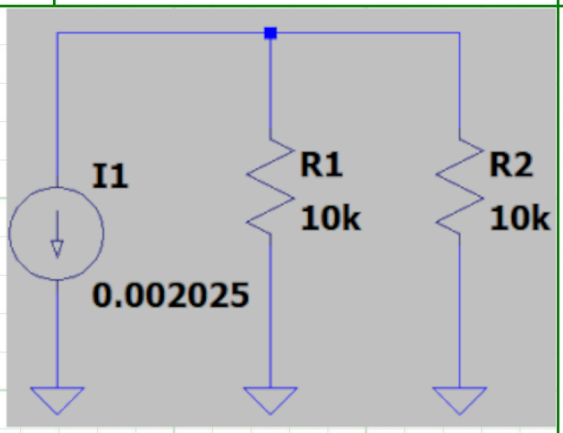
EENG 331 | Prelab 3 | Jeremy Munson

How much current flows in each resistor?

$I_1 \cdot \frac{R_n}{R_1+R_2} = \frac{1}{2} I_1 = 1.0125\ mA$



Assuming that an NMOS is operating in the saturation region and a $k_p = \frac{100\mu A}{V^2}$, $V_{GS} = 5V$ and $V_{th} = 0.5V$, find $\frac{W}{L}$ that generates an $I_D = 0.002025A$.

$I_D = \frac{1}{2} k_p \frac{W}{L} V_{ov}^2$

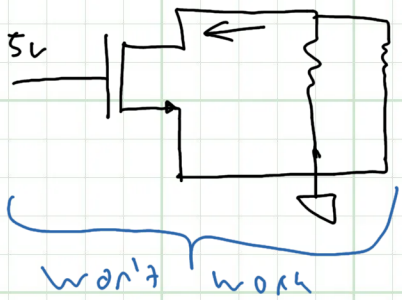
$V_{ov} = 5v - 0.5v = 4.5 \rightarrow V_{ov}^2 = 20.25$

$\frac{2 \cdot (.002025)}{20.25 \cdot 100\mu A} = \frac{W}{L} = 2$

Task 1 → Replace I_1 w/ NMOS

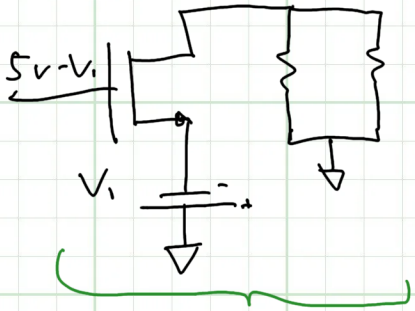
... As drawn, we can not. We need another source.

Literal interpretation



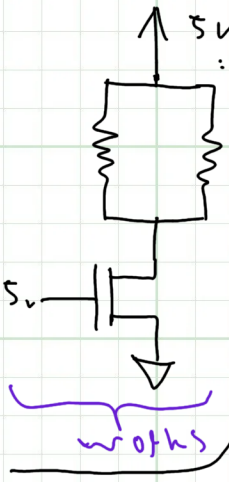
won't work

Possible Soln #1



works

+ keeps Resistors connected to gnd
− Changes V_g to maintain V_{gs}
− 'unusual' to have negative voltages in ckt



works

Possible Soln 2

+ Simple, $R_D = R_1 // R_2$
− Narrow window of operation → $4.5 \leq V_{DS} \leq 5$
  └ Caused by high gate voltage. Could pick non-5v V_g
− Resistors not gnd connected like in Prelab

Note that connecting the resistors to the source terminal is not a good idea - V_{gs} will change with different R_1, R_2.

Possible Soln 1 and 2 are mathematically identical → just change defn of gnd.

I am choosing Soln 1 with $V_1 = 15\ V$