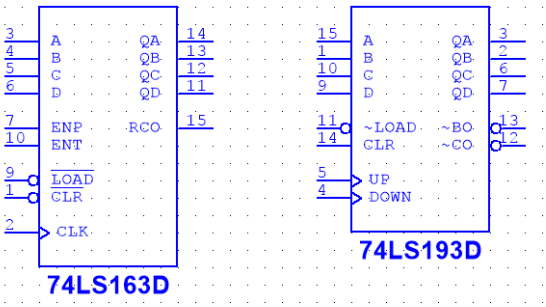
*(60 pts) Approx. 4 days*

The second part of this unit introduces two new IC chips for us. These new chips are referred as "Medium Scale Integration" because they have relatively complex circuits (4-bit binary synchronous counters using J/K Flip Flops) built into their chip structure. This makes them very compact and useful for creating counters. Part of our job in this part of the unit is to learn what these MIS IC chips are trying to do, and also how to use them in our own simulations and circuits!




In short, the 74LS163 chip will use the ABCD inputs to define the starting points and endpoints of the counting, and the QA, QB, QC, and QD outputs to send a 4-bit binary number out to display. Similarly, the 74LS193 chip uses athe ABCD inputs for the same definitions, the UP/DOWN inputs define the direction of counting, and the Q outputs give a 4-bit binary output for use in your circuit.

1. **Notes:** Start by watching the presentations on medium scale integration and these two chips in particular. There is a combination of general information about MSI chips as well as some very specific information about these two chips in particular.
2. **74LS163 Assignment & Breadboard:** Next, get the *74LS163 Assignment* from Mr. Benshoof and work through it. This assignment will ask you to make some pre-planned circuits as well as to modify those circuits to change the counting range. When you've finished the circuits, make sure everything is properly functioning in Multisim (only) and answer the few reflection questions in your engineering notebook.
3. **74LS193 Assignment & Breadboard:** Finally, get the *74LS193 Assignment* from Mr. Benshoof and work through the circuits it asks you to simulate. Make the requested modifications, make sure your simulation works well, and answer the corresponding reflection questions in your engineering notebook as always!

| *Part 1: Tasks* | *12-9 points* | *8-5 points* | *4-0 points* |
|---|---|---|---|
| Notes: Medium Scale Integration | + You took a full page of notes (or more) on Medium Scale Integration<br>+ Your notes include details on the two new chips: 74LS163 and 74LS193 | - Your notes are missing important parts<br>- Your notes do not include details on the 74LS163 or the 74LS193 | - Your notes are missing totally<br>- Your notes are significantly lacking |
| *74LS163 Assignment* | + You completed the *74LS163 Assignment* on the MSI Up Counter<br>+ You included responses to all short reflection questions | - You completed most of the assignment<br>- You answered most of the reflection questions | - You did not do the assignment |
| *74LS163 Breadboard* | + You successfully breadboarded the required 74LS163 circuit | - Your breadboarded circuit did not work as intended | - Your breadboarded circuit is very incomplete |
| *74LS193 Assignment* | + You completed the *74LS193 Assignment* on the MSI Up/Down Counter<br>+ You included responses to all short reflection questions | - You completed most of the assignment<br>- You answered most of the reflection questions | - You did not do the assignment |
| *74LS193 Breadboard* | + You successfully breadboarded the required 74LS193 circuit | - Your breadboarded circuit did not work as intended | - Your breadboarded circuit is very incomplete |