EEE 120

Lab 2 Answer Sheet (Online Class)

Multiplexers, Decoders and the Arithmetic and Logic Unit (ALU)

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Semester/Year/Session (A/B): Summer/2023/C Date: 6/4/2023

**Task 2-1: Build and Test a 1-Bit 2:1 Multiplexer**

Include a picture of your Digital circuit here:

A screenshot of a computer

Description automatically generated

Please comment on the single biggest issue you were facing when designing the circuit.

There was no issues building this circuit.

**Task 2-2: Build a 4-Bit 2:1 Multiplexer**

Include a picture of your Digital circuit here:

A screenshot of a computer

Description automatically generated

Please comment on the single biggest issue you were facing when designing the circuit.

Dealing with the splitters / mergers was my biggest issue when facing designing the circuit.

Include a picture of your simulation (timing diagram) here:

A screenshot of a computer

Description automatically generated

Which tests did you perform and why? The following table is an example of how to describe your test sequence. You need to make sure to perform a sufficient number of tests to check the circuit for eventual faults.

|  |  |  |
| --- | --- | --- |
| **Test Stimulus** | **Test Motivation** | **Pass/Fail** |
| A\_1\_0\_A | To see if input B passes through properly with sel = 1 | Pass |
| A\_0\_A\_0 | To see if input A passes through properly with sel = 0 | Pass |
| F\_1\_0\_F | To see if input B is stuck at 0 | Pass |
| F\_0\_F\_0 | To see if input A is stuck at 0 | Pass |
| 0\_1\_E\_0 | To see if input B is stuck at 1 | Pass |
| 0\_0\_0\_9 | To see if input A is stuck at 1 | Pass |

Please comment on the single biggest issue you were facing when simulating the circuit.

The biggest issue was testing the different inputs in the stim text. Thinking about what inputs to give for proper testing was difficult as well.

**Task 2-3: Add 7-Segment Displays to Your Circuit**

Include a picture of your Digital 7-Segment Display here:

A screenshot of a computer

Description automatically generated

Please comment on the single biggest issue you were facing when adding the displays.

There were no issues with adding the displays.

**Task 2-4: Build the NOT/NEG Circuit**

Include a picture of your Digital circuit here:

A screenshot of a computer program

Description automatically generated with medium confidence

Please comment on the single biggest issue you were facing when designing the circuit.

There were no issues with building this circuit.

**Task 2-5: Build the AND/ADD Circuit**

Include a picture of your Digital circuit here:

A screenshot of a computer

Description automatically generated

Please comment on the single biggest issue you were facing when designing the circuit.

The biggest issue was rotating the splitter / merger.

**Task 2-6: Build and Test the ALU Circuit**

Include a picture of your Digital circuit here:

A screenshot of a computer

Description automatically generated

Please comment on the single biggest issue you were facing when designing the circuit.

There were no issues with designing the circuit.

Please complete the ALU function definition table shown below:

| arith | invert | pass | Function |
| --- | --- | --- | --- |
| 0 | 0 | 0 | AND, A AND B\* |
| 0 | 0 | 1 | Pass, A \* |
| 0 | 1 | 0 | AND, A’ AND B\* |
| 0 | 1 | 1 | 1’s Complement,A\* |
| 1 | 0 | 0 | Arithmetic Sum, A+B\* |
| 1 | 0 | 1 | Pass,A\* |
| 1 | 1 | 0 | Subtract, -A+B\* |
| 1 | 1 | 1 | Two’s Complement, A\* |

Include all pictures of simulations (timing diagrams) for each function here:

AND (A . B), arith/invert/pass = 000

A screenshot of a computer

Description automatically generated

PASS (A), arith/invert/pass = 001 files= alu\_pass1.v and alu\_pass1.exe

A screenshot of a computer

Description automatically generated

AND(A’,B) arith/invert/pass = 010 files: andb.v and andb.vcd

A screenshot of a computer

Description automatically generated

1s Complement of A arith/invert/pass = 011 files: alu.ones.v and alu.ones.vcd

A screenshot of a computer

Description automatically generated

Arithmetic Sum(A+B), arith=0,invert=0,pass=0 (alu\_add.v)

A screenshot of a computer

Description automatically generated

PASS (A), arith/invert/pass = 101 files= alu\_pass5.v and alu\_pass5.exe

A screenshot of a computer

Description automatically generated

Subtract -A + B, arith/invert/pass = 110 files= alu\_pass5.v and alu\_pass5.exe

A screenshot of a computer

Description automatically generated

Twos Complement A, arith/invert/pass = 111 files = alu\_twos.v and alu\_twos.exe

A screenshot of a computer

Description automatically generated

Did the circuit behave as expected? If no, what was wrong?

Yes, It behaved as expected.

Please comment on the single biggest issue you were facing when simulating the circuit.

Generating so many stimuli and checking each one was tiresome.

**Task 2-7: Create a video and submit your report (Optional)**

[This task is useful to get partial credit if your schematic is not working. Take advantage of it to explain to the grader your understanding of the circuit. More importantly, explain where you think the mistake is in and what you would do if you were given more time to fix it.]

Record a short video showing your schematic in Digital and your waveforms in GTKWave. Be sure to show yourself in the video and show your screen. **Upload the video to your Google Drive (personal one or ASU one). Copy and paste the sharing link to that video here. Make sure the link is working and pointing to the correct video. Do NOT upload your video to YouTube.** If your circuit is not working as expected, explain in the video how it is not working and where you expect the mistake to be from.

**Video Link:**

**At the beginning of your recording, say your name, the task number and circuit name. Be brief in your recording. Submit the completed template to Canvas.**

**Make sure all your files are in the Lab2 directory. Create a zip file of the Lab2 directory. Remember to turn in the zip file and your completed template on Canvas! Make sure you upload the template before the zip file.**

Lab 2: Lab Report Grade Sheet

|  |  |
| --- | --- |
| **Name:** |  |

## Instructor Assessment

| **Grading Criteria** | **Max Points** | **Points Lost** |
| --- | --- | --- |
| **Description of Assigned Tasks, Work Performed & Outcomes Met** |  |  |
| Task 2-1: Build and Test a 1-bit 2:1 Multiplexer | 10 |  |
| Task 2-2: Build a 4-Bit 2:1 Multiplexer | 10 |  |
| Task 2-3: Add 7-Segment Displays to Your Circuit | 10 |  |
| Task 2-4: Build the NOT/NEG Circuit | 10 |  |
| Task 2-5: Build the AND/ADD Circuit | 15 |  |
| Task 2-6: Build and Test the ALU Circuit | 15 |  |
| Task 2-7: Create a video and submit your report. |  |  |
|  | **Points Lost** |  |
| Lab Score (70 points total) | **Late Lab** |  |
|  | **Lab Score** |  |