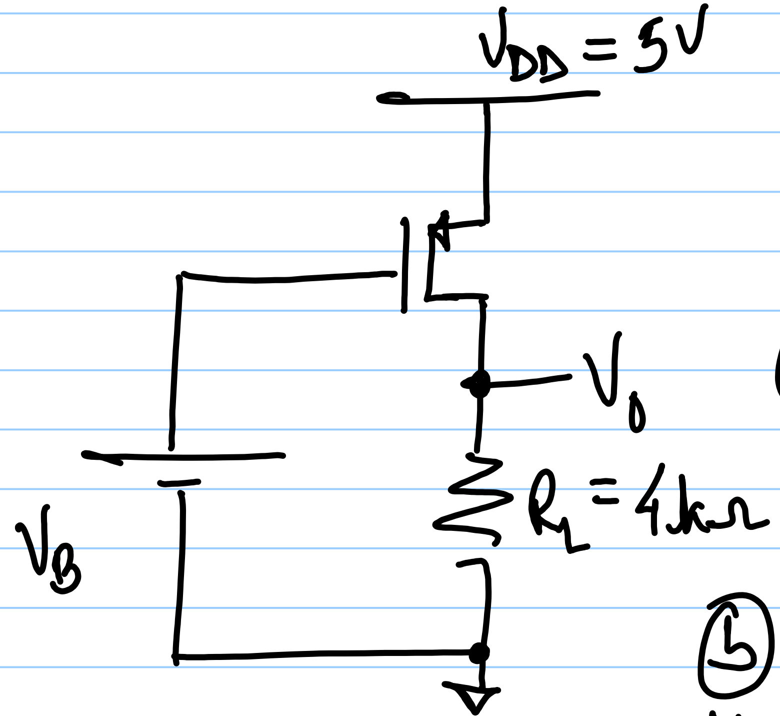
Note Title

# Question Set #5

(1)



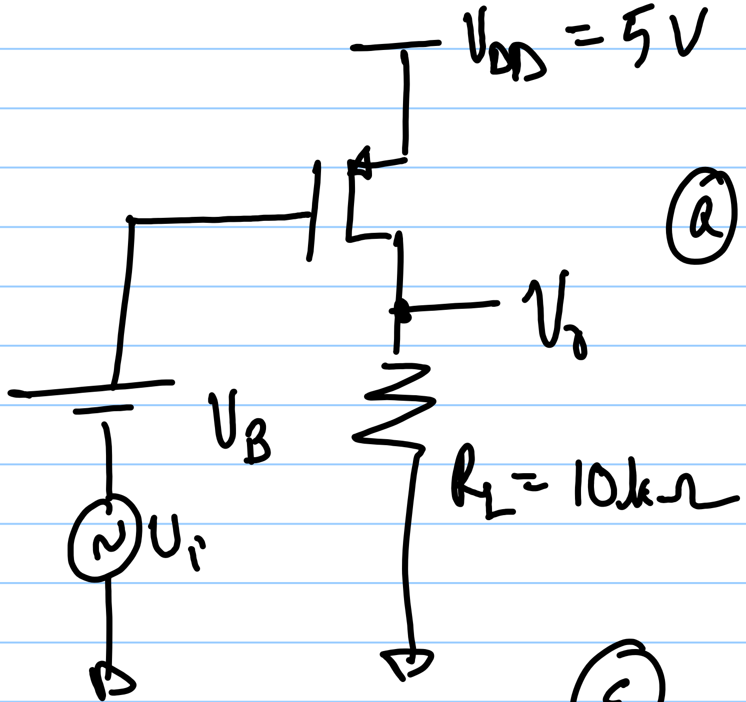

Assume $\mu_p C_{ox} \frac{W}{L} = 2 mA/V^2$, $V_{thp} = 1V$

(a) Plot $V_o$ with respect to $V_B$ if $V_B$ is varied from 0 to 5V.

(b) Mark all regions of operation in the plot.

(c) Mark the regions the plot where the |slope| > 1. What does this signify?

(2)




$\mu_p C_{ox} = 100 \mu A/V^2$, $V_{thp} = 1V$

(a) Find $V_B$ and $W/L$ of the transistor to obtain $|v_o/v_i| = 10$.

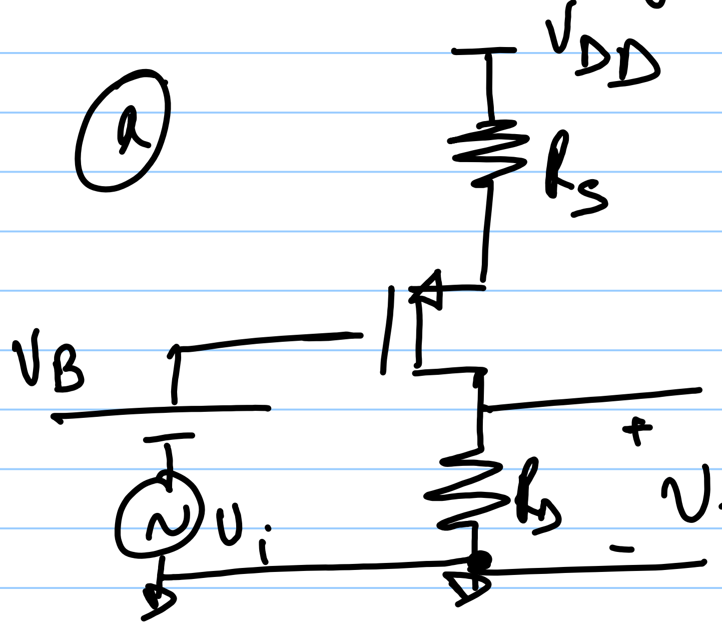
(b) Is the solution unique?

(c) Assume that we need to keep a minimum overdrive voltage, $V_{OV} = V_{SG} - V_{thp} = 100mV$, and maintain a small-signal gain of $-10$. If $v_i = V_p \sin(\omega_0 t)$, find a $V_B$ and $W/L$

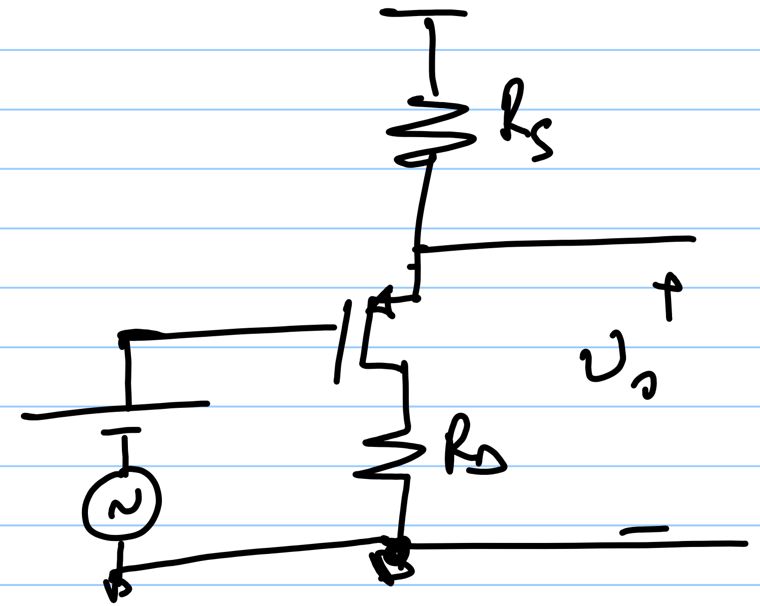
such that the transistor is always in saturation for a $V_p = 100mV$.

(3) Sketch the "small-signal" Norton's equivalent network for the following networks. Assume that the transistors are biased in saturation. Also represent $y_{21}$ of the MOSFET as $g_m$. (to avoid confusion between $y_{21}$ of the network, and $y_{21}$ of a transistor). Find $v_o/v_i$ for all cases.

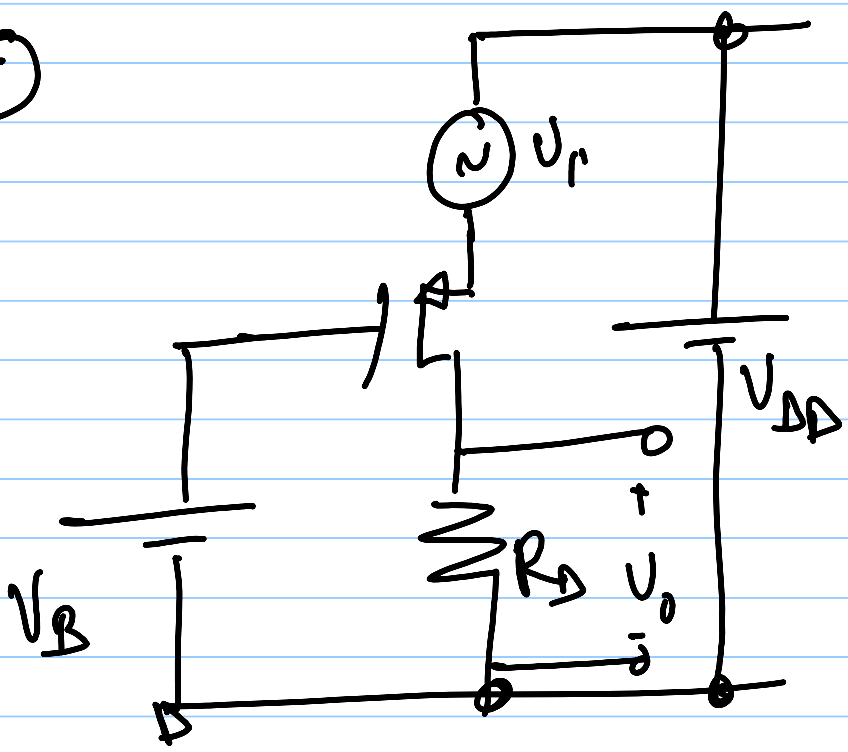
(a)



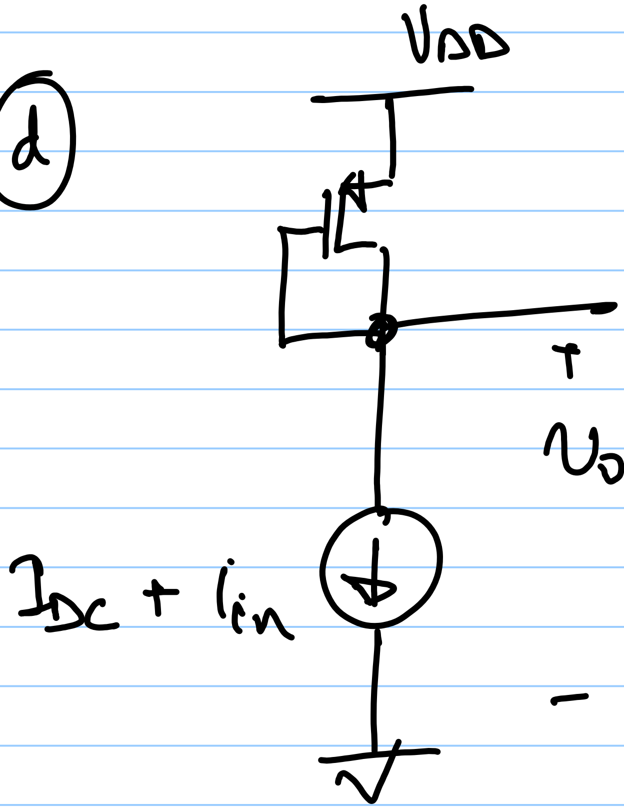

(b)



(c)

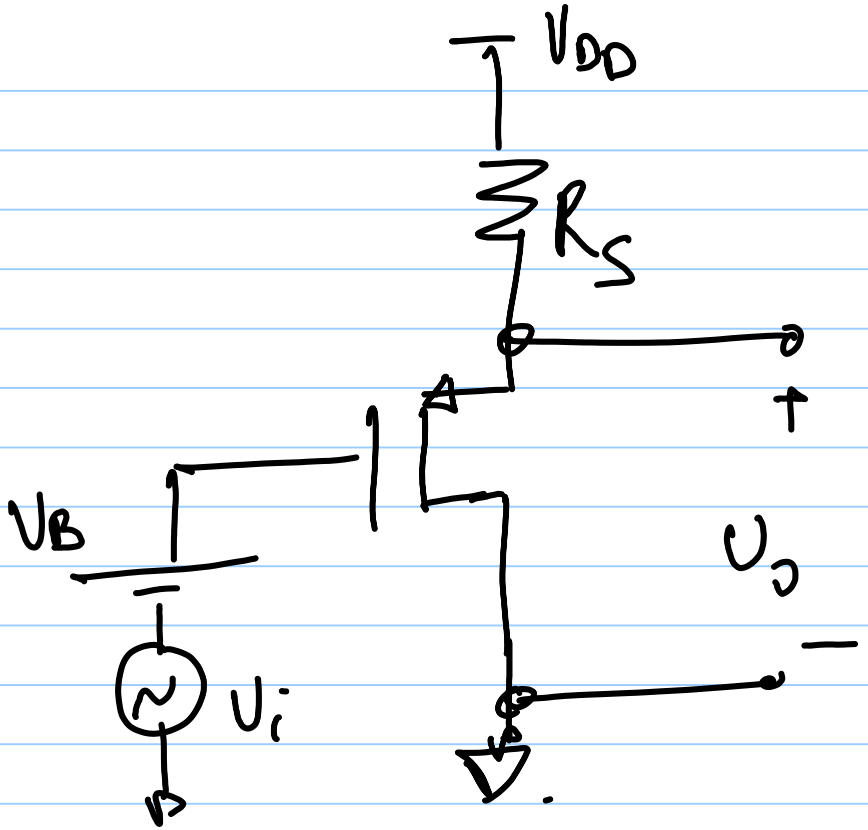



(d)




Find $v_o / i_{in}$ in this case

(4)




$V_{DD} = 5V$ $\quad R_S = 3.5k\Omega$

$W/L = 20$ $\quad \mu_p C_{ox} = 100\,\mu A/V^2$, $V_{thp} = 1V$

(a) Find $V_B$ such that

$V_{OQ} = 1.5V$

(b) Find $v_o/v_i$.

(c) If $v_i = V_p \sin(\omega_0 t)$, what is the max $V_p$ that you can apply while keeping the transistor in saturation and keeping $V_{ov} > 100mV$.