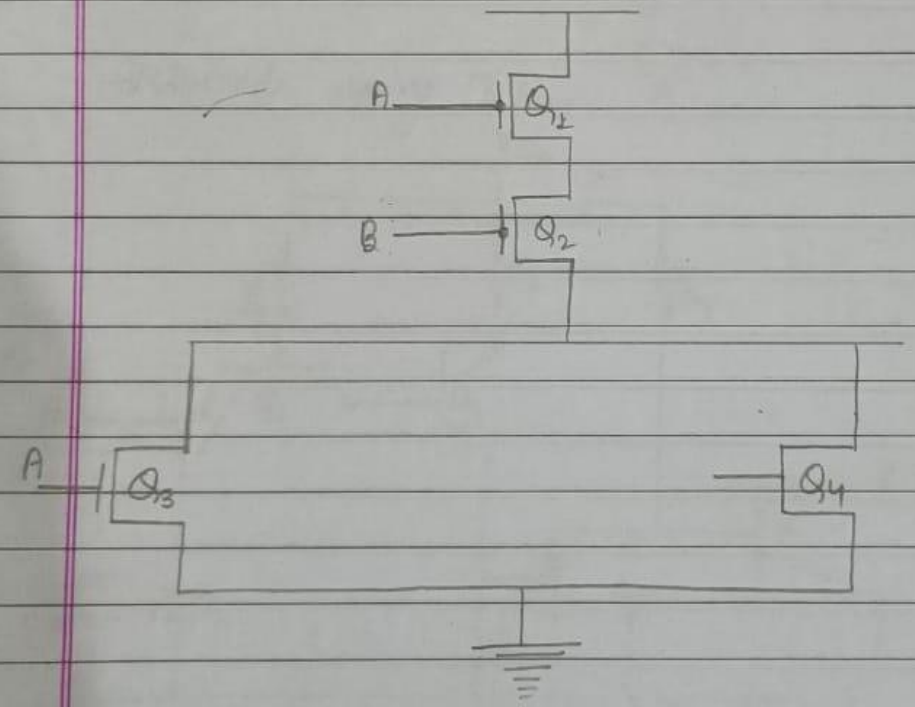
Q1 Using Multisim online simulator to design a CMOS NOR Gate, verify the truth table and show timing diagram wave form.

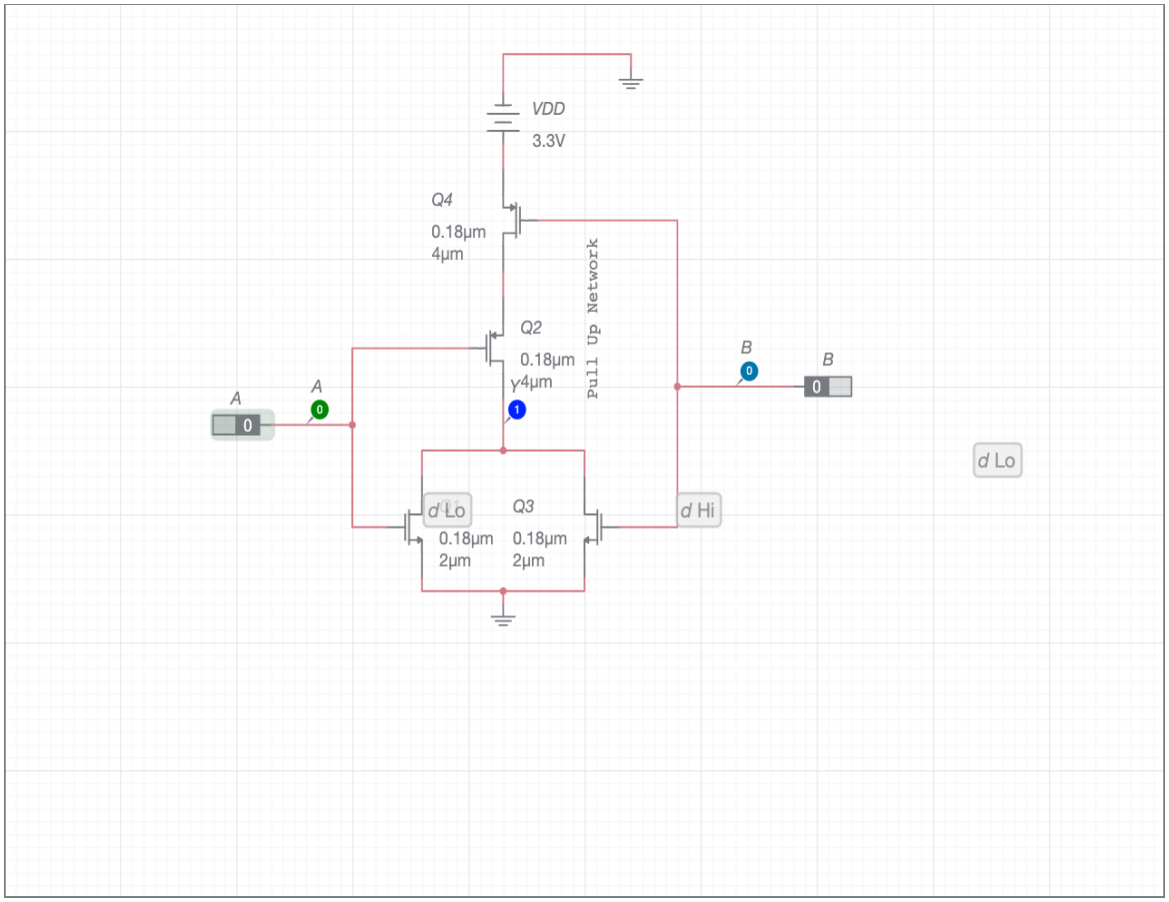
PMOS

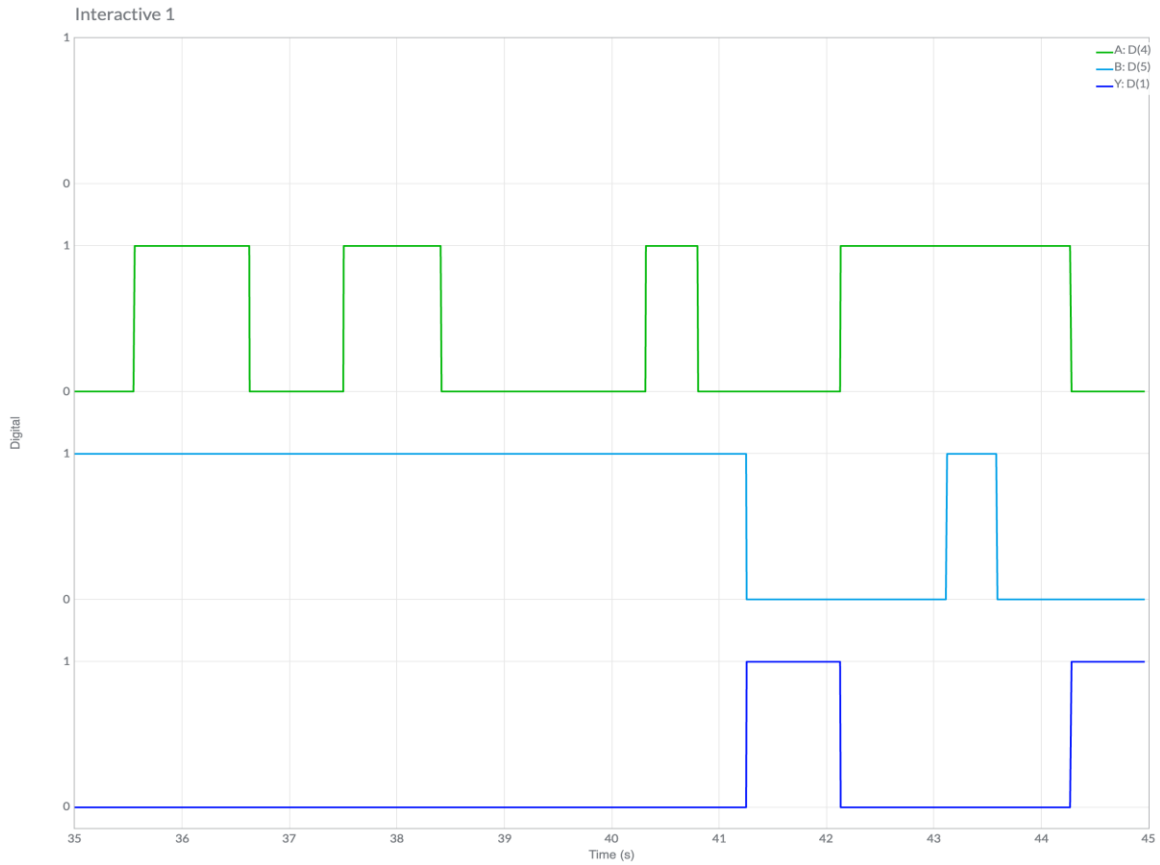
A	B	Q_1	Q_2
0	0	0	0
0	1	0	1
1	0	1	0
1	1	1	1

NMOS

Q_3	Q_4	Cout
0	0	1
0	1	0
1	0	0
1	1	0




VDD
3.3V
Q4
0.18µm
4µm
Q2
0.18µm
4µm
Pull Up Network
A
A
0
B
B
0
d Lo
Q3
d Lo
0.18µm
2µm
0.18µm
2µm
d Hi
d Lo


Interactive 1
A: D(4)
B: D(5)
Y: D(1)
Digital
Time (s)
35
36
37
38
39
40
41
42
43
44
45

Q3 Find the minimal sum of products for the Boolean expression, $f(w,x,y,z) = \Sigma(1,3,4,5,9,10,11) + \Sigma\phi(6,8)$ using the Quine-McCluskey Method.

1	0	0	0	1	1	0	0	0	1	(1,3)	0	0	-	1
3	0	0	1	1	4	0	1	0	0	(1,5)	0	-	0	1
4	0	1	0	0	8	1	0	0	0	(1,4)	-	0	0	1
5	0	1	0	1	3	0	0	1	1	(4,5)	0	1	0	-
6	0	1	1	0	5	0	1	0	1	(4,6)	0	1	-	0
8	1	0	0	0	6	0	1	1	0	(8,9)	1	0	0	-
9	1	0	0	1	9	1	0	0	1	(8,10)	1	0	-	0
10	1	0	1	0	10	1	0	1	0	(8,11)	-	0	1	1
11	1	0	1	1	11	1	0	1	1	(9,11)	1	0	-	1
										(10,11)	1	0	1	-

(1, 9, 3, 11) — 0 — 1
(8, 9, 10, 11) 1 0 — —
(8, 10, 9, 11) 1 0 — —

Left Minterm

(1,3) → A'B'D
(1,5) → A'C'D
(4,5) → A'BC'
(4,6) → A'BD'

Matched:
(1, 9, 3, 11) → B'D
(8, 9, 10, 11) → AB'

Final Table

			1	3	4	5	9	10	11
A'	B'	D	X	X					
A'	C'	D	X			X			
A'	B	C'			X	X			
A'	B	D'			X				
B'	D		X	X					
A	B'						X		X
B'	D						X	(X)	X
A	B'								

$\boxed{Y = AB'}$

Q4 Create the logic diagram and logic symbol of IC T4154 4 to 16 decoder and briefly explain its functions.

The IC T4154 is 4 to 16 decoder decodes four binary weighted address inputs to 16 mutually exclusive output. The device features two input points

A high on either of the input enables the output high. The device can be used as 1 to 16 demultiplexer by using one of that enables inputs as the multiplied data input. When the other enabled input is low the addressed output will follow the state of the applied data.