Assignment - 02

Amirun Nahin
ID: 23201416
Sec: 07
Course: CSE251
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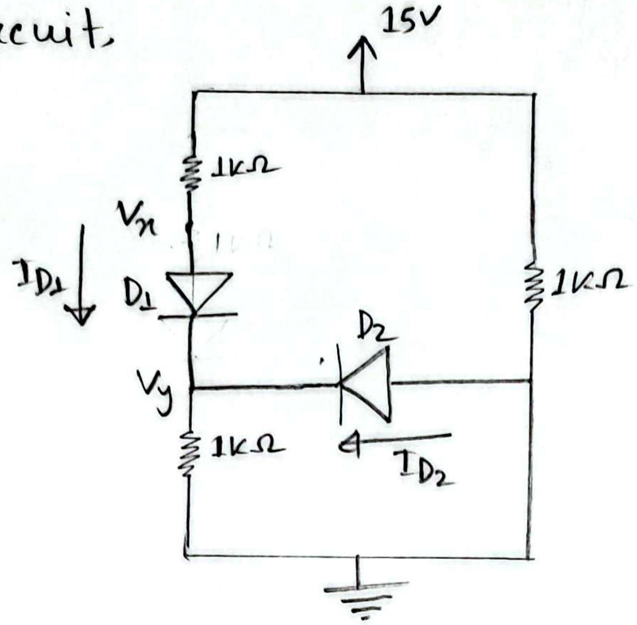
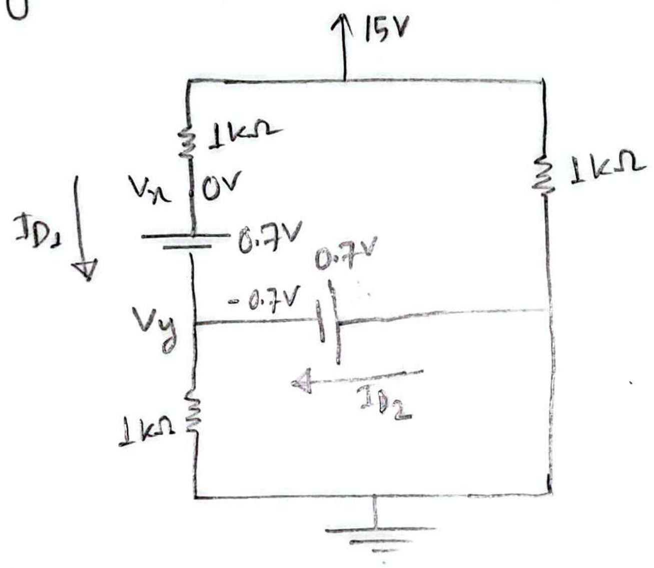
Answer to the que no - 01

given circuit.



assuming both diodes are ON,



here,

$V_x = 0\,V$

$V_y = -0.7\,V$

The current through 1kΩ resistor at top left is the same as I_{D_1}. So,

$$I_{D_1} = \frac{(15 - V_x)}{1} = \frac{(15-0)}{1} = 15\,mA \quad [\text{as } V_x = 0V]$$

Now, KCL at V_y,

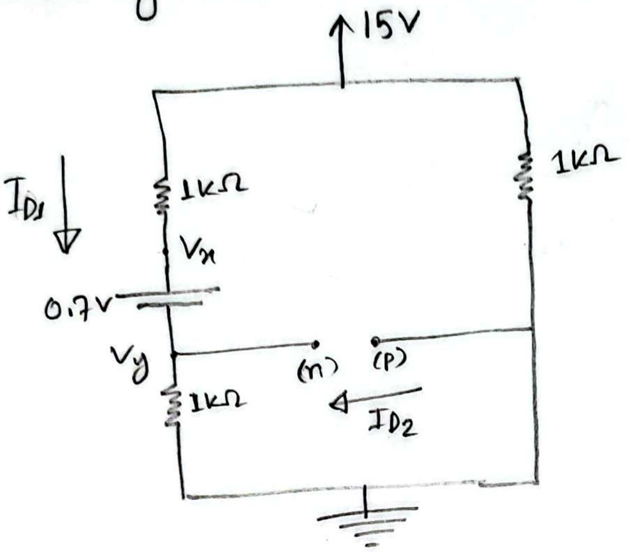
$$\frac{V_y - 0}{1} = I_{D_1} + I_{D_2}$$

$$\Rightarrow \frac{-0.7 - 0}{1} = 15 + I_{D_2}$$

$$\Rightarrow I_{D_2} = -0.7 - 15 = -15.7\,mA$$

As the value of I_{D_2} is negative, the assumption is wrong.

Now, assuming D_1 ON and D_2 OFF



applying KVL at supernode,

$$\frac{V_x - 15}{1} + \frac{V_y - 0}{1} = 0$$

$$\Rightarrow V_x + V_y = 15 \quad \text{------ (i)}$$

from supernode,

$$V_x - V_y = 0.7 \quad \text{------ (ii)}$$

solving (i) and (ii)

$$V_x = 7.85 \text{ V}$$
$$V_y = 7.15 \text{ V}$$

So, $I_{D_1} = \frac{15 - V_x}{1} = \frac{(15 - 7.85)}{1}$ mA

$= 7.15$ mA

and, $V_n - V_p = (7.15 - 0) = 7.15$ V

as, I_{D_1} is positive and $V_n > V_p$, the assumption that

D_1 is ON and D_2 is OFF are correct.

So,

$V_x = 7.85\ V$

$V_y = 7.15\ V$

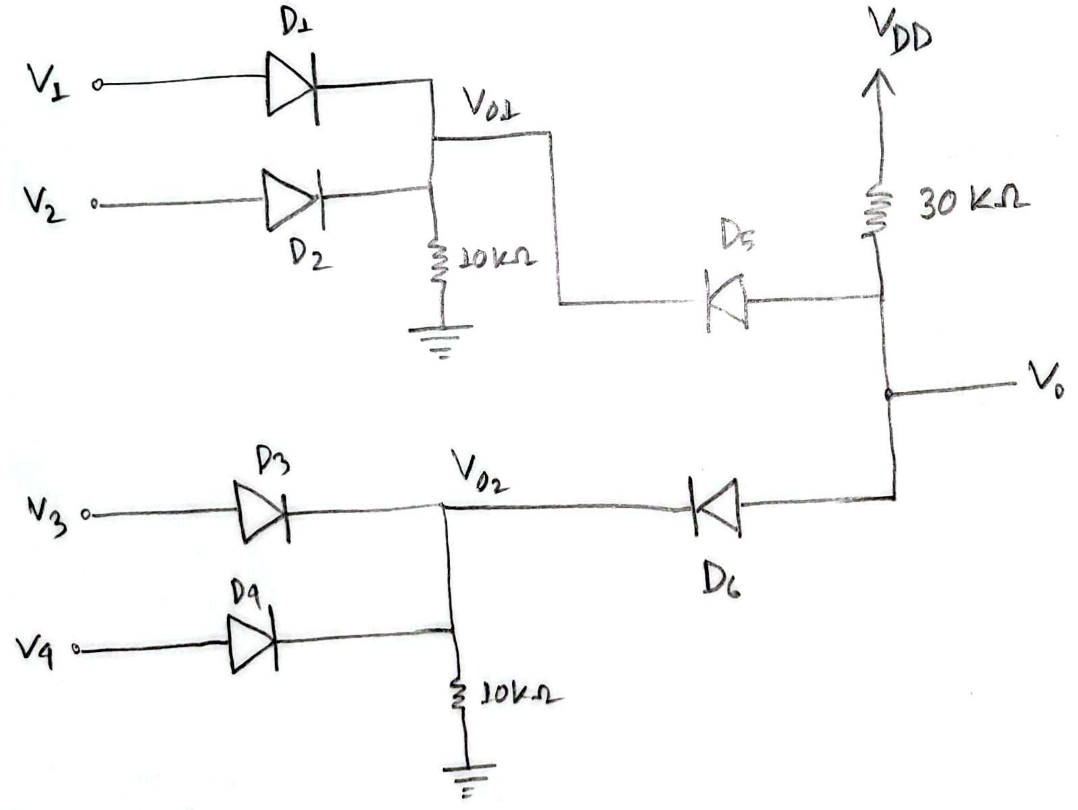
$I_{D_1} = 7.15\ mA$

$I_{D_2} = 0\ mA$

(Ans.)

Answer to the que. no-02 (a)

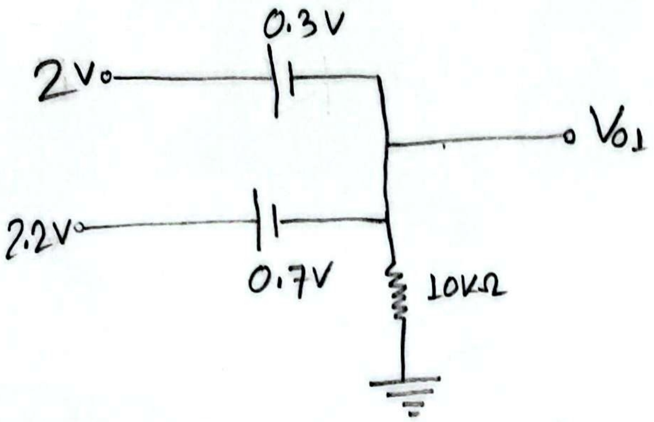
Given circuit,



and voltages,

$V_1 = 2V$	$V_{D1} = 0.3V$	$V_{D5} = 1V$
$V_2 = 2.2V$	$V_{D2} = 0.7V$	$V_{D6} = 1V$
$V_3 = 2.4V$	$V_{D3} = 0.5V$	$V_{DD} = 5V$
$V_4 = 2.5V$	$V_{D4} = 0.9V$	

Now, for V_{01}, the circuit,

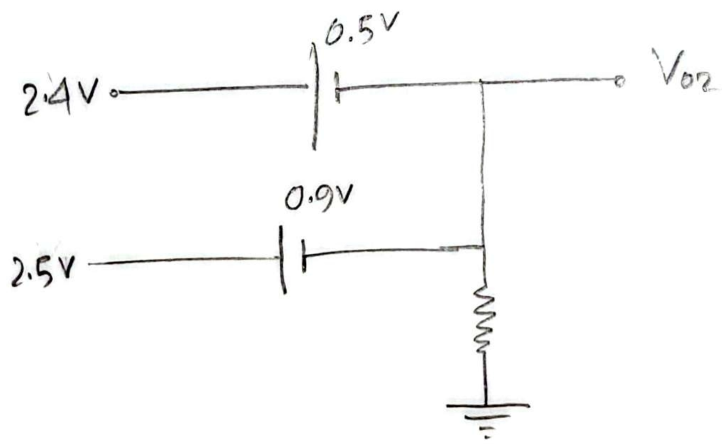


as this is a max gate and the input voltages are different, the maximum voltage will be the output voltage. Now, considering the voltage drop through D_1 and D_2,

$$V_1 = (2-0.3)\,V = 1.7\,V$$
$$V_2 = (2.2-0.7)\,V = 1.5\,V$$

$\therefore V_{01} = 1.7\,V$

for V_{02}, the circuit



Similarly, this is a max gate. We get the maximum input voltage. So, considering voltage drop through D_3 and D_4,

$$V_3 = (2.4-0.5) = 1.9\,V$$
$$V_4 = (2.5-0.9)\,V = 1.6\,V$$

$\therefore V_{02} = 1.9\,V$

Finally, we have,

$$V_{o1} = 1.7\ V$$

$$V_{o2} = 1.9\ V$$

(Ans.)

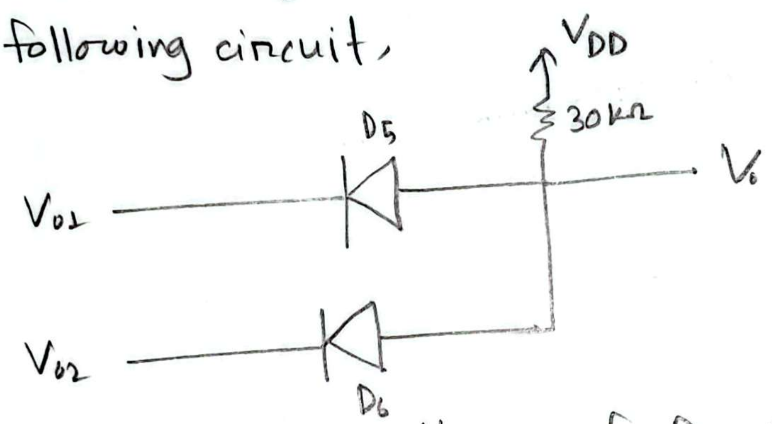
(b)

from (a), we have,

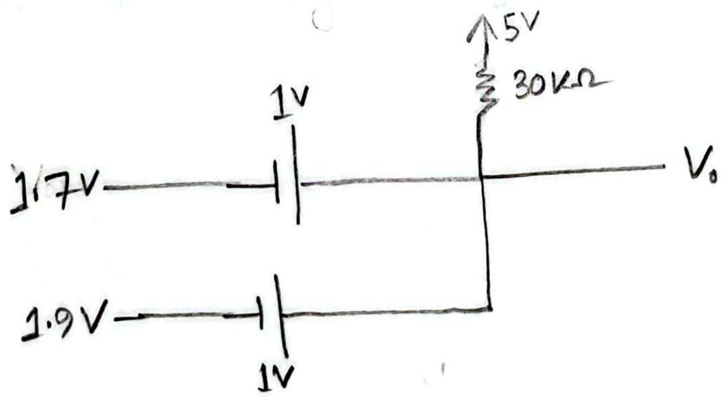
$$V_{o1} = 1.7V$$

$$V_{o2} = 1.9V$$

Now, from the circuit, we can see that this two are the input through D_5 and D_6 diode respectively. So, we get the following circuit,



Now, with barrier voltage of D_5 and D_6,



this is a min gate setup where if the input voltages are different, the input with lowest voltage is the output voltage.

So, considering the voltage drop through D_5 and D_6.

$$V_{o1} = (1.7 + 1)\,V = 2.7\,V$$

$$V_{o2} = (1.9 + 1)\,V = 2.9\,V$$

$$\therefore\ V_o = 2.7\,V$$

Finally, we get $V_o = 2.7\,V$. (Ans.)