EEE 120

Lab 3 Answer Sheet

Registers, Counters and the “Brainless CPU”

Name: Fauzan Amaan Mohammed Instructor/Time: Josh Hihath (Mon & Wed 3:00 – 4:15)

Date:\_\_Friday, 14th March 2025\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Task 3-1: Build and Test a 4-Bit D Register with Enable**

Include a picture of your Digital circuit here:

A computer screen shot of a computer

AI-generated content may be incorrect.

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

No issues faced

Include a picture of your GTKWave waveforms (timing diagram) here:

A screenshot of a computer

AI-generated content may be incorrect.

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

The circuit behaved as expected.

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

No issues

**Task 3-2: Build and Test a 4-Bit UP Counter**

Include a picture of your Digital circuit here:

A computer screen with blue lines and yellow squares

AI-generated content may be incorrect.

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

No Issues faced

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

The circuit behaved as expected where when reset is 1, q is 0 and when enable is 1, the clock is high, q is incremented.

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

No issues

**Task 3-3: Create a 4-Bit RAM with 16 4-Bit Words**

Include a picture of your Digital circuit here:

A diagram of a circuit

AI-generated content may be incorrect.

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

No issues

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

The circuit behaved as expected. The data has been stored perfectly.

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

No issues

**Task 3-4: Build and Test the Brainless Central Processing Unit**

Include a picture of your Digital circuit here:

A screenshot of a computer

AI-generated content may be incorrect.

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

No issues

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

The circuit behaves as expected

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

The outputs for the incrementor inside the one of the circuits in the ALU and inside the four bit reg circuit had different order of outputs. I just had to ensure the order of outputs for the incrementor stayed consistent between all circuits and the wiring was also correct.

**Task 3-5: Simulate the Brainless Central Processing Unit**

Include a picture of your GTKWave waveforms (timing diagram) here:

A screenshot of a computer

AI-generated content may be incorrect.

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

The circuit behaved as expected. The gtkwave were the exact same as the one shown in the lab manual.

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

No issues faced

**Task 3-6: Create Additional Tests**

As shown in the manual, paste the test\_vals you used for each of the tests here. Be sure to note which each set of test\_vals goes with each test.

**Brainless\_ext\_write.v**

test\_vals[0] = 28'h0\_0\_0\_0\_0\_0\_4;

test\_vals[1] = 28'h0\_0\_0\_9\_3\_0\_0;

test\_vals[2] = 28'h0\_0\_0\_9\_3\_0\_2;

test\_vals[3] = 28'h0\_9\_0\_0\_3\_0\_1;

test\_vals[4] = 28'h0\_0\_0\_0\_3\_0\_0;

test\_vals[5] = 28'h0\_0\_0\_0\_0\_0\_0;

test\_vals[6] = 28'h0\_0\_0\_0\_0\_0\_0;

test\_vals[7] = 28'h0\_0\_0\_0\_0\_0\_0;

**Brainless\_int\_write.v**

test\_vals[0] = 28'h0\_0\_0\_0\_0\_0\_4;

test\_vals[1] = 28'h5\_0\_0\_0\_1\_3\_1;

test\_vals[2] = 28'h5\_0\_0\_0\_1\_0\_0;

test\_vals[3] = 28'h5\_0\_0\_0\_2\_0\_A;

test\_vals[4] = 28'h5\_5\_0\_0\_2\_0\_1;

test\_vals[5] = 28'h5\_0\_0\_0\_2\_0\_0;

test\_vals[6] = 28'h5\_5\_0\_0\_2\_0\_1;

test\_vals[7] = 28'h5\_0\_0\_0\_0\_0\_0;

**Brainless\_alu.v**

test\_vals[0] = 28'h0\_0\_0\_0\_0\_0\_4;

test\_vals[1] = 28'hA\_A\_A\_A\_0\_3\_0;

test\_vals[2] = 28'h5\_5\_5\_0\_0\_9\_0;

test\_vals[3] = 28'h3\_3\_3\_3\_0\_3\_0;

test\_vals[4] = 28'h1\_0\_1\_5\_0\_1\_0;

test\_vals[5] = 28'h1\_0\_1\_0\_0\_0\_0;

test\_vals[6] = 28'h1\_0\_1\_0\_0\_0\_0;

test\_vals[7] = 28'h1\_0\_1\_0\_0\_0\_0;

If you changed your circuit since you took the screenshot for Task 3-4, take another and replace the screenshot in Task 3-4.

Include a picture of your GTKWave waveforms here (one per required test):

**Brainless\_ext\_write**

**A screen shot of a graph

AI-generated content may be incorrect.**

**Brainless\_int\_write.v**

**A screenshot of a computer

AI-generated content may be incorrect.**

**Brainless\_alu.v**

**A screenshot of a computer

AI-generated content may be incorrect.**

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

No issues

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

The circuit behaved as expected

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

No issues

**Task 3-7: Create a video and submit your report**

Record a short video showing your schematics in Digital and your waveforms in GTKWave. Be sure to show yourself in the video and show your screen. Explain how your circuit works – you need to convince the grader you did the lab and understand it! **Copy and paste the link to your video below. Make sure the link is working and pointing to the correct video. Remember to include the password if required. Do NOT upload your video to Canvas. It is recommended that you use Zoom to record to the cloud, pasting the link and password below.** If your circuit is not working as expected, explain in the video how it is not working and why you think it is not working.

**Video Link:** [**https://asu.zoom.us/rec/share/BflnnDxeBNsocLJdkVHJh7AtuivotF3h-hYboKZKJaSV4pX1x5zaWnTcg4M2BLPv.tG6CC1-TxS8D7FsT?startTime=1741990429000**](https://asu.zoom.us/rec/share/BflnnDxeBNsocLJdkVHJh7AtuivotF3h-hYboKZKJaSV4pX1x5zaWnTcg4M2BLPv.tG6CC1-TxS8D7FsT?startTime=1741990429000)

**Passcode: 56rL!wj5**

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

**Make sure all your files are in the Lab3 directory. Create a zip file of the Lab3 directory. Remember to turn in the zip file and your completed template on Canvas!**

**Do not include the video in the zip file! This makes the file very large and you run the risk of the zip file not uploading or taking so long to upload that your submission will be late. Remember that the submission is dated at the time the upload completes, not when it starts!**

Lab 3: Lab Report Grade Sheet

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

**NOTE: You submit the zip file in order to show your work.  
If the zip file is not submitted you will receive a 0 for this lab!**

## Instructor Assessment

|  |  |  |
| --- | --- | --- |
| **Grading Criteria** | **Max Points** | **Points Lost** |
| **Description of Assigned Tasks, Work Performed & Outcomes Met** |  |  |
| Task 3-1: Build and Test a 4-Bit D Register with Enable | 10 |  |
| Task 3-2: Build and Test a 4-Bit UP Counter | 10 |  |
| Task 3-4: Build and Test the Brainless Central Processing Unit | 10 |  |
| Task 3-5: Simulate the Brainless Central Processing Unit | 10 |  |
| Task 3-6: Create Additional Tests | 10 |  |
| Task 3-7: Create a video and submit your report | 10 |  |
|  | **Points Lost** |  |
| Lab Score (60 points total) | **Late Lab** |  |
|  | **Lab Score** |  |