

Due: 3 January 2021 @22 o'clock – **No late homework will be accepted.**

- 1) Determine the polarity of the feedback for the amplifier in Fig 1a. Clearly explain your reasoning.
- 2) Consider the feedback circuit depicted in Fig. 1b. Suppose the output quantity of interest is the collector current of  $Q_2$ ,  $I_{out}$ . Determine the closed loop gain, input and output impedances. Assume that  $V_A = \infty$ .

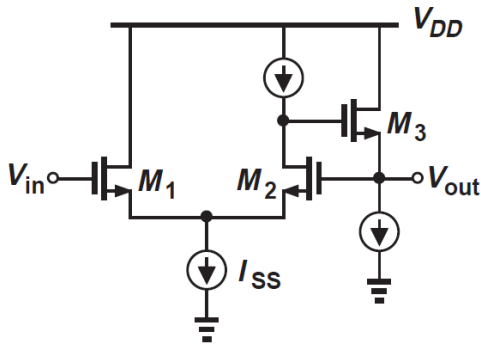


Fig 1a. Figure of Question 1

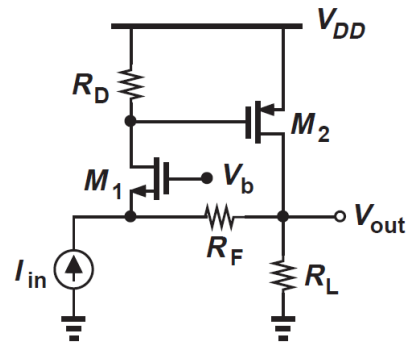


Fig 1b. Figure of Question 2

- 3) Find the closed loop gain, input and output impedances of the amplifier in Fig 2a. Assume that  $\lambda > 0$ .
- 4) In the amplifier in Fig 2b., the transistors have  $W/L = 25 \mu\text{m} / 0.18 \mu\text{m}$ . No need for hand calculations. All parts of the question should be done using simulations.
  - a. Determine the operating point of the circuit for an input DC level of 1.1 V.
  - b. Find the closed loop gain, input and output impedances.

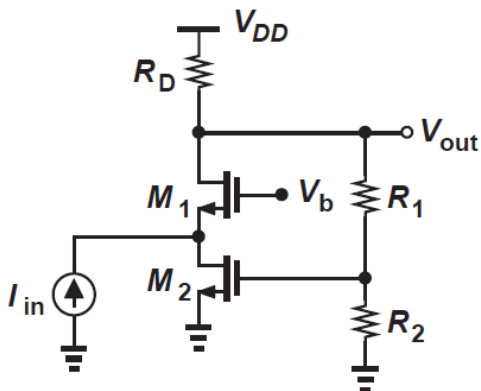


Fig 2a. Figure of Question 3

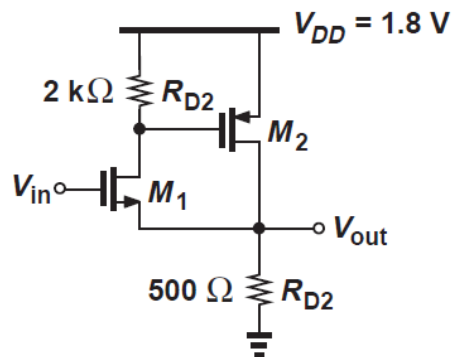


Fig 2b. Figure of Question 4

For this HW, you will use the following NMOS and PMOS models. You can import them into LTSpice or your favorite SPICE simulator. One helpful link regarding LTSpice is provided below.

Models: [http://ptm.asu.edu/modelcard/180nm\\_bulk.txt](http://ptm.asu.edu/modelcard/180nm_bulk.txt)

Incorporation of the models into LTSPICE: <http://www.linear.com/solutions/1083>