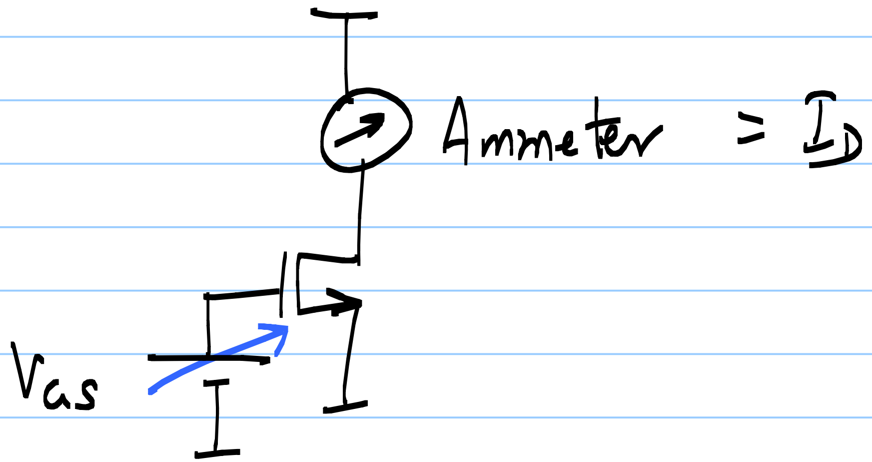
26/8/2020

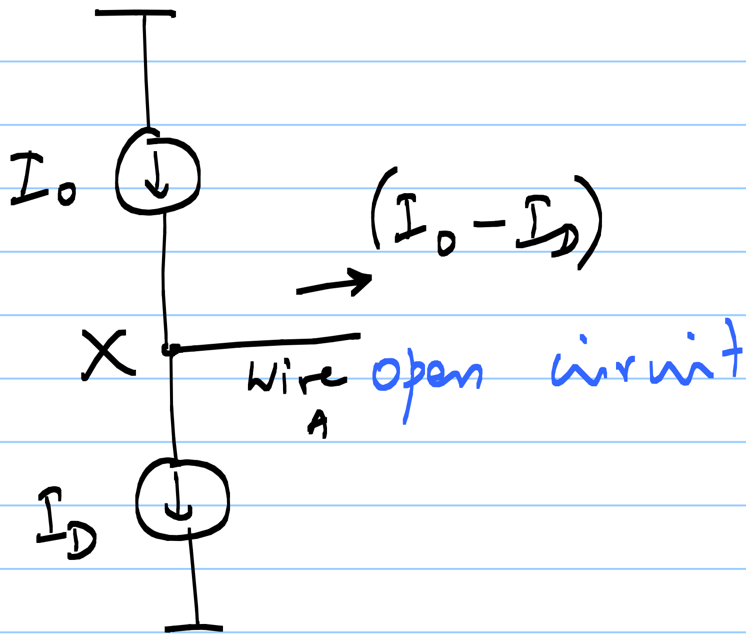
Lecture 13

Negative feedback biasing



1) Apply V_{GS}
2) Measure I_D
3) If $I_D > I_0$, ↓ V_{GS}
4) If $I_D < I_0$, ↑ V_{GS}
5) If $I_D = I_0$, V_{GS} = same as before

$(I_0 - I_D) \equiv$ comparing I_0 with I_D



In a MOSFET:

V_{GS} is cause

I_D is effect

If wire A is open circuited:

1) If $I_o > I_D$: $V_x \uparrow$

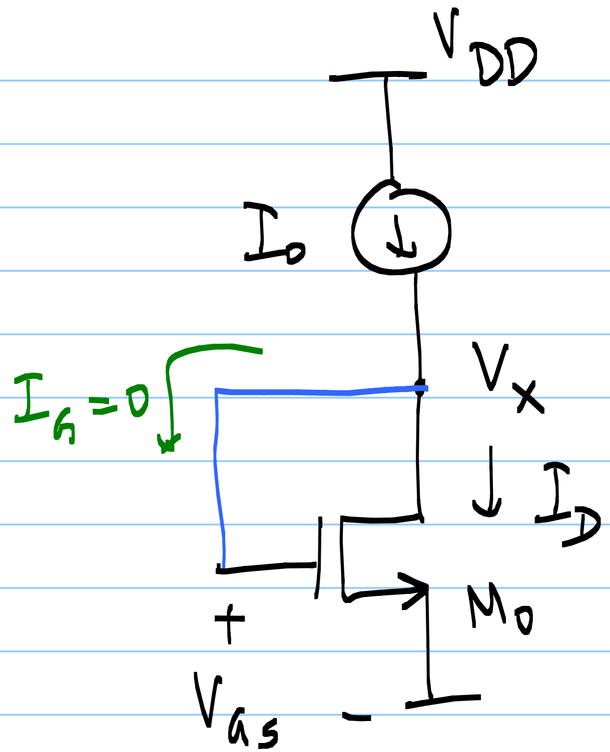
(need to $\uparrow V_{GS}$)

2) If $I_o < I_D$: $V_x \downarrow$

(need to $\downarrow V_{GS}$)

3) If $I_o = I_D$: V_x stays constant

(need to keep V_{GS} at same value)



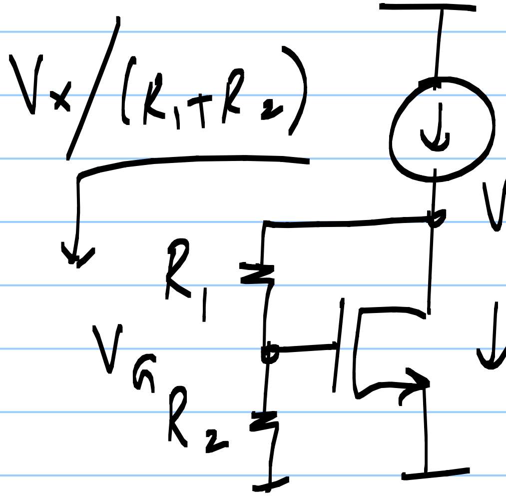
* Connect X to G : Valid
* $I_G = 0 \Rightarrow I_D = I_o$

$$V_x = V_{GS}\Big|_{I_D = I_o}$$

* Verify that M_o is in saturation:

$$V_D = V_G \Rightarrow V_D > V_G - V_T$$ ✓

M_o is in sat.

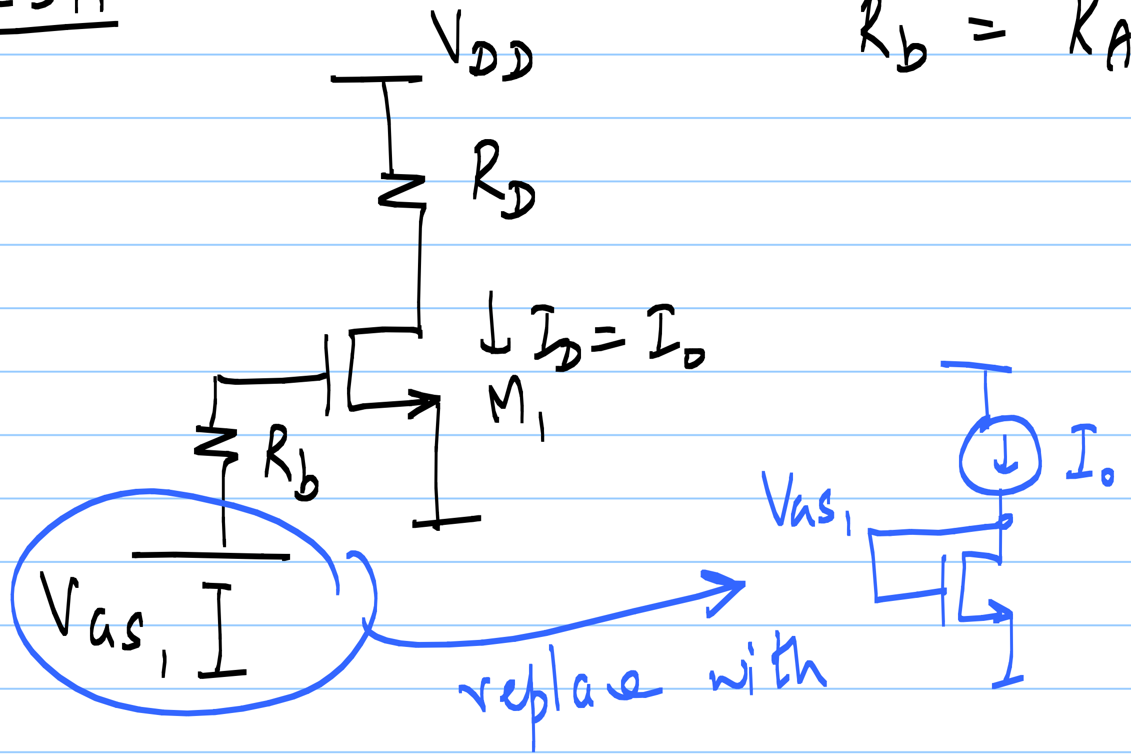


$$V_x = \left(\frac{R_1+R_2}{R_2}\right)\cdot V_{GS}$$

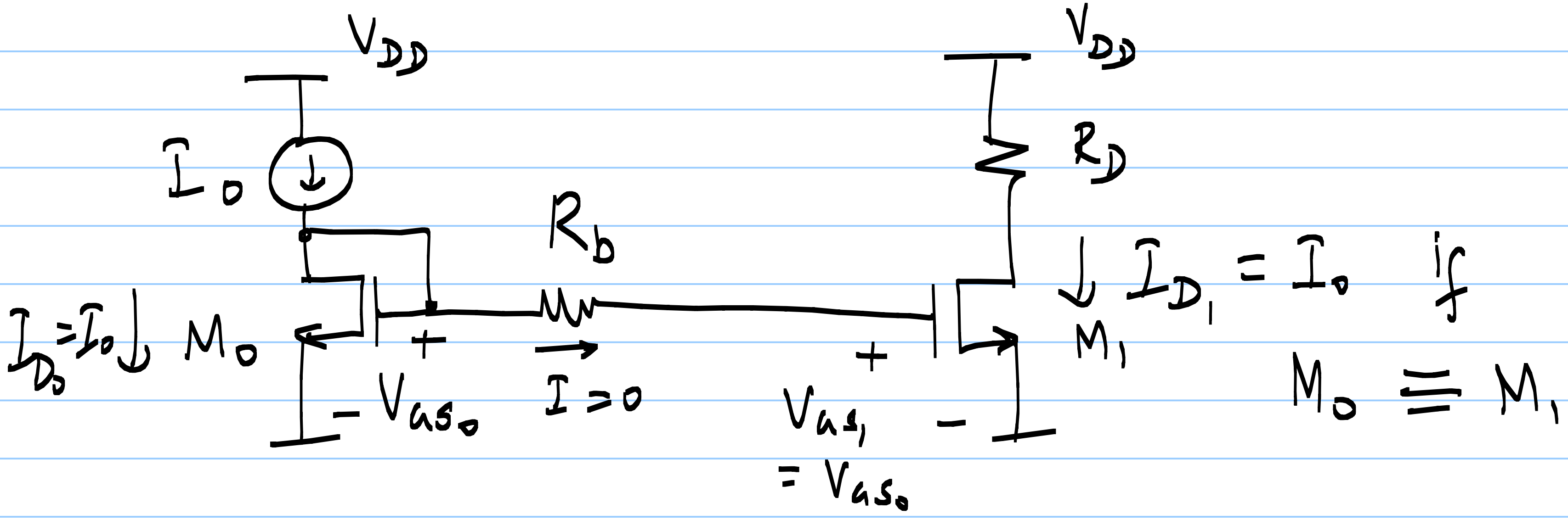
$$I_D = I_o - \left(\frac{V_x}{R_1+R_2}\right)$$

CSA

$$R_b = R_A \| R_B$$



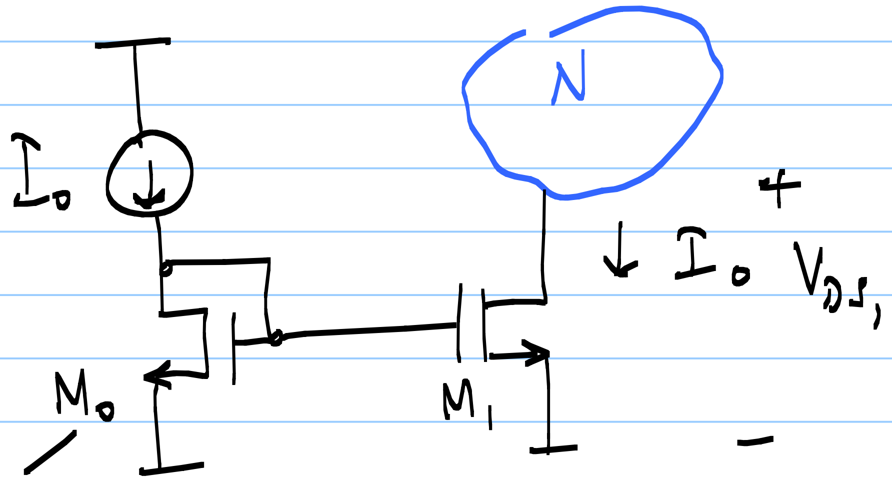
V_{DD}
R_D
$I_D = I_0$
M_1
R_b
V_{GS_1}
replace with
I_0
V_{GS_1}



V_{DD}
I_0
$I_{D_0} = I_0$
M_0
R_b
$I = 0$
V_{GS_0}
V_{DD}
R_D
M_1
$I_{D_1} = I_0$ if
$M_0 \equiv M_1$
$V_{GS_1} = V_{GS_0}$

$M_0 \equiv M_1$ means same μ_n, C_{ox}, V_T, $\left(\frac{W}{L}\right)$

{same W <u>and</u> L}



always in sat.

"Current Mirror" works well as long as $V_{DS_1} \geq V_{GS_1} - V_T$ (M_1 is in sat.)