EEE 120

Lab 3 Answer Sheet

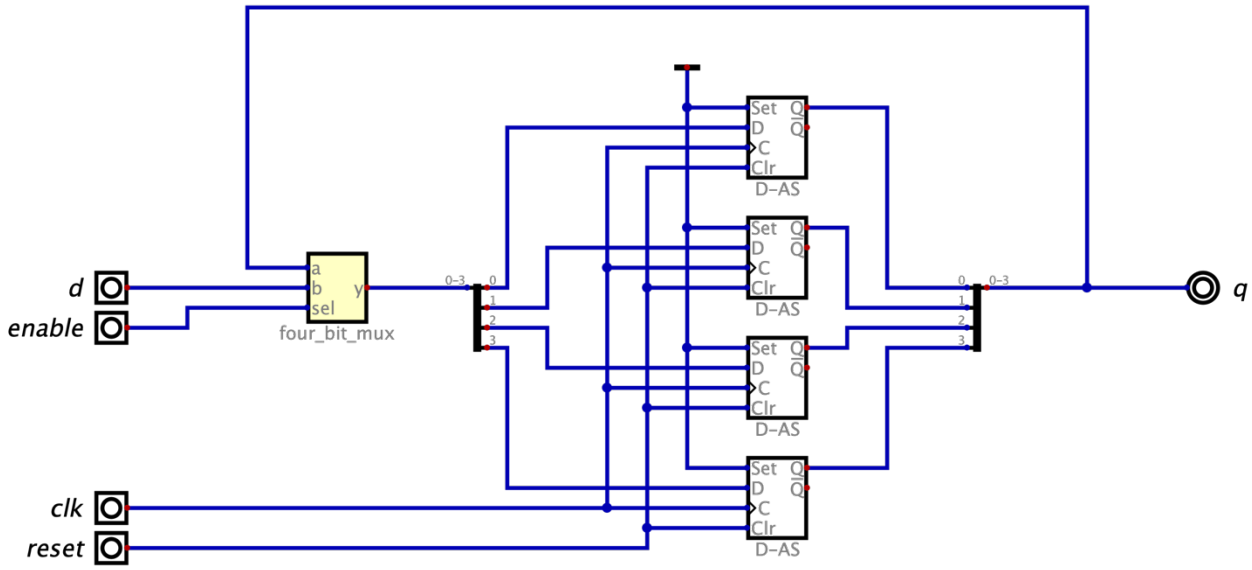
Registers, Counters and the “Brainless CPU”

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

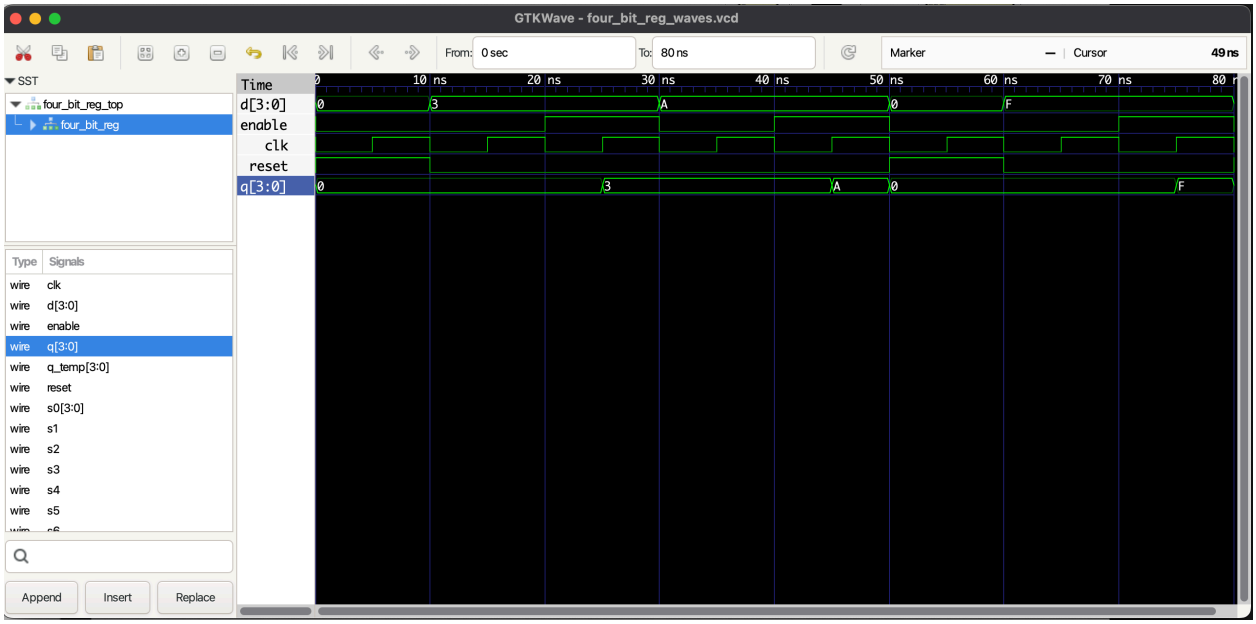
Include a picture of your Digital circuit here:



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:



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

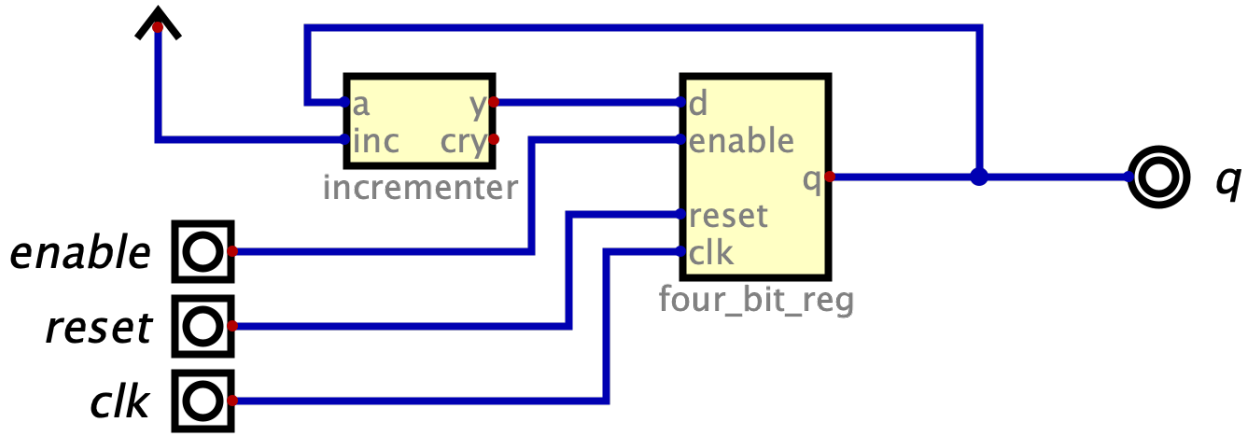
The circuit behaved as expected.

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:



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?

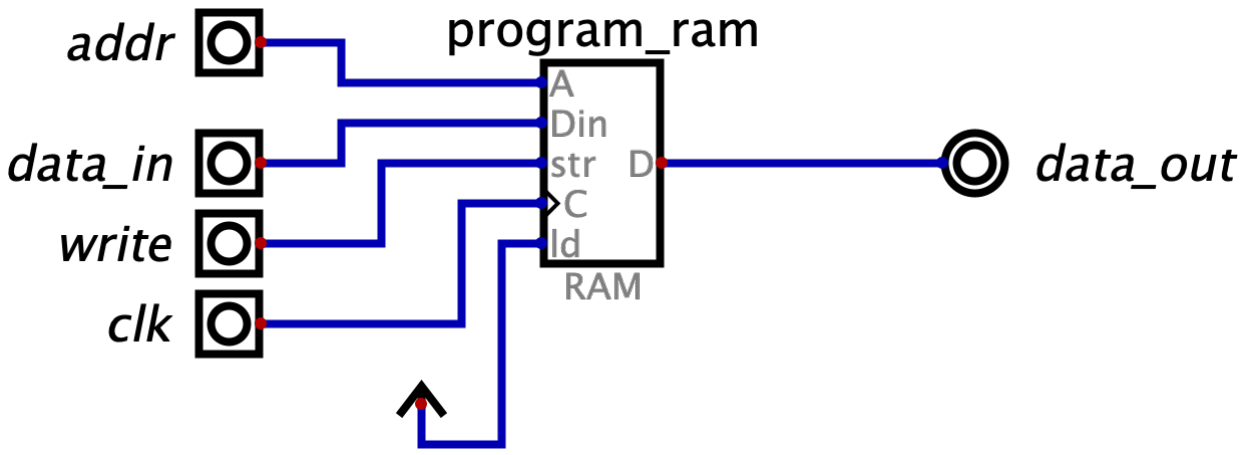
The circuit behaved as expected where when reset is 1, q is 0 and when enable is 1, the clock is high, q is incremented.

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:



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?

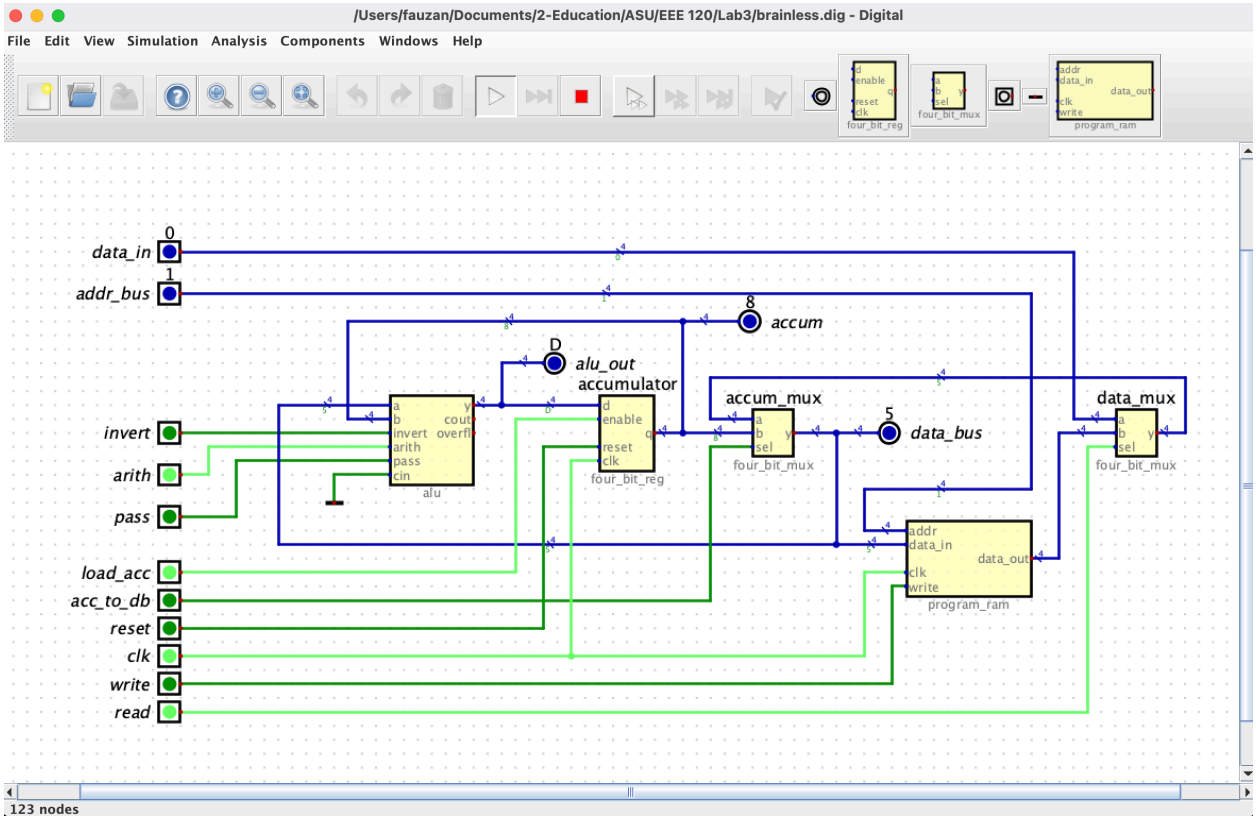
The circuit behaved as expected. The data has been stored perfectly.

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:



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?

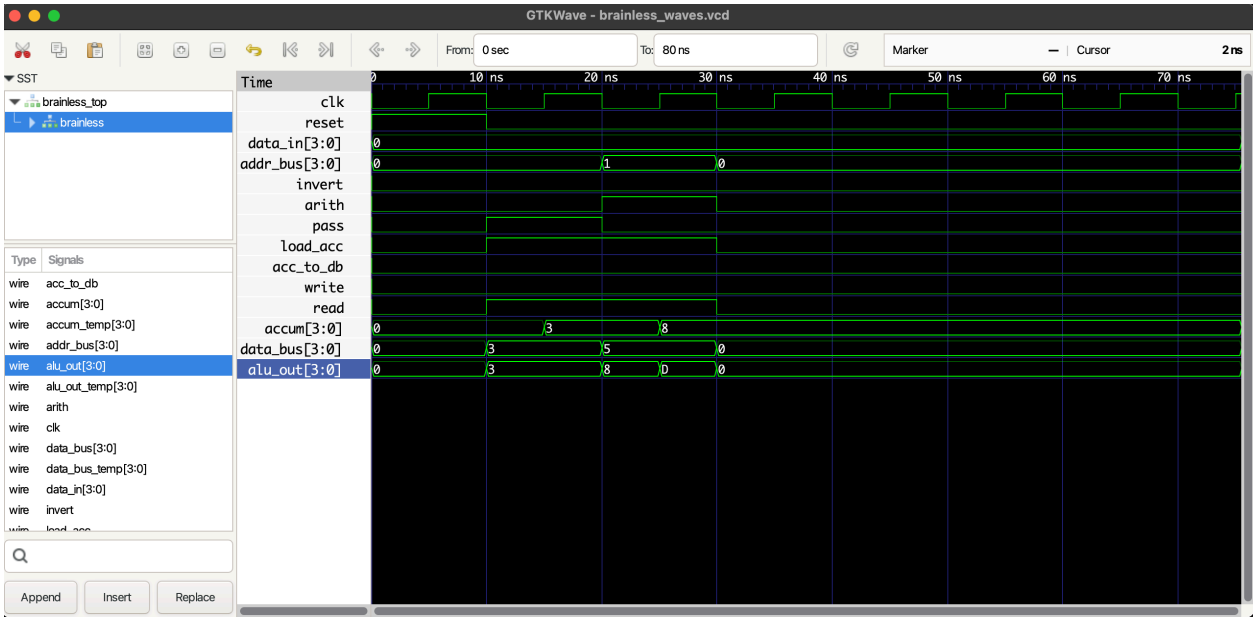
The circuit behaves as expected

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:



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;

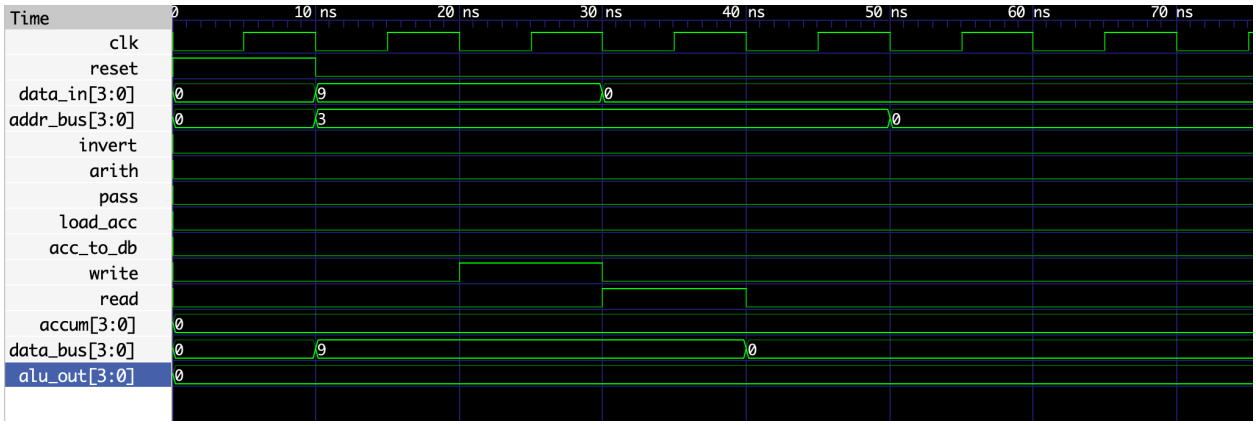
test_vals[6] = 28'h1_0_1_0_0_0_0;

test_vals[7] = 28'h1_0_1_0_0_0_0;

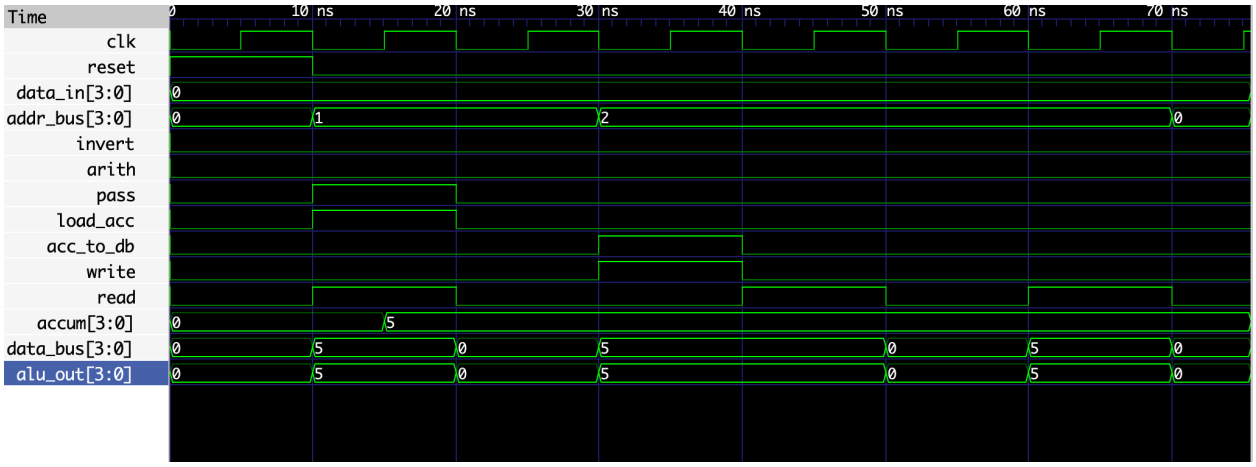
If you changed your circuit since you took the screenshot for Task 3-4, take another and replace the screenshot in Task 3-4.

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

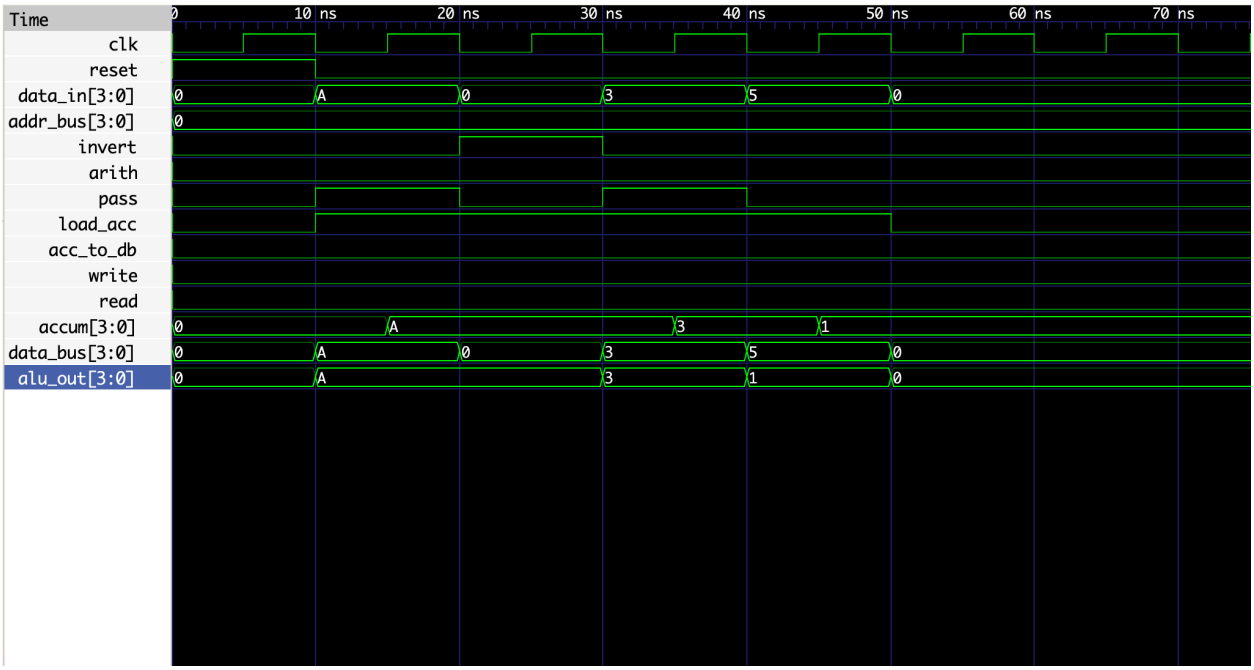
Brainless_ext_write



Brainless_int_write.v



Brainless_alu.v



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

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	
Lab Score (60 points total)	**Points Lost**	
	Late Lab	
	Lab Score	