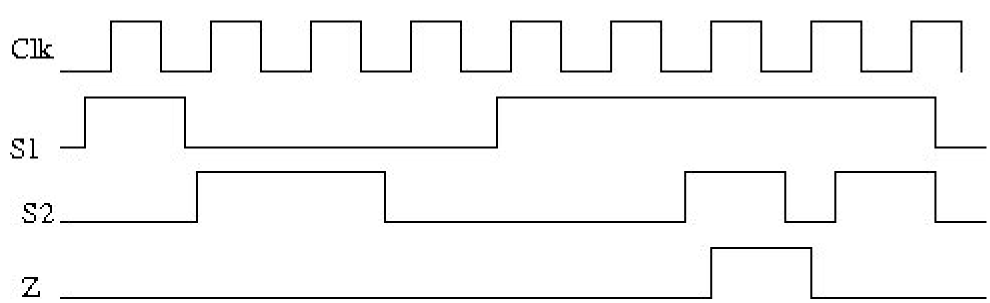
T2. Answer any general questions about HW11 and Lab 11.

T3. Solve the following problems.

1. Consider a state machine with 1 bit of input R and 3 bits of output D2 D1 D0. When the input R=0, the machine repeatedly outputs the sequence 000, 011, 110. When the input R=1, the machine resets, i.e., jumps to the state that outputs 000.
   a. Please draw the state diagram.
   b. Write the state table and the state-assigned table.
   c. Derive and draw the corresponding sequence circuit.

2. A combination lock has two switches, S_1 and S_2, and one output, Z. Z will become 1 and the lock will open if S_1 and S_2 are closed (i.e., assume a value of 1) in the following sequence:
   a. You must start from a state in which both S_1 and S_2 are open.
   b. S_1 is closed while S_2 is open. S_1 must then be held (it can be held for several clock cycles).
   c. S_2 is closed while S_1 is held in the closed position.

   The output Z will be 1 for one clock cycle only. Any other sequence will reset the lock. An example is shown below.



   Design a synchronous sequential circuit using D flip-flops that implements the above combination lock. Your circuit should be minimal.

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3. A sequential circuit has a 1-bit input P and a 1-bit output Q such that Q is 1 if and only if either # of 1's or # of 0's in the input sequence is divisible by 3. Please draw a state diagram for the sequential circuit.

4. Using the FSM approach, design and implement a 2-bit binary synchronous counter using JK flip-flops which has a control input, S:
    a. When S=0, it counts up.
    b. When S=1, it counts down.