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ELEC2210 T 11:00am

Experiment 3: Medium Scale Integrated Circuits

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In experiment three, the overall objective was to build and test an eight channel multiplexer and demultiplexer digital communication system. During the lab, I learned to set up and correctly connect and verify the correct operation of a 4-bit counter, a multiplexer and a demultiplexer. I also learned how to connect these components to the correct outputs in order to verify their communication. Through this lab, I was able to learn about digital communication systems through the setting up and verifying of decoders, demultiplexers and output selectors while furthering my knowledge of the ELVIS workstation and digital simulation.

**Step 1:**

The first part of the lab consisted of purely using just the 74LS161 4-bit counter. The table in the lab instructed exactly how to wire the chip to make the counter trigger from 000 to 111 in binary steps, then roll from 111 to 000 again on the next clock edge. These observations were made from connecting Qa, Qb, and Qc to LEDs 2-0, respectively. Overall, I encountered no problems with any wiring or logic issues, and it was very straight-forward.

**Step 2:**

In the second part of the experiment, we had to verify the correctness of the 74S151 8-input multiplexer. The connections listed in Table 3 located in the Experiment 3 instructions were made. All data inputs D0-D6 were connected to digital I/O DIO0-DIO6. This time the counter outputs QC-QB-QA from the previous part (counter) were connected to the C-B-A selection inputs of the multiplexer so that the count selects a channel for transmitting data. The multiplexer output Y was connected to LED7. We only used three counter outputs. The results of the multiplexer outputs are shown in Table 1. (Notice Qd is not shown in Table 1 since it was tied to ground for the entire duration of the experiment).

**Step 3:**

In the last part of the experiment, we had to verify correctness of the 74LS138 demultiplexer operation. The connections listed in Table 4 located in the Experiment 3 instructions were made. The counter outputs QC-QB –QA were connected to the input selection channels C-B-A of the demultiplexer. The eight demultiplexer outputs were connected to LED0-LED7 of the breadboard to display data. The Digital Writer was used to pulse the counter CLOCK, incrementing the counter and selecting channels in sequential order. The multiplexer output Y was connected to the demultiplexer enable signal (G2) so that data signal can be transmitted from the multiplexer to the demultiplexer. The results of the demultiplexer outputs are attached shown in Table 2, and the final circuit is shown in Figure 1.

In conclusion, this lab helped me understand the use and operation of multiplexer and demultiplexers through hands on experience. Because I was physically able to see the response of the counter, multiplexer and demultiplexer when toggling through values, I feel I understand how these seemingly theoretical devices work and provide information. Throughout the lab, I ran into problems with my wiring because of a messy set up on my part. Although I was able to spot and correct the problems, I will be setting up my breadboard in a much more organized fashion during the next lab in order to eliminate these mistakes.

**Table’s and Figure’s**

**Table 1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Qa** | **Qb** | **Qc** |  | **Z** |
| 0 | 0 | 0 |  | LED 0 is high, all others are low |
| 0 | 0 | 1 |  | LED 1 is high, all others are low |
| 0 | 1 | 0 |  | LED 2 is high, all others are low |
| 0 | 1 | 1 |  | LED 3 is high, all others are low |
| 1 | 0 | 0 |  | LED 4 is high, all others are low |
| 1 | 0 | 1 |  | LED 5 is high, all others are low |
| 1 | 1 | 0 |  | LED 6 is high, all others are low |
| 1 | 1 | 1 |  | LED 7 is high, all others are low |

**Table 2**

|  |  |
| --- | --- |
| Toggle input 7 on/off | LED 0 is off while all others are on |
| Toggle input 7 on/off | LED 1 is off while all others are on |
| Toggle input 7 on/off | LED 2 is off while all others are on |
| Toggle input 7 on/off | LED 3 is off while all others are on |
| Toggle input 7 on/off | LED 4 is off while all others are on |
| Toggle input 7 on/off | LED 5 is off while all others are on |
| Toggle input 7 on/off | LED 6 is off while all others are on |
| Toggle input 7 on/off | LED 7 is off while all others are on |

**Figure 1**

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