

UNIVERSITY OF CALIFORNIA AT BERKELEY
College of Engineering
Department of Electrical Engineering and Computer Science

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Midterm Exam
(3/11/04)

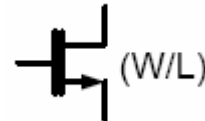
EECS 140
Spring 2004

Name: _____

SID: _____

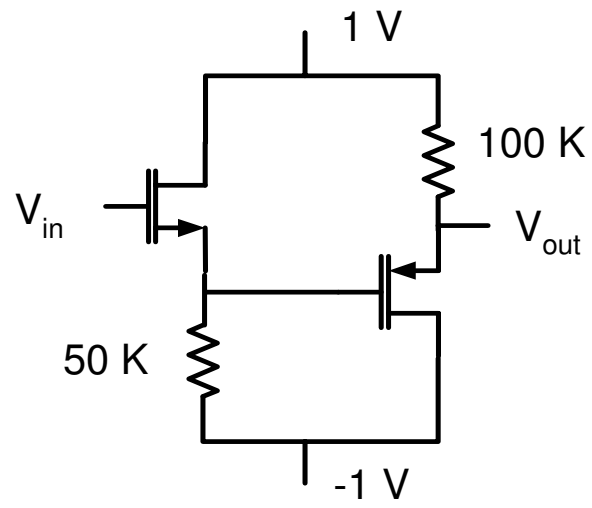
- Show your work.
- Make approximations to be within 10%.
- Write your answers on this page for 5 points.

Use the following parameters:



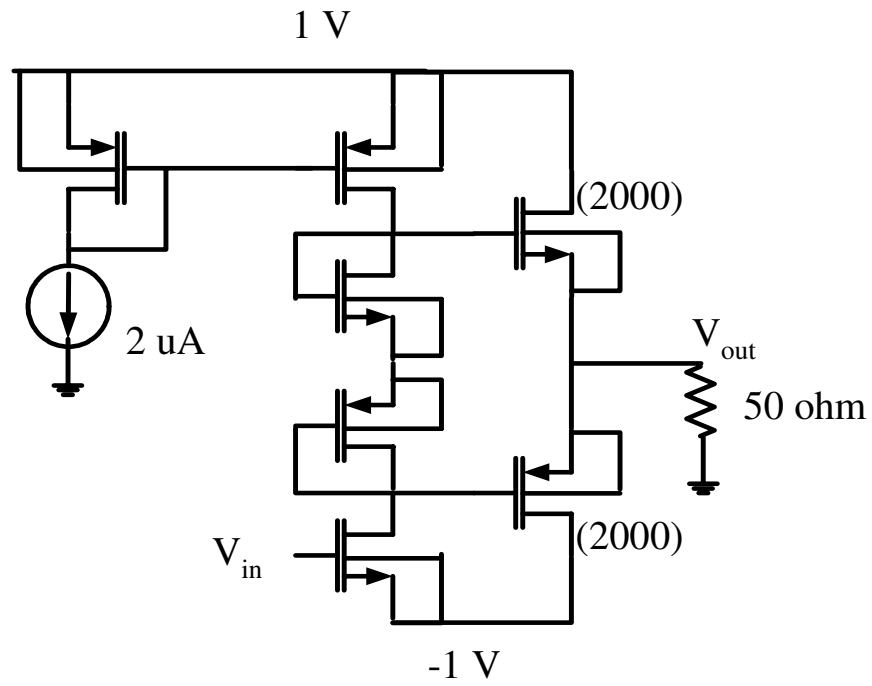
- Assume all $(W/L)=2$, unless otherwise shown in the circuit as
 - $K_n' = K_p' = 10^{-4} \text{ A/V}^2$
 - $\lambda_n = \lambda_p = 0.01$
 - $\gamma = 0.2 \text{ V}^{1/2}$
 - $2\Phi_f = 0.6 \text{ V}$
 - $V_{to,n} = V_{to,p} = 0.3 \text{ V}$
 - Assume all substrates tied to appropriate supply unless otherwise shown in the circuit.
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1.



a) What is V_{in} to set $V_{out}=0$?

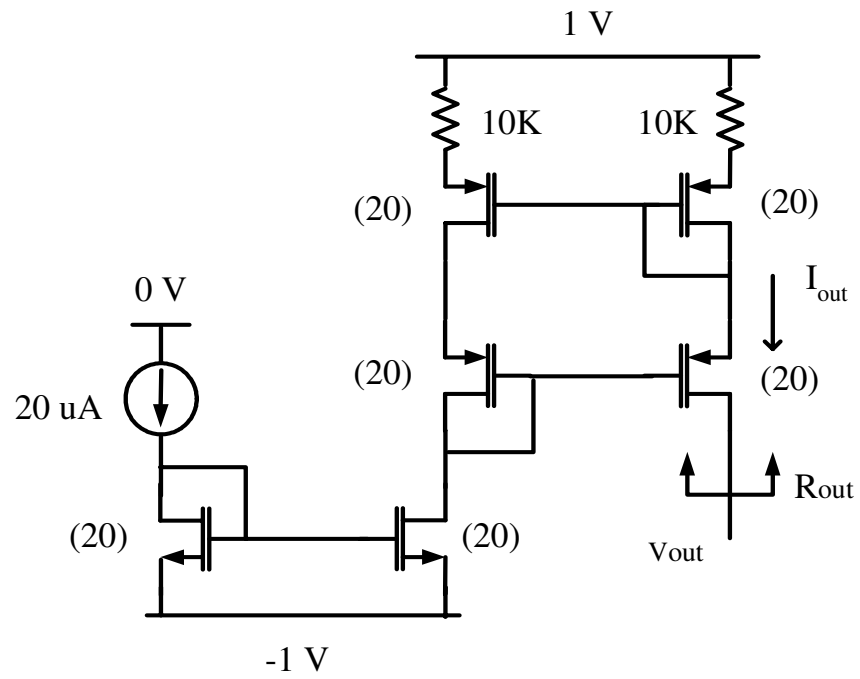
2.



a) What is the maximum voltage at V_{out} if $-1\text{ V} \leq V_{in} \leq 1\text{ V}$ and all transistors remain in saturation region?

b) Assume V_{in} is set so that $V_{out} = 0\text{ V}$, what is the DC power dissipation of this circuit?

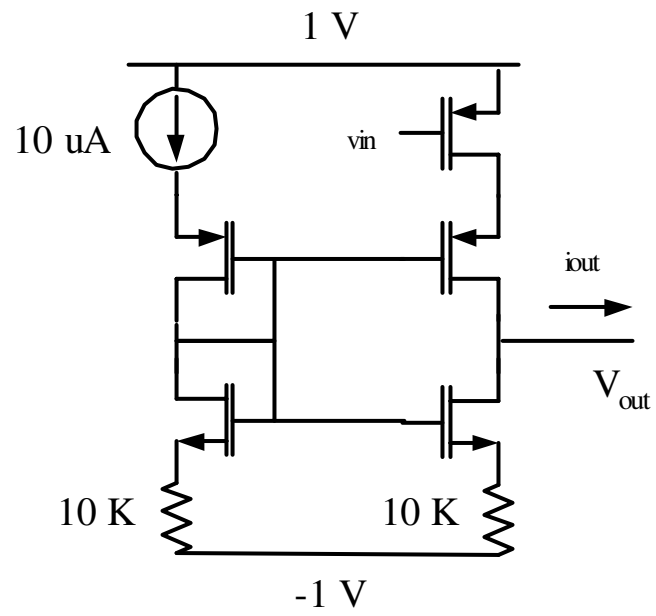
3.



a) What is the maximum output voltage, V_{out} ?

b) If $I_{out} = 10 \mu\text{A}$, what is R_{out} ?

4.

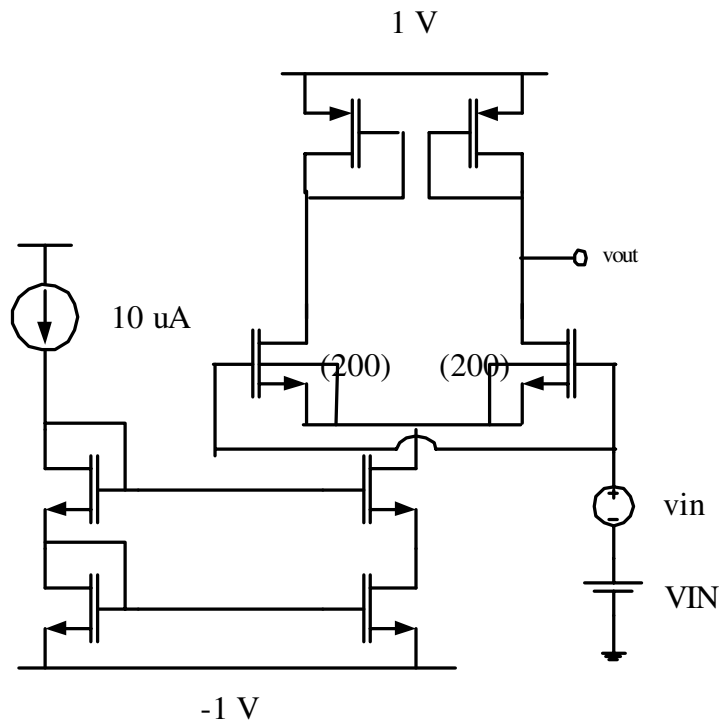


Assume the DC voltage at V_{out} is 0 V :

a) What is $G_m = \left. \frac{i_{out}}{v_{in}} \right|_{V_{out}=0}$?

b) What is R_{out} ?

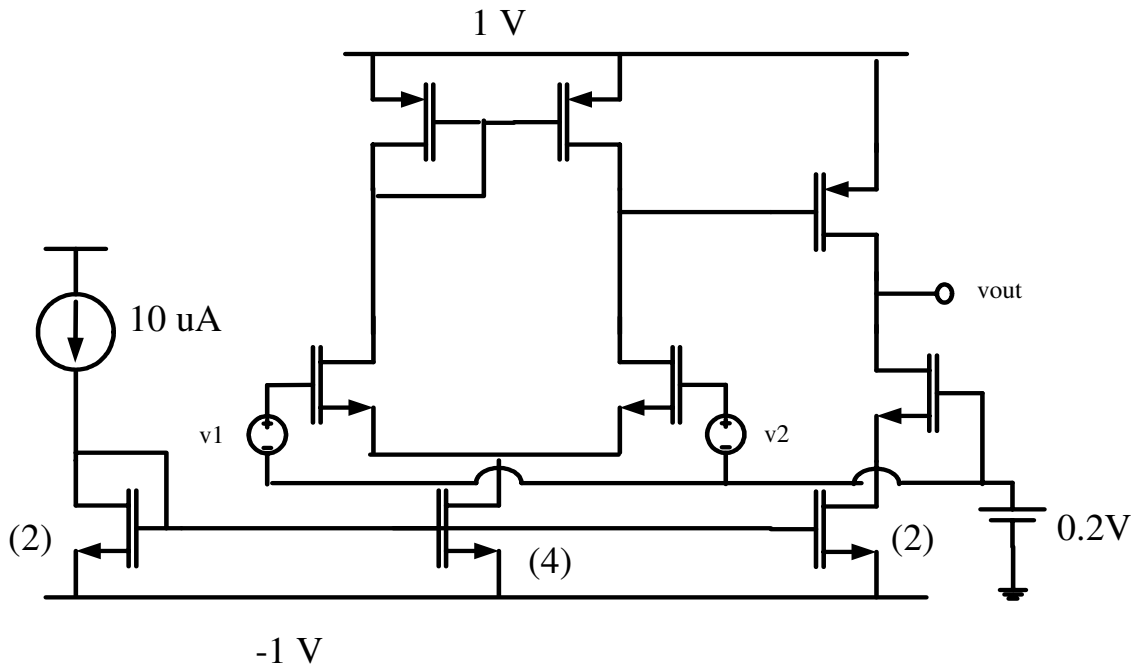
5.



a) What is $\frac{v_{out}}{v_{in}}$ if $V_{IN} = 0.4$ V?

b) What is the minimum value of V_{IN} that has all the transistors in saturation?

6.



a) What is the DC voltage at output node, vout?

b) What is the gain $\frac{v_{out}}{v_1 - v_2}$?