

Name: Solutions

Lab Section: _____

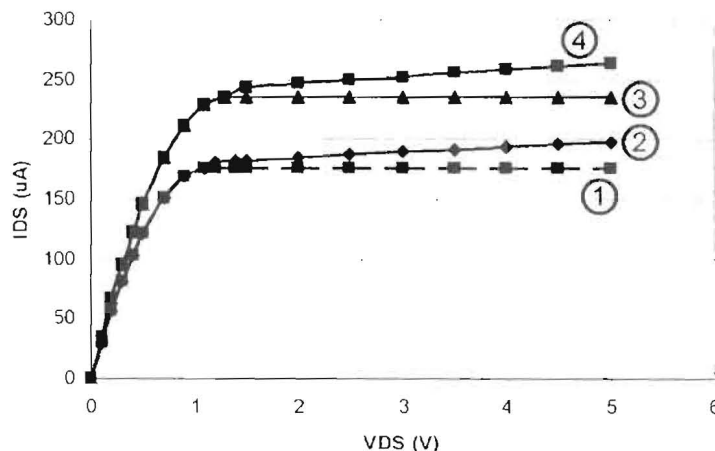
Problem 1 (4 points) The plot below shows measured I-V curves for four NMOS FETs with the same W/L , $V_{T,n}$, and $\mu_n C_{ox}$. Match each curve to the transistor parameters and bias points on the left.

② $V_{GS} = 3V, \lambda = 0.025V^{-1}$

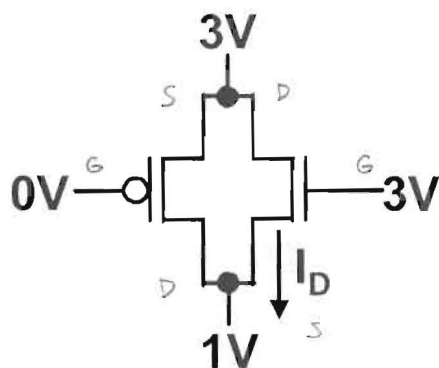
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Problem 2 (6 points) For the following circuit, find the current I_D given: $W_n/L_n = W_p/L_p = 1$, $V_{T,n} = 1.1V$, $\mu_n C_{ox} = 200 \times 10^{-6} A/V^2$, $V_{T,p} = -1.1V$, $\mu_p C_{ox} = 100 \times 10^{-6} A/V^2$, $\lambda = 0$, $\gamma = 0$, $V_{DD} = 3V$. Show all work to receive full credit.



$$I_D = I_{D,n} + I_{D,p}$$

NMOS: $V_{GS} = 2V$, $V_{DS} = 2V \geq V_{GS} - V_{T,n} = 0.9V$ sat

$$I_{D,n} = \frac{\mu_n C_{ox}}{2} \left(\frac{W}{L}\right)_n (V_{GS} - V_{T,n})^2 = \frac{200 \mu A/V^2}{2} (1) (0.9V)^2 = 81 \mu A$$

PMOS: $V_{GS} = -3V$, $V_{DS} = -2V \leq V_{GS} - V_{T,p} = -1.9V$ sat

$$I_{D,p} = \frac{\mu_p C_{ox}}{2} \left(\frac{W}{L}\right)_p (V_{GS} - V_{T,p})^2 = \frac{100 \mu A/V^2}{2} (1) (-3V + 1.1V)^2 = 181 \mu A$$

$$I_D = 262 \mu A$$