

# California State University, Northridge

Department of Electrical & Computer Engineering



ECE 526L

Lab 5 Report

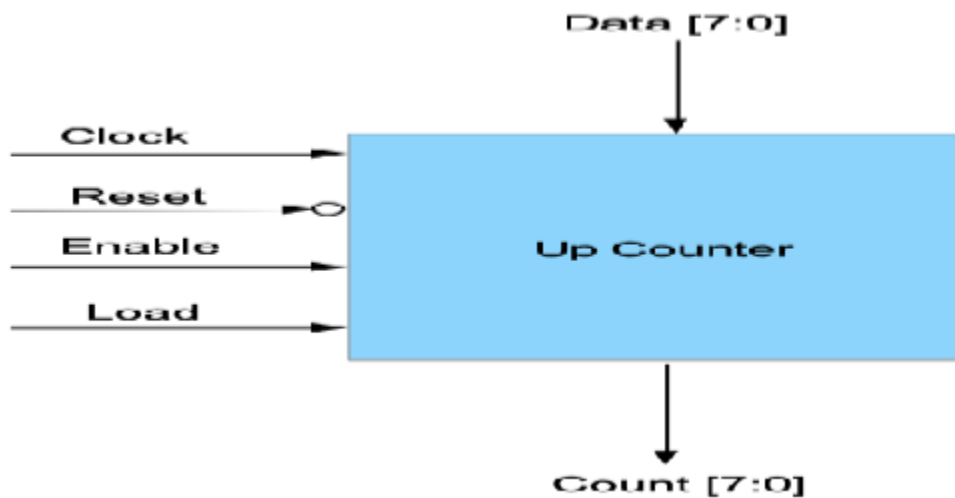
By

Avinash Damse

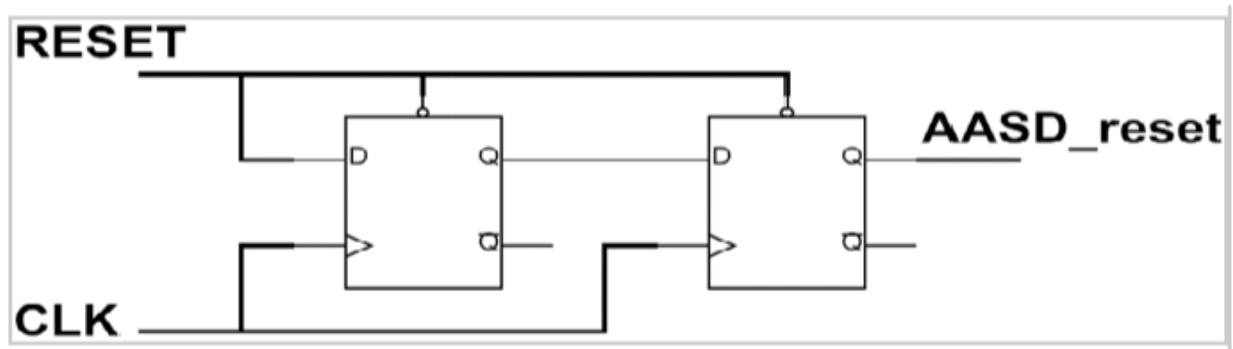
CSUN ID- 203131064

## 1: Introduction

The objective of this lab is to build Verilog model for a reloadable 8-bit up counter. And Implement an asynchronous assert, synchronous de-assert reset for the counter.



Here we have to use following diagram to build asynchronous assert, synchronous de-assert reset for the counter.



## **2: Procedure**

### **a. Part 1: Creating Counter Module**

In this lab I have created a Counter module for 8-bit up counter. Inside the module I have assigned "CLK, RST, ENA, LOAD, and DATA," as input variables and "CNT" as output variables. Then I wrote the counting logic inside module. After completing the code I ended the module using and saved the file with name "Counter.v".

### **b. Part 2: Creating AASD Module**

In this lab I have created a module AASD for asynchronous assert, synchronous de-assert reset. Inside the module I have assigned "RESET, CLOCK" as input variables and "RST" as output variables. Then I wrote the AASD logic . After completing the code I ended the module using and saved the file with name "AASD.v".

### **c. Part 2: Creating Top Module**

In this lab I have created a module Top in wich I have instantiated Counter and AASD modules. After completing the code I ended the module using and saved the file with name "Top.v".

### **d. Part 3: Creating Top\_tb Module**

I have written the test bench for the Top module. We require test bench just to make sure that the module we have created is working properly. Here, in this testbench I have used some delays and after using trial and error method I got the final expected output.

## e. Part 4: Creating “.f ” file for execution.

I have created Lab5.f file and wrote “vcs -debug -full64 Counter.v AASD.v Top.v Top\_tb.v” command in that file.

Now using “chmod +x Lab5.f” followed by “./Lab5.f” command I executed the file.

## f. Part 5: Simulation

After an execution of all modules, I have run the command “simv” for simulation.

```
DCD156.csun.edu (ad477306)
Terminal Sessions View X server Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help

Quick connect...
4477306@VerilogLab5
Name
..
simv.daidir
csrc
vcdplus.vpd
udt.key
Top_tb.v
Top.v
simv
Lab5.f
Counter.v
AASD.v

Remote monitoring
Follow terminal fold

VCS Simulation Report
Time: 966 ns
CPU Time: 0.220 seconds; Data structure size: 0.0Mb
Sun Mar 19 18:19:53 2023
$ simv -l Lab5.log
Chronologic VCS simulator copyright 1991-2017
Contains Synopsys proprietary information.
Compiler version N-2017.12-SP2-9 Full64; Runtime version N-2017.12-SP2-9 Full64; Mar 19 18:20 2023
VCD+ Writer N-2017.12-SP2-9 Full64 Copyright (c) 1991-2017 by Synopsys Inc.
0 CNT = xxx CLOCK = 0 RESET = 1 ENA = x LOAD = 0 DATA = xxx
3 CNT = 000 CLOCK = 0 RESET = 0 ENA = x LOAD = 0 DATA = xxx
10 CNT = 000 CLOCK = 1 RESET = 0 ENA = x LOAD = 0 DATA = xxx
13 CNT = 000 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
20 CNT = 000 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
30 CNT = 000 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
40 CNT = 000 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
50 CNT = 000 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
60 CNT = 000 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
70 CNT = 001 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
80 CNT = 001 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
90 CNT = 002 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
100 CNT = 002 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
110 CNT = 003 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
120 CNT = 003 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
130 CNT = 004 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
140 CNT = 004 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
150 CNT = 005 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
160 CNT = 005 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
170 CNT = 006 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
180 CNT = 006 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
190 CNT = 007 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
200 CNT = 007 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
210 CNT = 008 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
213 CNT = 008 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
220 CNT = 008 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
230 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
240 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
250 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
260 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
270 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
280 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0

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```

```
213 CNT = 008 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
220 CNT = 008 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
230 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
240 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
250 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
260 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
```

Here I have loaded 240(F0).

```
DCD156.csun.edu (ad477306)
Terminal Sessions View X server Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help

Quick connect...
Name
simv.dadir
csrc
vcdplus.vpd
udl.key
Top_tb.v
Top.v
simv
Lab5.f
Counter.v
AASD.v

Remote monitoring
Follow terminal fold

240 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
250 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
260 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
270 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
280 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
290 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
300 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
310 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
320 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
330 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
340 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
350 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
360 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
370 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
380 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
390 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
400 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
410 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
420 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
430 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
440 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
450 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
460 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
470 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
480 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
490 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
500 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
510 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
520 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
530 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
540 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
550 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
560 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
570 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
580 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
590 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
600 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
610 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
620 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
630 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
640 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0

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```
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Terminal Sessions View X server Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help

Quick connect...
Name
simv.dadir
csrc
vcdplus.vpd
udl.key
Top_tb.v
Top.v
simv
Lab5.f
Counter.v
AASD.v

Remote monitoring
Follow terminal fold

630 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
640 CNT = 0f0 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
650 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 1 DATA = 0f0
653 CNT = 0f0 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
656 CNT = 000 CLOCK = 1 RESET = 0 ENA = 1 LOAD = 0 DATA = 000
660 CNT = 000 CLOCK = 0 RESET = 0 ENA = 1 LOAD = 0 DATA = 000
666 CNT = 000 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 1 DATA = 000
670 CNT = 000 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
680 CNT = 000 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
690 CNT = 000 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
700 CNT = 000 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
710 CNT = 001 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
720 CNT = 001 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
730 CNT = 002 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
740 CNT = 002 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
750 CNT = 003 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
760 CNT = 003 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
770 CNT = 004 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
780 CNT = 004 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
790 CNT = 005 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
800 CNT = 005 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
810 CNT = 006 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
820 CNT = 006 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
830 CNT = 007 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
840 CNT = 007 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
850 CNT = 008 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
860 CNT = 008 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
866 CNT = 000 CLOCK = 0 RESET = 0 ENA = 0 LOAD = 0 DATA = 000
870 CNT = 000 CLOCK = 1 RESET = 0 ENA = 0 LOAD = 0 DATA = 000
880 CNT = 000 CLOCK = 0 RESET = 0 ENA = 0 LOAD = 0 DATA = 000
890 CNT = 000 CLOCK = 1 RESET = 0 ENA = 0 LOAD = 0 DATA = 000
900 CNT = 000 CLOCK = 0 RESET = 0 ENA = 0 LOAD = 0 DATA = 000
910 CNT = 000 CLOCK = 1 RESET = 0 ENA = 0 LOAD = 0 DATA = 000
920 CNT = 000 CLOCK = 0 RESET = 0 ENA = 0 LOAD = 0 DATA = 000
930 CNT = 000 CLOCK = 1 RESET = 0 ENA = 0 LOAD = 0 DATA = 000
940 CNT = 000 CLOCK = 0 RESET = 0 ENA = 0 LOAD = 0 DATA = 000
950 CNT = 000 CLOCK = 1 RESET = 0 ENA = 0 LOAD = 0 DATA = 000
960 CNT = 000 CLOCK = 0 RESET = 0 ENA = 0 LOAD = 0 DATA = 000

$finish called from file "Top_tb.v", line 58.
$finish at simulation time 966
VCS Simulation Report

UNREGISTERED VERSION - Please support MobaXterm by subscribing to the professional edition here: https://mobaxterm.mobatek.net
```

```
700 CNT = 000 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
710 CNT = 001 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
720 CNT = 001 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
730 CNT = 002 CLOCK = 1 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
740 CNT = 002 CLOCK = 0 RESET = 1 ENA = 1 LOAD = 0 DATA = 000
```

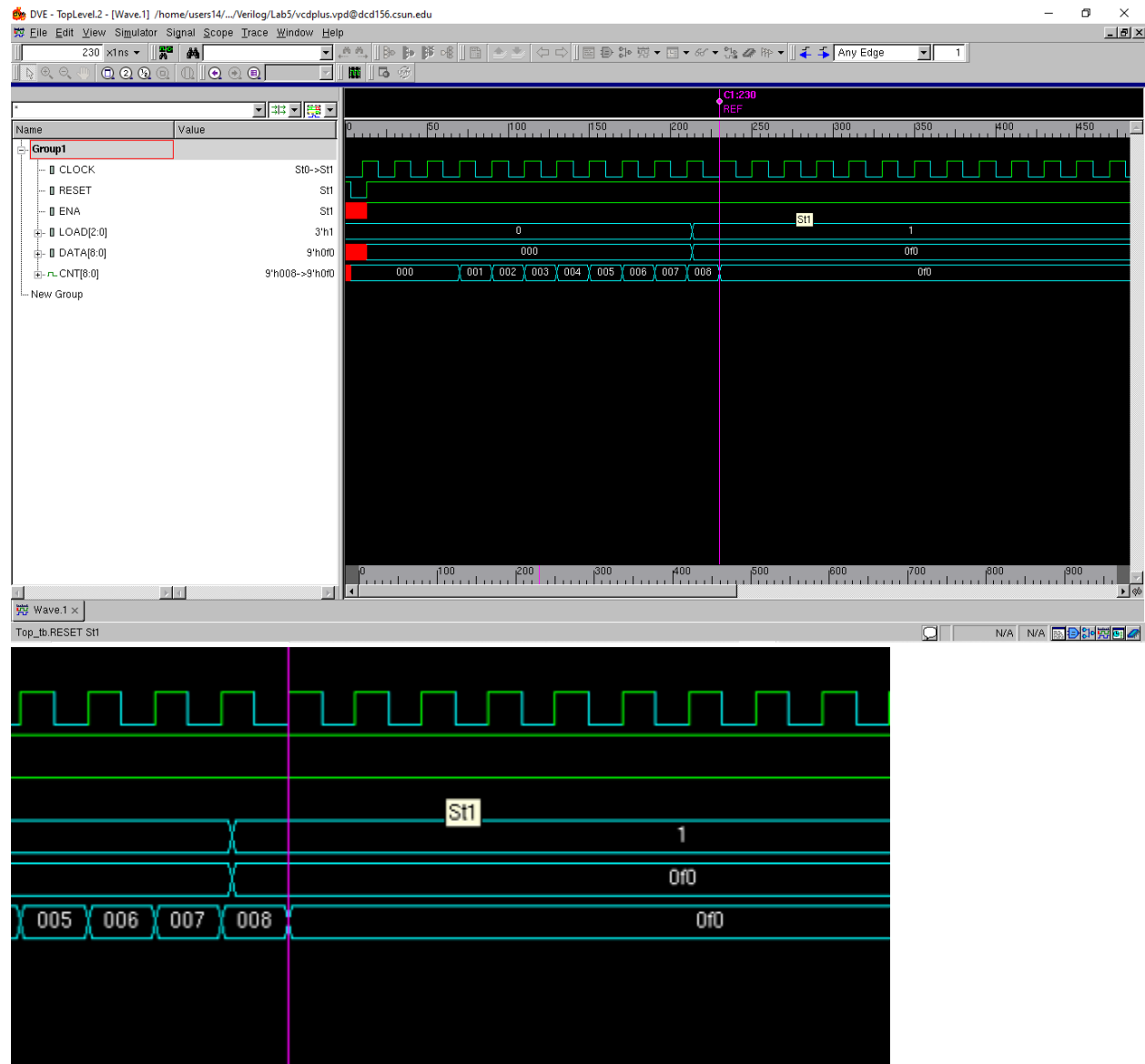
Again started counting from 1

### e. Part 5: Creating Log File

After running the simulation I created the log file using the “simv -l Lab5.log” command.

### f. Part 6: Seeing the waveform.

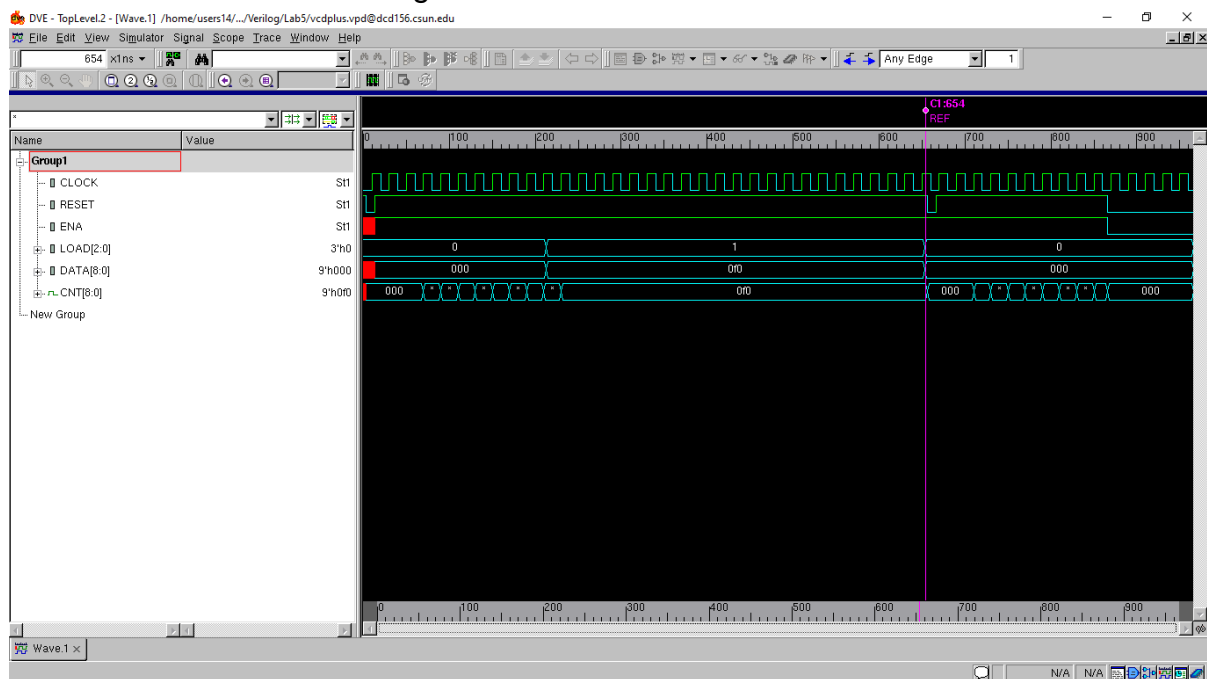
After creating the log file I opened the DVE using “dve -full64 &” command to see the waveforms.



Loaded 240 .



Rolls over and starts counting form 1



## Lab report question

a.If the reset was synchronous, how would the circuit behave differently?

Ans-

The reset signal would be synchronized with the clock signal, so the counter would be reset on the next clock edge after the reset signal goes low. The synchronous reset would be more predictable and easier to control, as it would not be affected by any setup or hold time violations that could occur in an asynchronous reset.

b.How would you change the code to have a defined max counter 240 and then counter rolls over (i.e. returns to zero) and then starts counting back up.

Ans –

Here I just loaded the 240 decimal value in Data and reset was already high so it started counting from 240(F0).

After 440 ns I Loaded Data 0 and set RESET to 0 then it started counting from 1 again



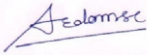
## Conclusion:

The behaviorally modeled 8-bit counter was verified of its functions which included the ENABLE, LOAD, and RST. The asynchronous assert, synchronous de-assert function was also successfully implemented for the counter's reset line. The counter also demonstrated a bit overflow situation and its resolution to wrapping back to the zero value. Finally, the counter also demonstrated the priority of the asynchronous reset over the other inputs.

I hereby attest that this lab report is entirely my own work. I have not copied either code or text from anyone, nor have I allowed or will I allow anyone to copy my work.

Name (printed) Avinash Damse

Name(signed)

A handwritten signature in blue ink, appearing to read 'Avinash Damse', is enclosed within a rectangular box.

Date : 19-March-2023