Circuit Simulation Project

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

Name of Participant: UTUKURI GEYARKA S NIKHILESH

Project Guide: Dr. MAHESWARI. R

Title of the Project: -

Design of 3 x 8 Decoder Using 2 x 4 decoders

Theory/Description: -

Decoder is a combinational circuit that has n input lines and maximum of 2^n output lines. One of these outputs will be active high based on the combination of inputs present, when the decoder is enabled. That means decoder detects a particular code. The binary information is passed in the form of N input lines. The output lines define the 2^n -bit code for the binary information.

In simple words, the Decoder performs the reverse operation of the Encoder. At a time, only one input line is activated for simplicity. The produced 2^n -bit output code is equivalent to the binary information.

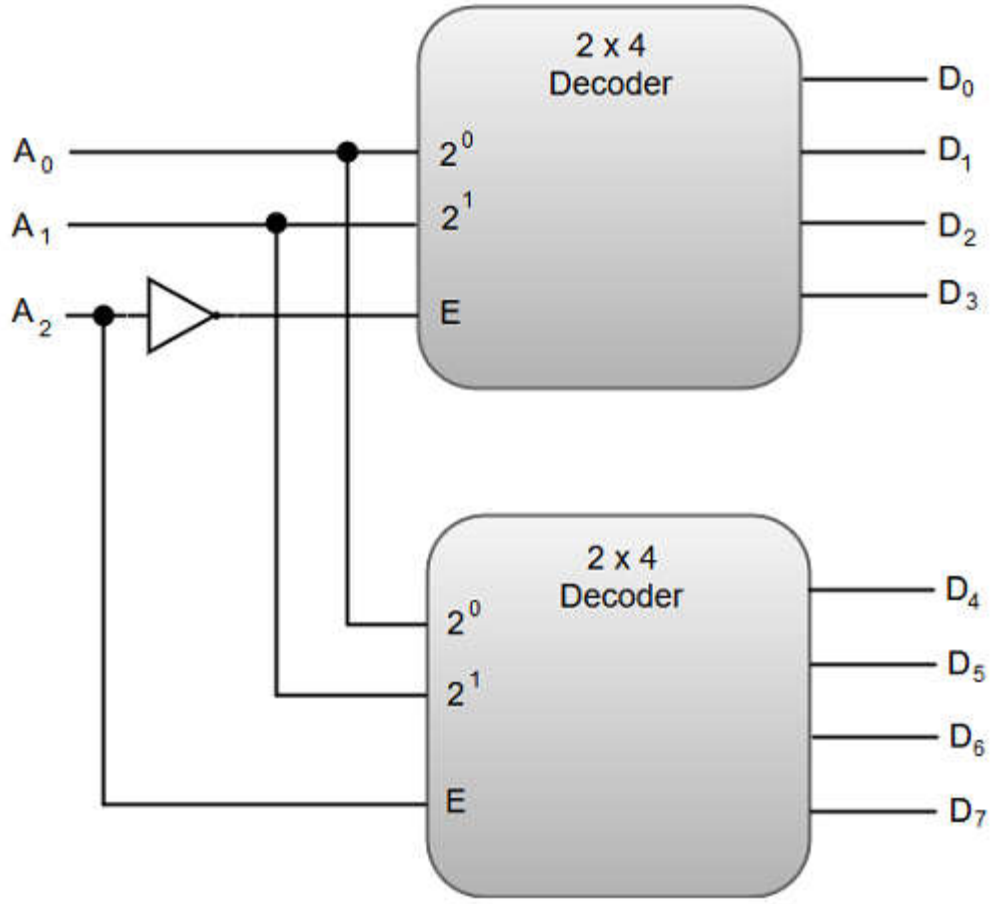
In a 3x8 decoder, there are a total of eight outputs, i.e., D0, D1, D2, D3, D4, D5, D6 and D7 and three inputs, i.e., A, B, and C. This 3x8 decoder can be implemented using logic gates or by using two 2x4 decoders.

Truth Table for 3 x 8 decoder circuit:

A	B	C	D0	D1	D2	D3	D4	D5	D6	D7
0	0	0	1	0	0	0	0	0	0	0
0	0	1	0	1	0	0	0	0	0	0
0	1	0	0	0	1	0	0	0	0	0
0	1	1	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	1	0	0	0
1	0	1	0	0	0	0	0	1	0	0
1	1	0	0	0	0	0	0	0	1	0
1	1	1	0	0	0	0	0	0	0	1

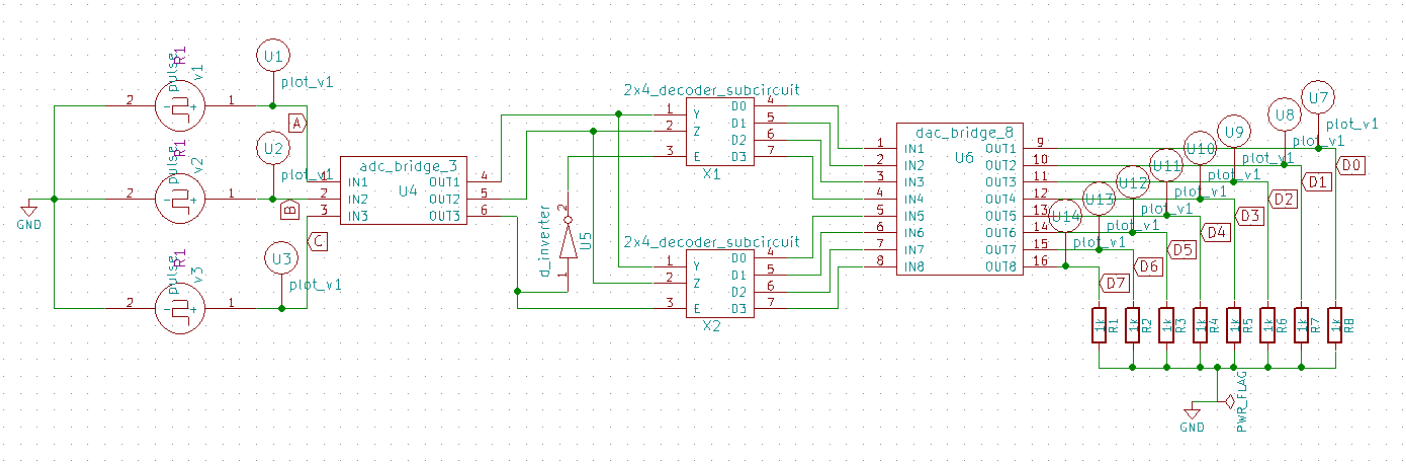
Here, A, B, C are inputs and D0, D1, D2, D3, D4, D5, D6, D7 are outputs.

Circuit for 3 x 8 Decoder using two 2 x 4 decoders:

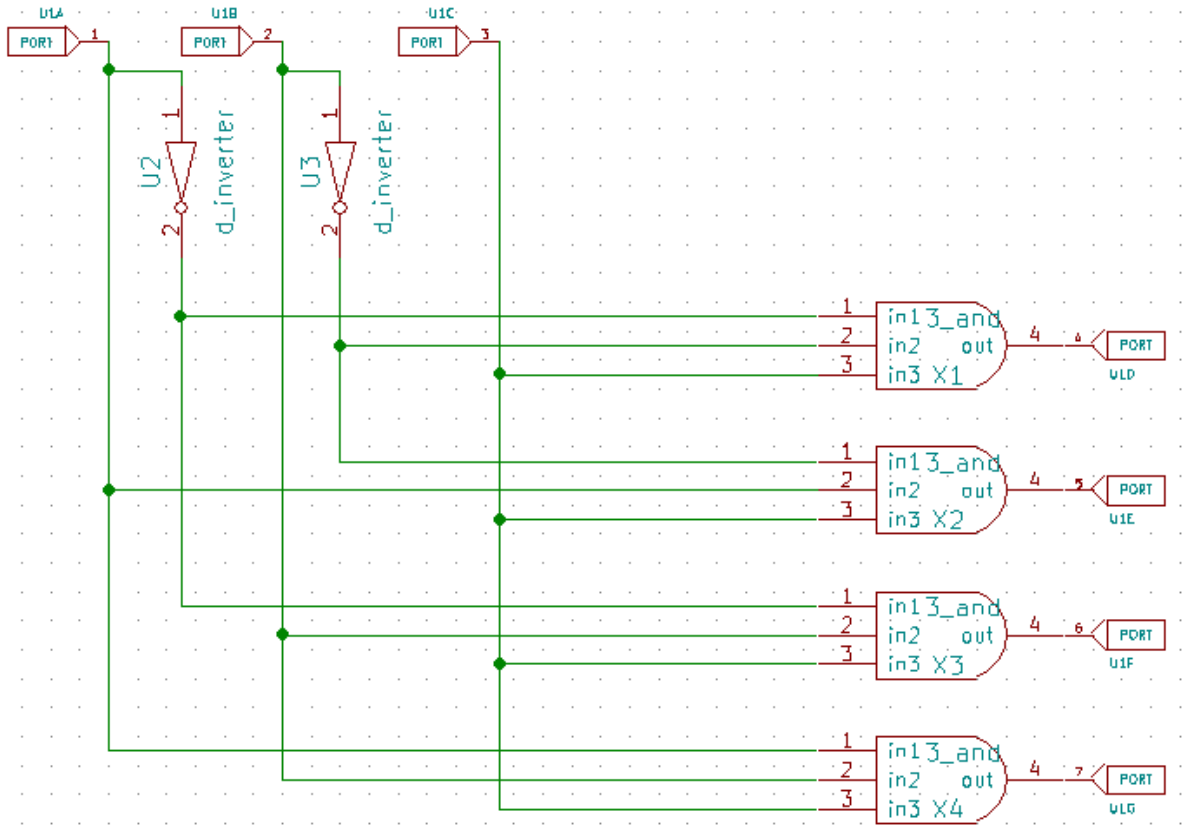


Schematic Diagram:

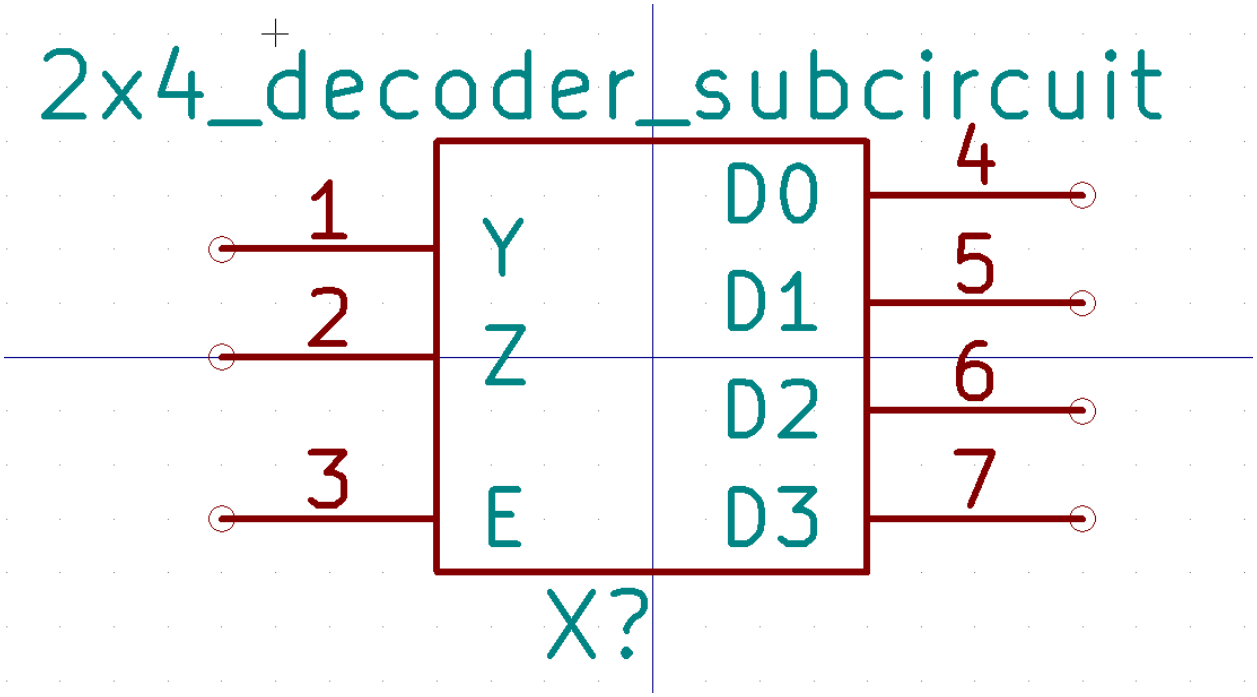
The circuit schematic for 3 x 8 decoder using 2 x 4 decoders in eSim is as shown below:



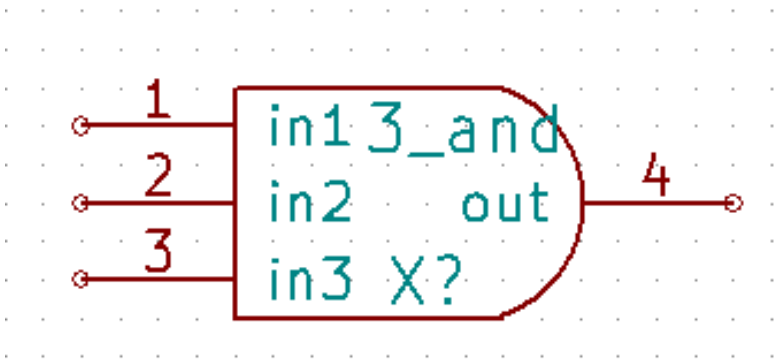
The Schematic for 2 x 4 decoder in eSim which is used as an sub-circuit is as shown below:



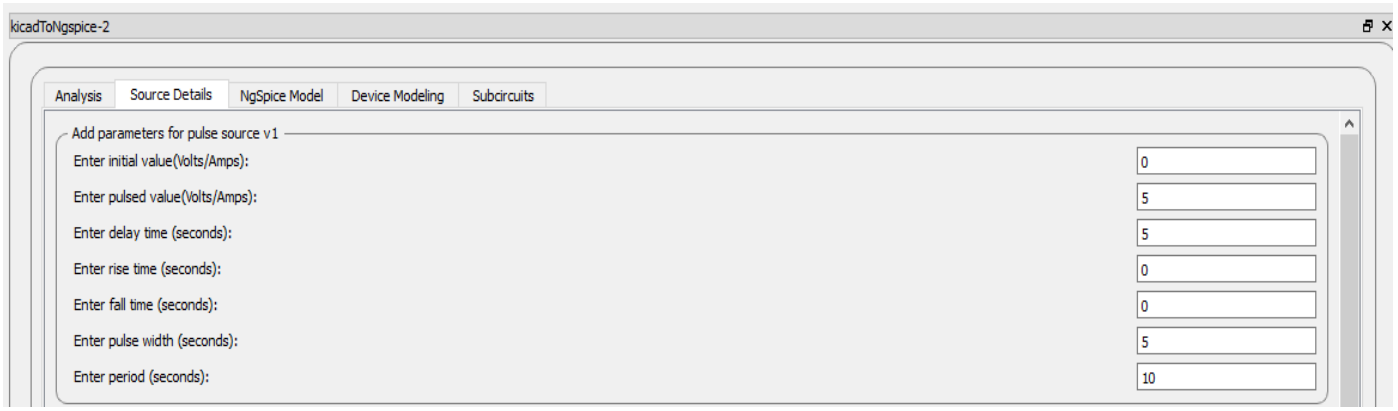
The Symbol for 2 x 4 decoder in eSim is as shown below:

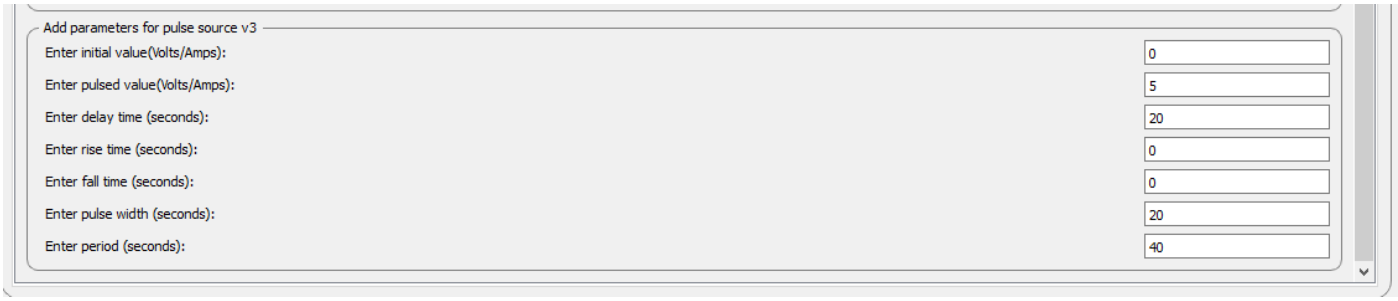


The Symbol for 3 input and gate which is already present in eSim is as shown below:



Source details:





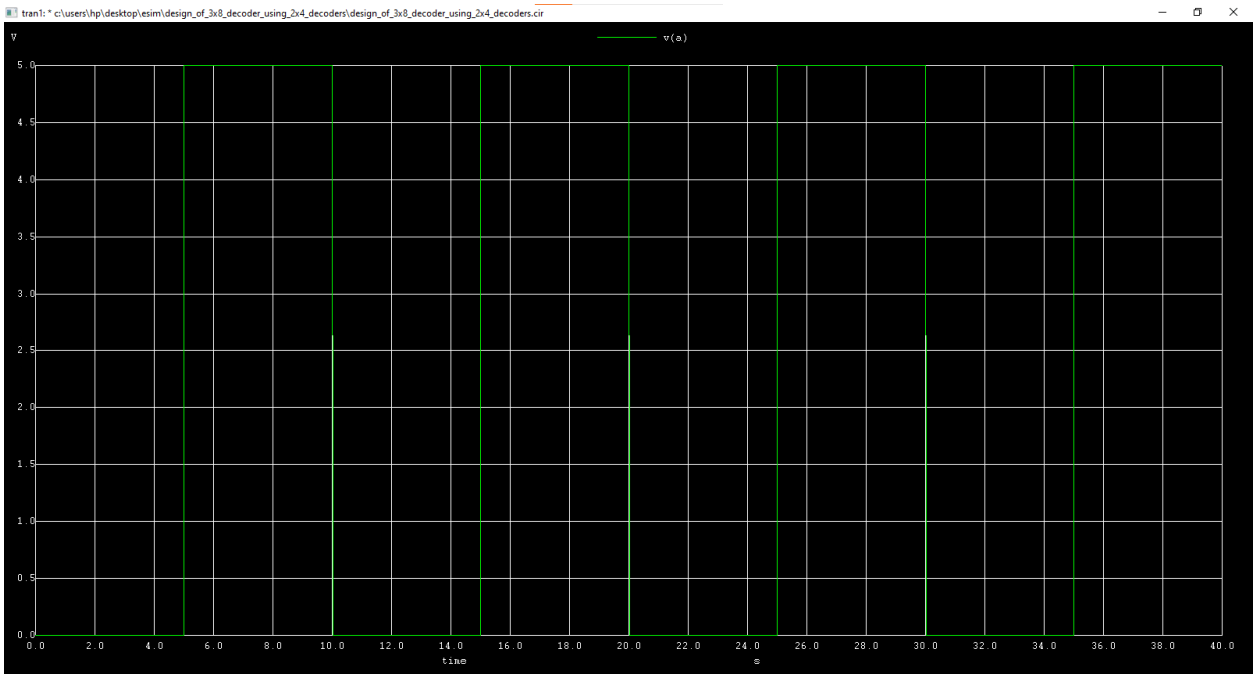
Analysis:

Simulation Results :

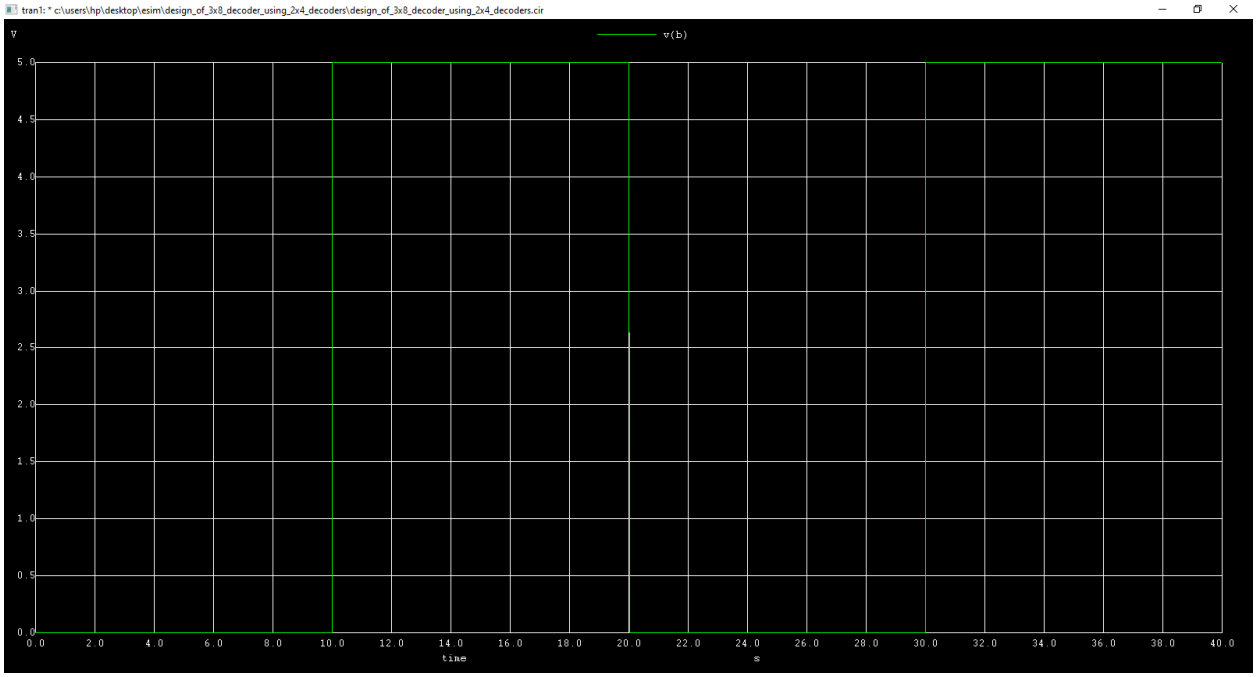
1) Ngspice plots:

Input waveforms:

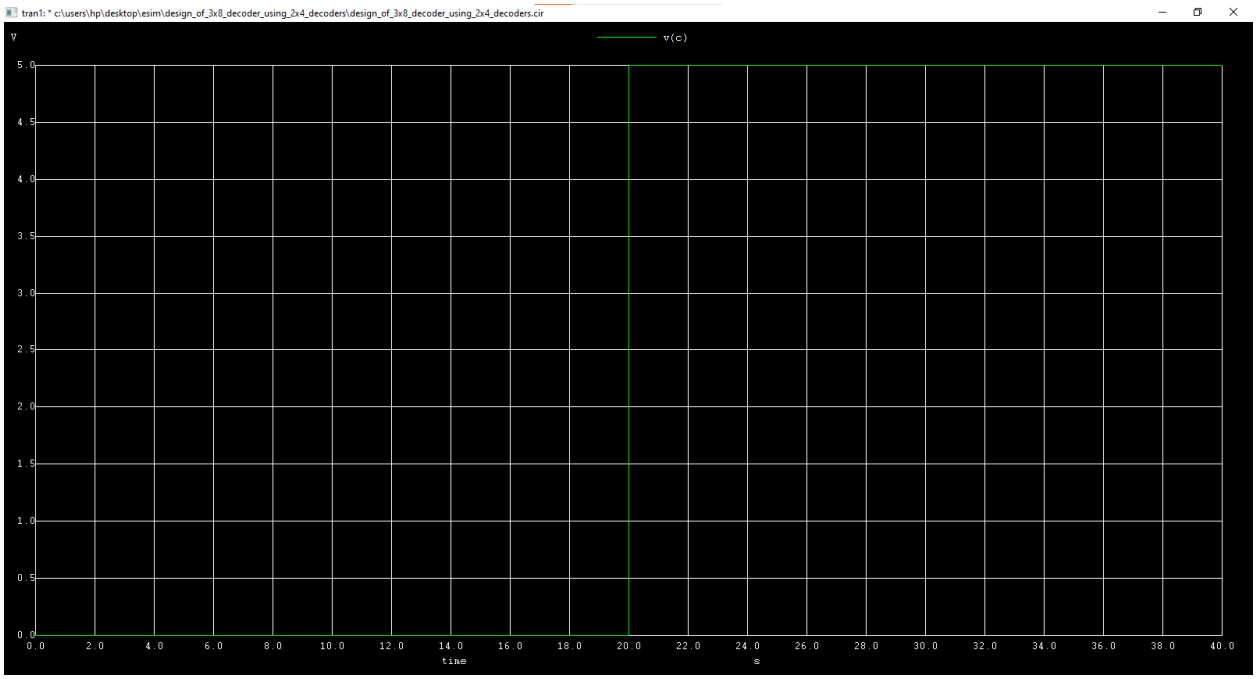
A:



B:

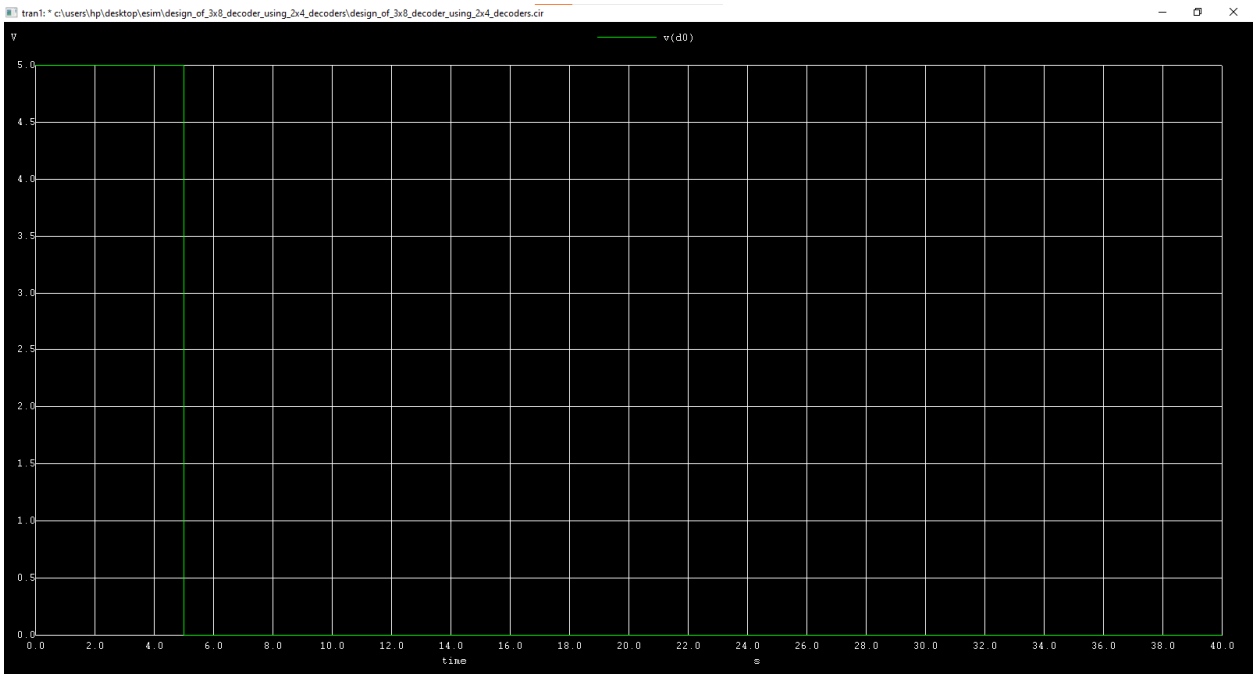

tran1: * c:\users\hp\desktop\esim\design_of_3x8_decoder_using_2x4_decoders\design_of_3x8_decoder_using_2x4_decoders.cir
V
v(b)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0 26.0 28.0 30.0 32.0 34.0 36.0 38.0 40.0
time
s

C:

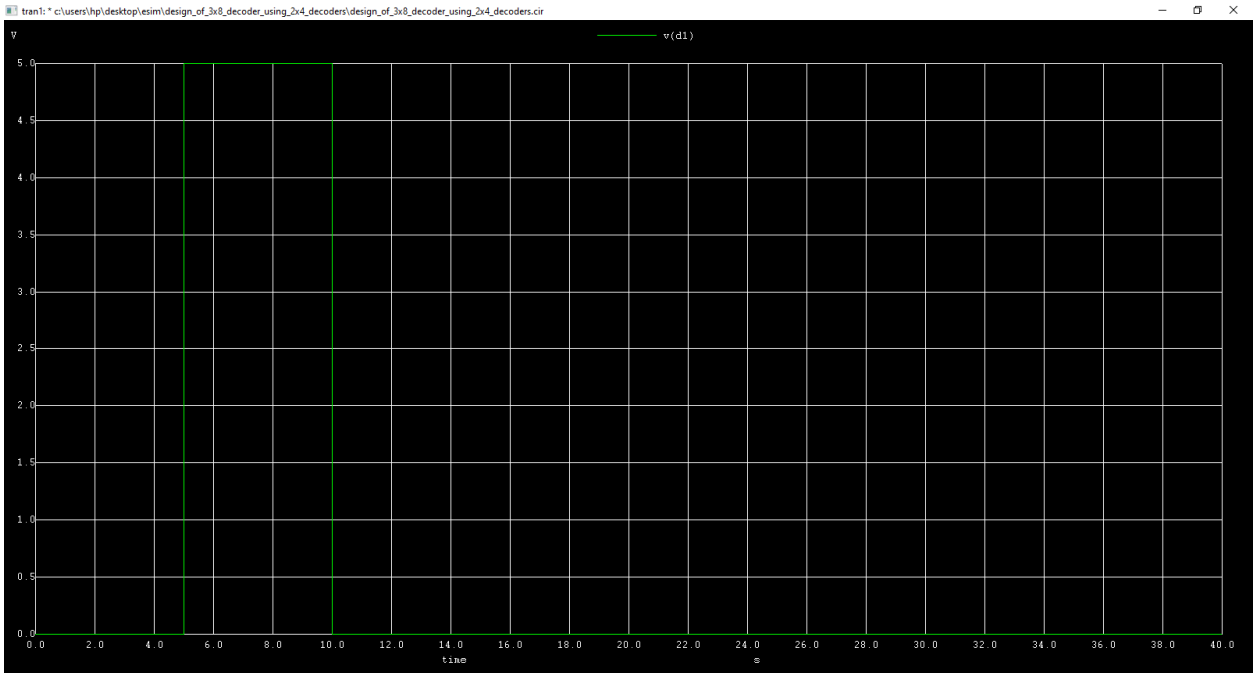

tran1: * c:\users\hp\desktop\esim\design_of_3x8_decoder_using_2x4_decoders\design_of_3x8_decoder_using_2x4_decoders.cir
V
v(c)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0 26.0 28.0 30.0 32.0 34.0 36.0 38.0 40.0
time
s

Output Waveforms:

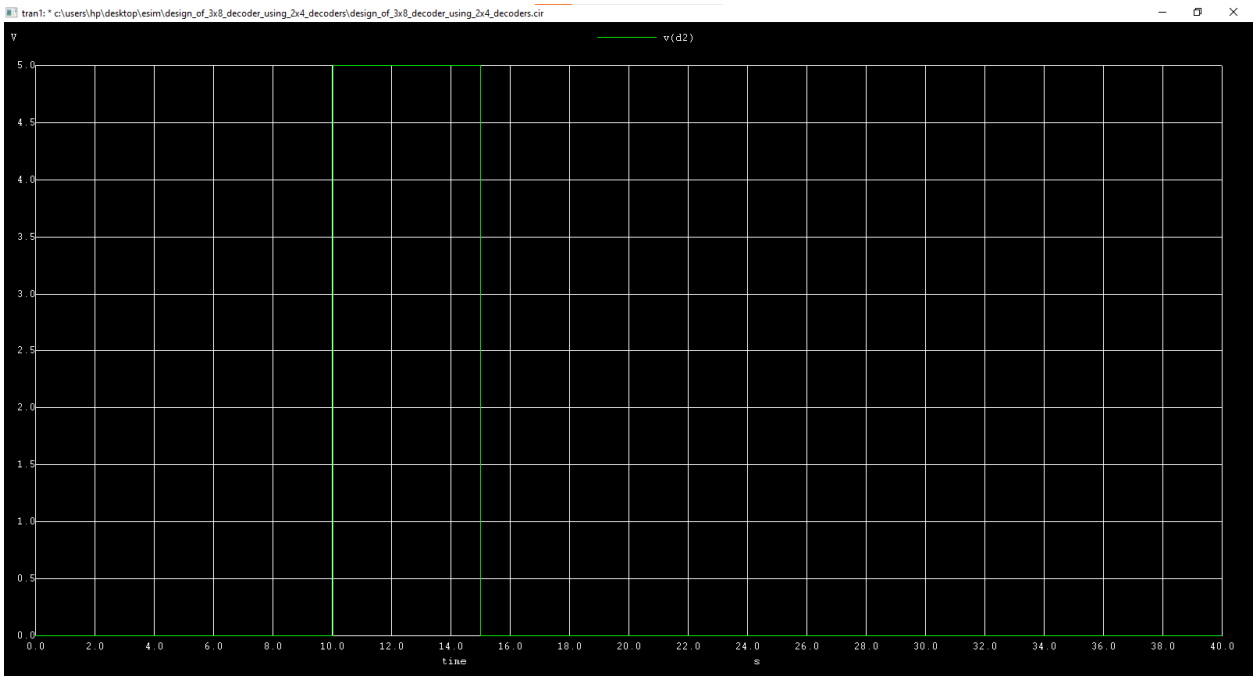
D0:



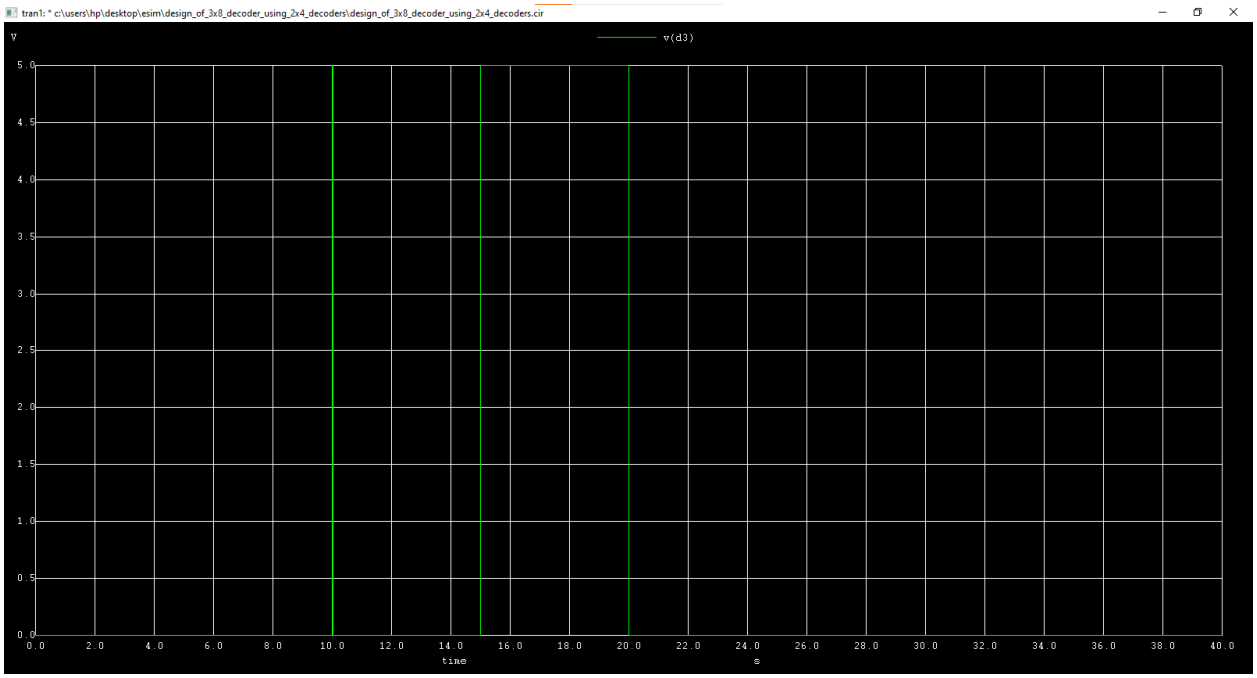
D1:



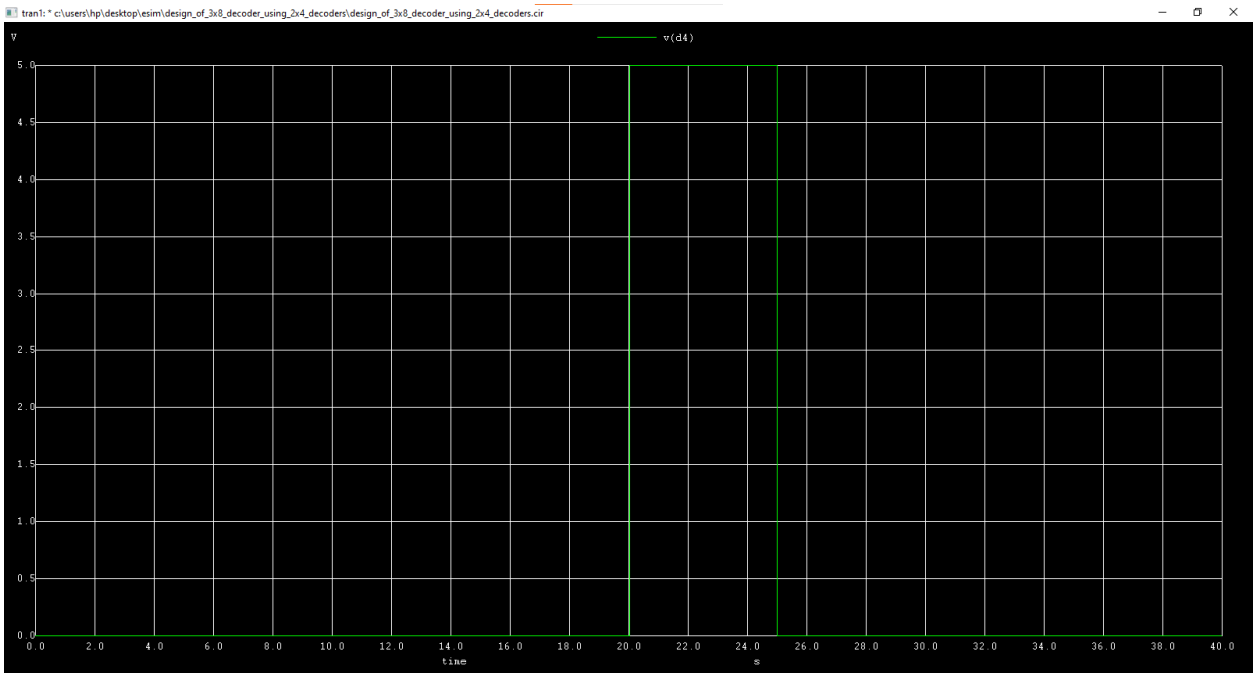
D2:


tran1: * c:\users\hp\desktop\esim\design_of_3x8_decoder_using_2x4_decoders\design_of_3x8_decoder_using_2x4_decoders.cir
V
v(d2)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0 26.0 28.0 30.0 32.0 34.0 36.0 38.0 40.0
time
s

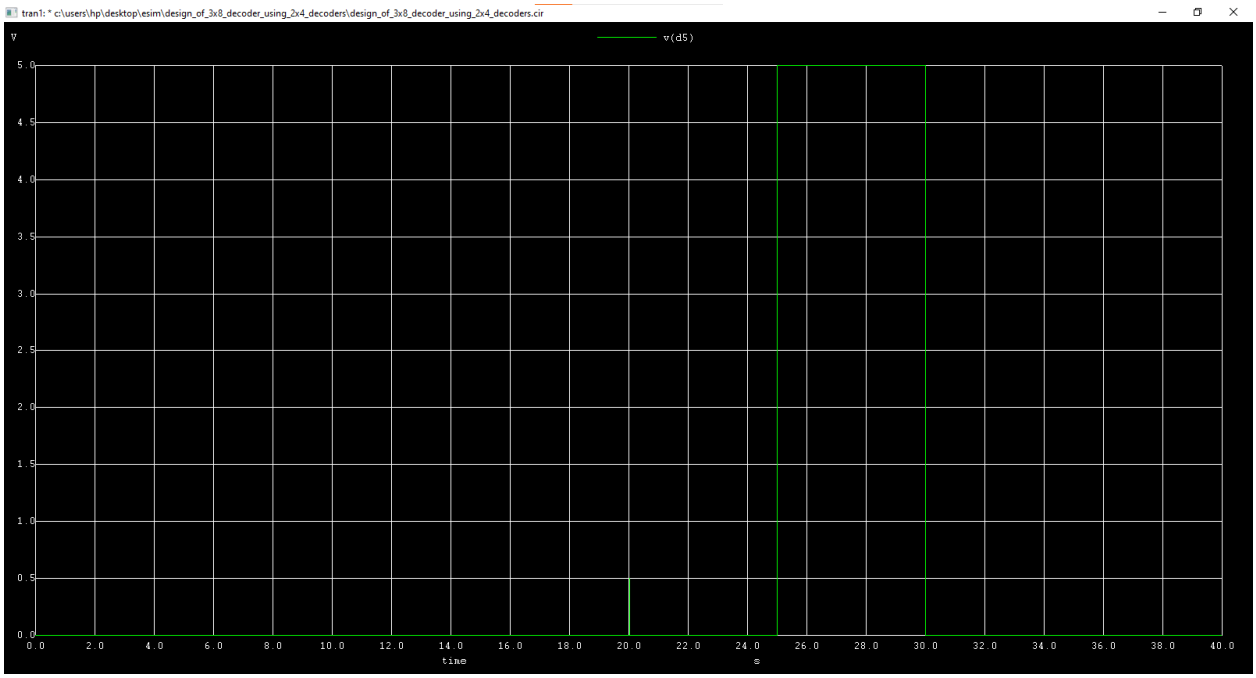
D3:


tran1: * c:\users\hp\desktop\esim\design_of_3x8_decoder_using_2x4_decoders\design_of_3x8_decoder_using_2x4_decoders.cir
V
v(d3)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0 26.0 28.0 30.0 32.0 34.0 36.0 38.0 40.0
time
s

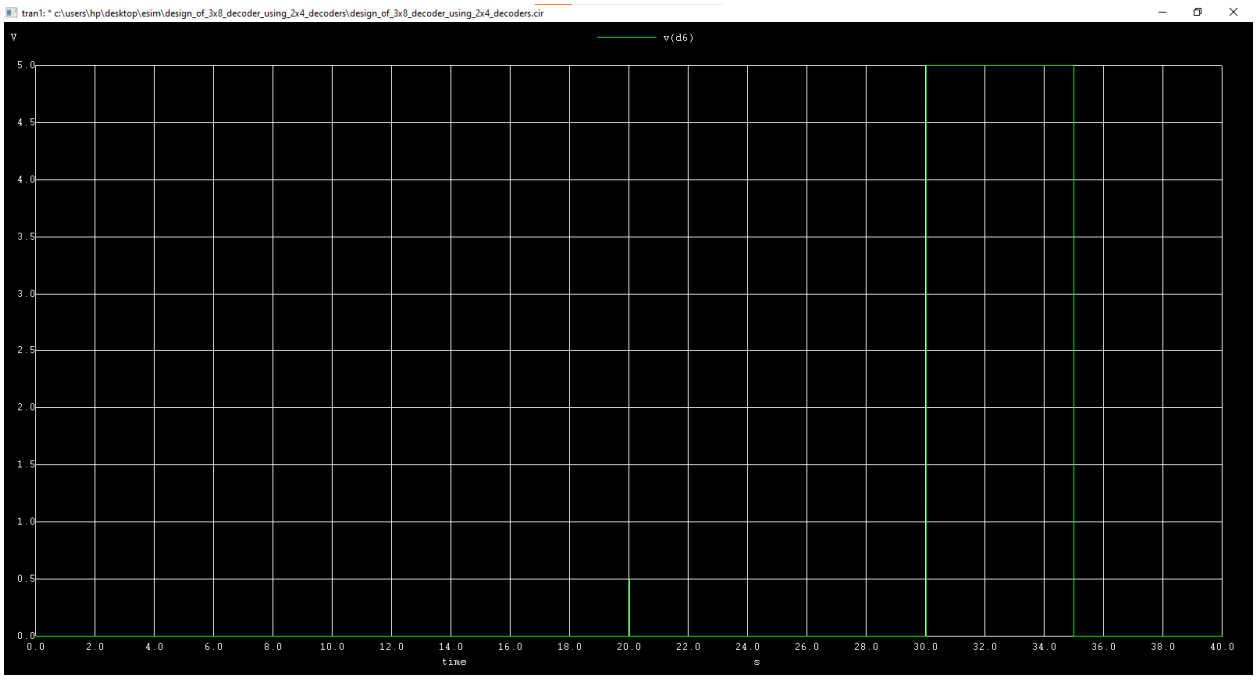
D4:


tran1: * c:\users\hp\desktop\esim\design_of_3x8_decoder_using_2x4_decoders\design_of_3x8_decoder_using_2x4_decoders.cir
V
v(d4)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0 26.0 28.0 30.0 32.0 34.0 36.0 38.0 40.0
time
s

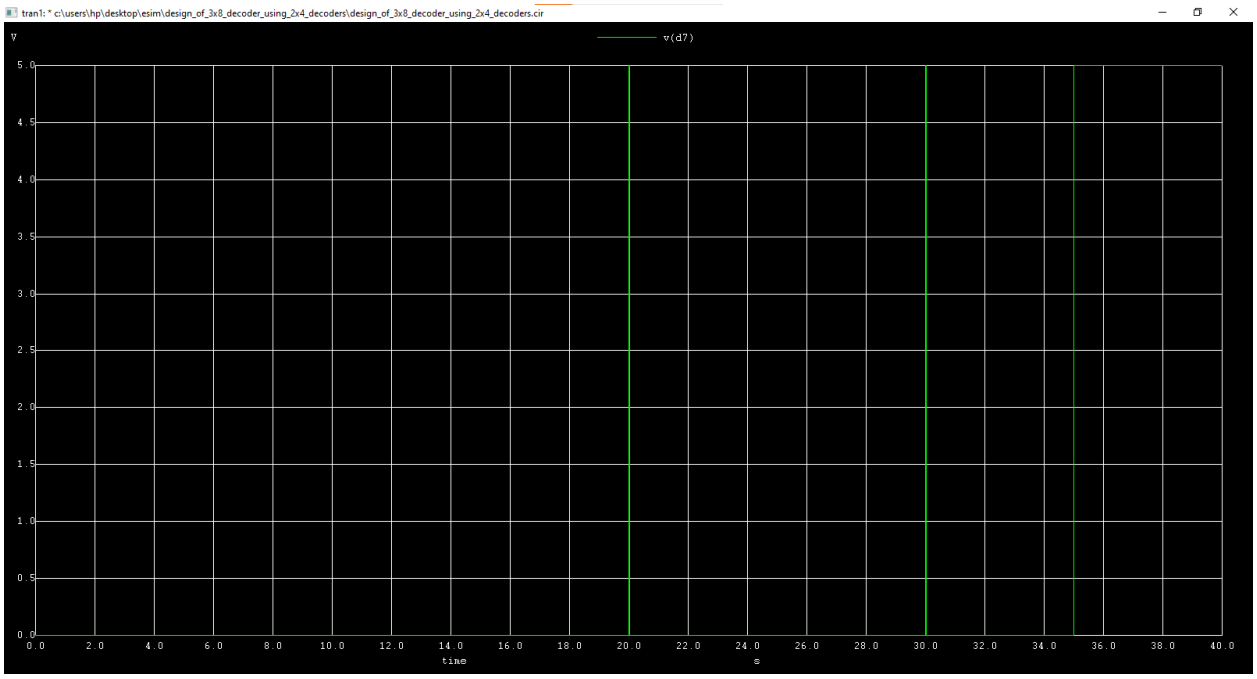
D5:


tran1: * c:\users\hp\desktop\esim\design_of_3x8_decoder_using_2x4_decoders\design_of_3x8_decoder_using_2x4_decoders.cir
V
v(d5)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0 26.0 28.0 30.0 32.0 34.0 36.0 38.0 40.0
time
s

D6:


tran1: * c:\users\hp\desktop\esim\design_of_3x8_decoder_using_2x4_decoders\design_of_3x8_decoder_using_2x4_decoders.cir
V
v(d6)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0 26.0 28.0 30.0 32.0 34.0 36.0 38.0 40.0
time
s

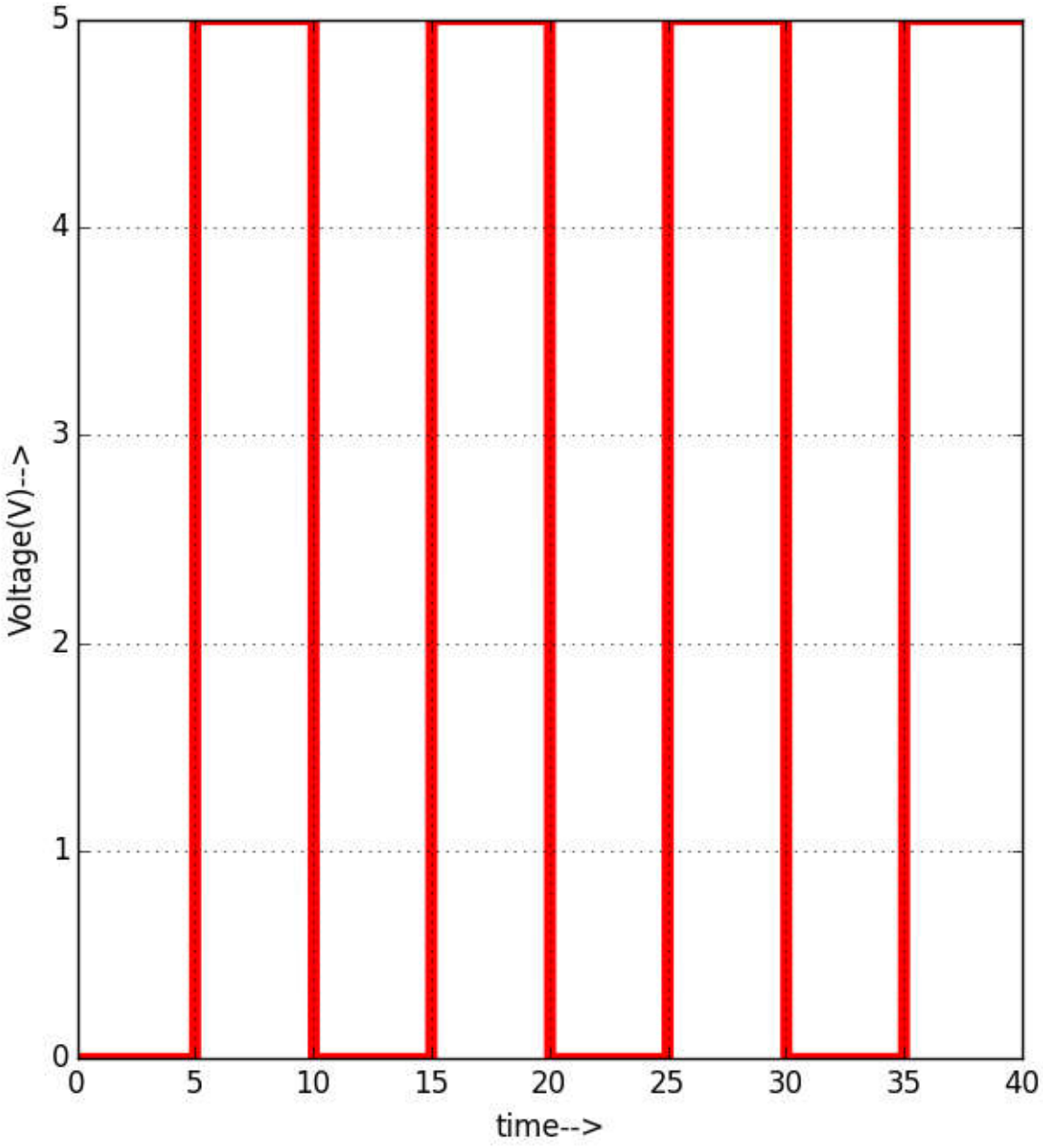
D7:


tran1: * c:\users\hp\desktop\esim\design_of_3x8_decoder_using_2x4_decoders\design_of_3x8_decoder_using_2x4_decoders.cir
V
v(d7)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0 26.0 28.0 30.0 32.0 34.0 36.0 38.0 40.0
time
s

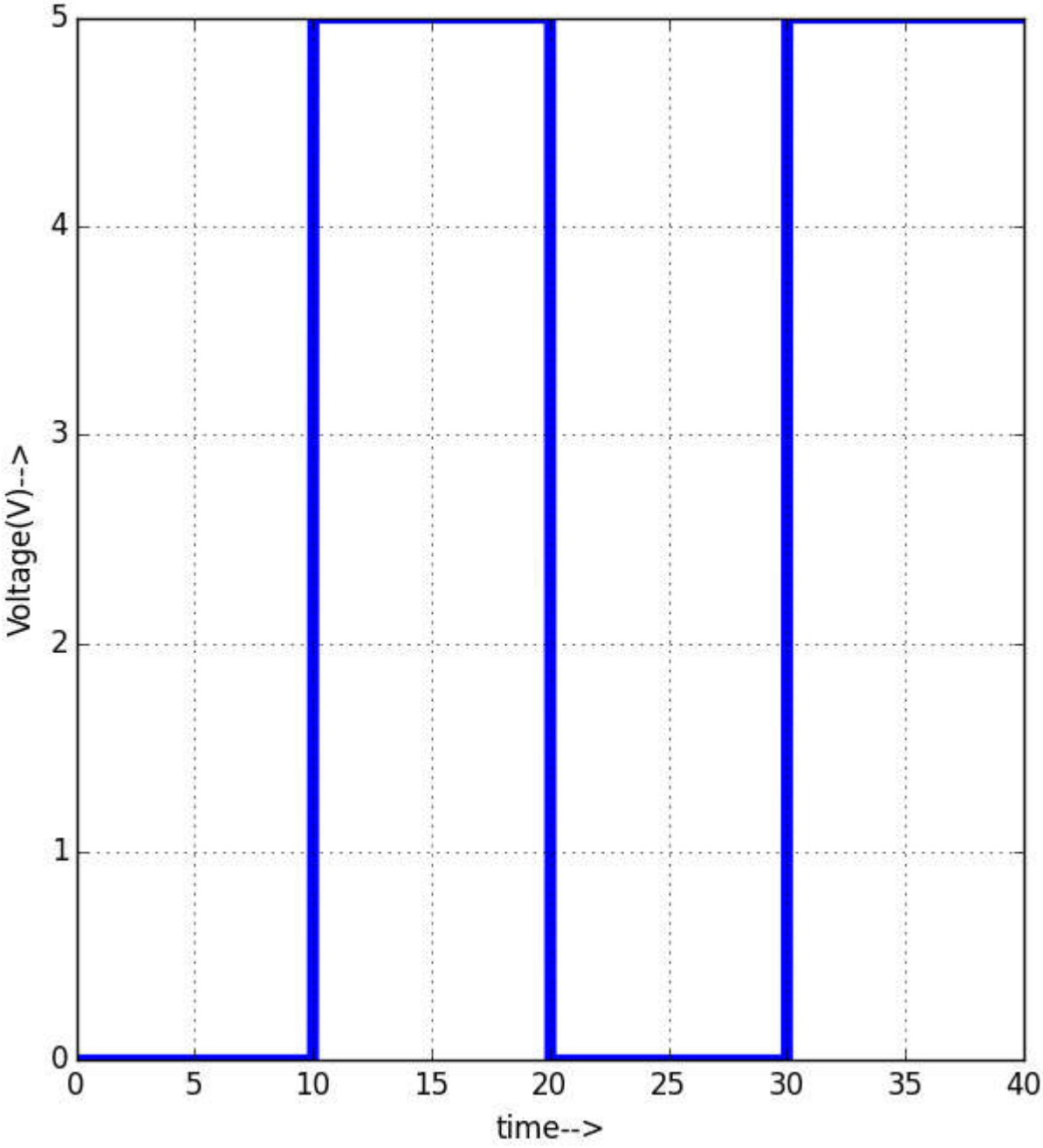
2) Python plots:

Input waveforms:

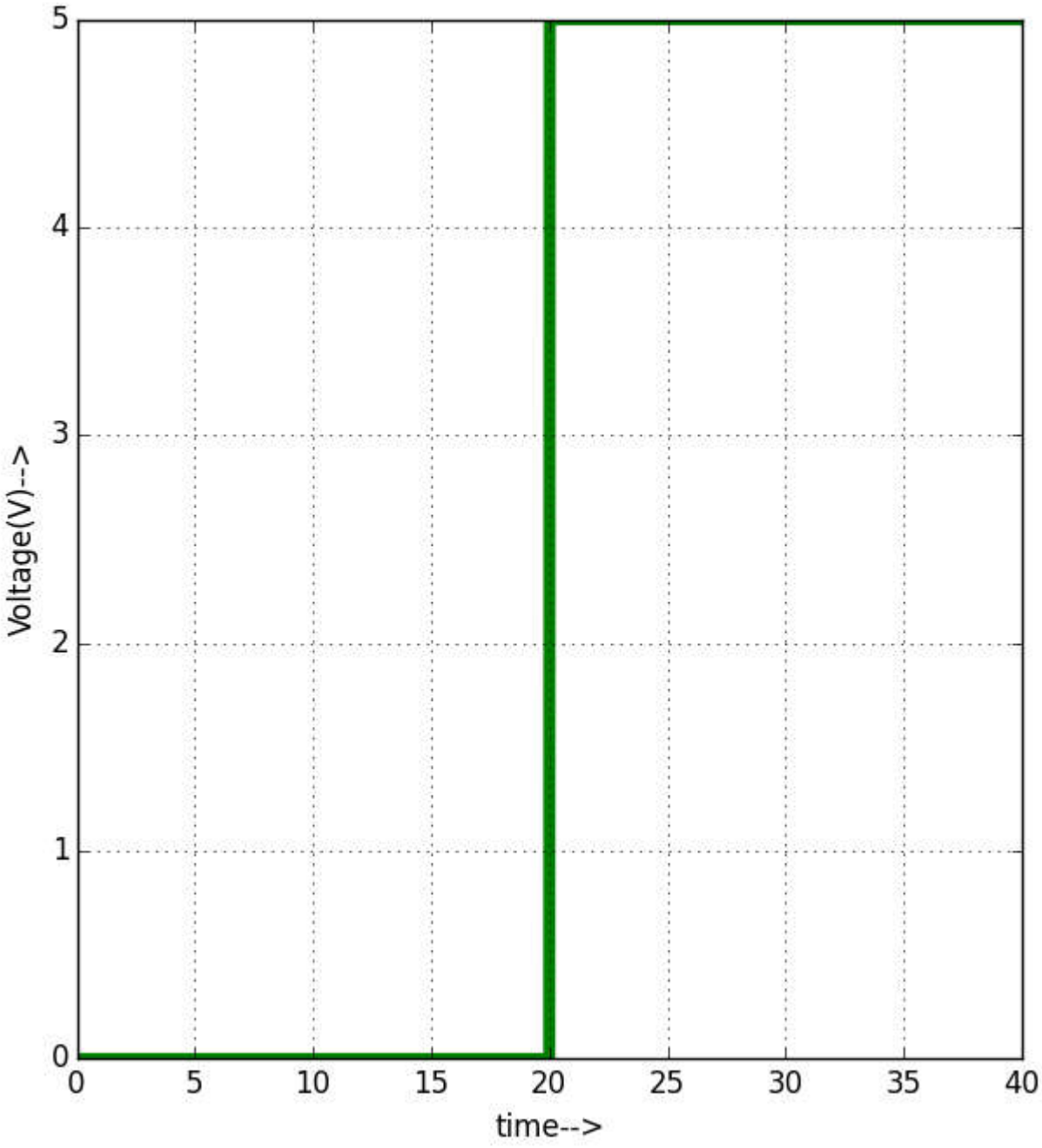
A:



B:

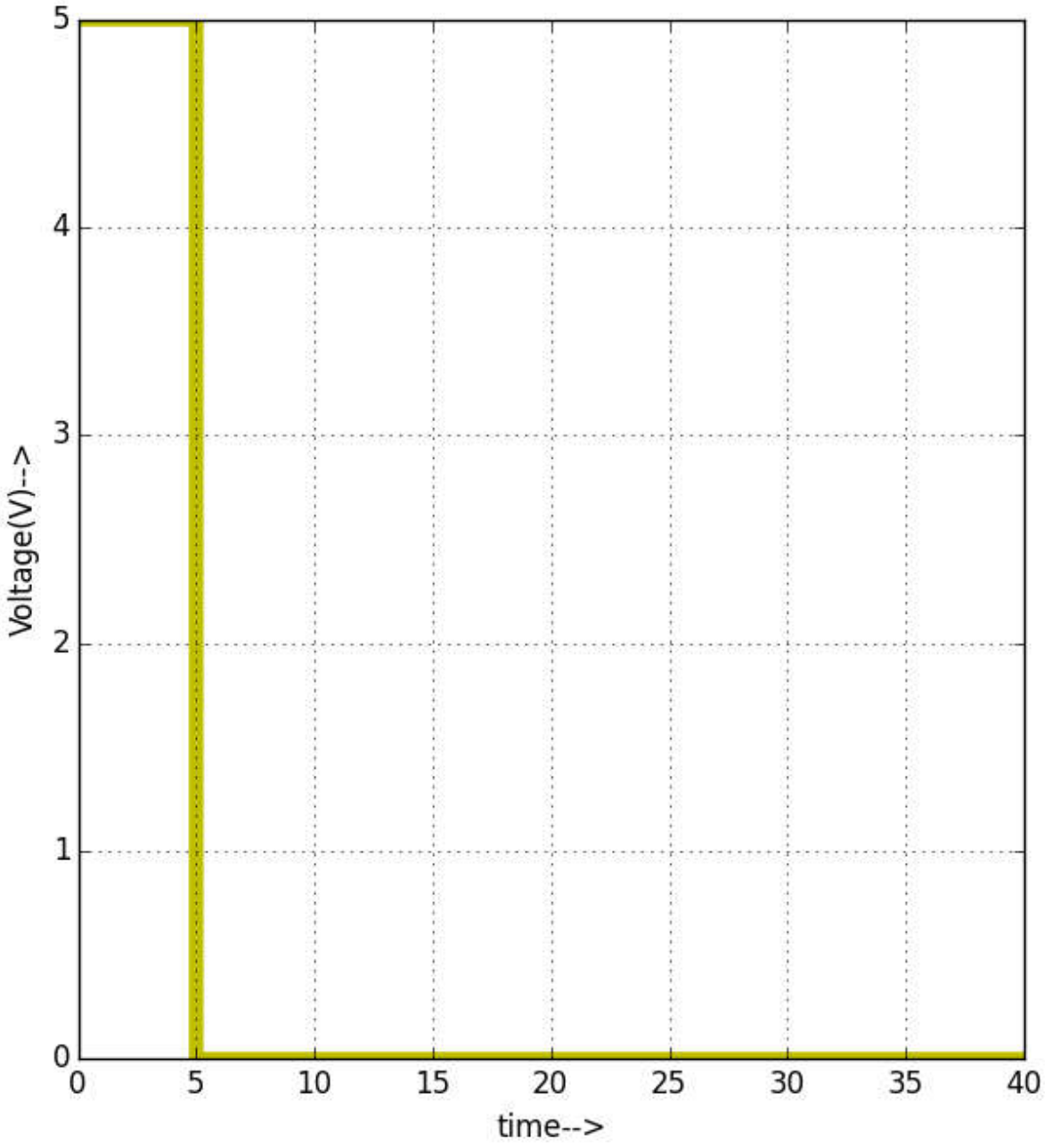


C:

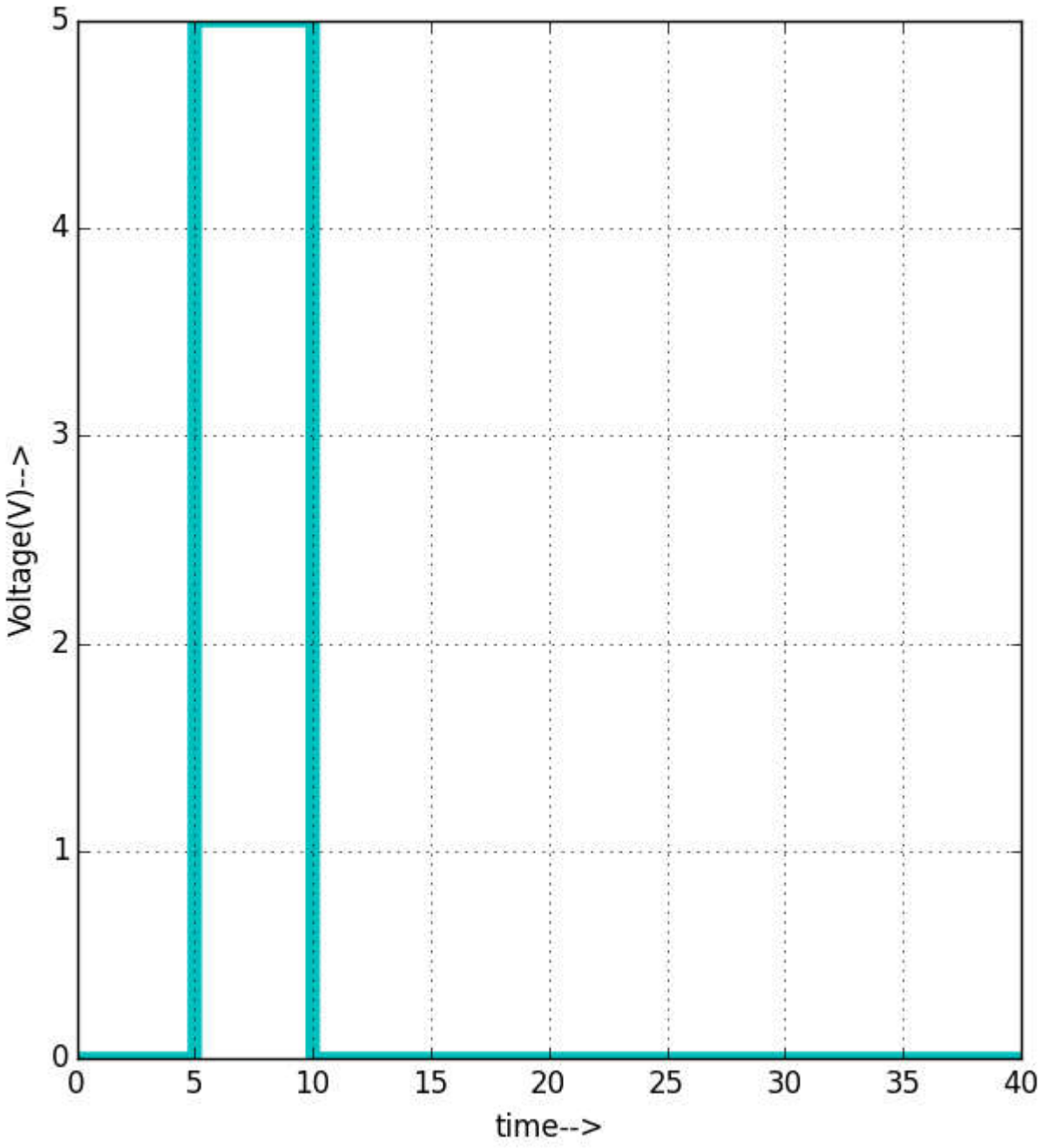


Output waveforms:

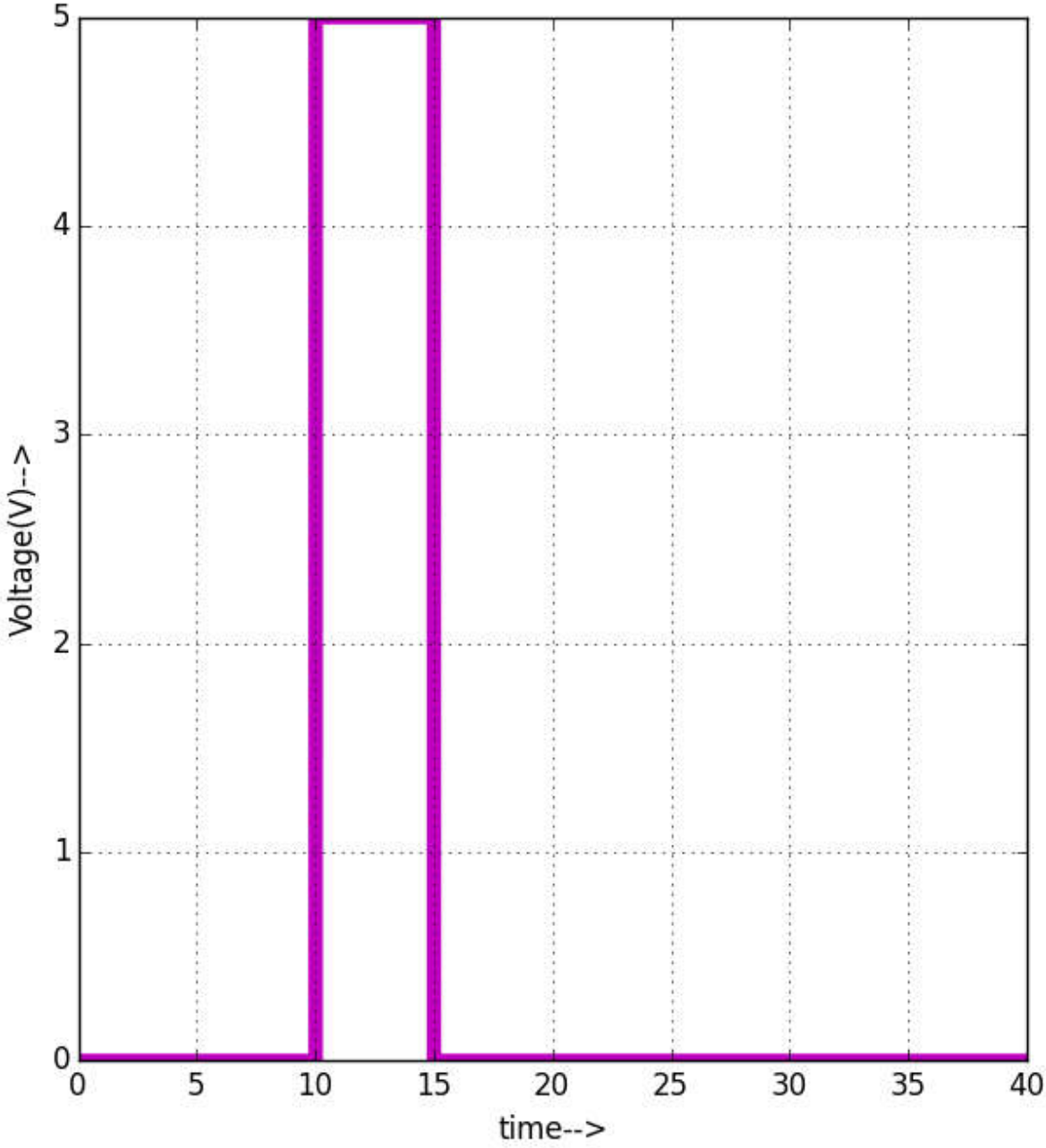
D0:



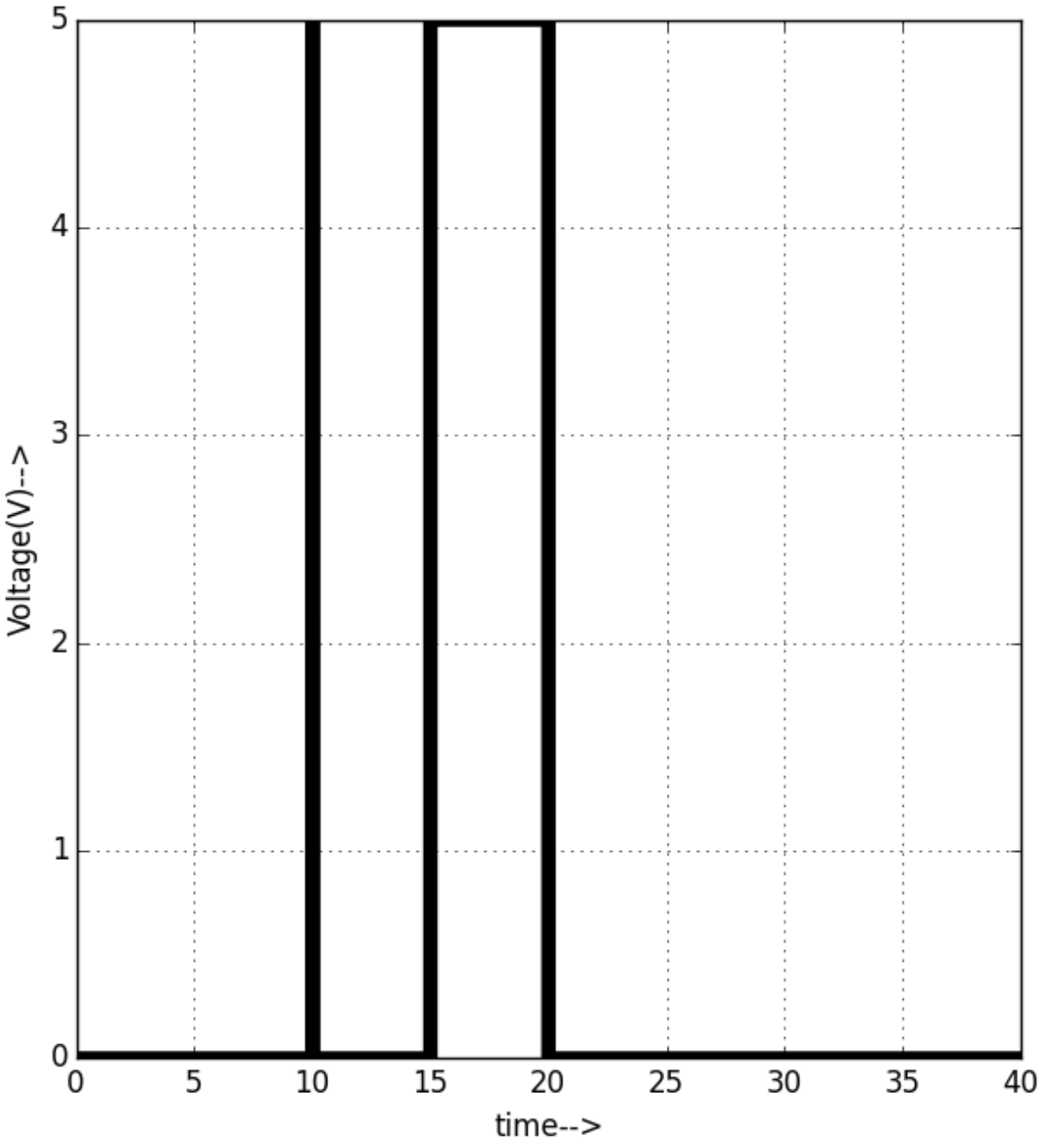
D1:



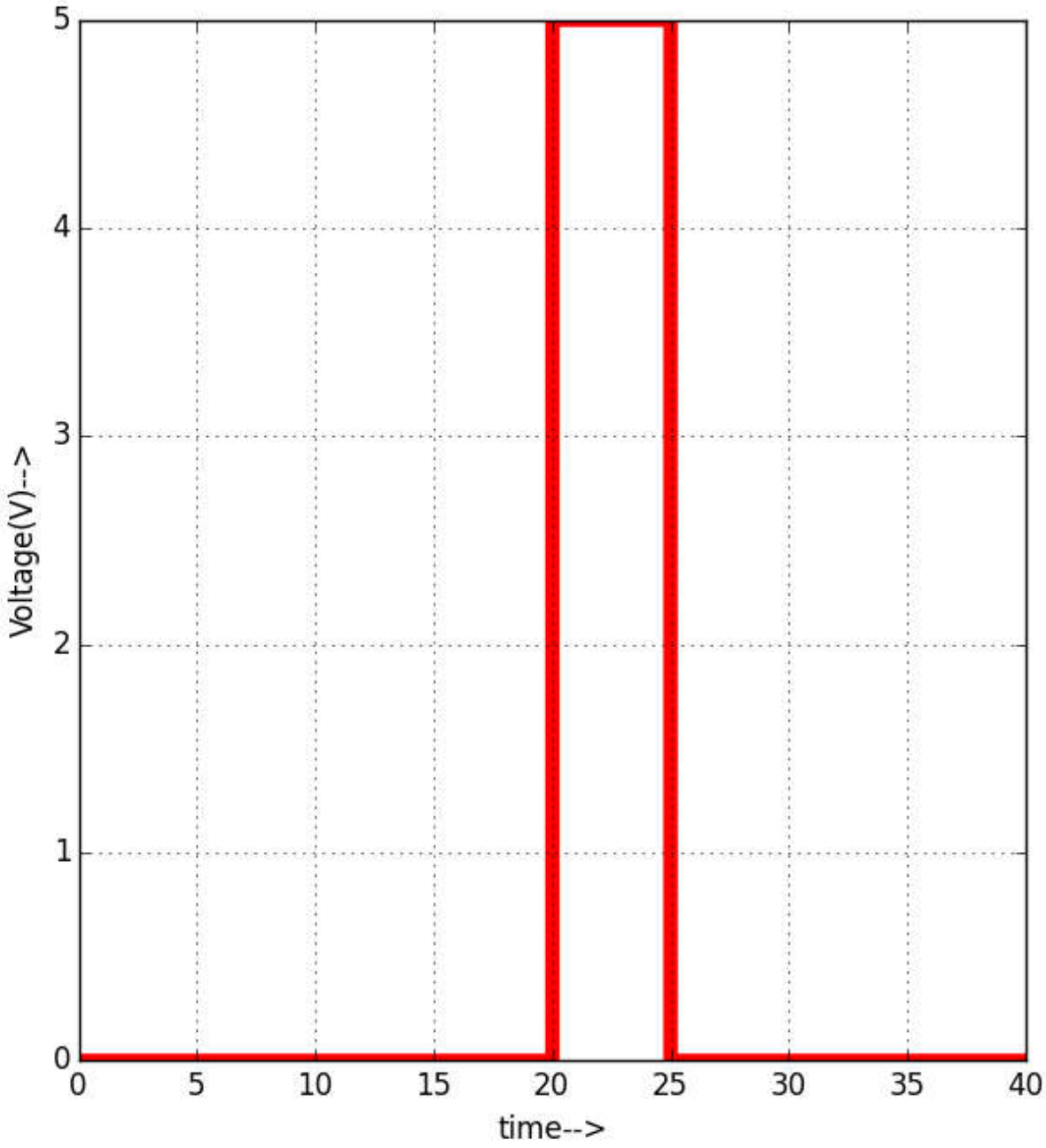
D2:



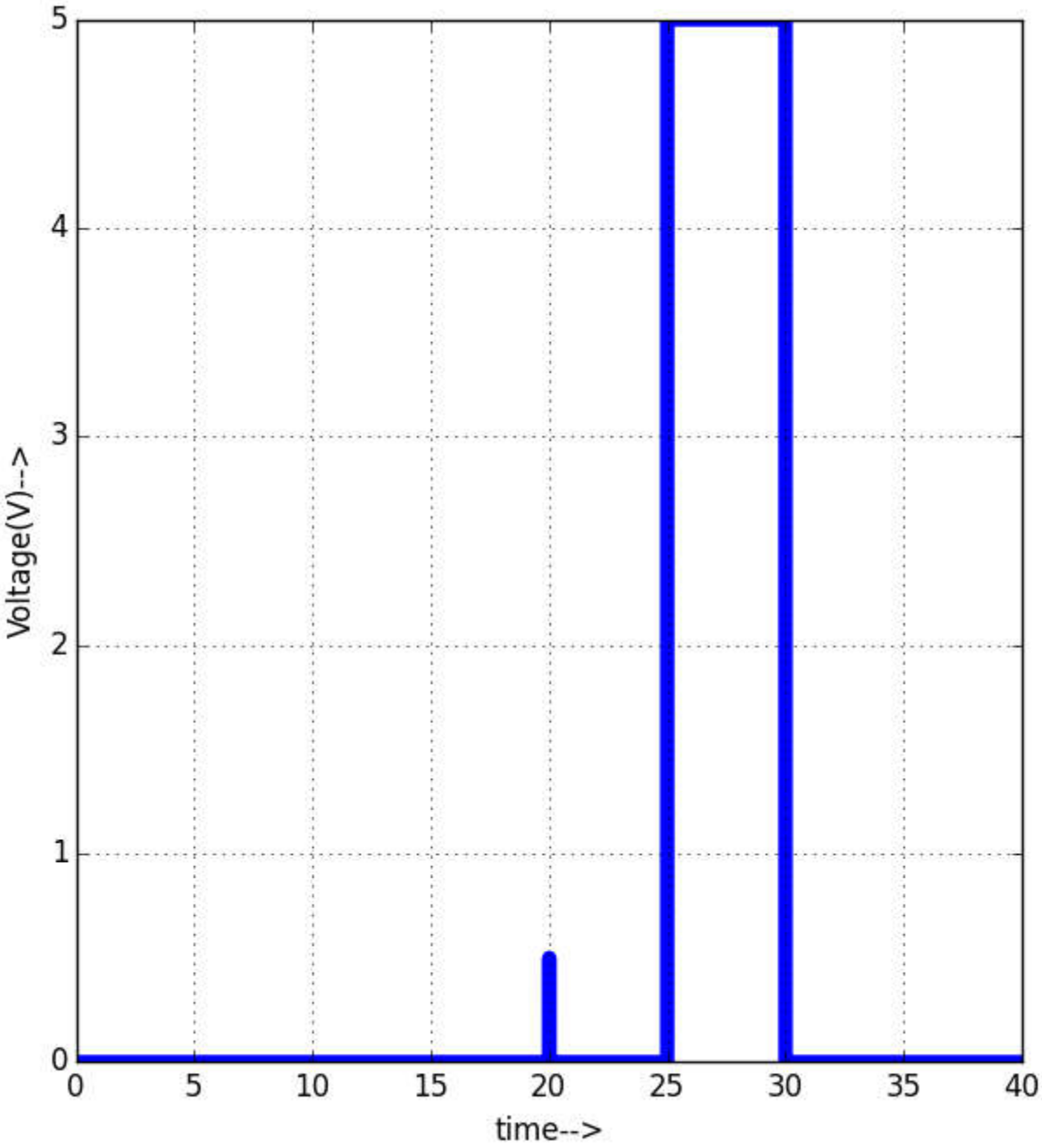
D3:



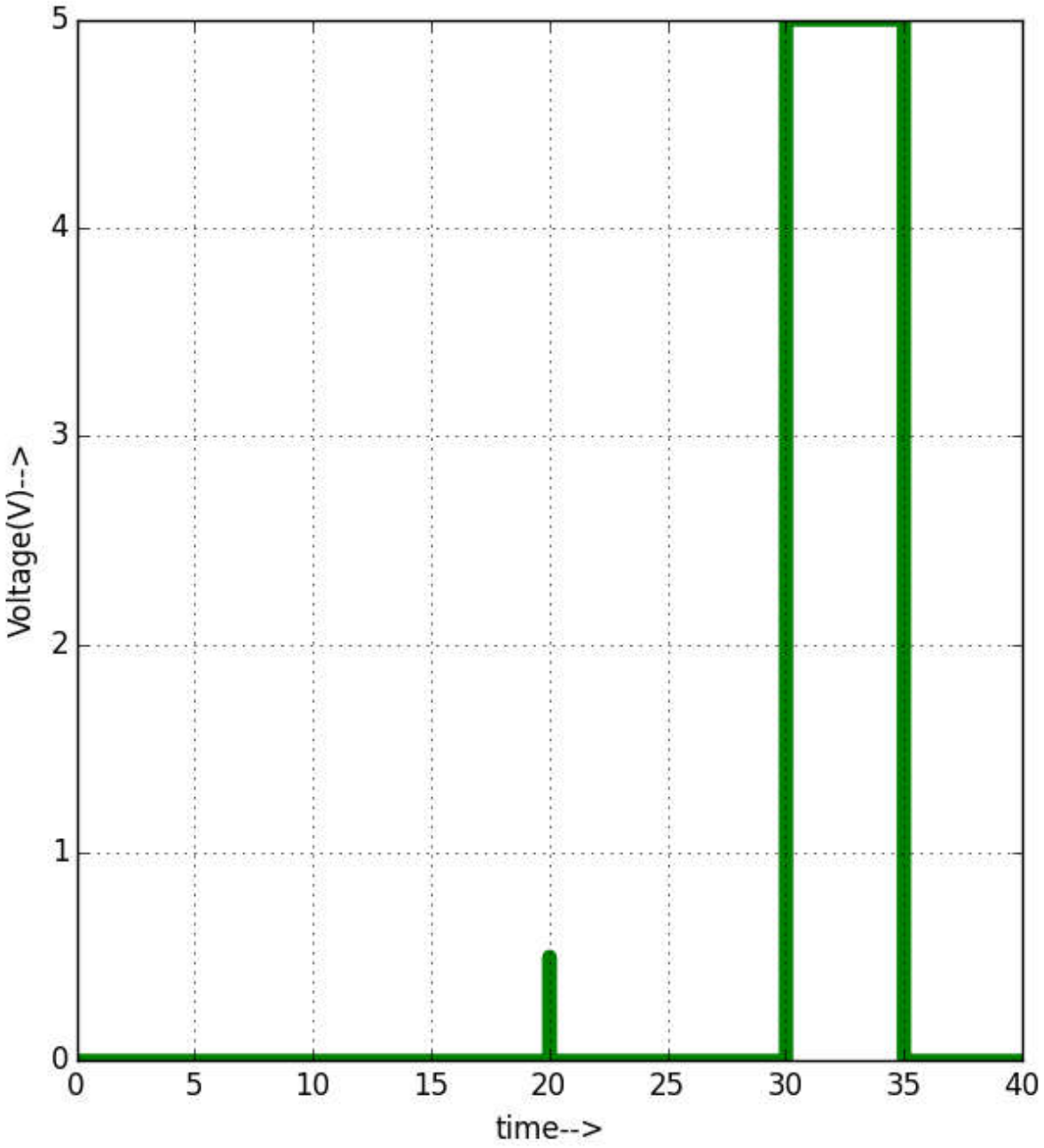
D4:



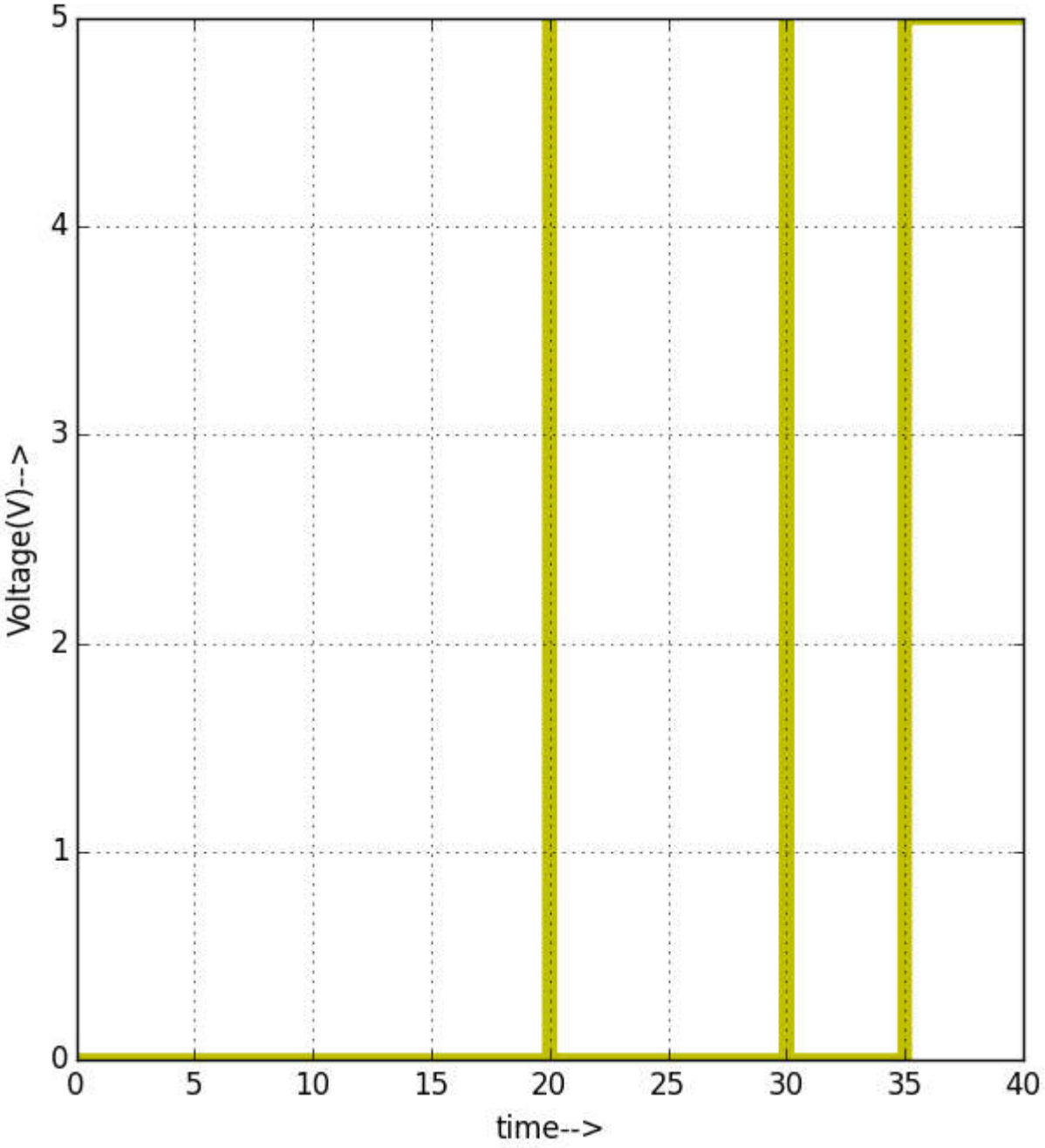
D5:



D6:



D7:



Conclusion:

Thus, we have studied the design of 3 x 8 decoder using 2 x 4 decoders using eSim and we get the appropriate waveforms.

References:

- https://www.javatpoint.com/decoders
- https://www.tutorialspoint.com/digital_circuits/digital_circuits_decoders.htm