

**CS2100 Computer Organisation**  
**Lab #10: Using Logisim II**  
(Week 13: 12 – 16 April 2021)

**Remember to  
bring this along  
to your lab!**

[ This document is available on LumiNUS and module website <http://www.comp.nus.edu.sg/~cs2100> ]

Name: \_\_\_\_\_

Student No.: \_\_\_\_\_

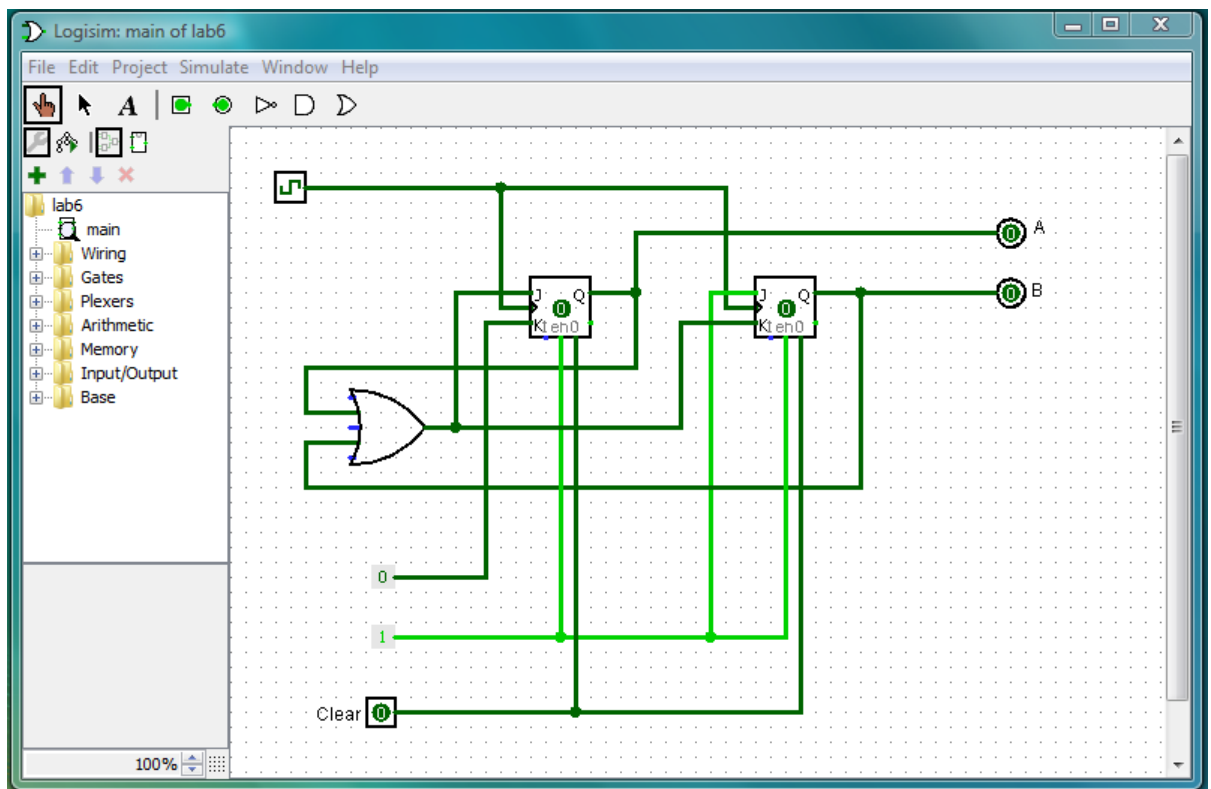
Lab Group: \_\_\_\_\_



**Objective:**

In this experiment, you will use **Logisim** to analyse and design sequential circuits.

**Part I**

1. Run Logisim, open the file **lab10part1.circ**. The circuit is shown below.



2. The circuit consists of two JK flip-flop and an OR gate. Note the following:
  - The outputs of the two JK flip-flops are labelled *A* and *B*, which form the state of the circuit.
  - The Clock  is connected to the clock inputs of the flip-flops.
  - The logic constant 1 is connected to the Enable inputs of the flip-flops.
  - The Clear switch  is connected to the clear inputs of the flip-flops. Hence when Clear = 1, it clears the contents of both flip-flops to 0, bringing the circuit to the initial state of  $AB=00$ .
  - The flip-flop inputs are as follows:

For flip-flop A:  $JA = A + B$ ;  $KA = 0$   
 For flip-flop B:  $JB = 1$ ;  $KB = A + B$

3. Complete the following table:

[6 marks]

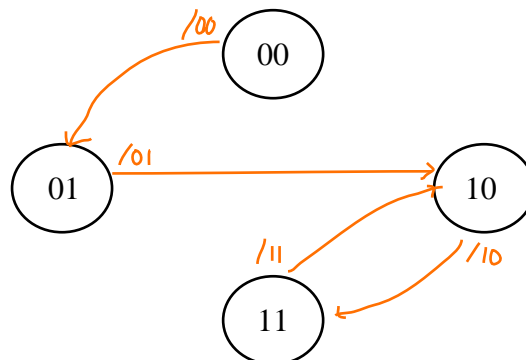
Present state		Flip-flop inputs				Next state	
A	B	JA	KA	JB	KB	A <sup>+</sup>	B <sup>+</sup>
0	0	0	0	1	0	0	1
0	1	1	0	1	1	1	0
1	0	1	0	1	1	1	1
1	1	1	0	1	1	1	0

4. Verify the correctness of your table above by testing the circuit in Logisim.

- Click on “Clear” input to get 1. This clears both flip-flops to 0, bringing the circuit to the initial state of AB=00.
- Click on “Clear” input to get 0 before you proceed. This puts the flip-flops in their normal operation mode.
- Clicking the “Clock” input toggles its value. When the “Clock” value changes from 0 to 1 (i.e. a rising edge), the flip-flops react according to the commands at their J and K inputs.
- Click the “Clock” input several times to simulate the square wave, and watch the outputs of the flip-flops change their values. Do the values follow your table above?
- If at any point of time you want to reset the flip-flops to the initial state of 00, go to step (a) above.

5. Complete the state diagram below.

[4 marks]



## Part II

6. You will design a sequential circuit using JK flip-flops. The flip-flop inputs are given below:

$$\begin{aligned} \text{For flip-flop A: } & \mathbf{JA = 1;} & \mathbf{KA = A \cdot B} \\ \text{For flip-flop B: } & \mathbf{JB = 0;} & \mathbf{KB = (A \cdot B)'} \end{aligned}$$

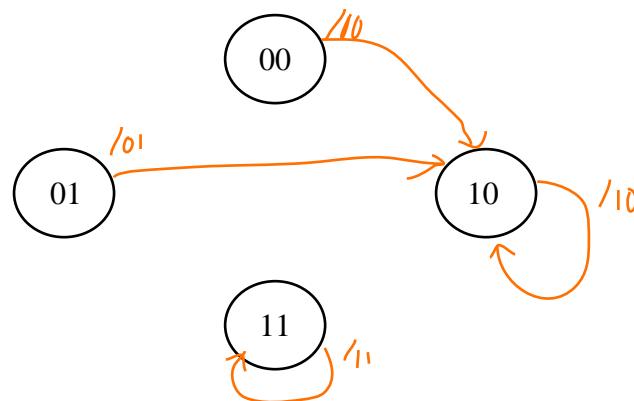
7. Complete the following table:

[6 marks]

Present state		Flip-flop inputs				Next state	
A	B	JA	KA	JB	KB	A <sup>+</sup>	B <sup>+</sup>
0	0	1	0	0	1	1	0
0	1	1	0	0	1	1	0
1	0	1	0	0	1	1	0
1	1	1	1	0	0	0	1

8. Complete the state diagram below.

[4 marks]



9. Implement the circuit on Logisim and show it to your lab TA. In your circuit, you should also include a “Preset” input so that you can set both flip-flops to 1. [5 marks]

10. As this is your final lab, your lab report will not be returned to you.

Total: 25 marks