

Ve270 Introduction to Logic Design

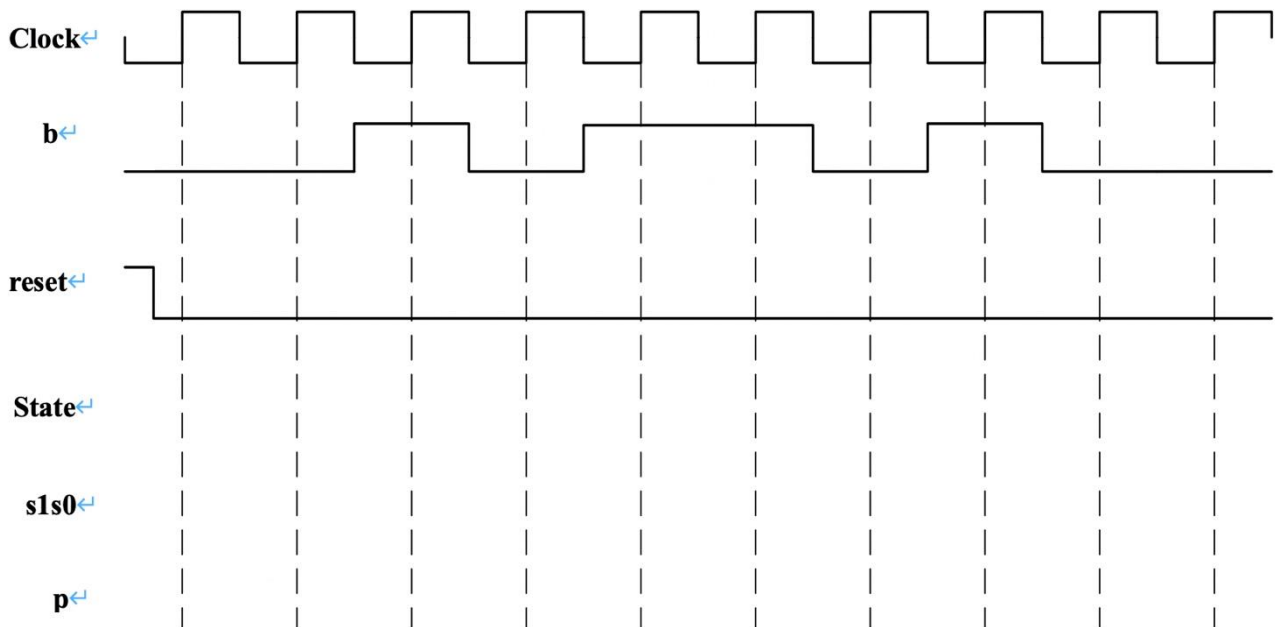
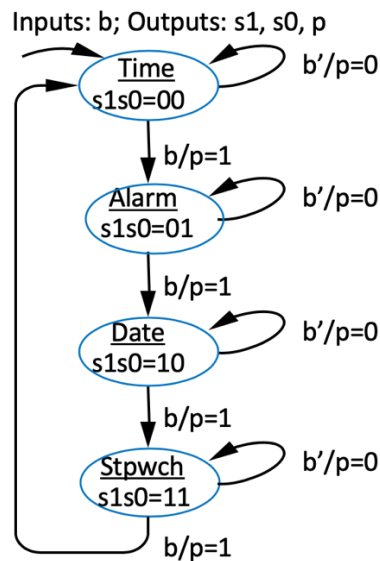
Homework 8

Assigned: July 14, 2020

Due: July 21, 2020, 2:00pm.

A pop quiz will be given on July 23.

- Given a finite state machine described as the following state diagram, complete the timing diagrams of states and outputs $s1s0$ and p according to the given inputs b and $reset$. Ignore delays. (20 Points)





2. Problem 5.3 (15 points)

- 5.3 Capture the following system behavior as an HLSM. The system has two single-bit inputs U and D each coming from a button, and a 16-bit output C , which is initially 0. For each press of U , the system increments C . For each press of D , the system decrements C . If both buttons are pressed, the system does not change C . The system does not roll over; it goes no higher than the largest C and no lower than $C=0$. A press is detected as a change from 0 to 1; the duration of that 1 does not matter.

3. Problem 5.4 (20 points)

- 5.4 Capture the following system behavior as an HLSM. A soda machine dispenser system has a 2-bit control input $C1\ C0$ indicating the value of a deposited coin. $C1\ C0 = 00$ means no coin, 01 means nickel (5 cents), 10 means dime (10 cents), and 11 means quarter (25 cents); when a coin is deposited, the input changes to indicate the value of the coin (for possibly more than one clock cycle) and then changes back to 00 . A soda costs 80 cents. The system displays the deposited amount on a 12-bit output D . The system has a single-bit input S coming from a button. If the deposited amount is less than the cost of a soda, S is ignored. Otherwise, if the button is pressed, the system releases a single soda by setting a single-bit output R to 1 for exactly one clock cycle, and the system deducts the soda cost from the deposited amount.

4. Problem 5.14. (25 points)

- 5.14 Use the RTL design process to create an alarm system that sets a single-bit output `alarm` to 1 when the average temperature of four consecutive samples meets or exceeds a user-defined threshold value. A 32-bit unsigned input CT indicates the current temperature, and a 32-bit unsigned input WT indicates the warning threshold. Samples should be taken every few clock cycles. A single-bit input `clr` when 1 disables the alarm and the sampling process. Start by capturing the desired system behavior as an HLSM, and then convert to a controller/datapath.
5. (20 points) Create an FSM that interfaces with the datapath in following figure. The FSM should use the datapath to compute the average value of the 16 32-bit elements of an array A . Array A is stored in a memory, with the first element at address 26, then second at address 27, and so on. Assume that putting a new value onto the address lines M_addr causes the memory to almost immediately output the read data on the M_data lines. Ignore overflow issues.

