Department of Computer Science and Engineering (CSE)
BRAC University

Practice Problem Set 3.3

CSE251 – Electronic Devices and Circuits

Diode Logic Circuits

OR Gate, AND Gate, and Cascaded Logic Circuits

Course Description, COs, and Policies

BRAC UNIVERSITY
Inspiring Excellence

Midterm and Final Questions

For any error or issues, contact purbayan.das@bracu.ac.bd

Problem 1

- Implement the following logic functions using diodes.

I. $A.C + B + D$

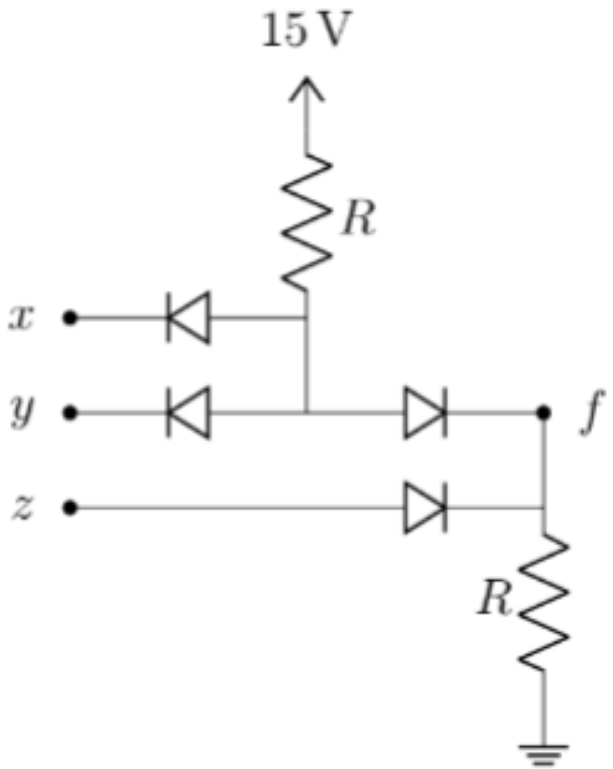
II. $A.C + B.D$

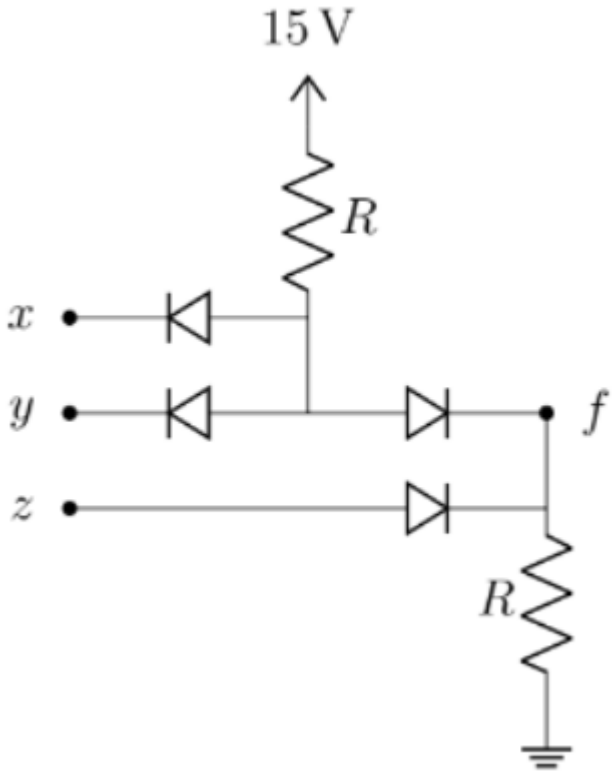
III. $(A + C).(B + D)$

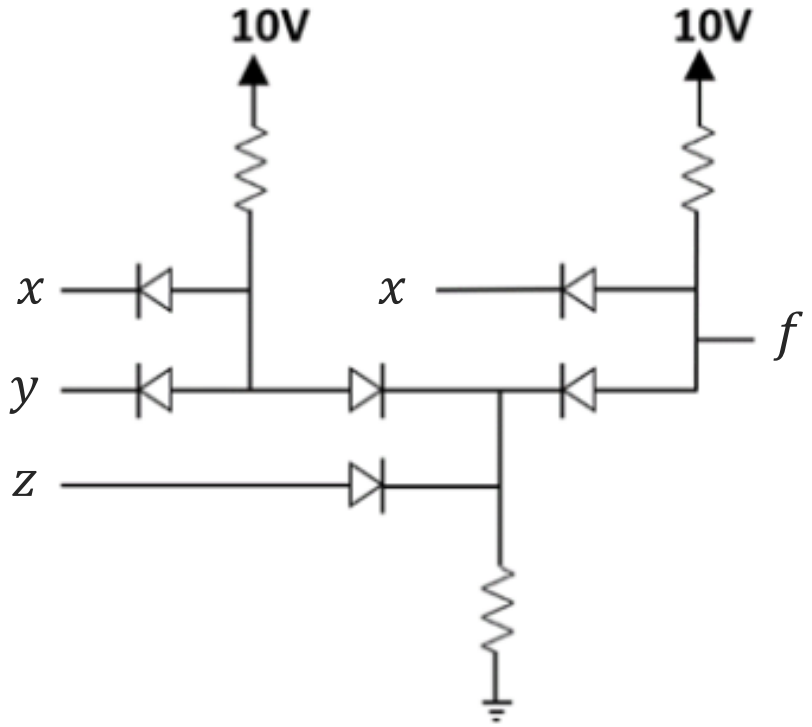
IV. $A.C.(B + D)$

Problem 2

- For each of the circuits shown below, assuming x, y, and z are Boolean inputs, express f in terms of x, y, and z.

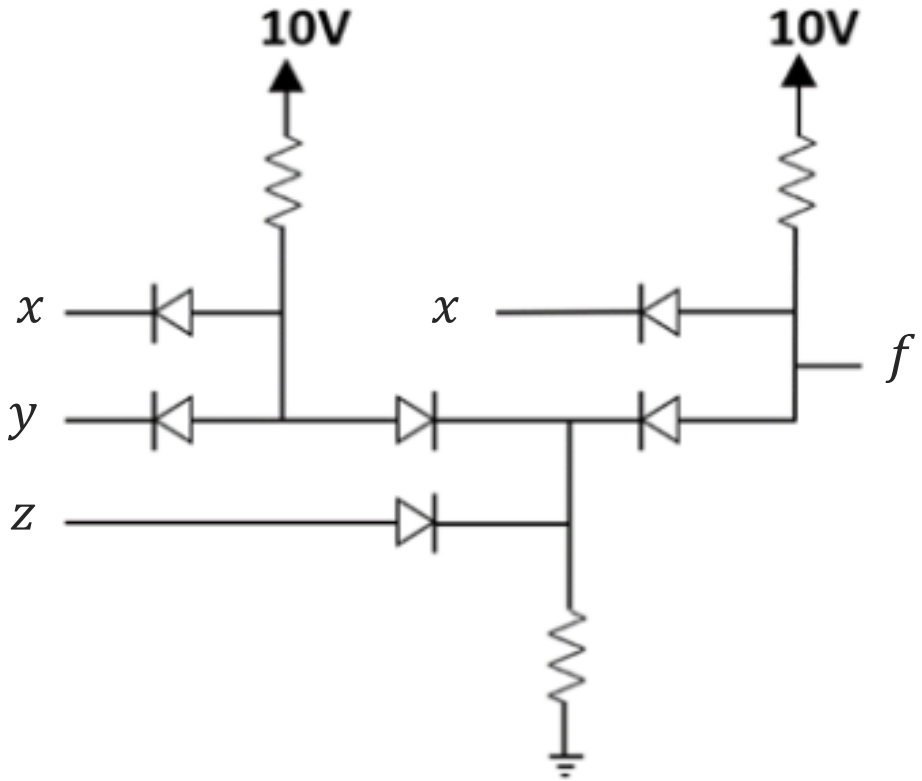






Problem 3

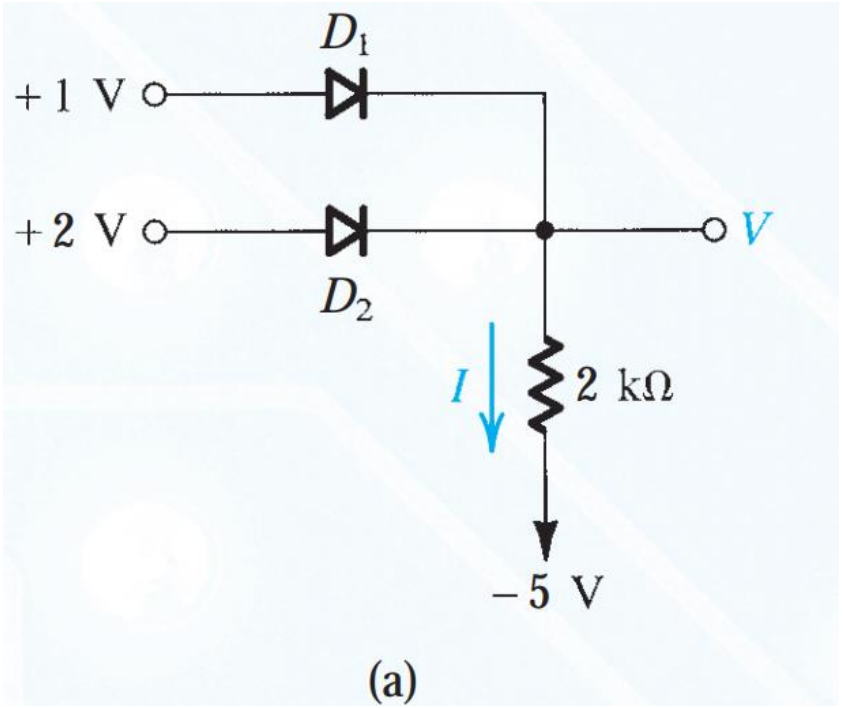
- If x, y, and z are Boolean inputs and f is the Boolean output, complete the following table. Assume that the diodes are ideal.

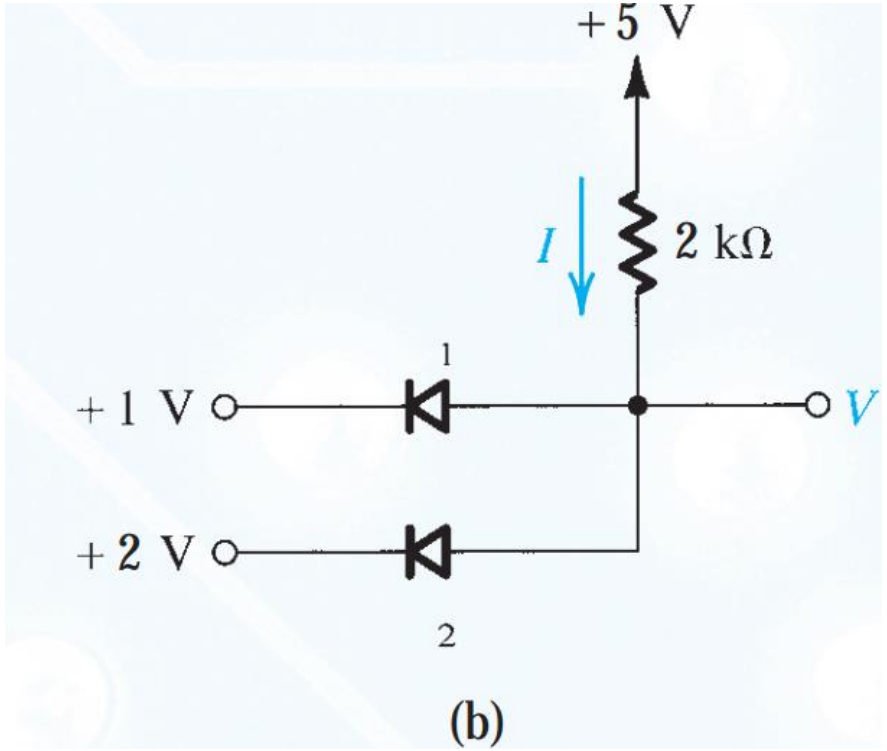


x	y	z	f
$4\ V$	$3\ V$	$4\ V$	
$5\ V$	$3\ V$	$4\ V$	
$13\ V$	$3\ V$	$4\ V$	

Problem 4

- For the logic circuits shown below, use ideal diode model, find the values of the voltages and currents indicated.

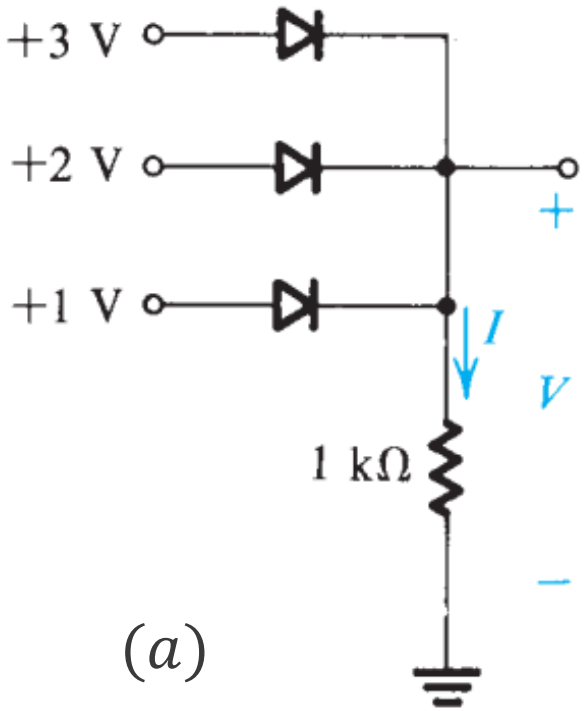




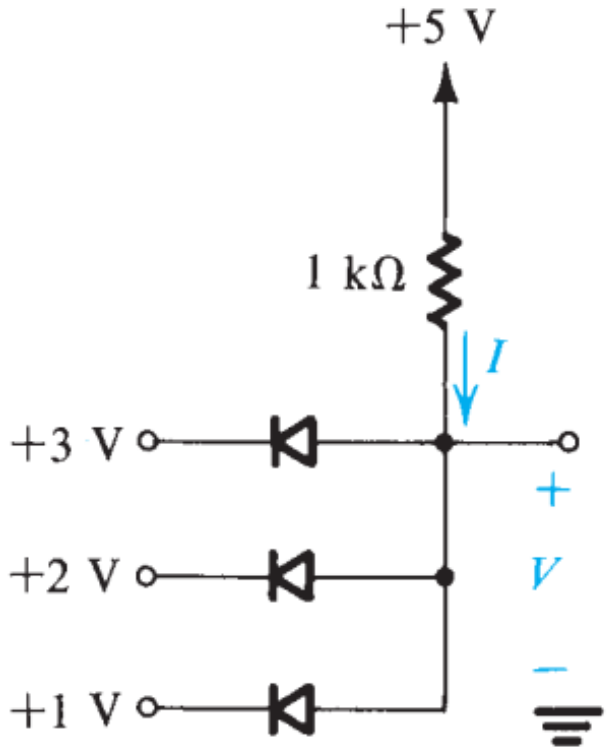
Ans: $(a)\ V = 2\ V,\ I = 2.5\ mA; (b)\ V = 1\ V,\ I = 2\ mA$

Problem 5

- For the logic circuits shown below, use ideal diode model, find the values of the voltages and currents indicated.



(a)

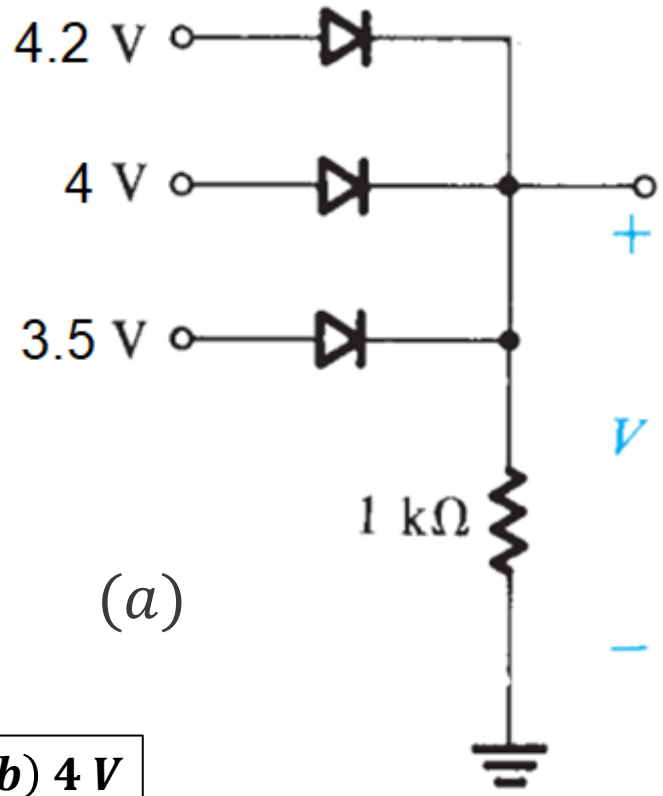


(b)

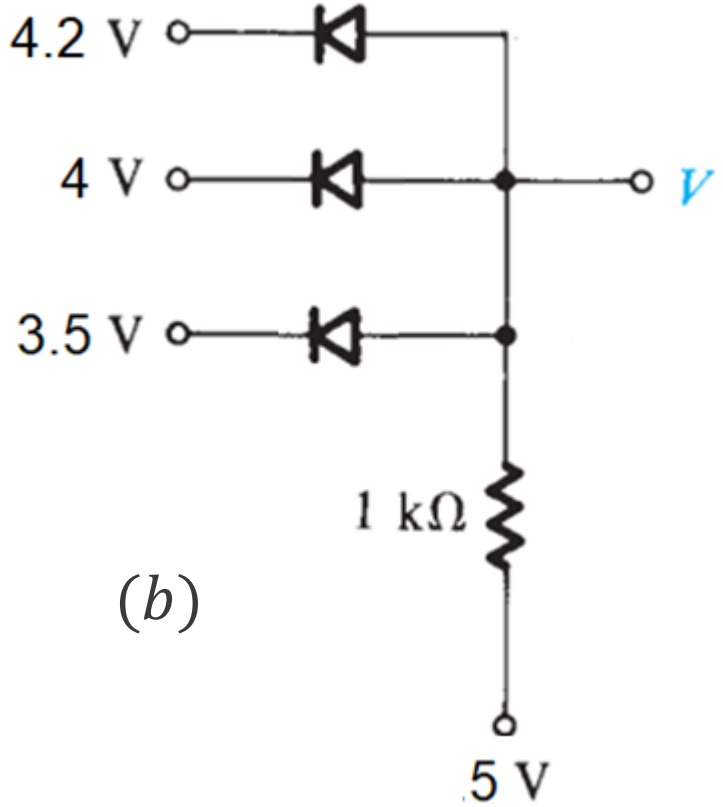
Ans: $(a)\ V = 3\ V,\ I = 3\ mA; (b)\ V = 1\ V,\ I = 4\ mA$

Problem 6

- For each of the circuits shown below, use CVD model, find the values of the voltages and currents indicated. Take $V_{D_{o_1}} = 1\,V$, $V_{D_{o_2}} = 0.7\,V$, and $V_{D_{o_3}} = 0.5\,V$.



(a)

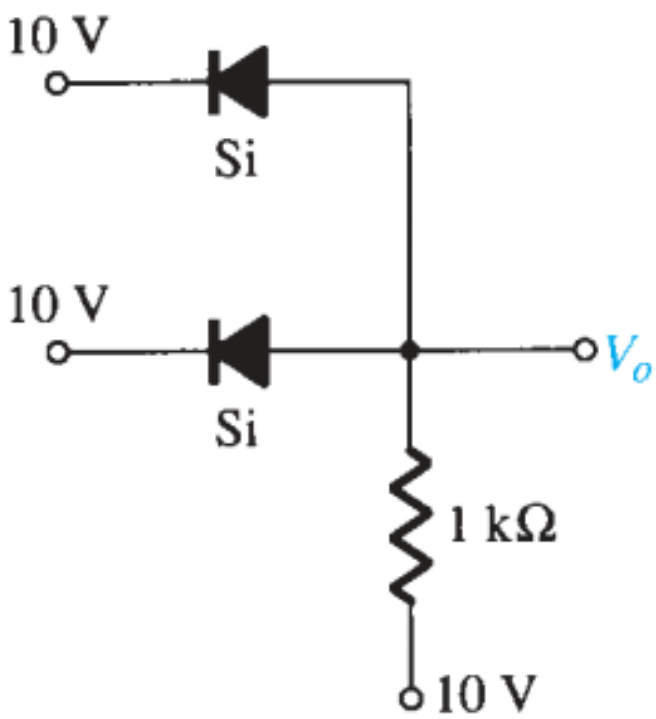


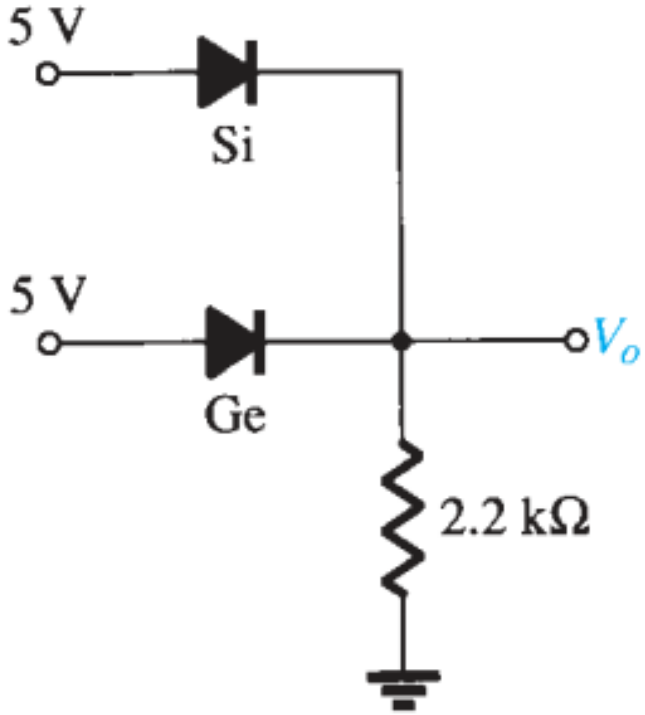
(b)

Ans: (a) $\boldsymbol{V = 3.3\,V}$; $\boldsymbol{(b)\ 4\,V}$

Problem 7

- For the logic circuits shown below, determine. Use CVD+R model with $V_{D_o,\,Si} = 0.7\ V$ and $V_{D_o,\,Ge} = 0.3\ V$ and $r_o = 10\ \Omega$ for both.

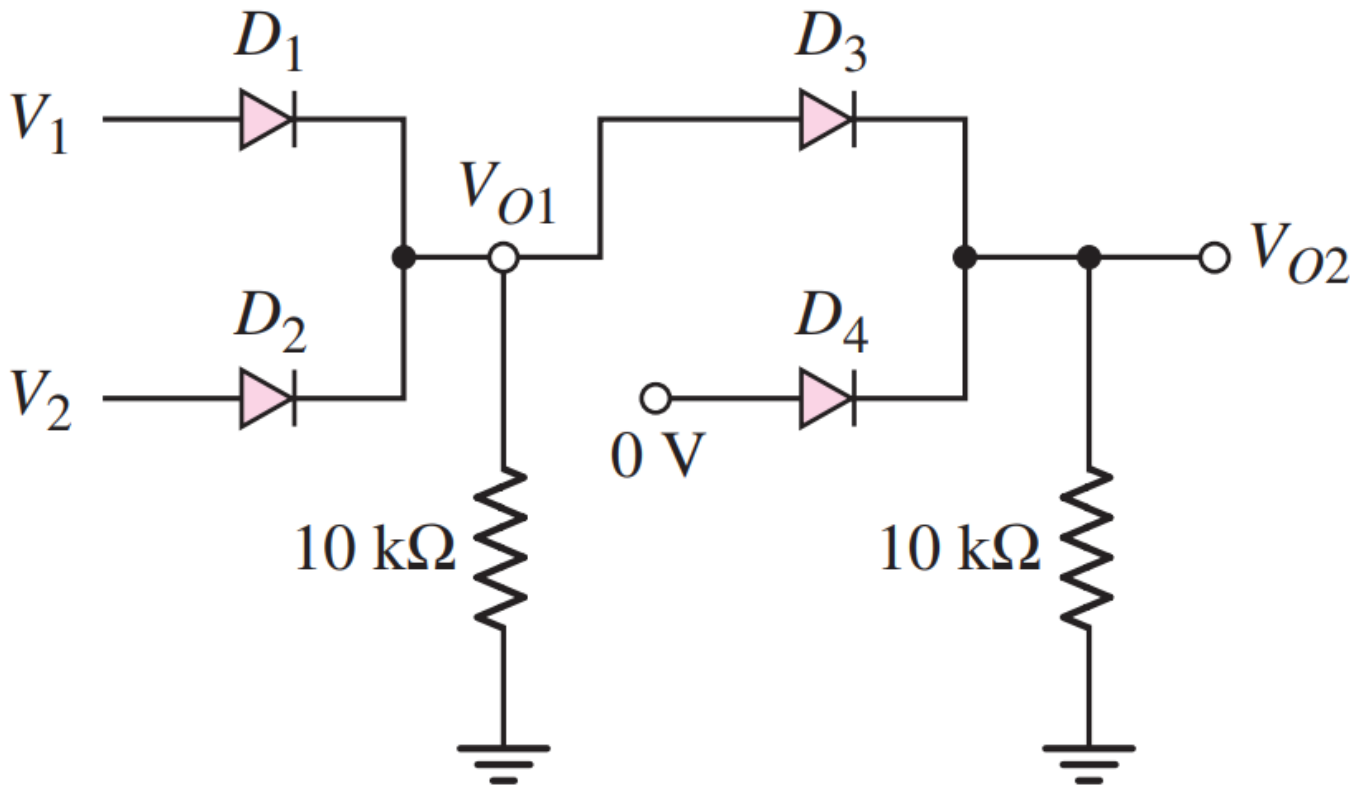




Ans: $(a)\ V_o = 10.7\ V; (b)\ V_o = 4.7\ V$

Problem 8

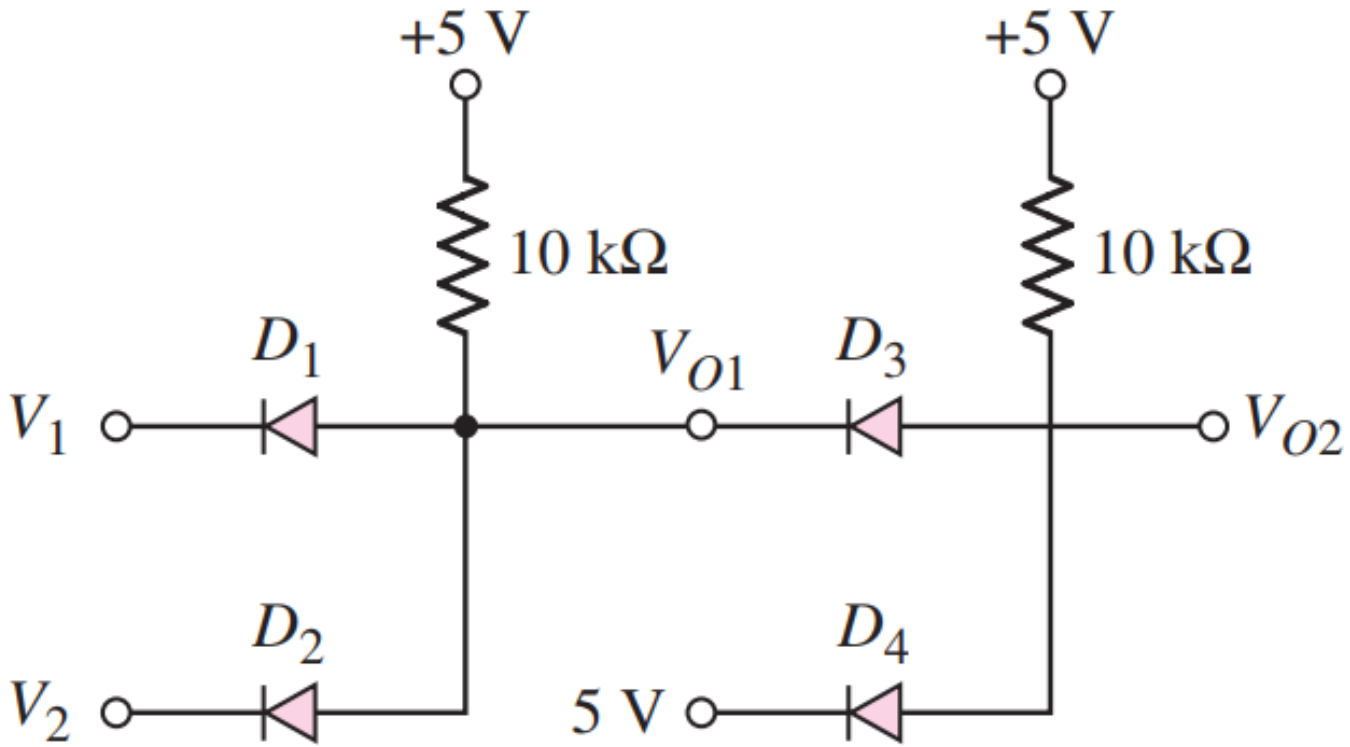
- From the logic network shown, express V_{O2} as a Boolean expression of V_1 and V_2. Determine V_{O2} if $V_1 = 3\ V$ and $V_2 = 1\ V$. Use CVD model with $V_{D_o} = 0.7\ V$.



Ans: $\boldsymbol{V_{O2} = 2\ V}$

Problem 9

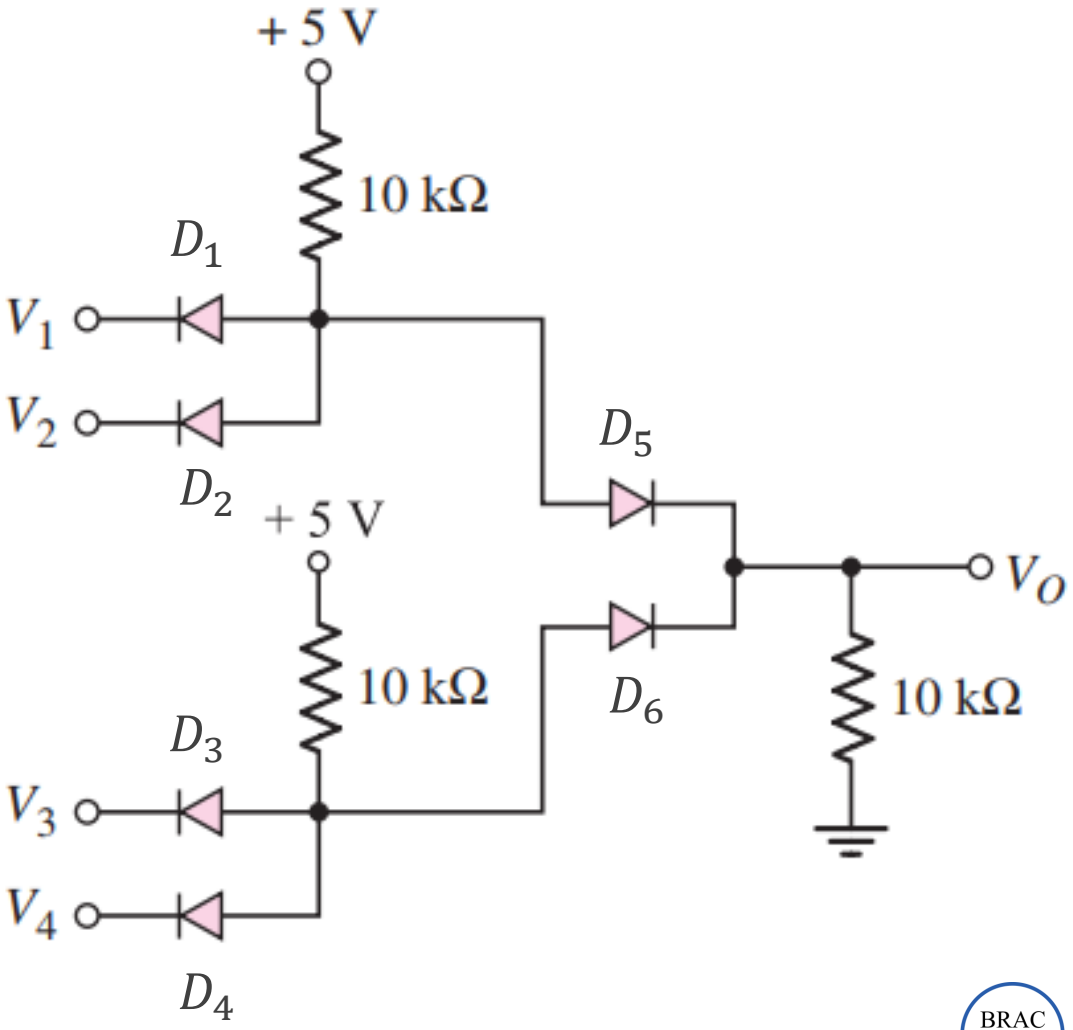
- From the logic network shown, express V_{O2} as a Boolean expression of V_1 and V_2. Determine V_{O2} if $V_1 = 3\ V$ and $V_2 = 1\ V$. Use CVD model with $V_{D_o} = 0.7\ V$.



Ans: $\boldsymbol{V_{O2} = 2.4\ V}$

Problem 10

- From the logic network shown, determine V_O if $V_1 = 2\,V$, $V_2 = 2.2\,V$, $V_3 = 2.4\,V$, and $V_4 = 2.5\,V$. Use CVD model with $V_{D_{o_1}} = 0.3\,V$, $V_{D_{o_2}} = 0.5\,V$, $V_{D_{o_3}} = 0.7\,V$, $V_{D_{o_4}} = 0.9\,V$, $V_{D_{o_5}} = 1\,V$, and $V_{D_{o_6}} = 1.5\,V$.



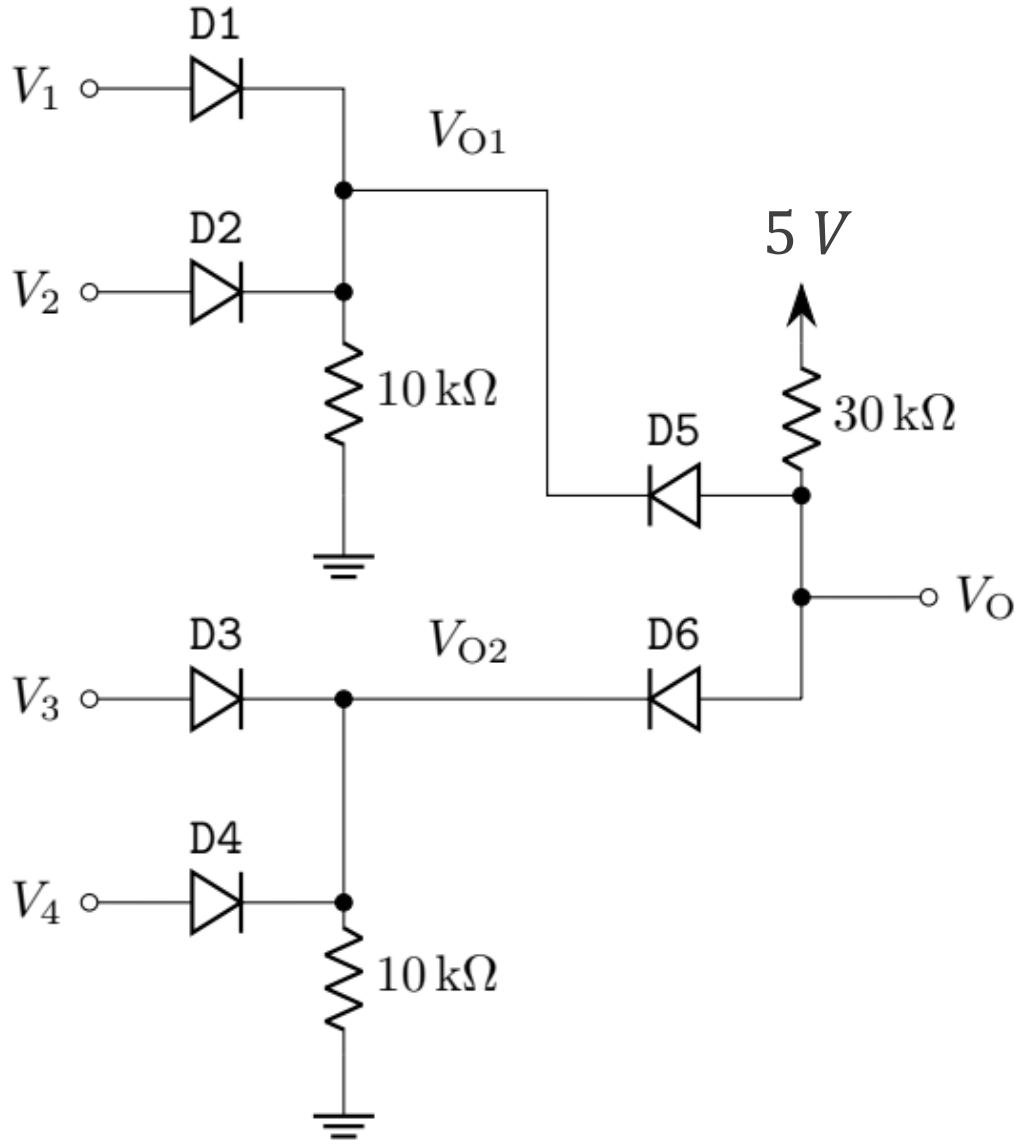
Ans: $\boldsymbol{V_O = 1.6\,V}$

Problem 11

a. From the logic network shown, determine V_{O1} and V_{O2} if $V_1 = 2\,V$, $V_2 = 2.2\,V$, $V_3 = 2.4\,V$, and $V_4 = 2.5\,V$. Use CVD model with $V_{D_{o_1}} = 0.3\,V$, $V_{D_{o_2}} = 0.5\,V$, $V_{D_{o_3}} = 0.7\,V$, $V_{D_{o_4}} = 0.9\,V$, and $V_{D_{o_5}} = V_{D_{o_6}} = 1\,V$.

b. Now if V_3 and V_4 are changed to $-2\,V$ and $-3\,V$ while keeping all other parameters unchanged, identify the states of the diodes D_3 and D_4. Determine V_O.

[Hint: V_{O1} is as it is for (a). However, you don't know V_{O2} now. You need to apply method of assumed states to check the states if $D5$ and $D6$.]



Ans: $(a)\ V_{O1} = 1.7\,V,\ V_{O2} = 1.7\,V$; $(b)\ V_{O1} = 1.7\,V,\ V_{O2} = 1\,V, V_O = 2\,V$