EE341 Fall 2019 HW 5
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8.1

Find R

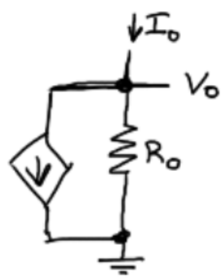
$$I_{D1} = \frac{1}{2}k_n' \frac{W}{L}\left(V_{GS1} - V_t\right)^2$$
$$\rightarrow 100\mu\text{A} = \frac{1}{2} \cdot 500\mu\text{A/V}^2 \left(V_{GS1} - 0.4\text{V}\right)^2$$
$$V_{GS1} = 1.03\text{V}$$

$$V_{GS1} = V_{D1} = V_{D2} = V_{DD} - I_{REF}R$$
$$\boxed{\rightarrow R = \frac{V_{DD} - V_{GS1}}{I_{REF}} = \frac{1.3 - 1.03}{100 \times 10^{-6}} = 2.7\text{k}\Omega}$$

Lowest value of V_O

$$\boxed{V_{Omin} = 1.03\text{V}}$$

Output Resistance R_O



$$\lambda = \frac{1}{V_A' \cdot L} = \frac{1}{0.5\mu\text{m} \cdot 5\text{V}/\mu\text{m}} = 0.4\text{V}^{-1}$$

$$I_O = I_{sat}(1 + \lambda \cdot V_O) = 100(1 + 0.4 \cdot 1.03) = 141.2\mu\text{A}$$
$$\boxed{R_O = \frac{V_O}{I_O} = 7.3\text{k}\Omega}$$

Change in Output Current δI_O

$$I_O = I_{sat}(1 + \lambda \cdot V_O) = 100(1 + 0.4 \cdot 1.53) = 161.2\mu\text{A}$$
$$\boxed{\delta I_O = 161.2 - 141.2 = 20\mu\text{A}}$$

8.3

SPICE