Circuit Simulation Project

https://esim.fossee.in/circuit-simulation-project

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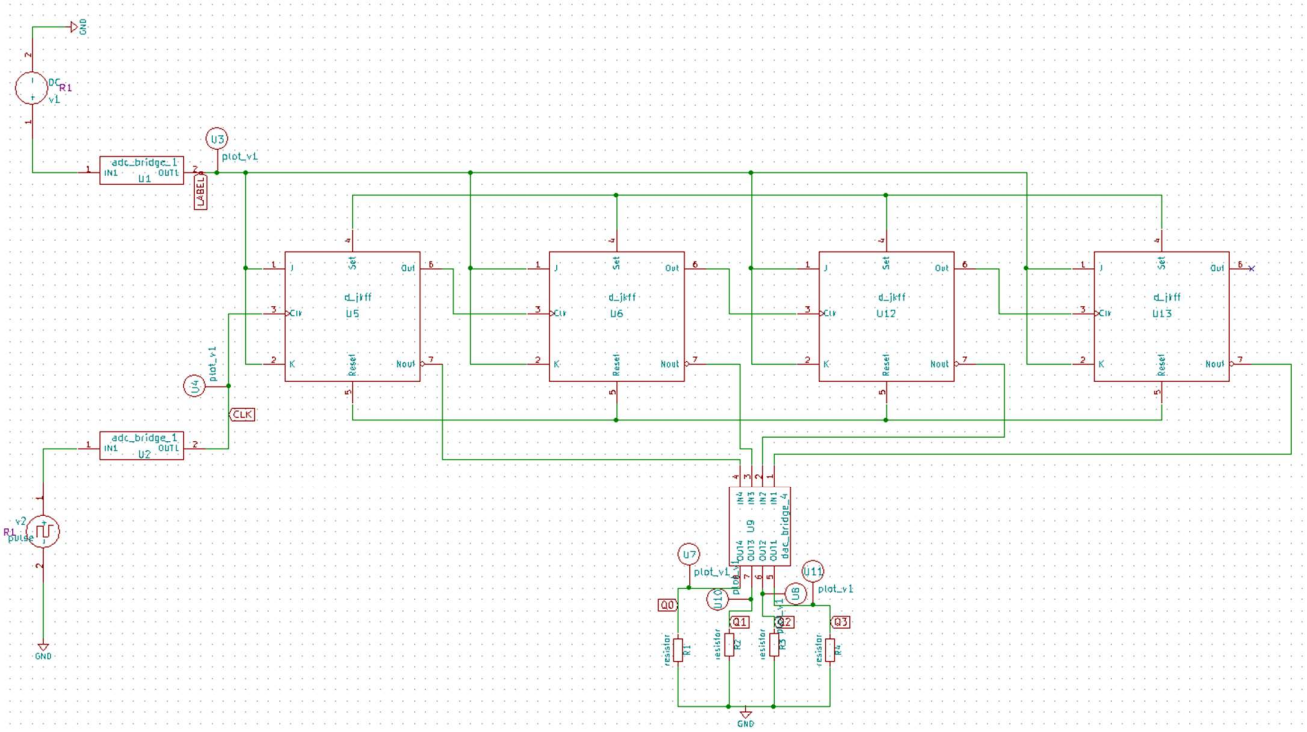
Project Guide: Dr R. Maheshwari
Title of the Circuit: 4-Bit Asynchronous down Counter using JK Flip Flop

Description:

A counter is a sequential logic circuit that goes through a prescribed sequence of states upon the application of input pulses. The prescribed sequence can be a binary sequence or any other sequence. A counter that goes through 2N (N is the number of flip-flops in the series) states is called a binary counter. The modulus of a counter is the number of different states it is allowed to have. Counter modulus is normally 2N unless controlled by a feedback circuit which limits the number of possible states (an example being the decimal counter). Counters are very widely used in almost all computers and other digital electronic systems. There are two major categories of counters: asynchronous counters and synchronous counters.

Asynchronous counter can count using **Asynchronous clock input**. Counters can be easily made using flip-flops. As the count depends on the clock signal, in case of an Asynchronous counter, changing state bits are provided as the clock signal to the subsequent flip-flops. Those Flip-flops are serially connected together, and the clock pulse ripples through the counter. Due to the ripple clock pulse, it's often called a ripple counter. An Asynchronous counter can count $2^n - 1$ possible counting states.

SCHEMATIC:



Source details :

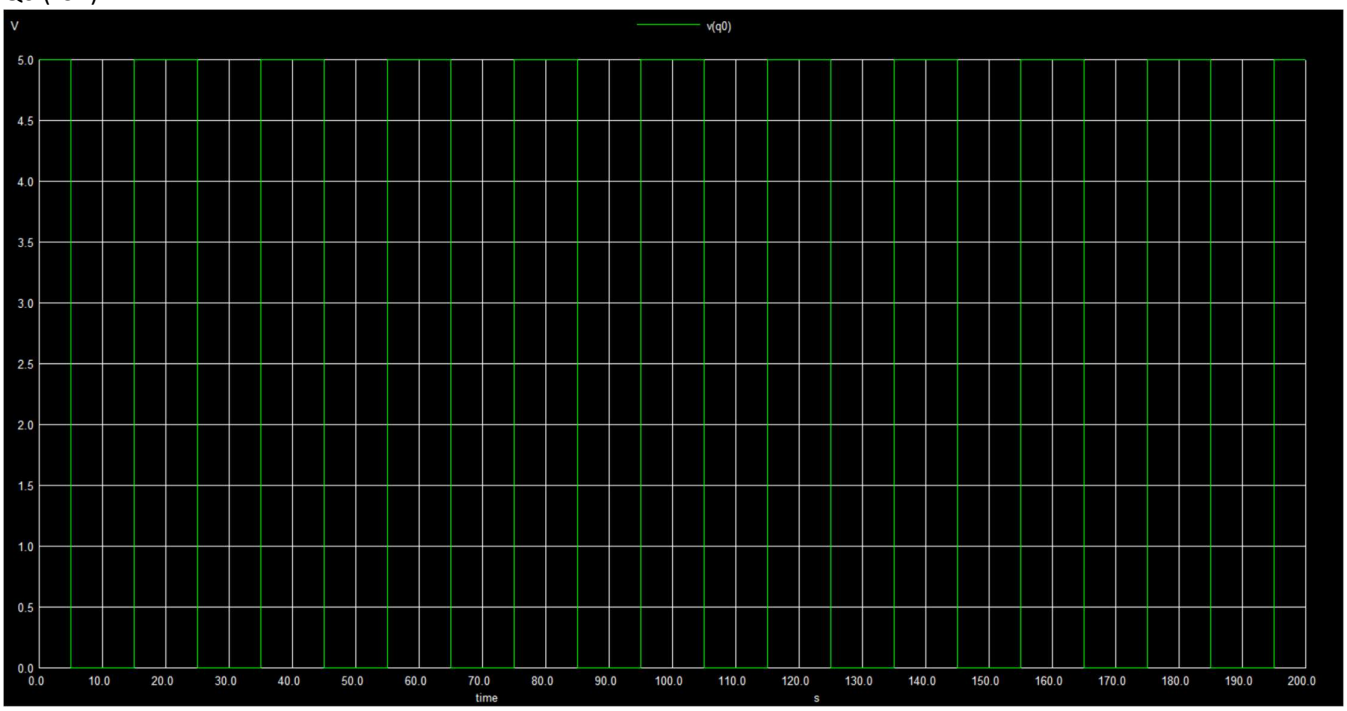
Transient details :

Simulation results :

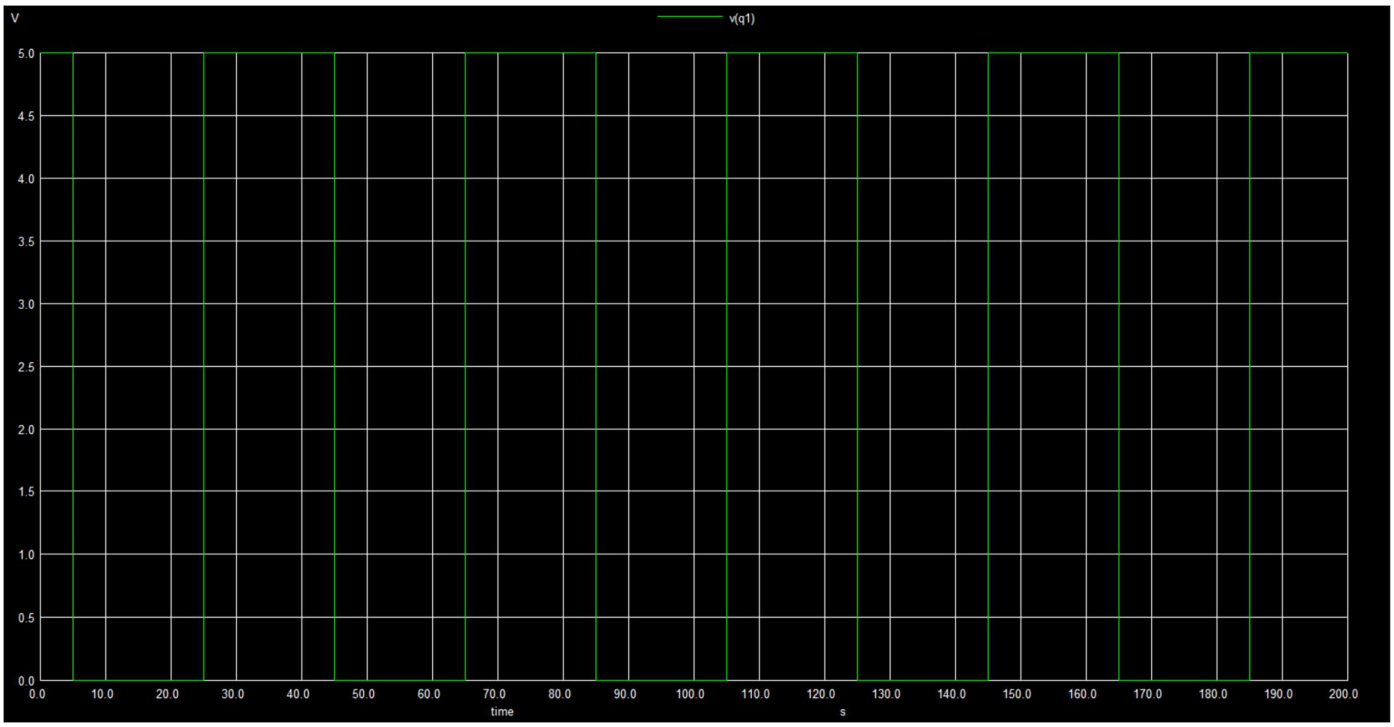
1.NgSpice Waveforms

clk (Clock Pulse)

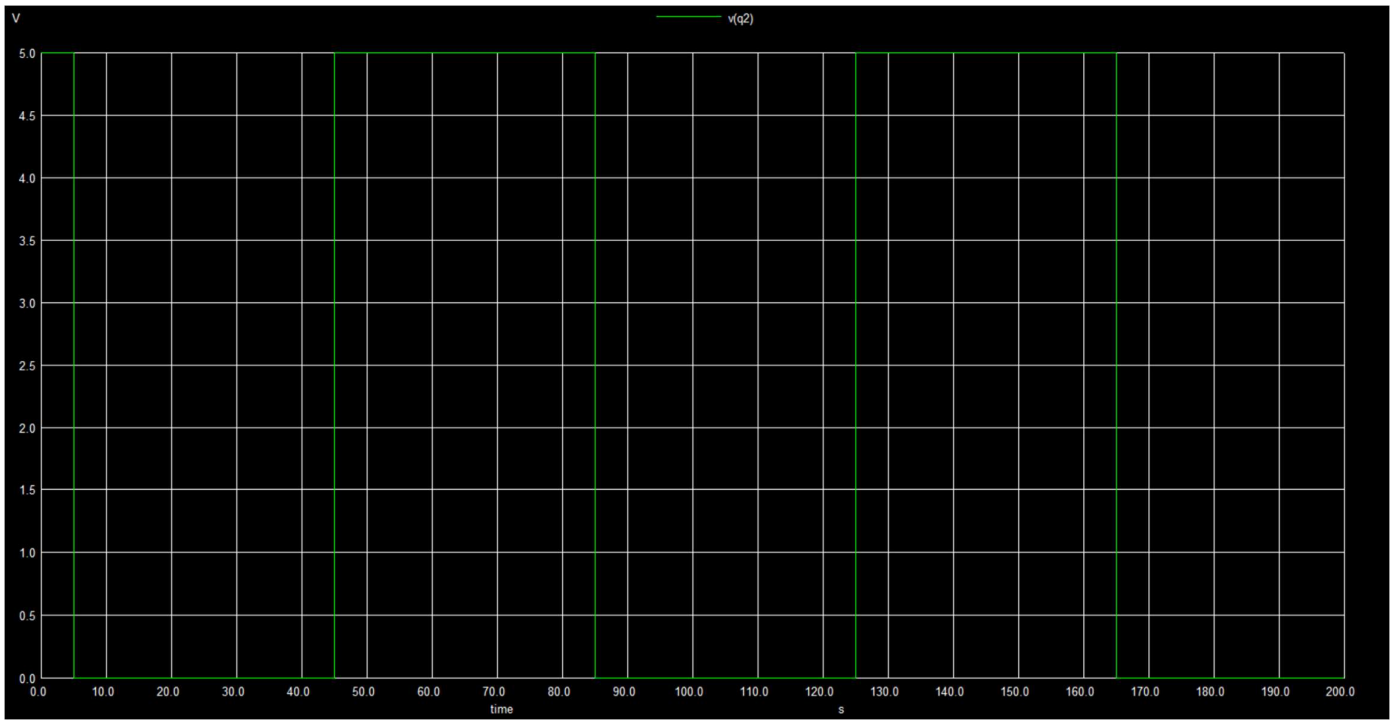
Q0 (LSB)



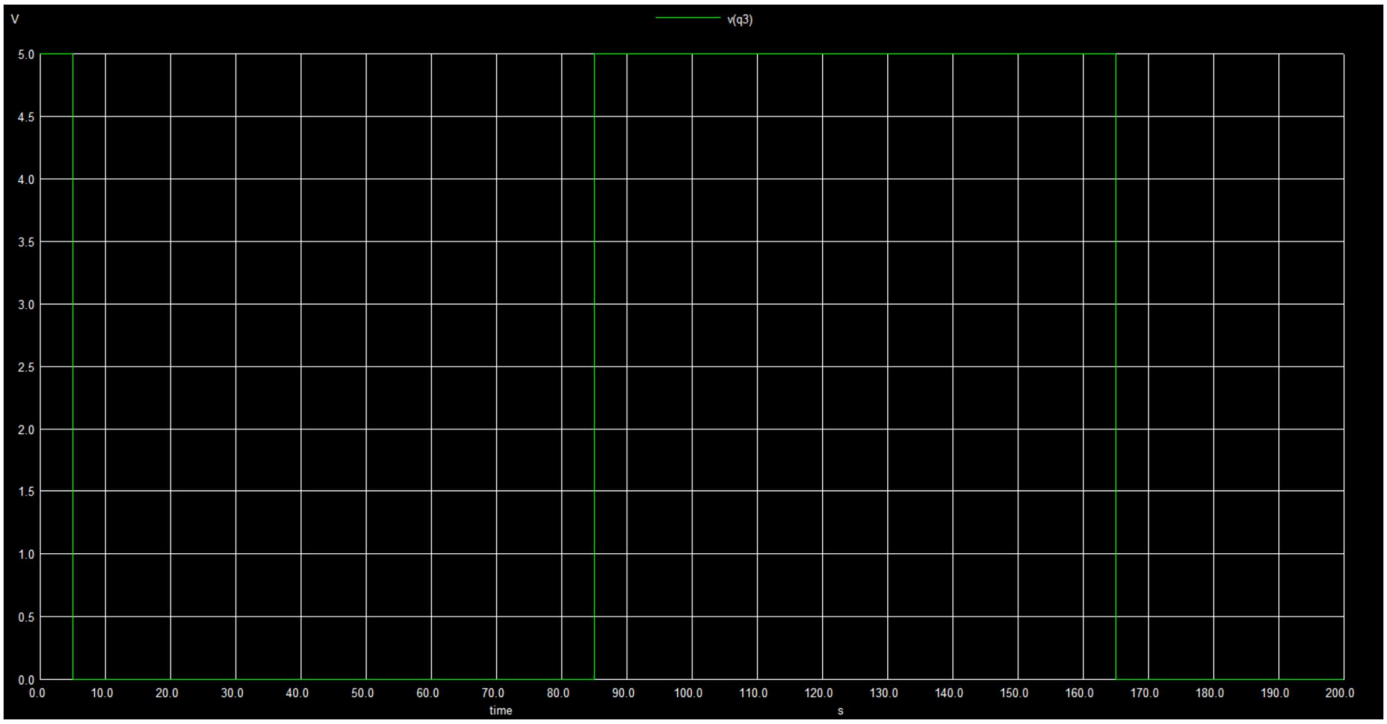
Q1



Q2

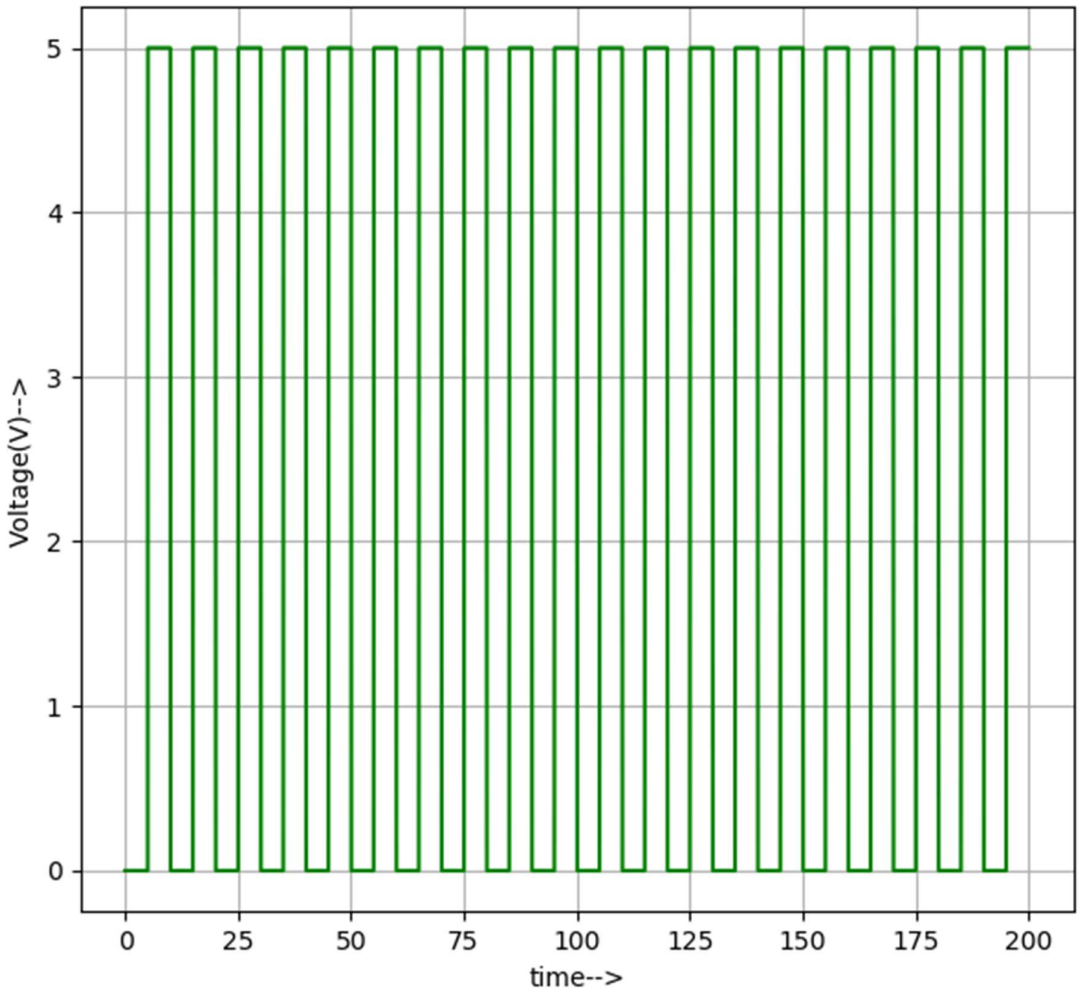

V
v(q2)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0 90.0 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 180.0 190.0 200.0
time
s

Q3 (MSB)

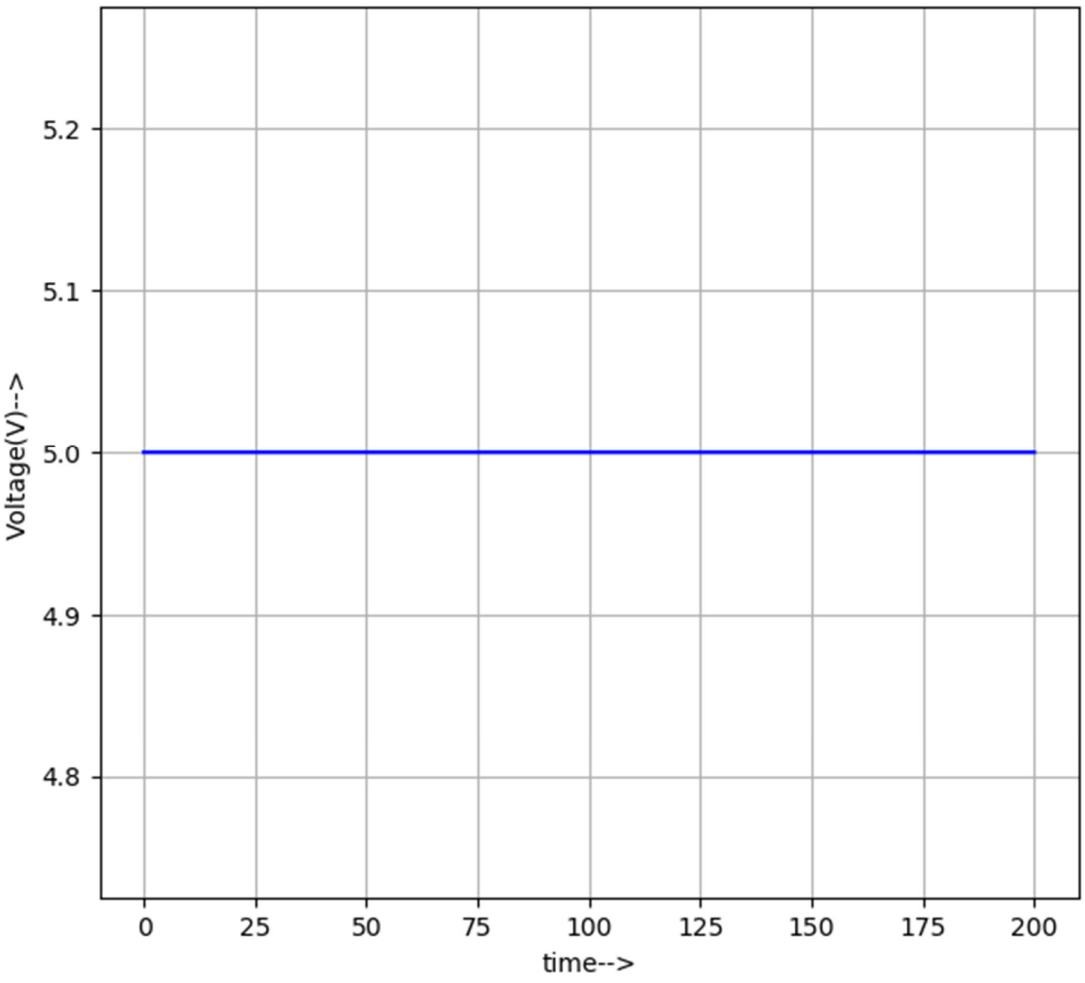

V
v(q3)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0 90.0 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 180.0 190.0 200.0
time
s

2.Python Waveform

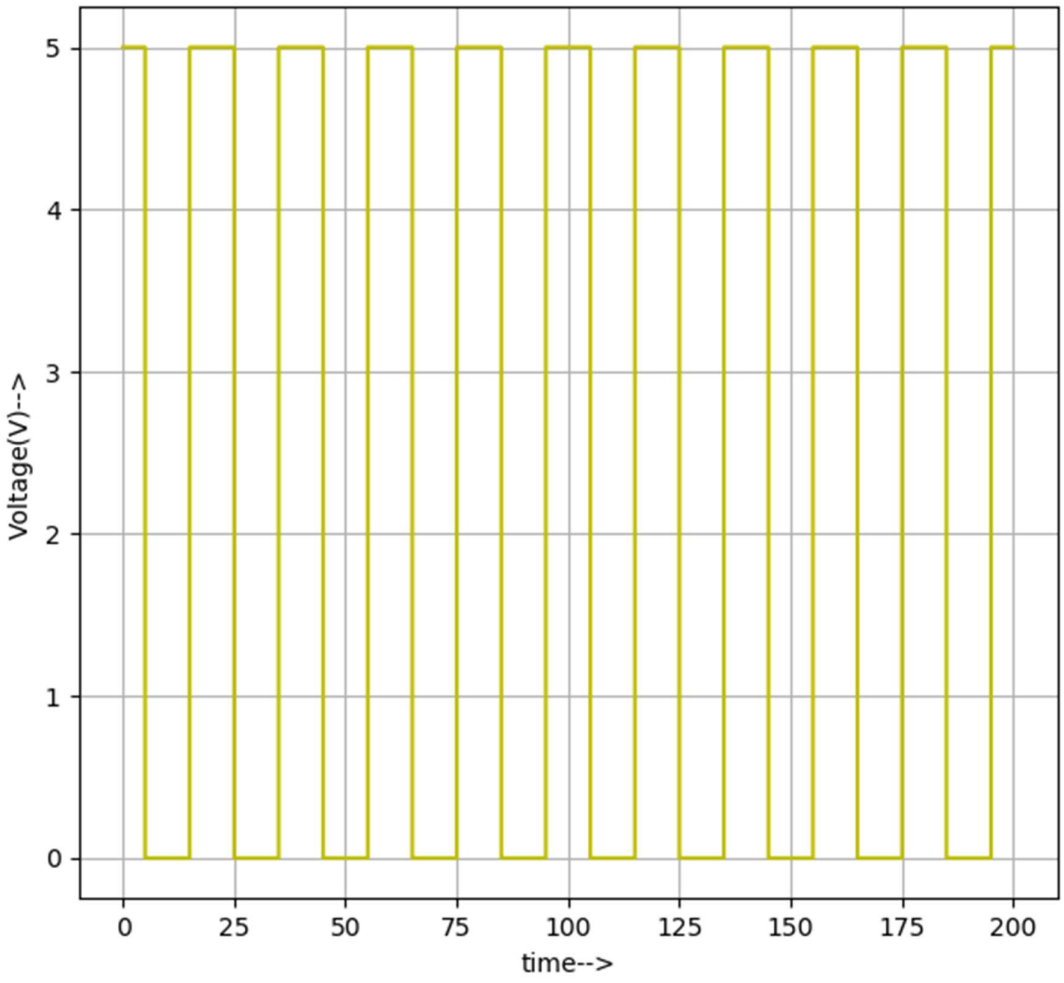
clk (Clock pulse)



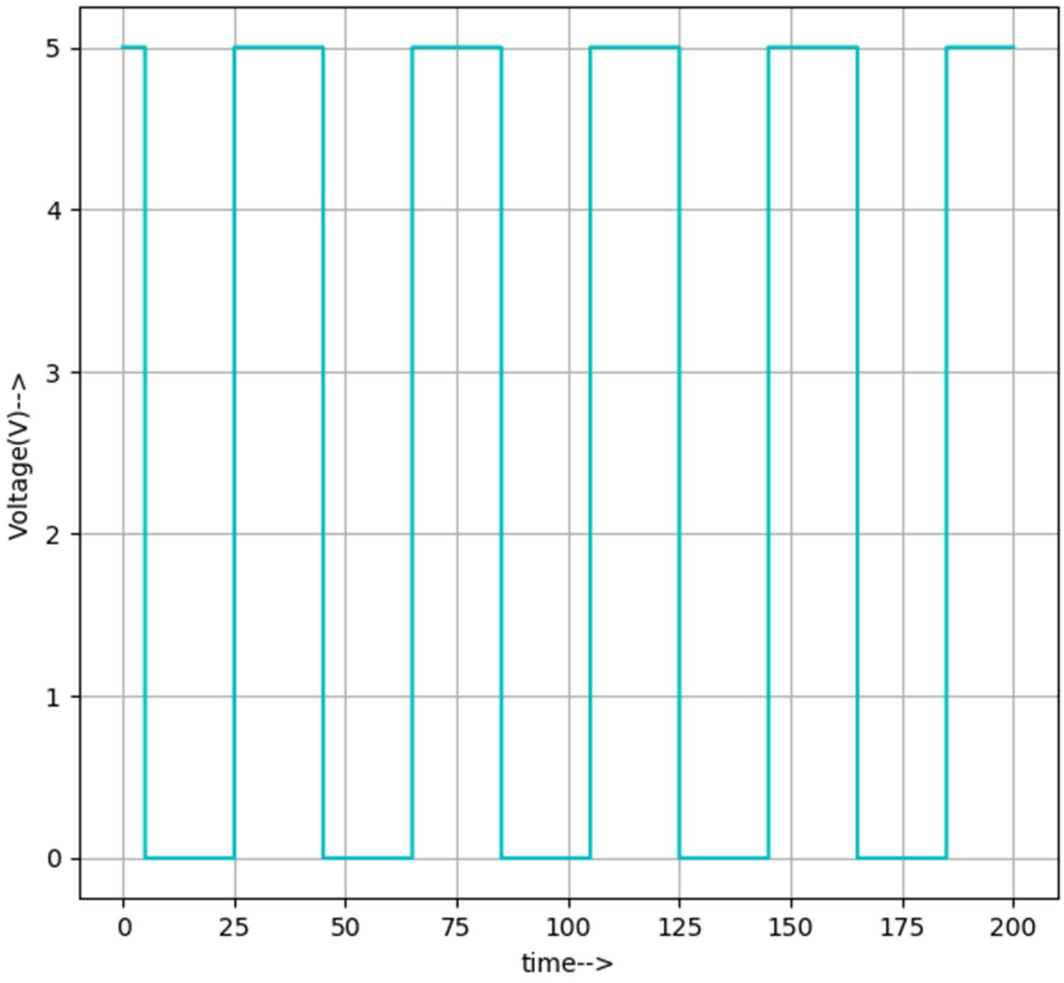
Logic



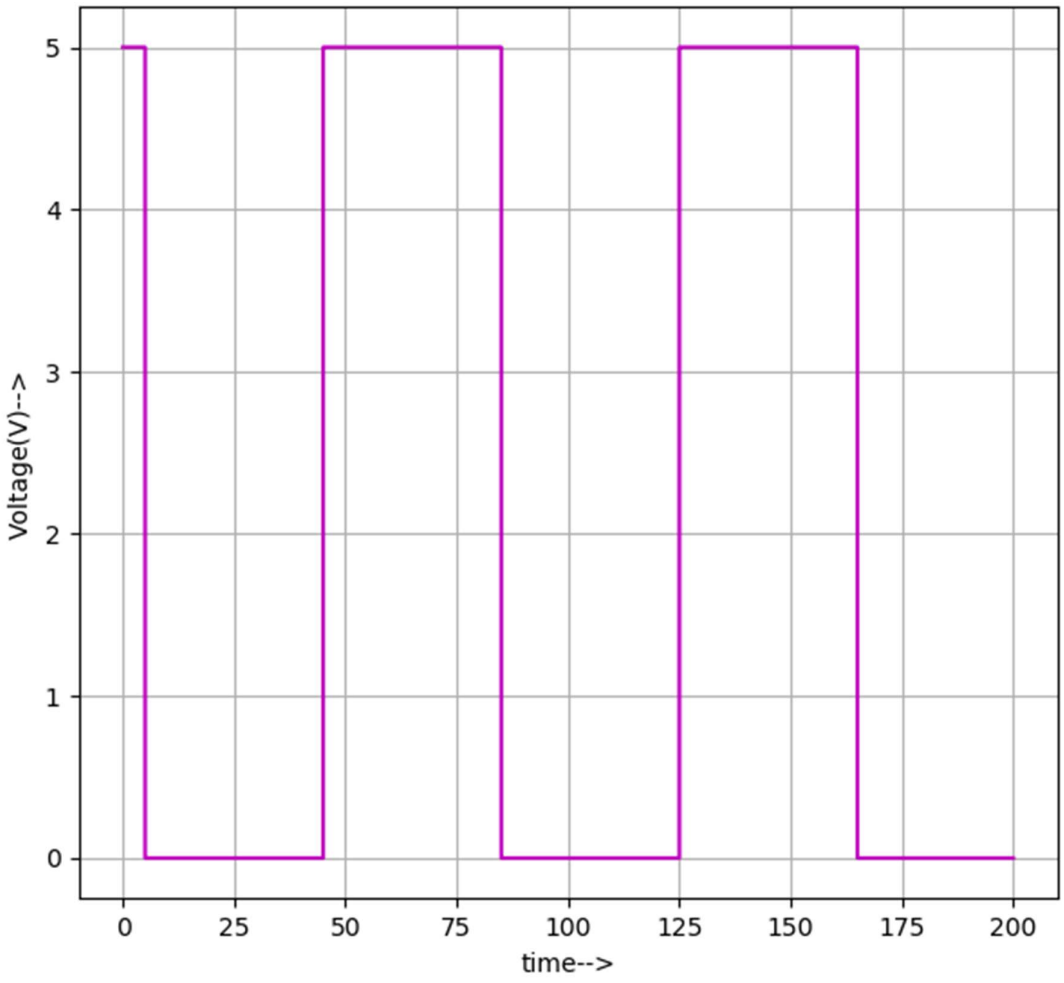
Q0 (LSB)



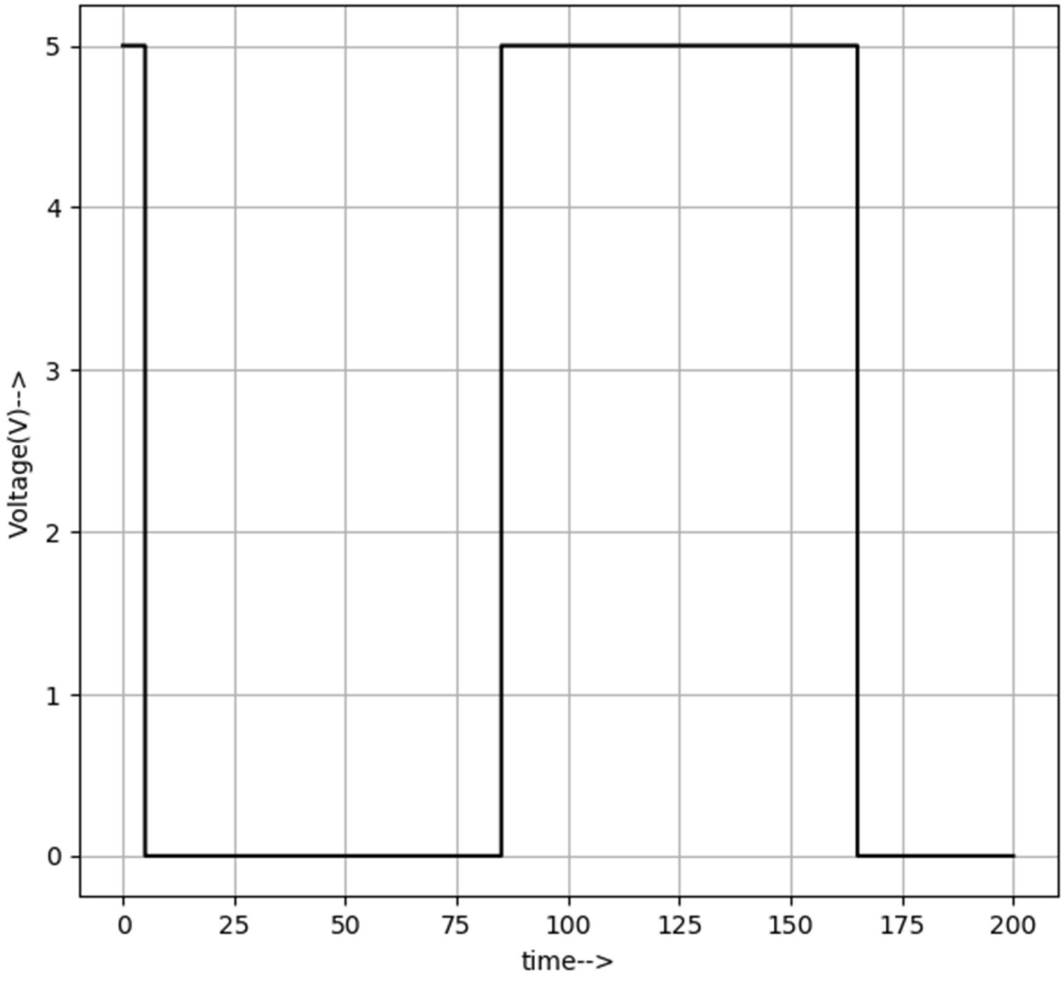
Q1



Q2



Q3 (MSB)



Reference: https://circuitdigest.com/tutorial/asynchronous-counter

https://www.geeksforgeeks.org/asynchronous-down-counter/