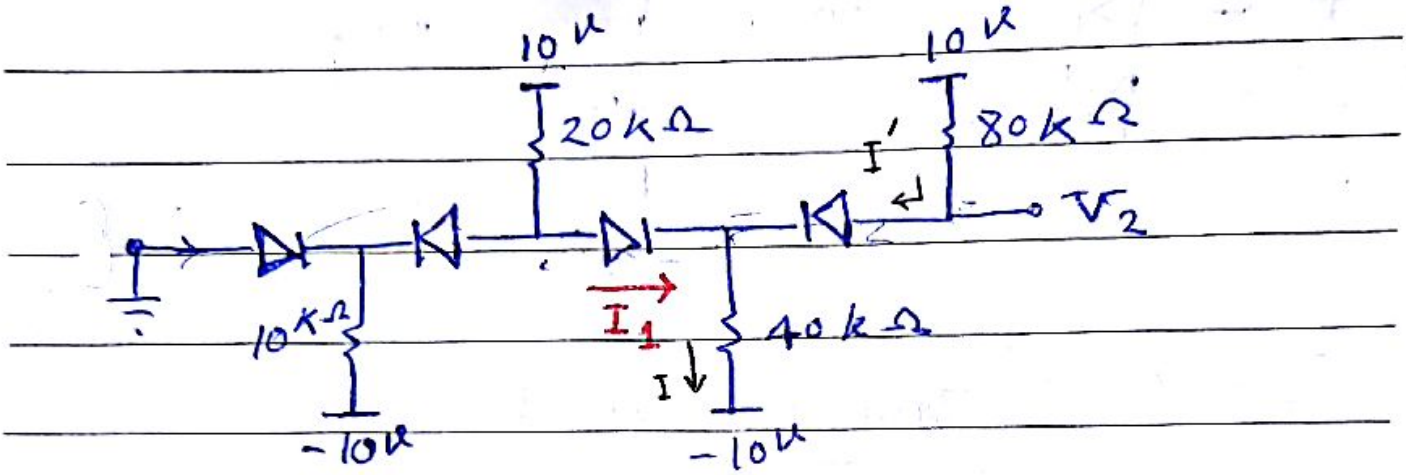
1. Calculate V_2, I_1 ?

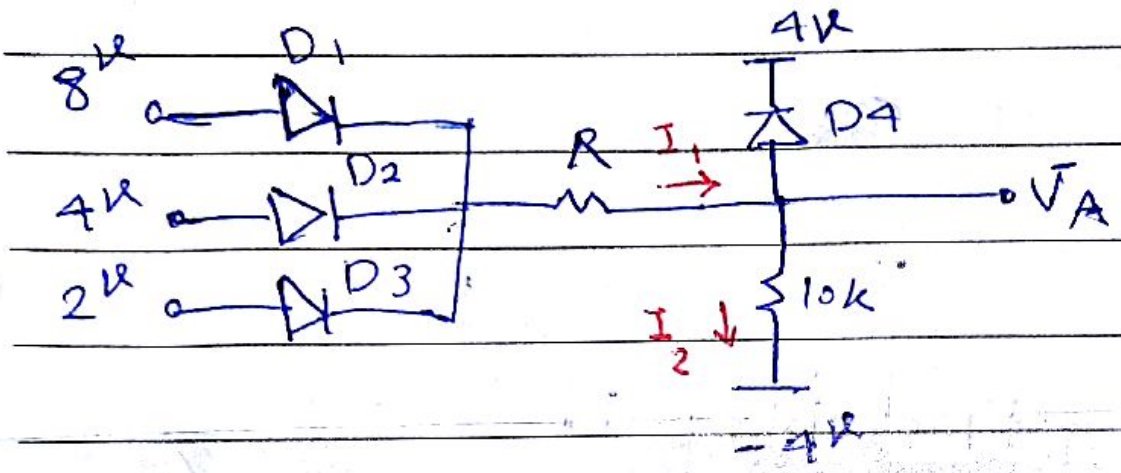


Sol: (1) all diodes are on: $\rightarrow V_2 = 0^{\mu}$

$$I_1 = I - I'$$

$$\begin{cases} I = \dfrac{10^{\mu}}{40k} = \dfrac{1}{4}\,mA \\ I' = \dfrac{10^{\mu}}{80k} = \dfrac{1}{8}\,mA \end{cases} \rightarrow I_1 = \frac{1}{4} - \frac{1}{8} = \frac{1}{8}\,mA$$

2. In The Fig-1 assuming ideal diodes, calculat R while $V_A = 2V$ and in this case calculate I_1, I_2 ?



SOL (2): if $\begin{cases} V_A = 2^{u} \\ D_4 : off \end{cases} \Rightarrow$ Assume $\begin{cases} D_1 : on \\ D_2 : off \\ D_3 : off \end{cases}$

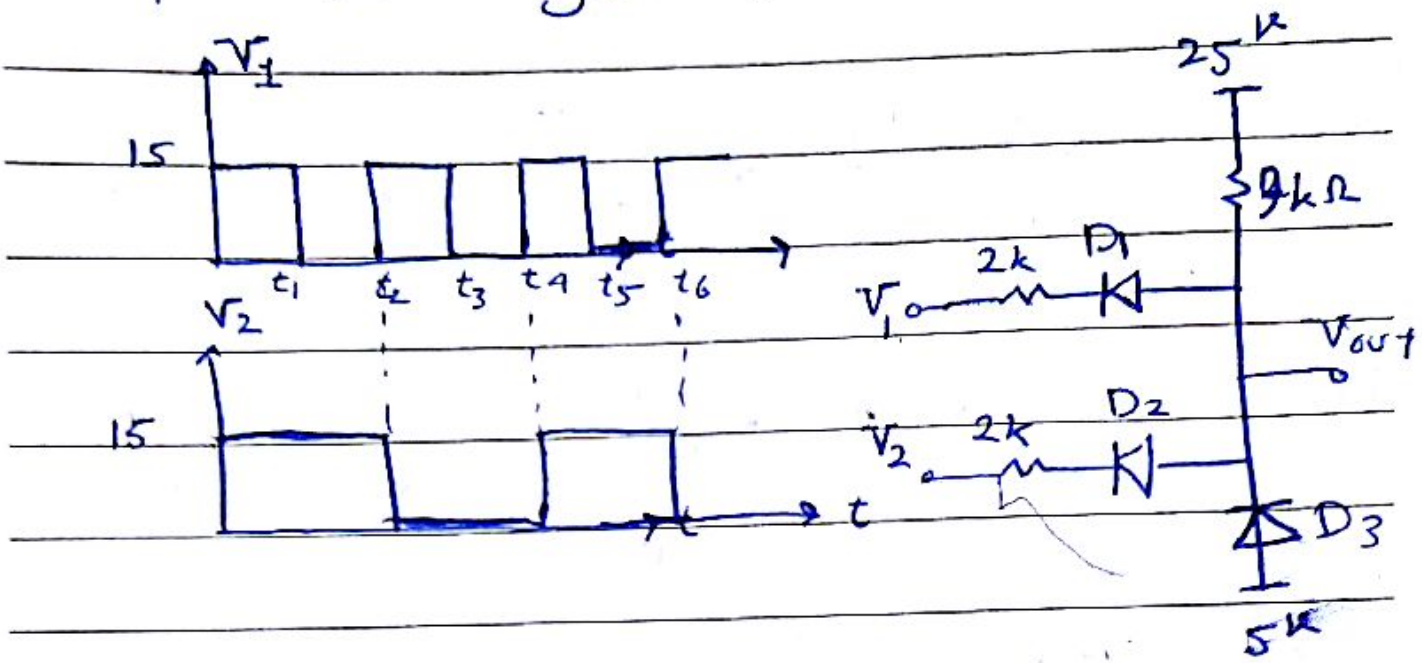
$\hookrightarrow \dfrac{8 - V_A}{R} = \dfrac{V_A - (-4)}{10^{k\Omega}} \rightarrow \dfrac{8-2}{R} = \dfrac{2+4}{10^{k}}$

$\hookrightarrow \dfrac{6}{R} = \dfrac{6}{10^{k}} \Rightarrow R = 10^{k\Omega}$

$I_1 = \dfrac{8-2}{10^{k}} = \dfrac{6}{10^{k}} = \dfrac{6}{10}\,mA$

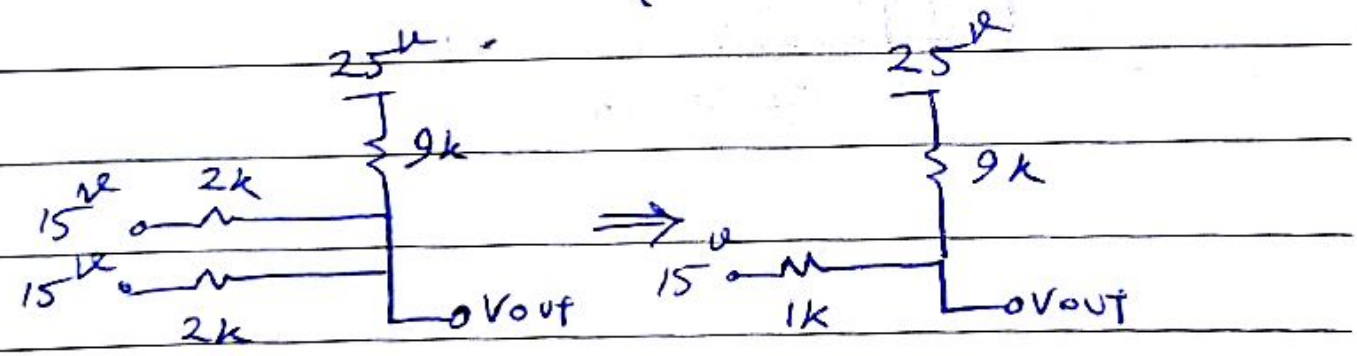
3. In the fig all diodes are ideal

plot the voltage V_{out}.



Sol: (3)

in $0 < t < t_1$ { D_1 : on, D_2 : on, D_3 : off . So:



$V_{out} = ?$ KCL $\quad \frac{V_{out} - 15}{1k\Omega} + \frac{V_{out} - 25}{9k} = 0$

$$\frac{V_{out} - 15}{1k} = \frac{25 - V_{out}}{9k} \rightarrow 9(V_{out} - 15) = 25 - V_{out}$$

$$10\,V_{out} = 160 \rightarrow V_{out} = 16\,Volt$$

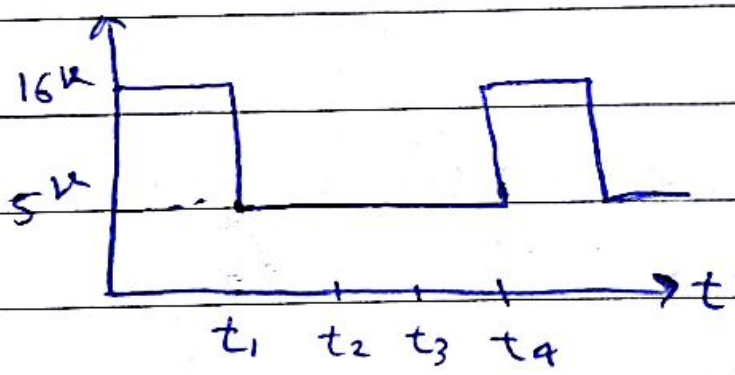
Year: Month: Date: Sol (3) Subject:

in $t_1 < t < t_2$ → D_1 = on, D_2 : off, D_3 = on → $V_{out} = 5^{V}$

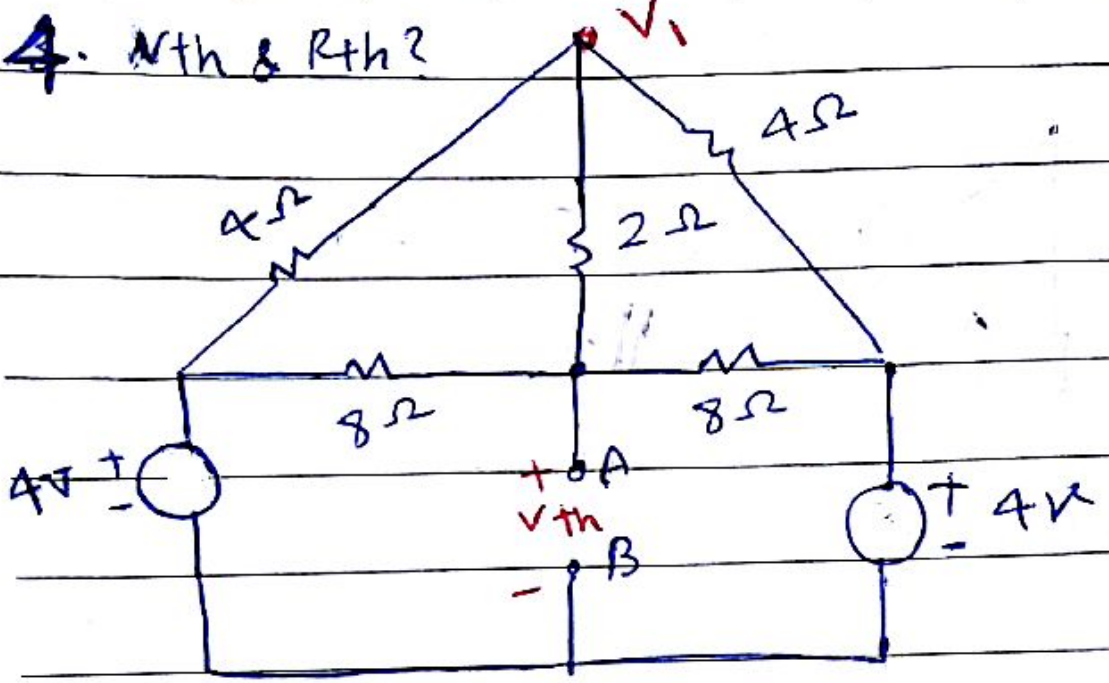
in $t_2 < t < t_3$ → D_1 : off, D_2 : on, D_3 : on → $V_{out} = 5^{V}$

in $t_3 < t < t_4$ → D_1 : on, D_2 : on, D_3 : on → $V_{out} = 5^{V}$

So:



4. Vth & Rth?



Sol (4.) KCL 1) $\frac{V_1 - 4^V}{4\Omega} + \frac{V_1 - V_{th}}{2\Omega} + \frac{V_1 - 4^V}{4\Omega} = 0$

$V_1 - 4 + 2V_1 - 2V_{th} + V_1 - 4 = 0$

$4V_1 = 2V_{th} + 8$ (1)

KCL 2) $\frac{V_{th} - 4^V}{8\Omega} + \frac{V_{th} - V_1}{2\Omega} + \frac{V_{th} - 4^V}{8\Omega} = 0$

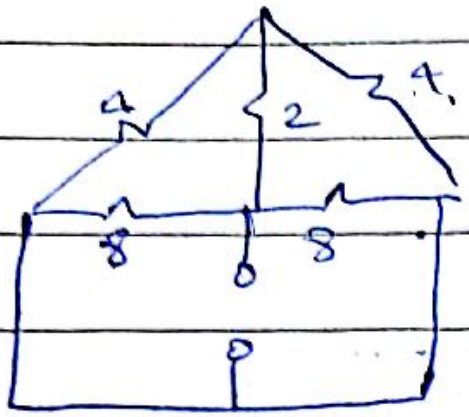
$V_{th} - 4 + 4V_{th} - 4V_1 + V_{th} - 4 = 0$

$4V_1 = 6V_{th} - 8$ (2)

(2) → (1) $\Rightarrow 6V_{th} - 8 = 2V_{th} + 8$

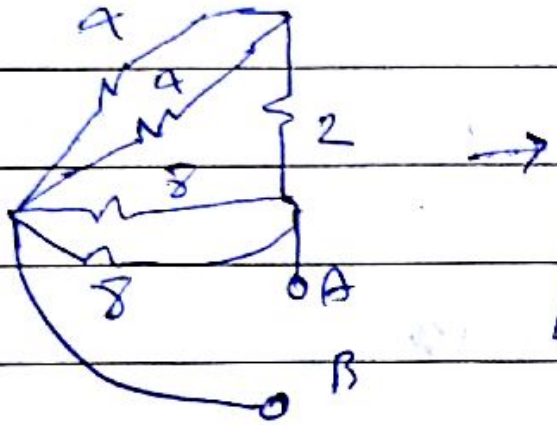
$4V_{th} = 16 \rightarrow V_{th} = 4^V$

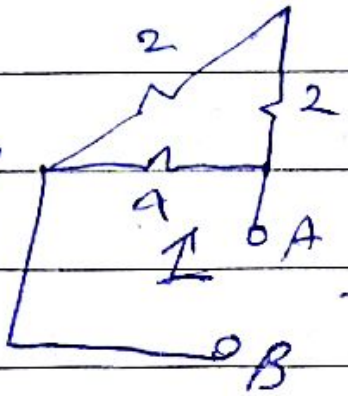
Rth: Sol (4)



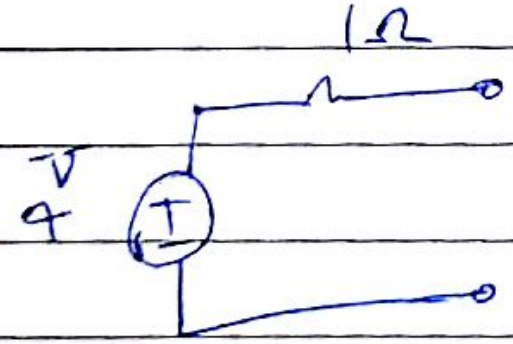
$8 \| 8 = 4\Omega$

$4 \| 4 = 2\Omega$





$\rightarrow R_{th} = 1\Omega$



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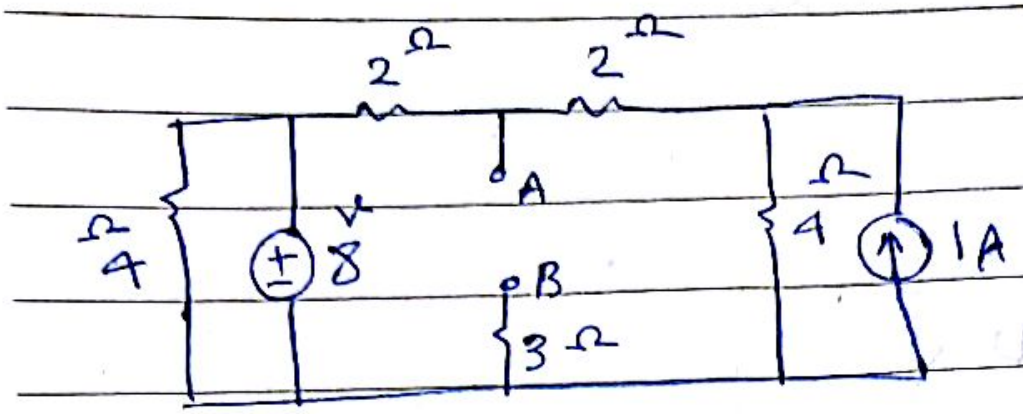
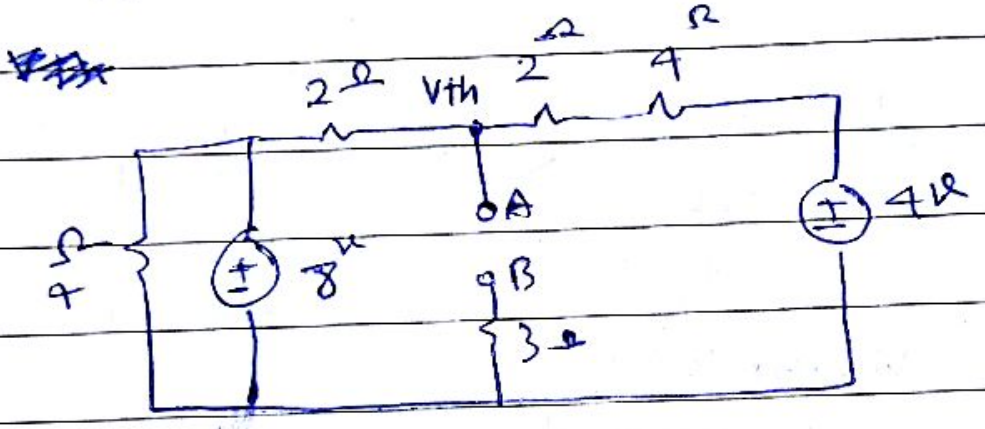
5. Vth & Rth ?



Sol (5) Vth: KCL)

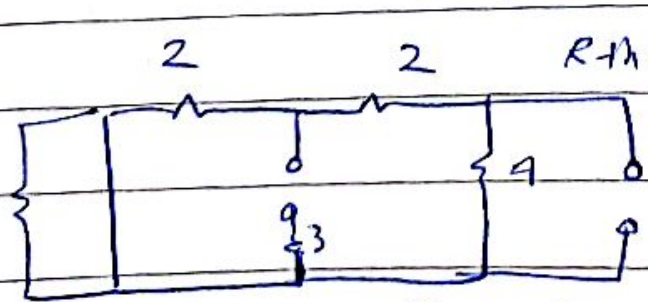


KCL: $\frac{V_{th}-8}{2} + \frac{V_{th}-4}{6} = 0$

$3V_{th} - 24 + V_{th} - 4 = 0 \rightarrow 4V_{th} = 28$

$V_{th} = \frac{28}{4} = \frac{14}{2}$ Volt

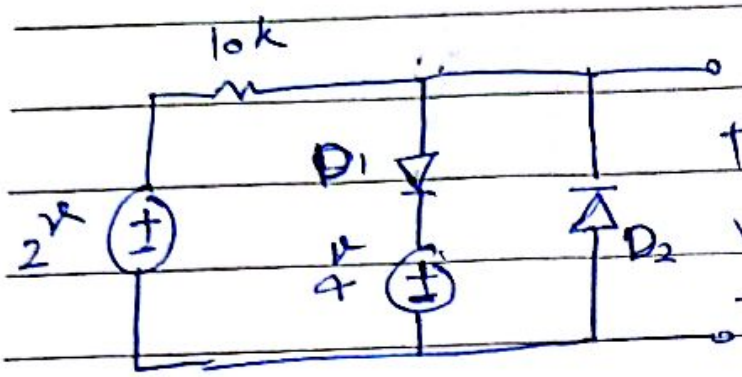
Rth:



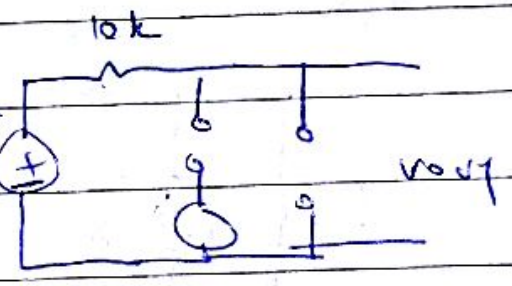
Rth: $\{6 \Omega \,||\, 2\Omega\} + 3\Omega$

$R_{th} = \frac{12}{4} + 3 = \frac{4}{3} + 3 = \frac{13}{3}\ \Omega$

6. calculate Vout
(assume diodes are ideal)

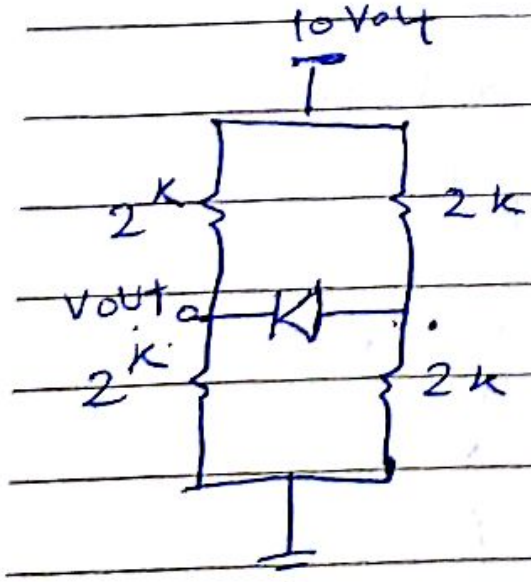


Sol (6) D_1 : off
D_2 : off



Vouths 2 Volt

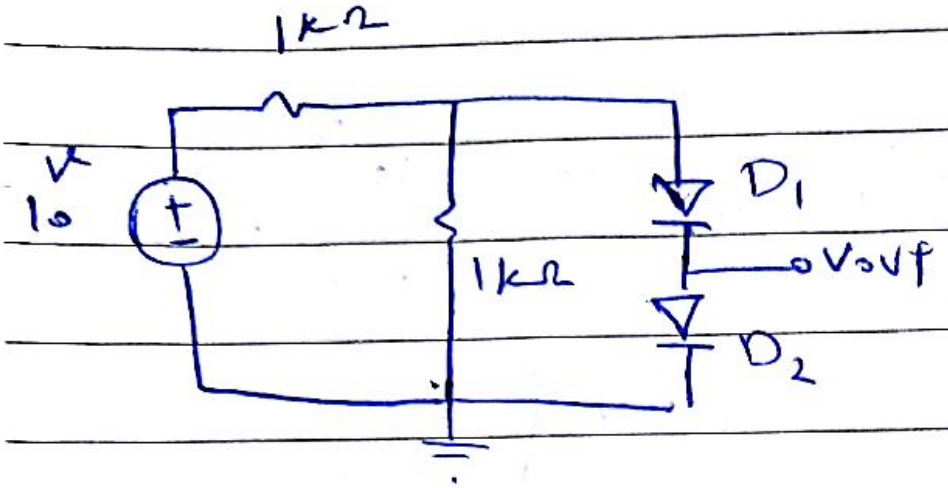
7. calculath Vout ?



Sol (7)

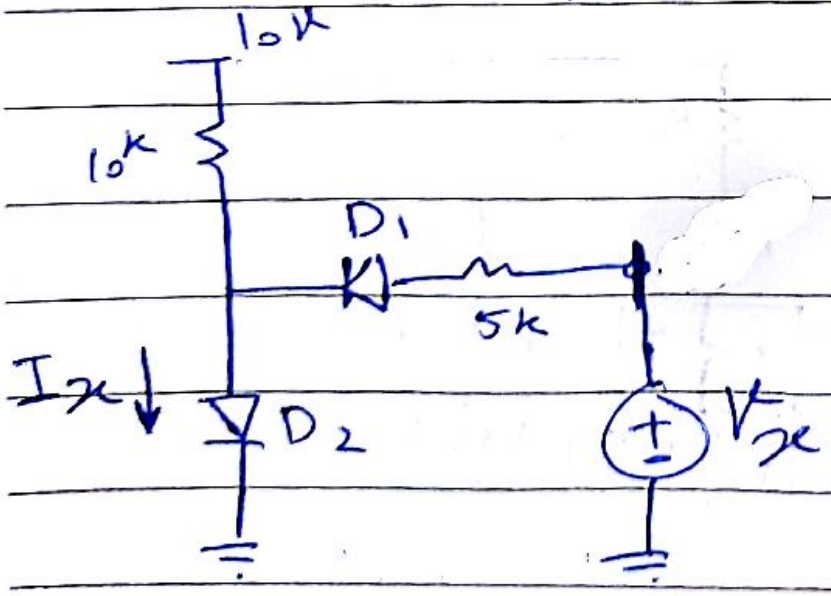
$$V_{out} = \frac{10^{Volt} \times 2^{k}}{2^{k}+2^{k}} = 5^{Volt}$$

8. calculate V_{out} ? "Diodes ideal"



Sol (8) D_1 & D_2 : on $\Rightarrow$ $V_{out} = 0$

9. Calculat I_x ?
if $V_x = -15$ Volt



Sol (9) $\begin{cases} D_1 : off \\ D_2 : on \end{cases} \Rightarrow I_x = \frac{10\ V}{10\ k} = 1\ mA$

10. in question "9" calculate I_x while $V_x = +15$ Volt ?

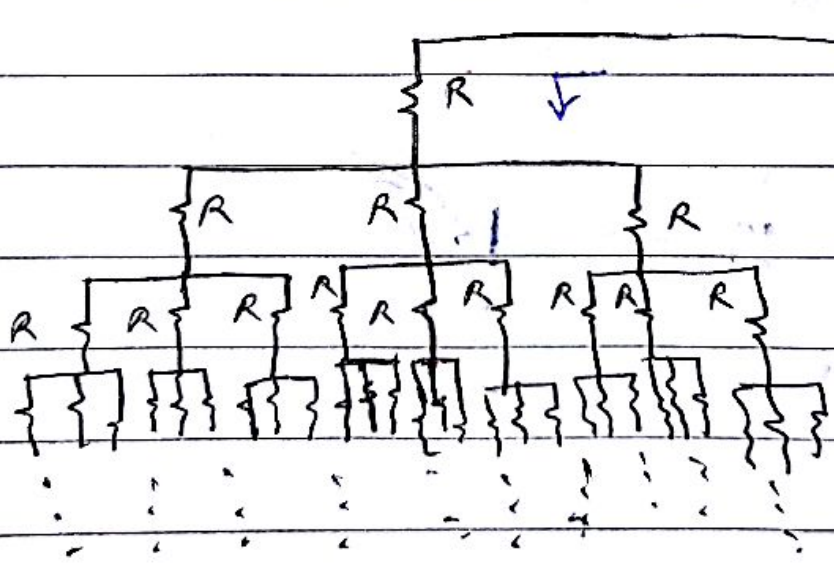
Sol (10) D_1 : on, D_2 : on

$$I_x = \frac{10}{10k}\,mA + \frac{15}{5k}\,mA = 1 + 3\,mA$$

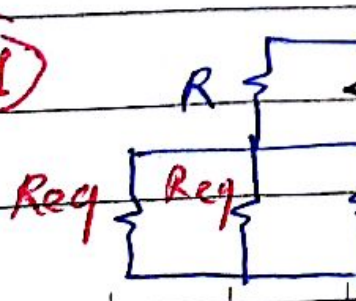
$$= 4\,mA$$

11. Calculate R_{th} ? (Extra bonus!!)

all $R = 1\,\Omega$



Sol (11)



$$R_{eq} = R + \frac{1}{3} R_{eq}$$

$$\frac{2}{3} R_{eq} = 1\,\Omega$$

$$R_{eq} = \frac{3}{2}\,\Omega$$