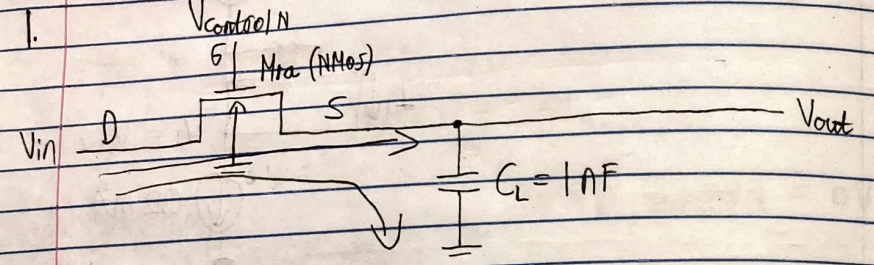
Noble Huang

Prelab #7

Part 1:

1.



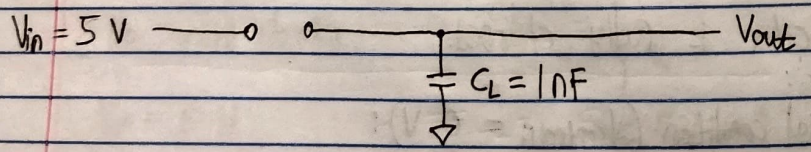
$V_{TN} = 1\ V$ $V_{TP} = -1\ V$	$\lambda = 0$	$K_n' = 20\ nA/V^2$ $K_p' = 10\ nA/V^2$

$L = 500\ nm$
$W = 10\ nm$

a. $V_{in} = 5\ V$

Initial voltage condition ($V_G = 0$):

$C_L = 0\ V$



$V_D = V_{in} = 5\ V$

$V_S = V_{CL} = 0\ V$

$V_G - V_S = V_{GS}\ ?\ V_{TN}$

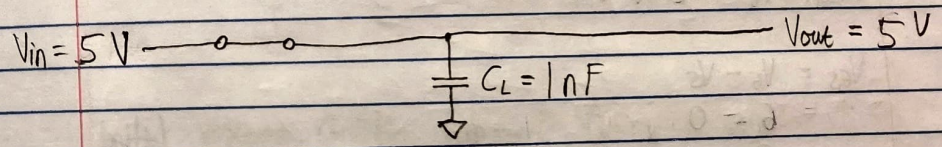
$V_{GS} = V_G - V_S$
$= 0 - 0$
$= 0$

$V_{GS} < V_{TN}$: $0 < 1 \rightarrow$ Cutoff Region

When $V_G = 5\ V$:

$V_{GS} = V_G - V_S \rightarrow$ before charging
$= 5 - 0$
$= 5\ V$

$V_{GS} > V_{TN}$: $5 > 1 \longrightarrow$ switch on, charging



$V_{CL} = V_{in} = 5 \rightarrow$ Capacitor will eventually reach 5 V

$$\frac{V_{out} - V_{CL}}{Z_{CL}} = 0$$

$V_{out} = V_{CL} = 5$

$\downarrow$

$V_{out} = 5\ V$

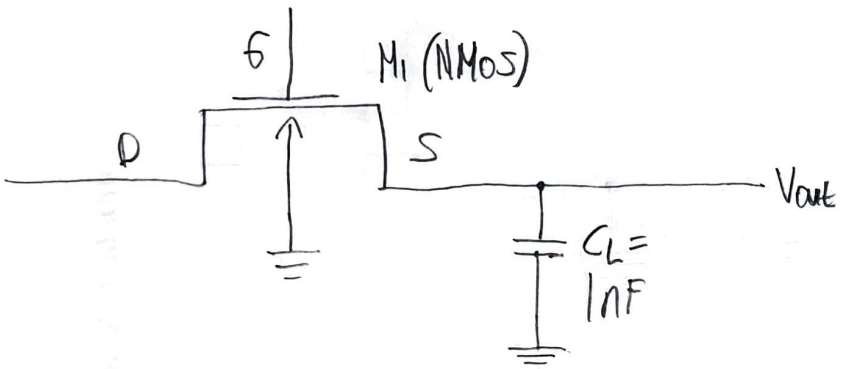
Noble Huang

$V_{TN} = 1\ V$ $\quad k_n' = 20\ \mu A/V^2$

$V_{TP} = -1\ V$ $\quad k_p' = 10\ \mu A/V^2$

$\lambda = 0$ $\quad L = 500\ nm$ $\quad W = 10\ \mu m$

1. $V_{control}$



b. $V_{CL} = 5\ V$

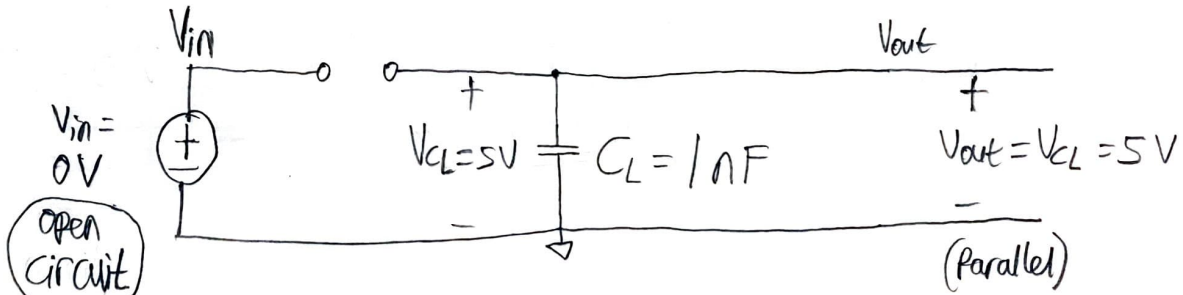
i. $V_G = 0$

$V_{GS} = V_G - V_S = V_G - V_{CL}$

$= 0 - 5$

$= -5 < 1$

$V_{GS} < V_{TN}$

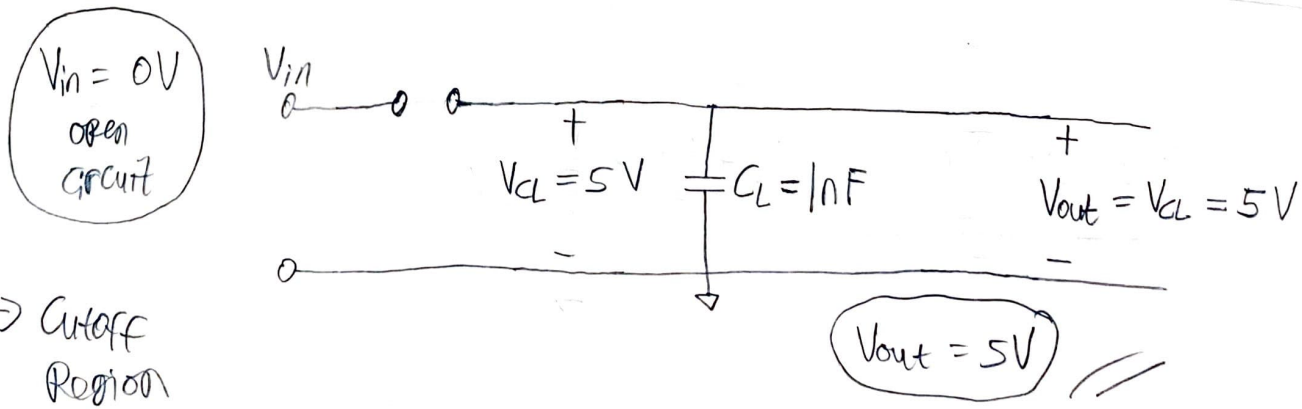


ii. $V_G = 5\ V$:

$V_{GS} = V_G - V_S$

$= V_G - V_{CL} = 5 - 5 = 0$

$V_{GS} < V_{TN} \rightarrow 0 < 1 \rightarrow$ Cutoff Region



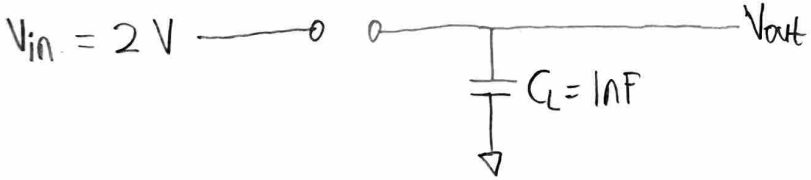
(c) $V_{in} = 2\ V$; $V_{CL} = 0\ V = V_S$

$V_G = 0$:

$V_{GS} = V_G - V_S = 0 < 1$

$V_{GS} < V_{TN}$

(cutoff Region)

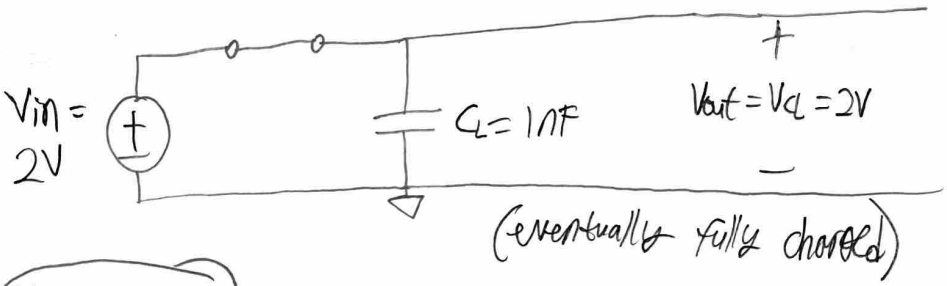


$V_G = 5$:

$V_{GS} > V_{TN}$

$V_{GS} = V_G - V_S = 5 > 1$

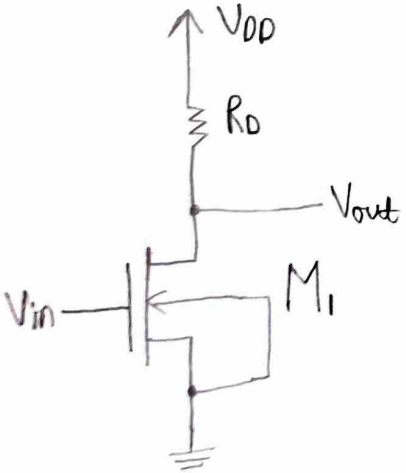
(switch on)



(eventually fully charged)

$V_{out} = 2V$ //

Part 2:



$V_{DD} = 2.5\ V$

$V_{to} = 0.6\ V$

$K' = 30\ \mu A/V^2$

$\lambda = 0$

$W = 100\ \mu m$

$L = 1\ \mu m$

$R_D = 150\ K\Omega$