BCD Counter with parallel load

EE 3109 Computer Aided Digital Design
Lab Assignment #4

Pre-lab Due: Oct 2, 2009
Lab Report Due: Oct 12, 2009

The purpose of this exercise is to design a BCD counter with parallel load using J-K Flip-Flops.

I. The counter should go through sequence of 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, 1 ….etc only when it is enabled. If it disabled, it should stop counting. If it is enabled, it should start again from the same number it stopped before. Also it should have active high reset signal.

II. The counter should be a self correcting i.e., if it goes to any unused sequence by accident it has to come back to the original sequence. Use second last digit of your student ID for this purpose.

III. Inputs & Outputs
Design the BCD counter in the same way 4-bit binary counter was designed in the previous lab. In addition to the inputs already present, you will need a load control input (load), and load bits D3, D2, D1 and D0. There would be a total of 8 inputs and 4 outputs.

1) The load control signal should work as follows:
   load = 1, should load D3, D2, D1, D0 to the output
   load = 0, counter should work normally

2) The count input will behave as follows: This is same as the Enable input from previous lab.
   count = 1 enables the counter i.e., it should go to the next binary state
   count = 0 disables the counter i.e., it should stop counting

3) A clock timing signal to increment the counter by one.

4) A reset signal to reset the counter to 0000.
   reset = 0, the counter works normally
   reset = 1, resets the counter to 0000

5) Four outputs (ABCD) to display the state of the counter.

IV. Your simulation results should show the following four waveforms

1) BCD Counter working with count = 1, load = 0, reset = 0
2) Counter with reset = 1 in the middle (count = 1, load = 0)
3) Counter with count = 0 in the middle (load = 0, reset = 0)
4) Counter with load = 1 in the middle (count = 1, reset = 0, D3=0, D2 = 1, D1 = 0, D0 = 1)

V. Turn in the report before 5:00PM on the due date. Remember to write your report in the format that was given to you in the first class.

Pre-lab:
1. Truth table for the counter using J-K flip-flops
2. K-maps for the BCD counter
3. Final Equations of the counter
4. Equations for the load circuit (Show all the steps)

Reading: