Temperature coefficient = $-1.8\ mV/°C$

$\Delta t = 5°$

$\therefore \Delta V = -1.8 * \Delta t = -9mV$

$\therefore V_n = V + \Delta V = 0.68 - 0.009 = 0.671V$

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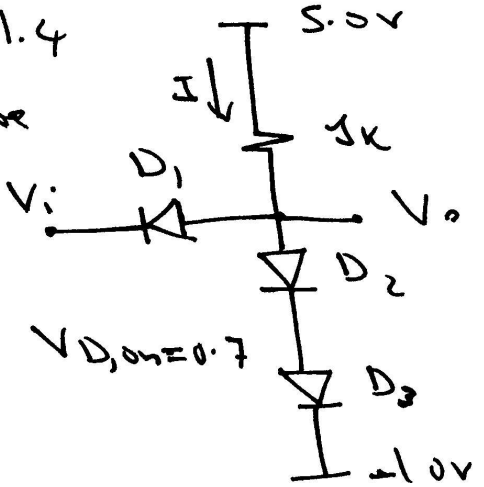
if D_1 is on $\Rightarrow V_o = 1.4$

$\Rightarrow$ D_2 and D_3 must be on

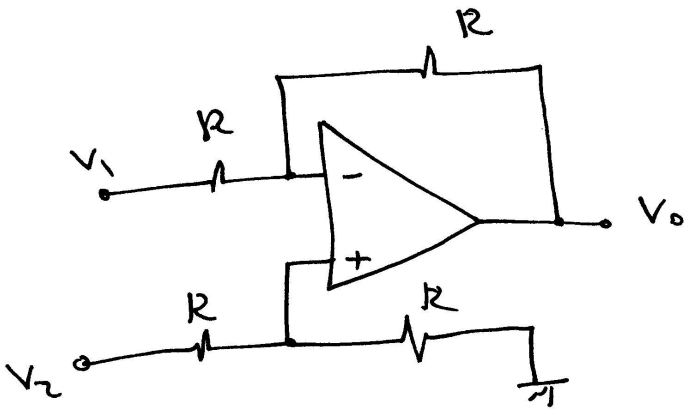


if D_2 and D_3 are on $\Rightarrow V_o = 0.4V$

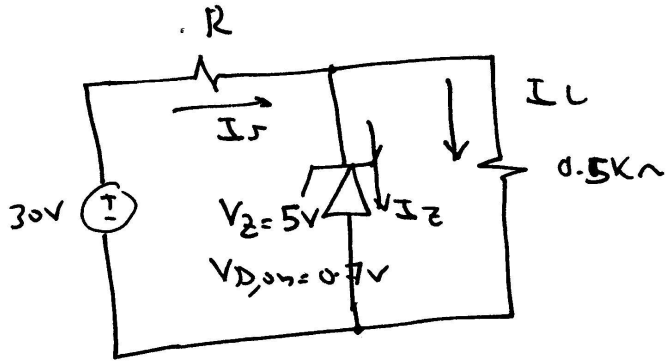
$\Rightarrow$ D_1 is off

only possible state is that D_2 and D_3 are on $\Rightarrow I = \frac{5.0 - 0.4}{1K}$

$I = 4.6mA$

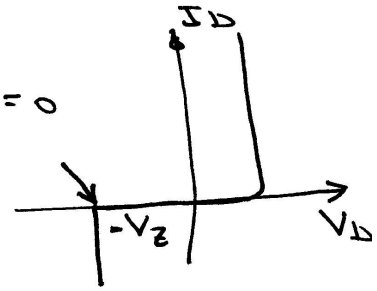


$$V_o = (V_2 - V_1) \Longrightarrow A_{cm} = 0$$



$$I_s = I_L + I_z$$

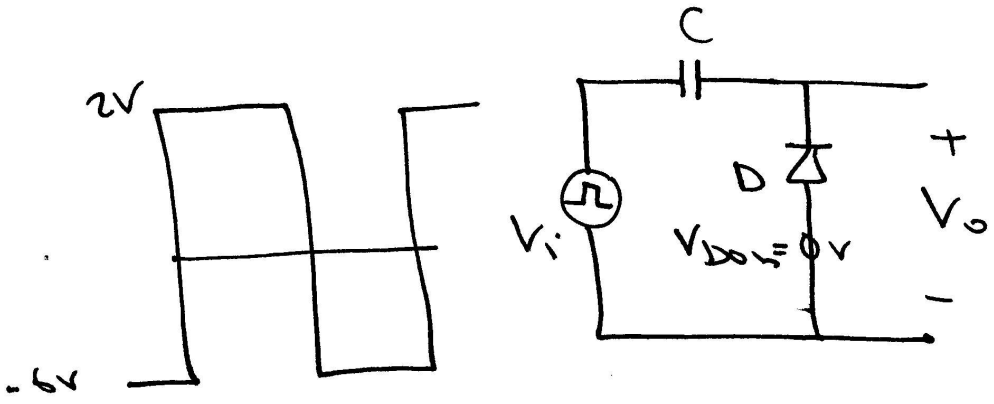
largest value makes $I_z = 0$



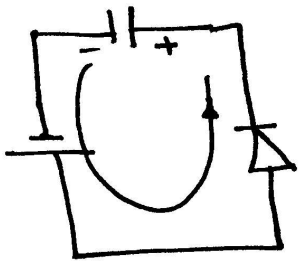
$$I_s = I_L$$

$$\frac{30 - 5}{R} = \frac{5}{0.5\,K}$$

$$R = 2.5K\Omega$$

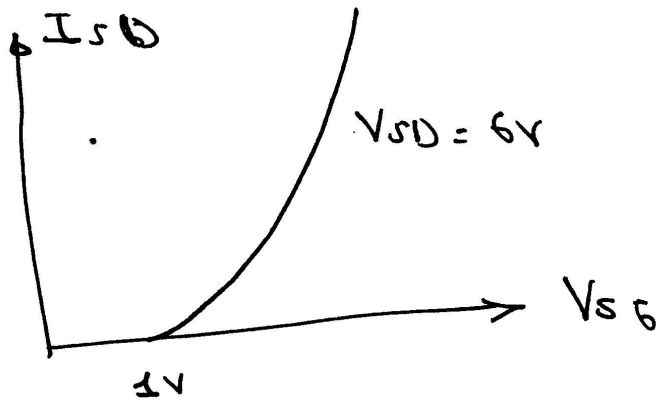


During -ve input part, diode is on, and Capacitor charges to 6V



During +ve input part, diode is off,

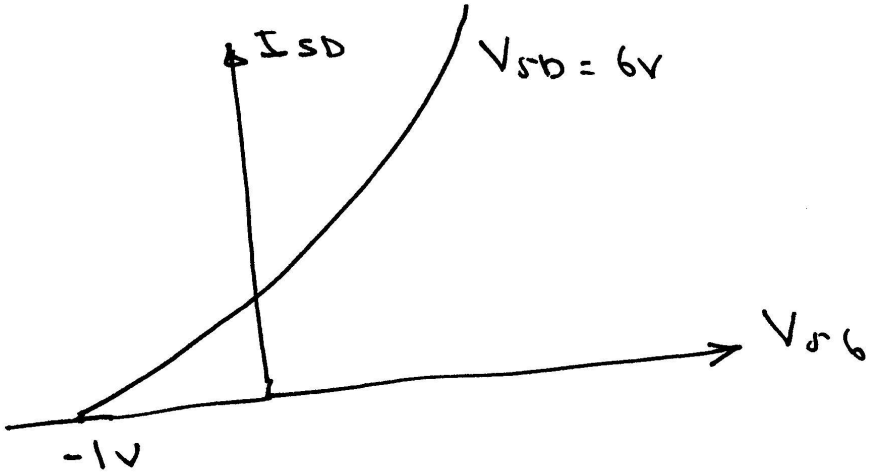
$V_o = V_i + 6V \Rightarrow 0 \leq V_o \leq 8V$



On Condition

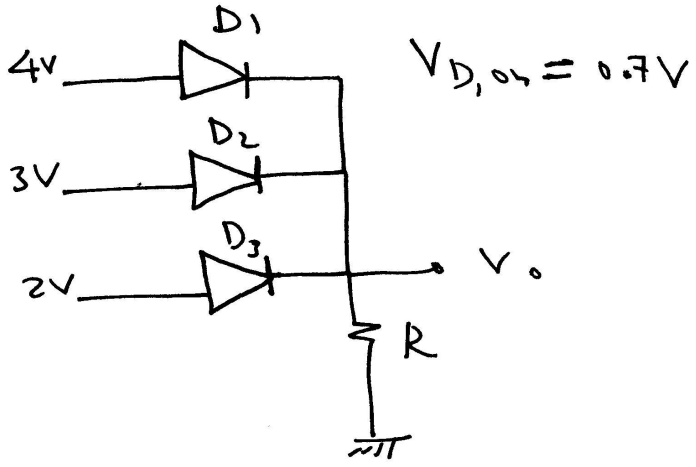
$$V_{SG} > -V_{TP} \Longrightarrow V_{TP} = -1V$$

Enhancement type PMOS



$$V_{SG} > -V_{TP} \Longrightarrow V_{TP} = 1V$$

depletion type PMOS

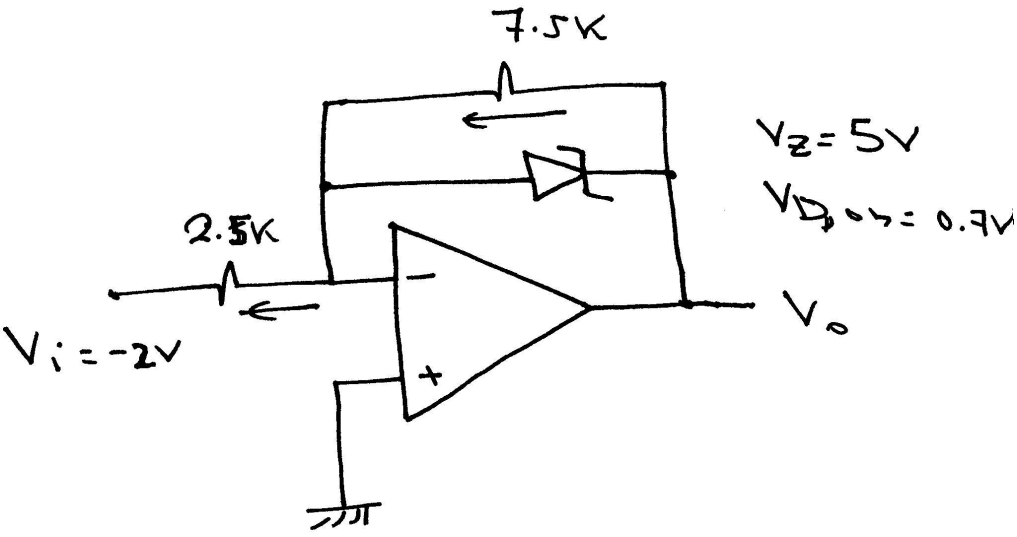


8 possible states

* if D_2 or D_3 are on $\Longrightarrow$ D_1 is on
* if D_1 is on $\Longrightarrow$ D_2 and D_3 are off
* Diodes can not be off simultaneously
* only one possible state

  D_1 is on, D_2 and D_3 are off

  $V_o = 3.3V$



* Zener diode Can not be forward biased because of polarity of current

* Assume that diode is in cut-off region (open-circuit) $\Longrightarrow V_o = 6V > V_z$

It follows that Zener is in breakdown region $\Longrightarrow V_o = 5V$