

Name & Std No.: \_\_\_\_\_ Lab Section: \_\_\_\_\_

Date: \_\_\_\_\_

### Submission Instructions:

#### Prelab:

1. Complete the prelab
2. Submit this report with the prelab completed to Canvas before your lab starts

#### Lab:

1. Complete the lab according to the instructions
2. Take screenshots of your ModelSim waveform (note: to receive points your NetID has to be present in the screenshot) and insert them into this document.
3. Include screenshots of any related block design files or Verilog files in the report
4. Complete this report and reupload it to Canvas

**PRELAB:**

*Refer to Chapter 5 in your textbook and the lab instructions to complete your pre-lab. Please read all the material and complete the circuit diagrams before you come to the lab.*

**Q1.** Draw the circuit diagram for the 4-bit **Shift Register** using D flip-flops in the space below.

**Q2.** Draw the circuit diagram for the 4-bit **Synchronous Up-Counter** using D flip-flops in the space below.

**Q3.** Draw the circuit diagram for the 4-bit **Synchronous Up-Counter** using **T flip-flops** in the space below.

**Q4.** Draw the circuit diagram for the 4-bit **Asynchronous Up-Counter** using T flip-flops in the space below.

**Q5.** Draw the circuit diagram for the 4-bit **Asynchronous Down-Counter** using T flip-flops in the space below.

**LAB:**

**2.0** Fill in the sequence table below. *Watch out for switch bouncing!*

<i>In</i>	<i>Q1</i>	<i>Q2</i>	<i>Q3</i>	<i>Q4</i>
t0 = 1	----	----	----	----
t1 = 0		----	----	----
t2 = 1			----	----
t3 = 1				----
t4 = 1				
t5 = 0				
t6 = 0				
t7 = 0				

<<<Insert a screenshot of shift register here>>>

<<< Insert a screenshot of your waveform for shift register here>>>

**To get full points, replace this screenshot with your results**

- To find your NetID, open the start menu and search for "This PC". Then scroll down to reveal your NetID

**Example Screenshot  
Replace Me!**

**Must show your  
NetID and  
verified waveform**

Synchronous counters:

<<<Insert a screenshot of SYNC UP counter DFF>>>

<<< Insert a screenshot of your waveform for SYNC UP counter DFF here>>>

**To get full points, replace this screenshot with your results**

- To find your NetID, open the start menu and search for "This PC". Then scroll down to reveal your NetID

**Example Screenshot  
Replace Me!**

**Must show your  
NetID and  
verified waveform**

<<<Insert a screenshot of SYNC UP counter TFF>>>

<<< Insert a screenshot of your waveform for SYNC UP counter TFF here>>>

**To get full points, replace this screenshot with your results**

- To find your NetID, open the start menu and search for "This PC". Then scroll down to reveal your NetID

**Example Screenshot Replace Me!**

**Must show your NetID and verified waveform**

Your NetID Here  
(\\my.files.iastate.edu)\User

Transcript  
VSDM 13> Force -freeze sim:/lab1step1/B 1'h1 0  
VSDM 14> run  
# Causality operation skipped due to absence of debug database file  
VSDM 15>

Asynchronous counters:

<<<Insert a screenshot of ASYNC UP counter>>>

<<< Insert a screenshot of your waveform for ASYNC UP counter here>>>

**To get full points, replace this screenshot with your results**

- To find your NetID, open the start menu and search for "This PC". Then scroll down to reveal your NetID

**Example Screenshot Replace Me!**

**Must show your NetID and verified waveform**

Your NetID Here  
(\\my.files.iastate.edu)\User

Network Drive (Z:)  
543 GB free of 808 GB

Transcript  
VSDM 13> Force -Freeze sim:/lab1step1/B 1'h1 0  
VSDM 14> run  
# Causality operation skipped due to absence of debug database file  
VSDM 15>



<<<Insert a screenshot of ASYNC Down counter>>>

<<< Insert a screenshot of your waveform for ASYNC Down counter here>>>

**To get full points, replace this screenshot with your results**

- To find your NetID, open the start menu and search for "This PC". Then scroll down to reveal your NetID

**Example Screenshot  
Replace Me!**

**Must show your  
NetID and  
verified waveform**