ECE 2544: Fundamentals of Digital Systems

Learning Experience E.3 (Major): Design and Implementation of a Digital Sign (Part 2)

# Validation Sheet (Page 1)

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Student: **Fill in the blanks in the “Resulting Counter State” and “HEX” boxes of the Validation Table as follows:**

* The numbers in the “Key Pressed” boxes are meant to indicate the order in which you should proceed through the validation sheet. They do not necessarily correspond to the state of your counter. ***You should enter your counter states in the order in which they will appear.***
* In row ①, the grader will press KEY1, which should cause your counter value to become 0000. In the corresponding cells for the HEX displays, use the seven-segment display diagrams to show how your sign should appear for the counter value 0000. *If a seven-segment display is blank for any reason, do not mark it*.
* In row ②, the grader will press KEY0, which should cause your counter value to become the state that follows state 0000 is in your design. Write down this value in the “Resulting Counter State” box. (For example, if the next state of your counter after 0000 is 1110, you should enter 1110 in row ②.) Use the seven-segment display diagrams to show how your sign should appear for that counter value.
* For each subsequent step, write down the value of the counter value’s next state in the “Resulting Counter State” box. Use the seven-segment display diagrams to show how your sign should appear for that counter value.
* Continue this pattern until you reach the state whose next state is 0000. This will be the last set of “Resulting Counter State” and seven-segment displays that you fill in according to the pattern described above.

Since your counter might not use all sixteen 4-bit states, you might not fill in every element of the Validation Table. **Only complete the rows for the valid states of your counter**. For example, if your counter has 11 valid states, your 12th Key Press should correspond to a return to the 0000 state and you will not complete the last four rows. **Your sign should progress through the states in your table from top to bottom, then repeat.** If you have done this correctly, the validation table will illustrate the order in which your sign sequences on the board.

GTA: Switch SW0 and the pushbuttons on the DE10-Lite Board represent the input interface to a four-bit binary counter implemented on the DE10-Lite. The four-bit state of the counter will appear on LED[3:0].

The student has filled in the table to show the order of state changes in the student’s counter and the characters that should appear on the HEX displays for each counter value. To test the student’s submission, do the following:

* First, set SW0 to 0 and press KEY1. The counter state should become 0000. Verify that the seven segment displays appear as indicated
* Next, press KEY0 for each “Resulting Counter State” and set of seven-segment displays that the student has filled in.
  + The state should take on the value given in the “Resulting Counter State” box. The seven segment displays should take on the indicated appearance. Verify that the state and character appear correctly.
  + This pattern continues until you reach the last set of boxes that the student has filled in. The next press of KEY0 should take you back to counter value 0000. The seven-segment displays should take on the corresponding appearance.

Students are required to have used at least four seven-segment displays (HEX3 – HEX0). They are not required to use all six. Therefore, the columns for HEX5 and HEX4 may not be filled in. In addition, since the student’s counter may not use all sixteen states, it is possible that not every row in the table will be filled.

**Validation Comments**: (only required if something is unusual or wrong)

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Validation Sheet (Page 2)

## **Validation Table**

| Key Pressed | Resulting Counter State | HEX5 | HEX4 | HEX3 | HEX2 | HEX1 | HEX0 |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ① KEY1 | 0000 |  |  |  |  |  |  |
| ② KEY0 | 0001 |  |  |  |  |  |  |
| ③ KEY0 | 0010 |  |  |  |  |  |  |
| ④ KEY0 | 0011 |  |  |  |  |  |  |
| ⑤ KEY0 | 0100 |  |  |  |  |  |  |
| ⑥ KEY0 | 0101 |  |  |  |  |  |  |
| ⑦ KEY0 | 0110 |  |  |  |  |  |  |
| ⑧ KEY0 | 0111 |  |  |  |  |  |  |
| ⑨ KEY0 | 1000 |  |  |  |  |  |  |
| ⑩ KEY0 | 1001 |  |  |  |  |  |  |
| ⑪ KEY0 | 1010 |  |  |  |  |  |  |
| ⑫ KEY0 | \_\_\_\_ \_\_\_\_ \_\_\_\_ \_\_\_\_ |  |  |  |  |  |  |
| ⑬ KEY0 | \_\_\_\_ \_\_\_\_ \_\_\_\_ \_\_\_\_ |  |  |  |  |  |  |
| ⑭ KEY0 | \_\_\_\_ \_\_\_\_ \_\_\_\_ \_\_\_\_ |  |  |  |  |  |  |
| ⑮ KEY0 | \_\_\_\_ \_\_\_\_ \_\_\_\_ \_\_\_\_ |  |  |  |  |  |  |
| ⑯ KEY0 | \_\_\_\_ \_\_\_\_ \_\_\_\_ \_\_\_\_ |  |  |  |  |  |  |