Self-Study

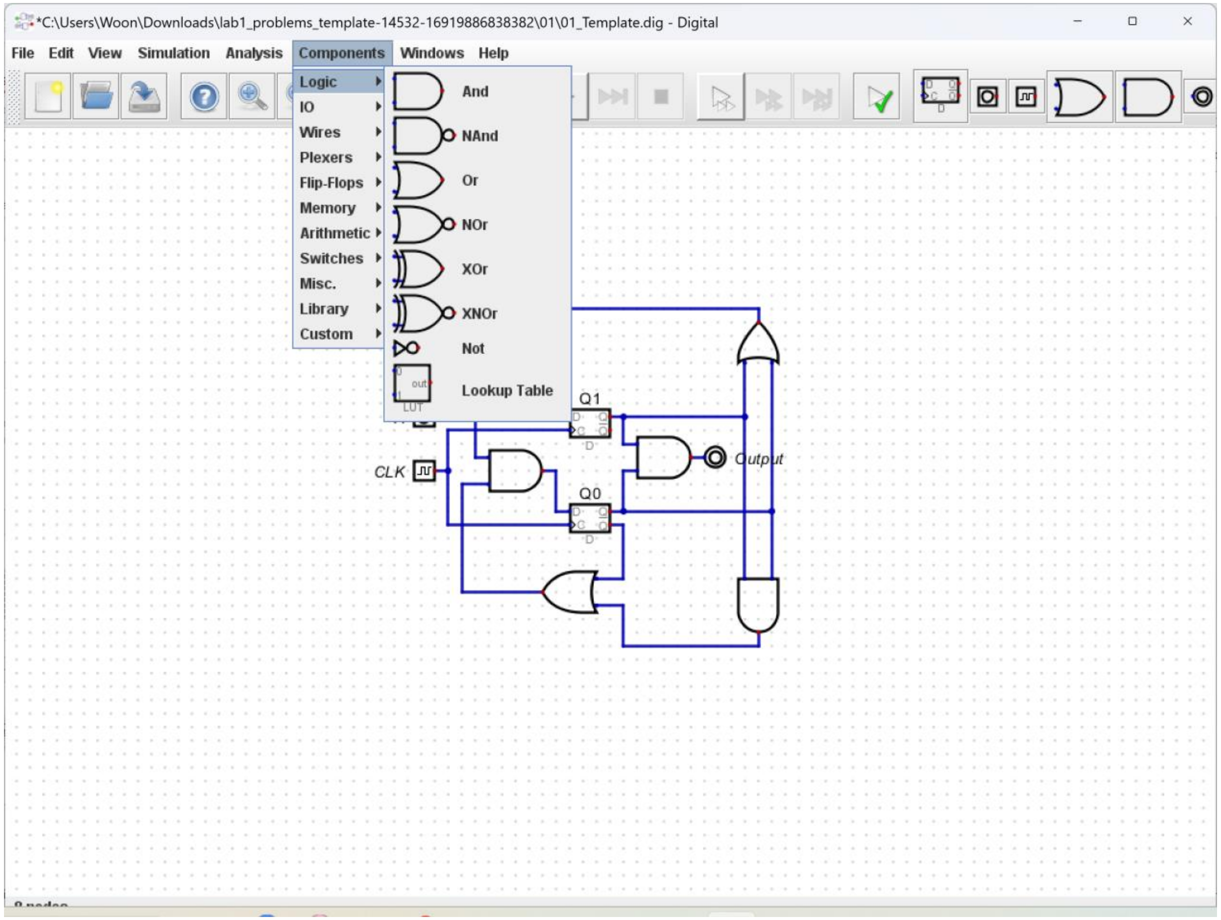
Implement the circuit to fully understand the behavior of the state machine.

Self Study

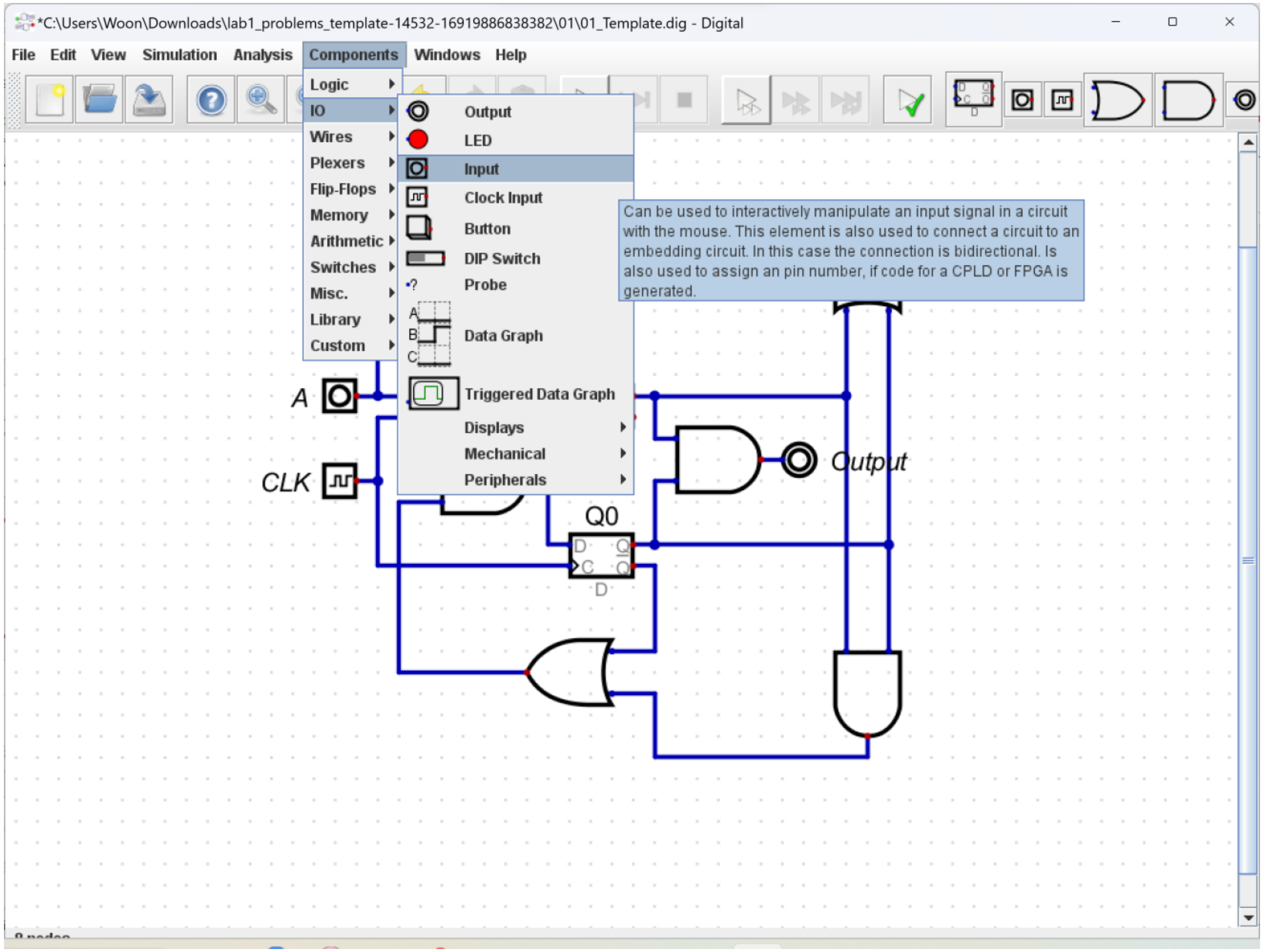
- Download a simple circuit simulator "DIGITAL" from github
- https://github.com/hneemann/Digital?tab=readme-ov-file

- Unzip the file and it's ready to use!

Add gates and inputs from the menu bar

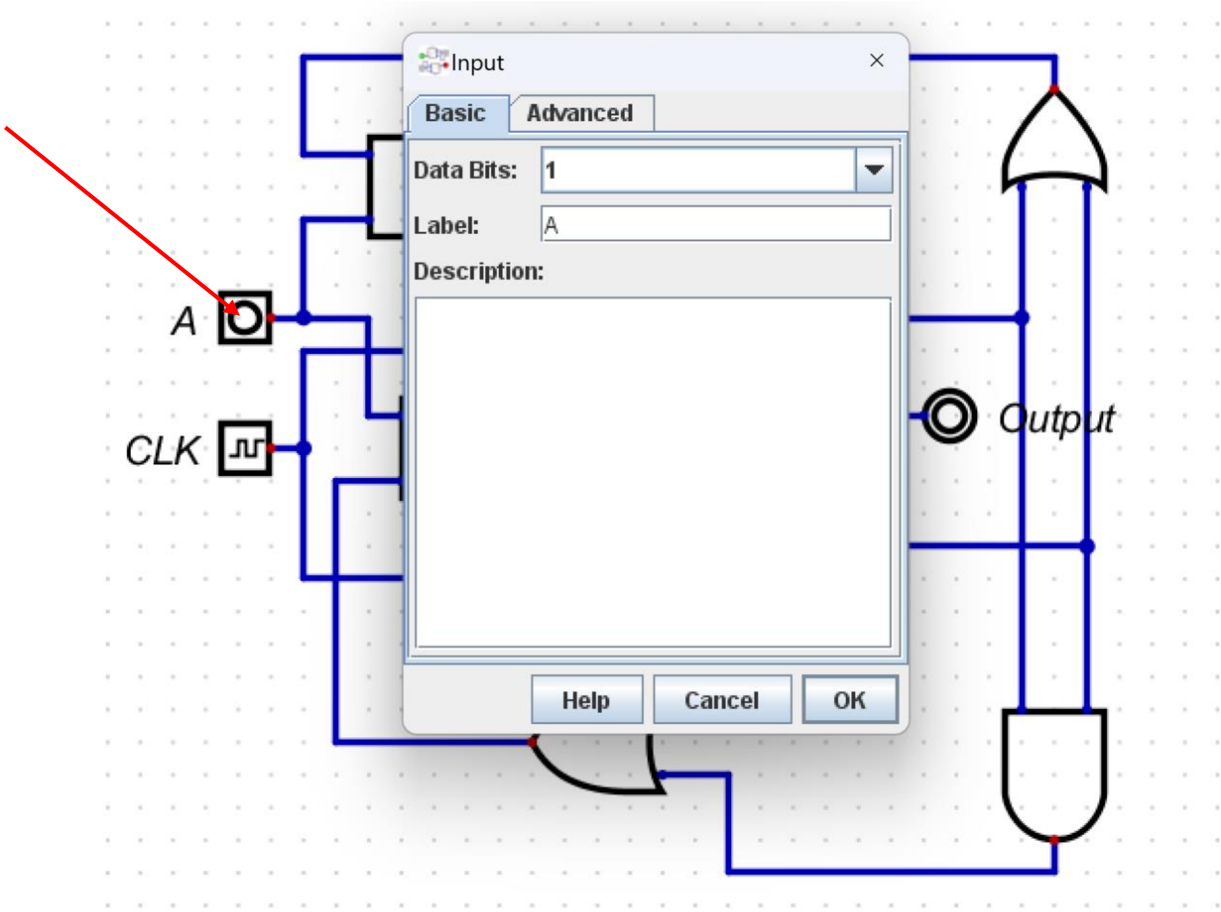


Add gates and inputs from the menu bar



Can be used to interactively manipulate an input signal in a circuit with the mouse. This element is also used to connect a circuit to an embedding circuit. In this case the connection is bidirectional. Is also used to assign an pin number, if code for a CPLD or FPGA is generated.

Labeling by right click on the components

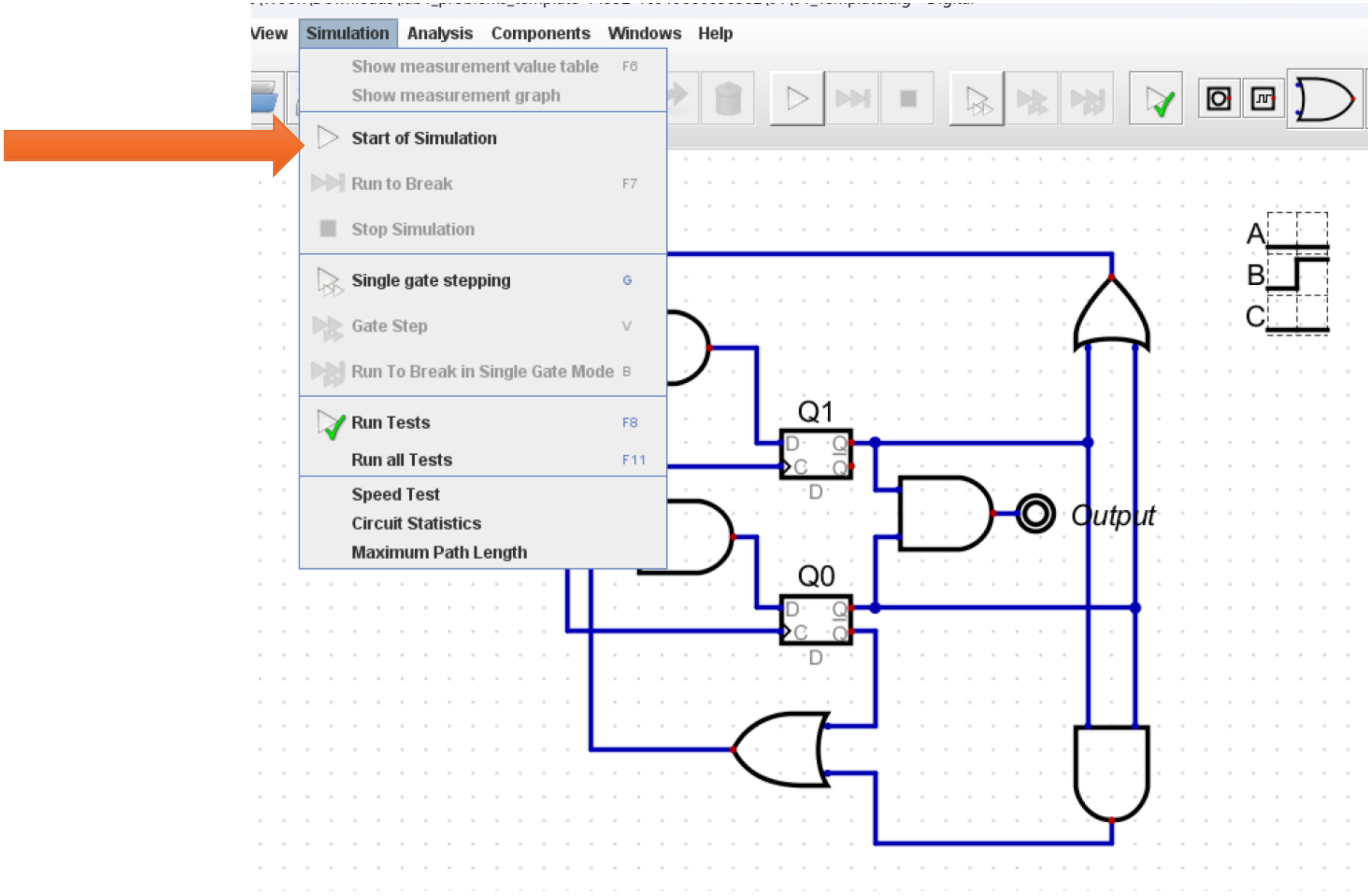


Data Bits: 1

Label: A

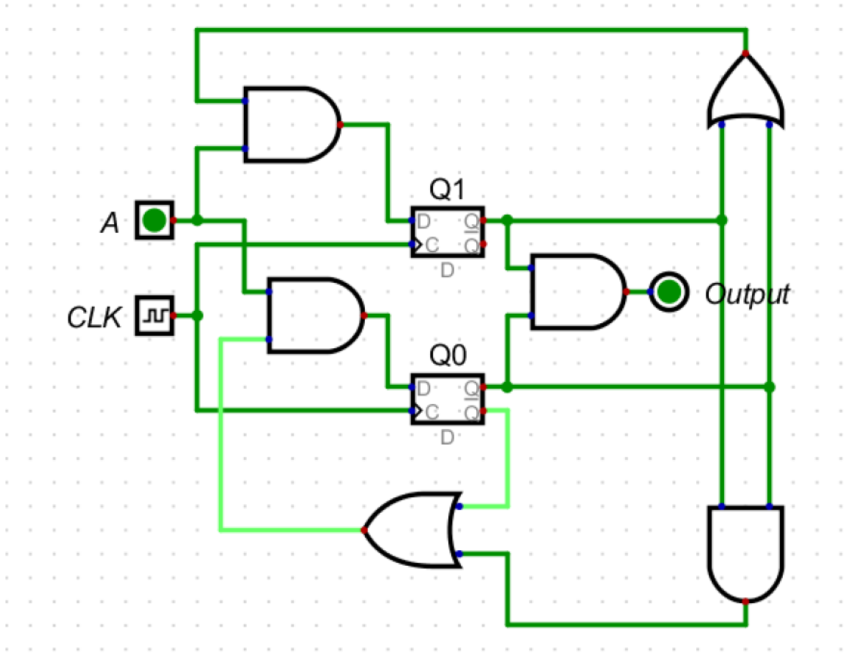
Description:

Start the simulation



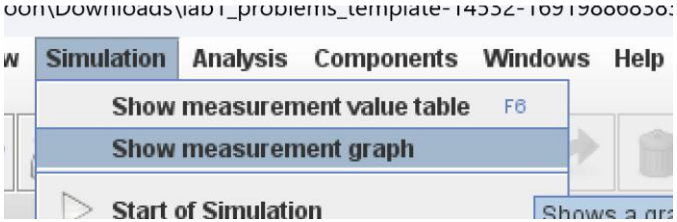
Running the simulator

- You can click on the input A to change from 0 to 1 and vice versa

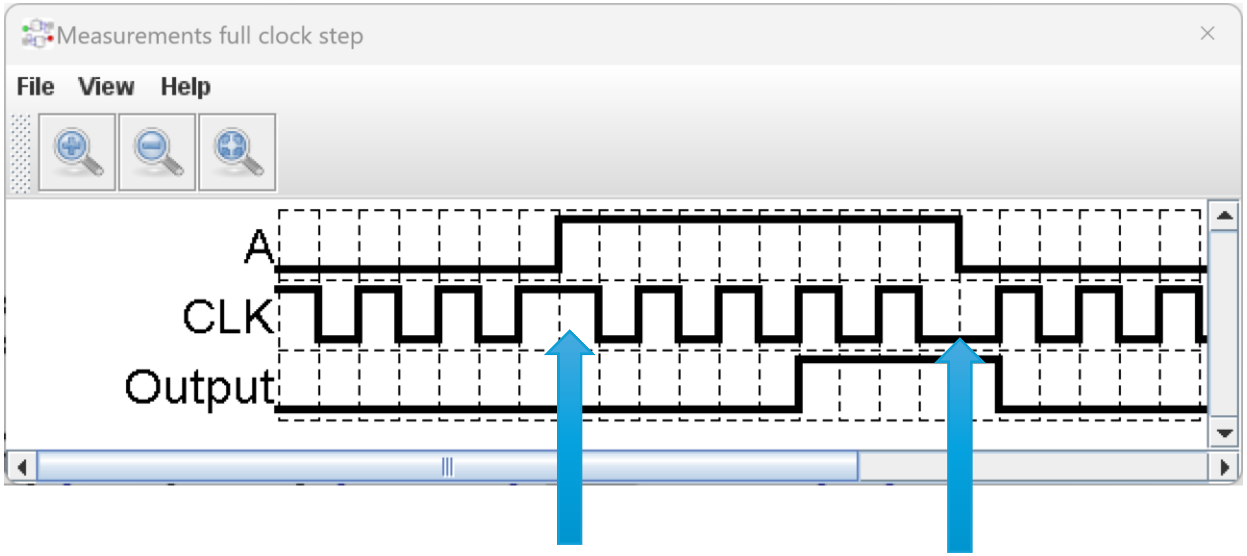


Dark green = 0 (off)
Light green = 1 (on)

Display the graph



The graph will give you a better idea of how the values change over time.



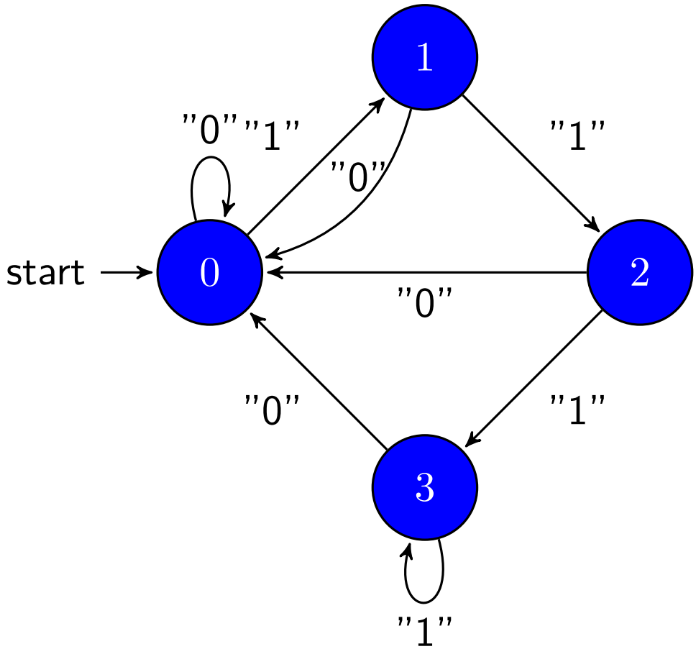
Note: ignore the glitch of the Clock in these two spots. The clock supposes to have a steady cycle of 1s and 0s

Simulate the circuit from the last class

We want one output to be "1"

- Whenever "A" is 1 for 3 clock cycles in a row

State machines

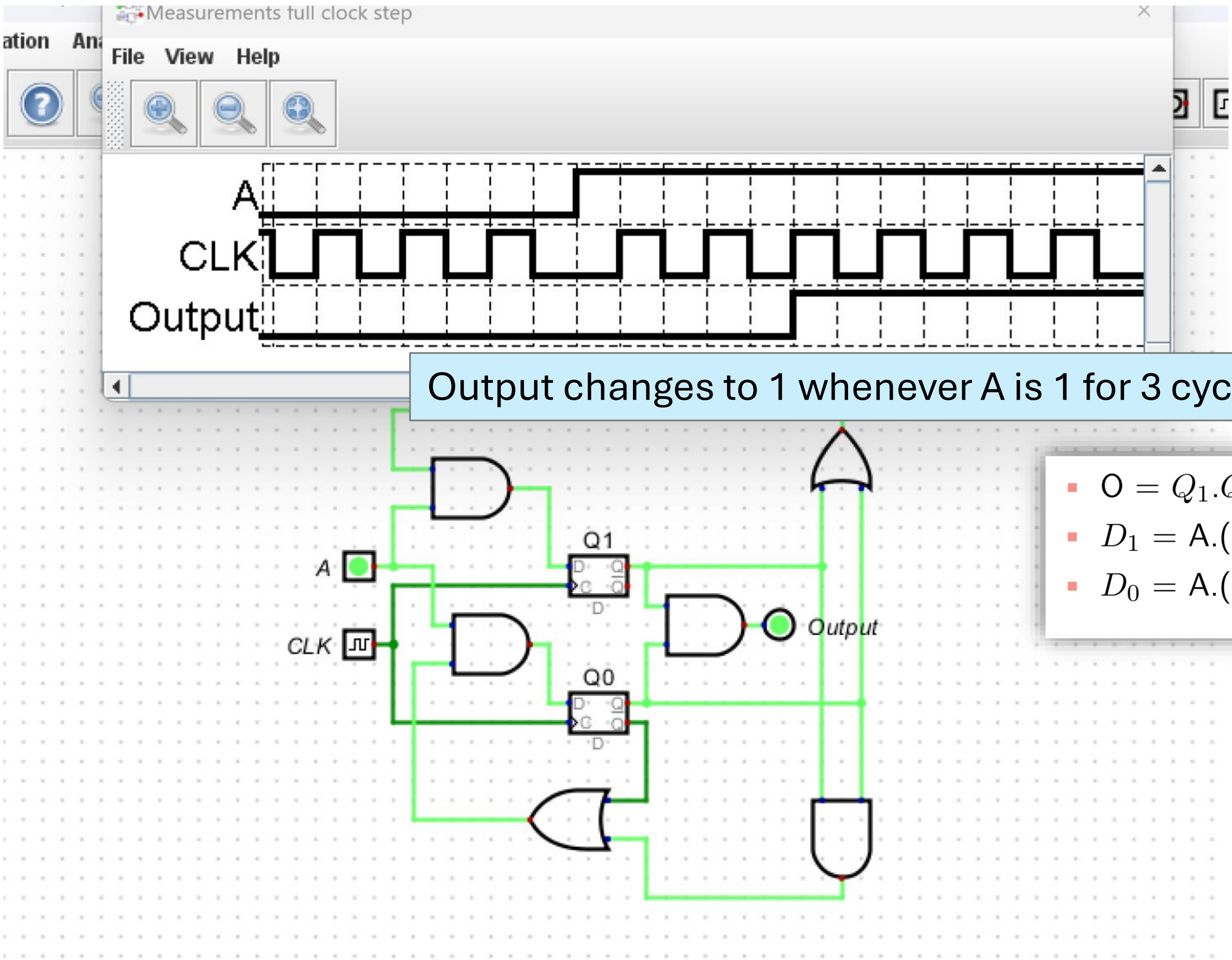


Q_1	Q_0	A	D_1	D_0	O
0	0	0	0	0	0
0	0	1	0	1	0
0	1	0	0	0	0
0	1	1	1	0	0
1	0	0	0	0	0
1	0	1	1	1	0
1	1	0	0	0	1
1	1	1	1	1	1

Output is "1" in state 3

- O $= Q_1.Q_0$
- $D_1 =$ A.$(Q_1 + Q_0)$
- $D_0 =$ A.$(!Q_0 + Q_1.Q_0)$

Simulate the circuit



Output changes to 1 whenever A is 1 for 3 cycles in a row.

- $\text{O} = Q_1.Q_0$
- $D_1 = \text{A}.(Q_1 + Q_0)$
- $D_0 = \text{A}.(!Q_0 + Q_1.Q_0)$

Try to build the simple vending machine

- Design a simple vending machine that sells drink for 15 baht.
- Inputs are
  - Sensors that detect 5 baht coin, 10 baht coin, drink picked up.
- Outputs are
  - Drink (changes to 1 when the coins received equals to15 or 20 baht)
  - Change (changes to 1 when the coins received equals to 20 baht)
- Assume that users cannot insert more than 20 baht and the sensor to detect drink picked up is activated when the drink has been released only.

Simple vending machine

- How many states required to build this machine?
- How many D-flipflops are needed?