INTRODUCTION
You will assemble a simple single bit adder and then use the integrated 4 bit adder included in your kit. When you add two binary numbers $X$ and $Y$, they are composed of several individual digits. For example if they are defined by 4 bits then $X=X_3X_2X_1X_0$ and $Y=Y_3Y_2Y_1Y_0$. When you add a number you might analyze only one column, let’s say column 1, then you add $X_1+Y_1+C_1$ where $C_1$ is the possible carry over from the column 0. Therefore the result of the sum in column 1 is $C_2S_1=X_1+Y_1+C_1$ (where $C_2$ is the carry over going to the column 2). (See Chapter 4)

PRE-LAB (Individual part)
Make a truth table for a single bit adder where the bits $X_i$ $Y_i$ and $C_i$ (carry from previous column) are added. The result is $C_{i+1}S_i$ Where $S_i$ is the sum of the column and $C_{i+1}$ is the carry over to the next column. An example is shown in the table below.

<table>
<thead>
<tr>
<th>Example</th>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$X_i$</td>
<td>$Y_i$</td>
</tr>
<tr>
<td>0+0+1=01</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1+1+0=10</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

- Turn in a page with the requested information TYPED or PRINTED in the upper right corner of the page.
  - EE2169
  - Pre-LAB #5
  - Name
  - Last 4 digits of Id,
  - Date
- Complete the required table.
- Late Pre-Labs will not be accepted after given time
LABORATORY (Team effort)

Description
Using the three inputs, X0, Y0 and C0 assemble the two outputs S0 and C1 for the single bit adder. The circuit is simplified in the Chapter 4 of the textbook.

You will implement the equivalent of two cells in the Simuaid software that comes with the textbook.

Procedure
1. Find the single bit adder simplified diagrams in chapter 4.
2. Draw logic diagrams for the single bit adder Sum and Carry out functions. It is recommended that you do this step in Simuaid.
3. Draw the electric diagrams. (Print the logic diagram from Simuaid and draw by hand additional numbers and components)
4. Implement the circuit in your kit
5. Test the eight possible combinations and write them in a truth table.
6. Compare results with your pre-lab analysis.
7. Write the truth table for both functions in your report.
8. Compare the results of your truth table designs and the experimental results.
9. Using Simuaid, construct two more cells and connect them to be able to add two numbers made of 3 bits each. The value of C0, the first carry in should be 0 and the other Cout will be connected to the Cin of the next cell.
10. Connect the six inputs A2A1A0 and B2B1B0 to the corresponding circuit to do simple sums. Connect probes to the outputs of S2S1S0 and the C2 carry over.
11. Test 101+011; 011+011 and other two sums of your selection. Print the results and attach to the report.
12. Write your conclusions, comment on problems and things you learned.

Helpful information
See Chapter 4 of textbook, Install Simuaid form the CD in the back of text.

Report and Demonstration
a) Reserve a demonstration time block with the Teaching Assistants
b) Cover page including EE2169, Semester - Year, LAB#5, Student names, last 4 digits of student IDs,

c) Theoretical truth table from pre-labs.
d) A logic diagram for each function.
e) Electric Diagrams for the experiment (including power supply)
f) Experimental results in a truth table

g) Description of your approach to the construction.

h) Simuaid simulations of a 3 bit adder device.

i) Conclusion or additional comments.

j) The completed circuits implemented with TTL chips.

**Due Date:**

PRE-LAB: beginning of the lab section during the week 6 of semester

LAB DEMONSTRATION and REPORT: Reserve time slot with TAs during week 7 of semester