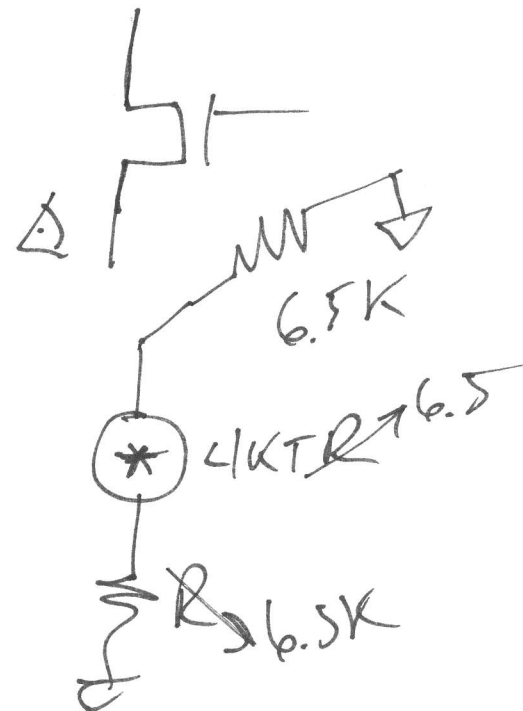


$$V_{out, noise}^2(f) = (r_{ON} || r_{OP})^2 \cdot$$

$$(i_1^2(f) + i_2^2(f) + i_3^2(f) + i_4^2(f))$$

$$A_v^2 = g_m^2 (r_{ON} || r_{OP})^2$$

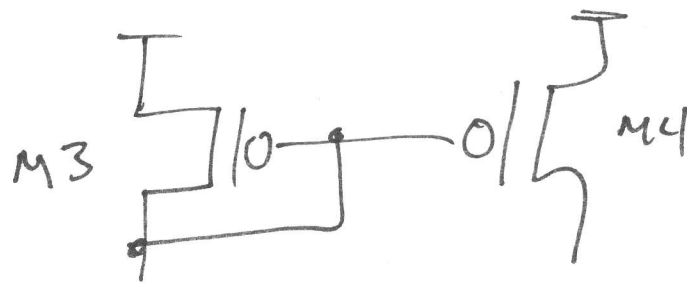
$$V_{i, noise}^2(f) = \frac{(i_1^2 + i_2^2 + i_3^2 + i_4^2)}{g_m^2}$$



1)

$$V_{i\text{NOISE}}^2(f) = \frac{(i_1^2 + i_2^2 + i_3^2 + i_4^2)}{g^2}$$

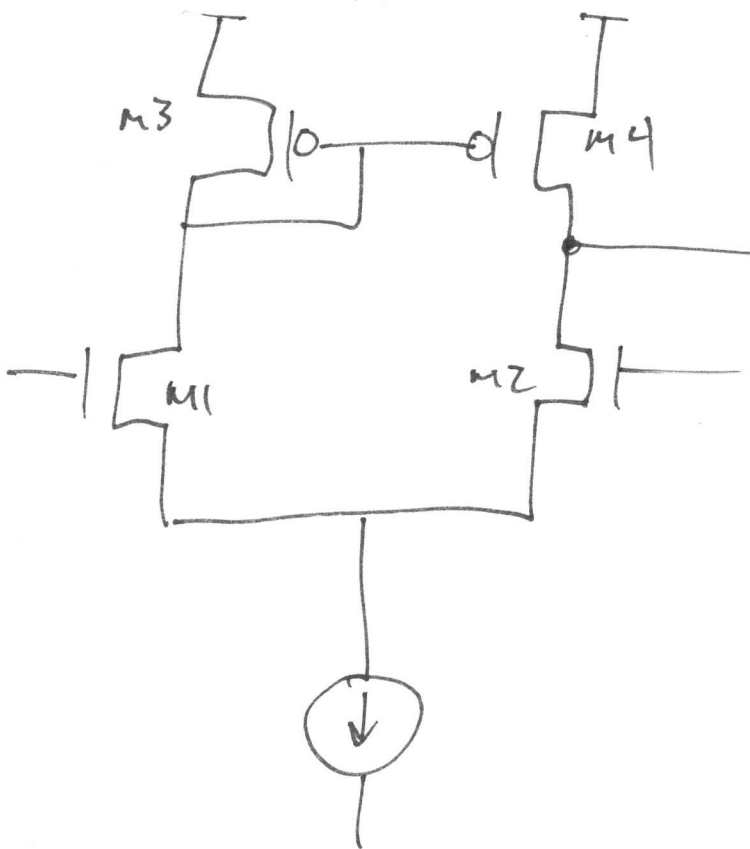
$$i_1^2 = \frac{8KT}{3} \cdot g_m + \frac{KF \cdot I_0}{f \cdot C_{ox} \cdot L \cdot W}$$



$$L \uparrow \quad r_{op} \uparrow \quad g_m = \sqrt{K_P \cdot \frac{W}{L} \cdot I_0}$$

$$L \uparrow, \quad g_m (r_{m} || r_{op}) \uparrow$$

2)



$(\sigma_{v_{noise}})^2 = i_{n1}^2 + i_{n2}^2 + i_{n3}^2 + i_{n4}^2 = V_{noise}^2(f)$

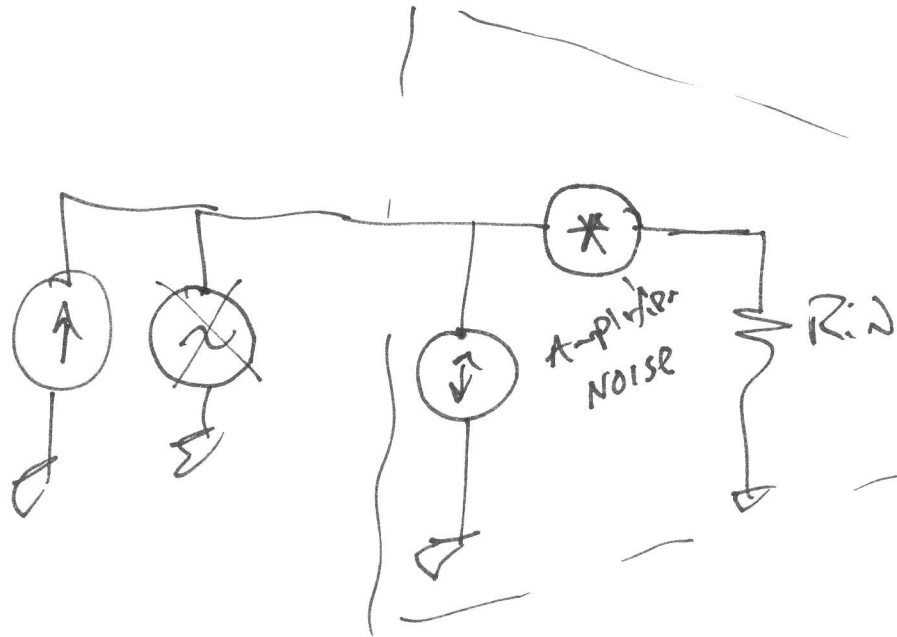
$g_m \uparrow \quad A_v \uparrow \quad V_{noise}^2 \uparrow$

$$i_n^2 = \frac{8kTg_m}{3} + \frac{I_D \cdot K_F}{\omega L \cdot C_{ox} \cdot f}$$

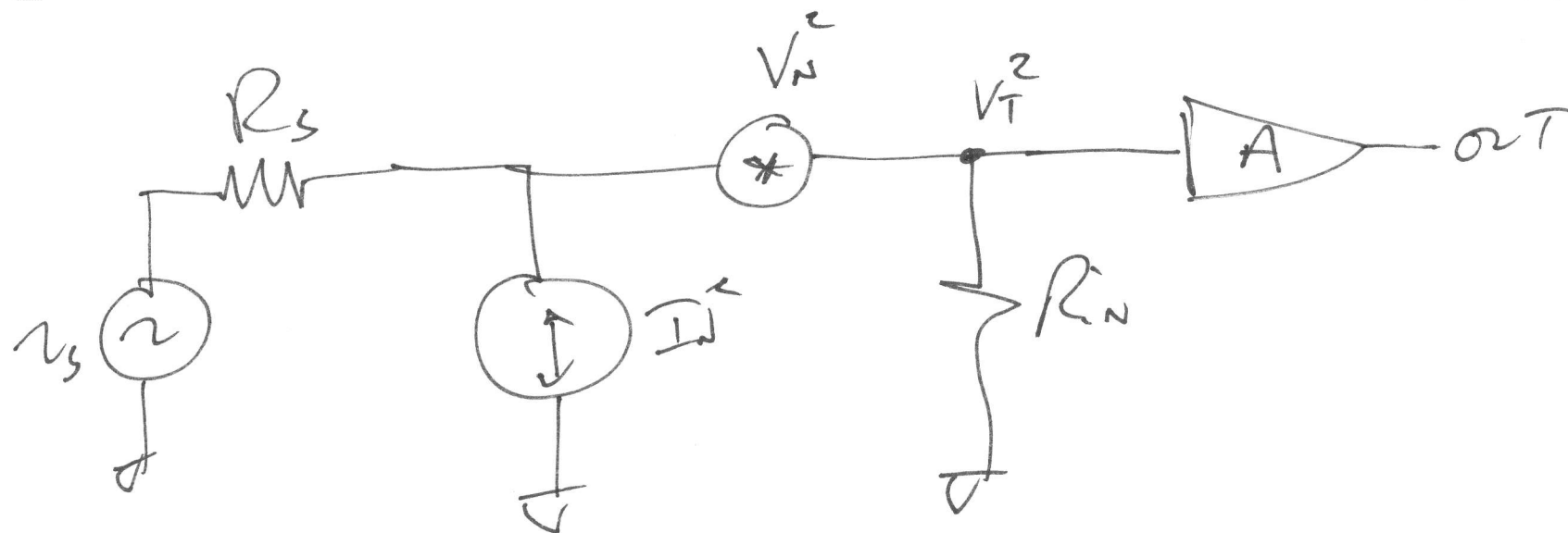
$$V_{iNOISE}^2(f) = \frac{i_1^2 + i_2^2 + i_3^2 + i_4^2}{g_m^2}$$

b)

Optimum Source Resistance



4)



$$V_T^2 = I_n^2 \cdot (R_s \parallel R_L)^2 + V_n^2 \cdot \frac{R_L^2}{(R_L + R_s)^2} + 4kTR_s \cdot \frac{(R_L)^2}{(R_s + R_L)^2}$$

$$V_{n, R_L}^2 = v_s^2 \cdot \frac{R_L^2}{(R_L + R_s)^2} \quad R_{s, opt} = \frac{V_n, R_L}{I_n, R_s}$$

$$\frac{V_n^2}{V_T^2} = \frac{v_s^2}{I_n^2 \cdot R_s^2 + V_n^2 + 4kTR_s}$$

5)