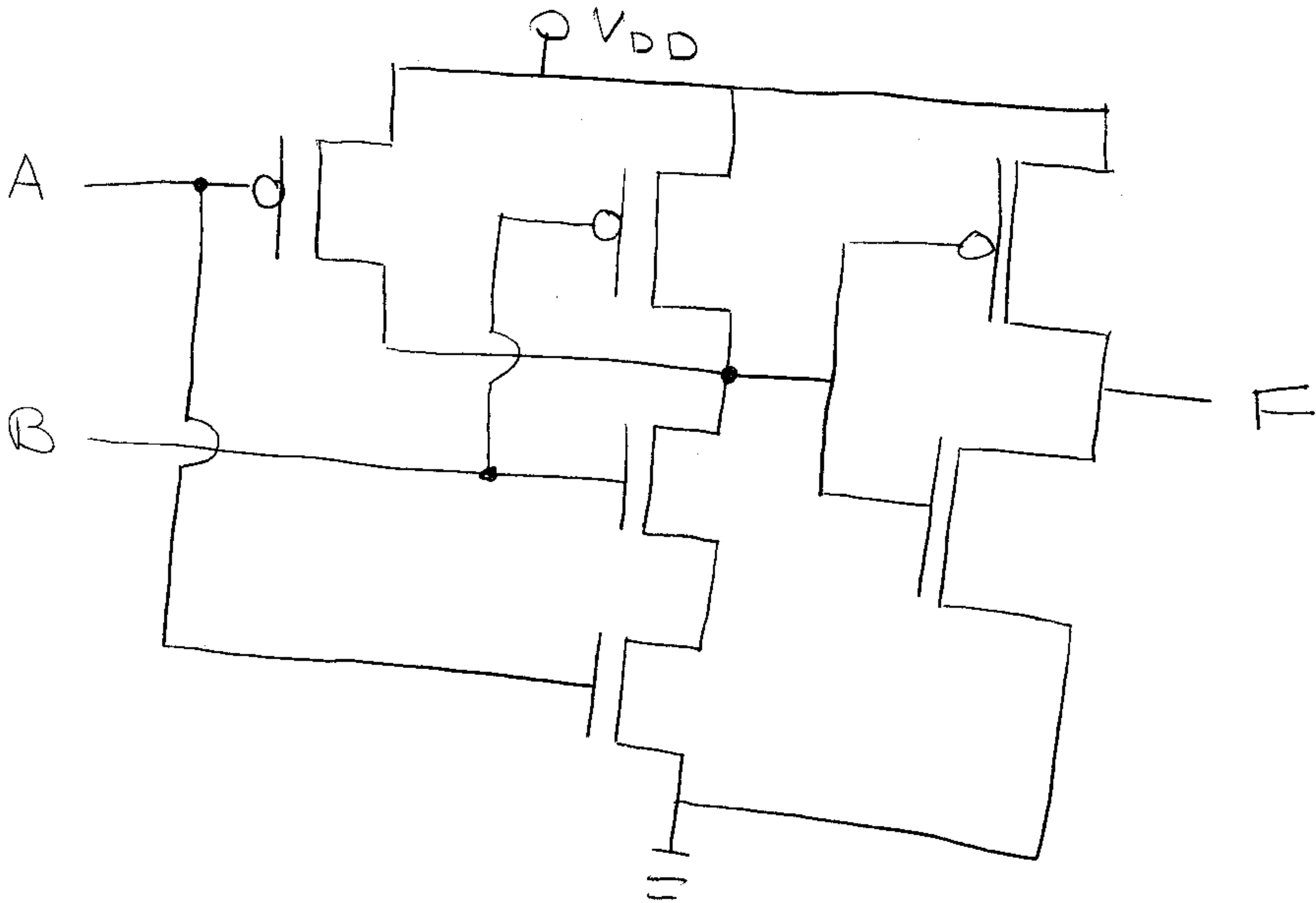


EE 40

Homework 7

Problem 1: For the CMOS logic circuit below, create a truth table and determine which Boolean function it performs.



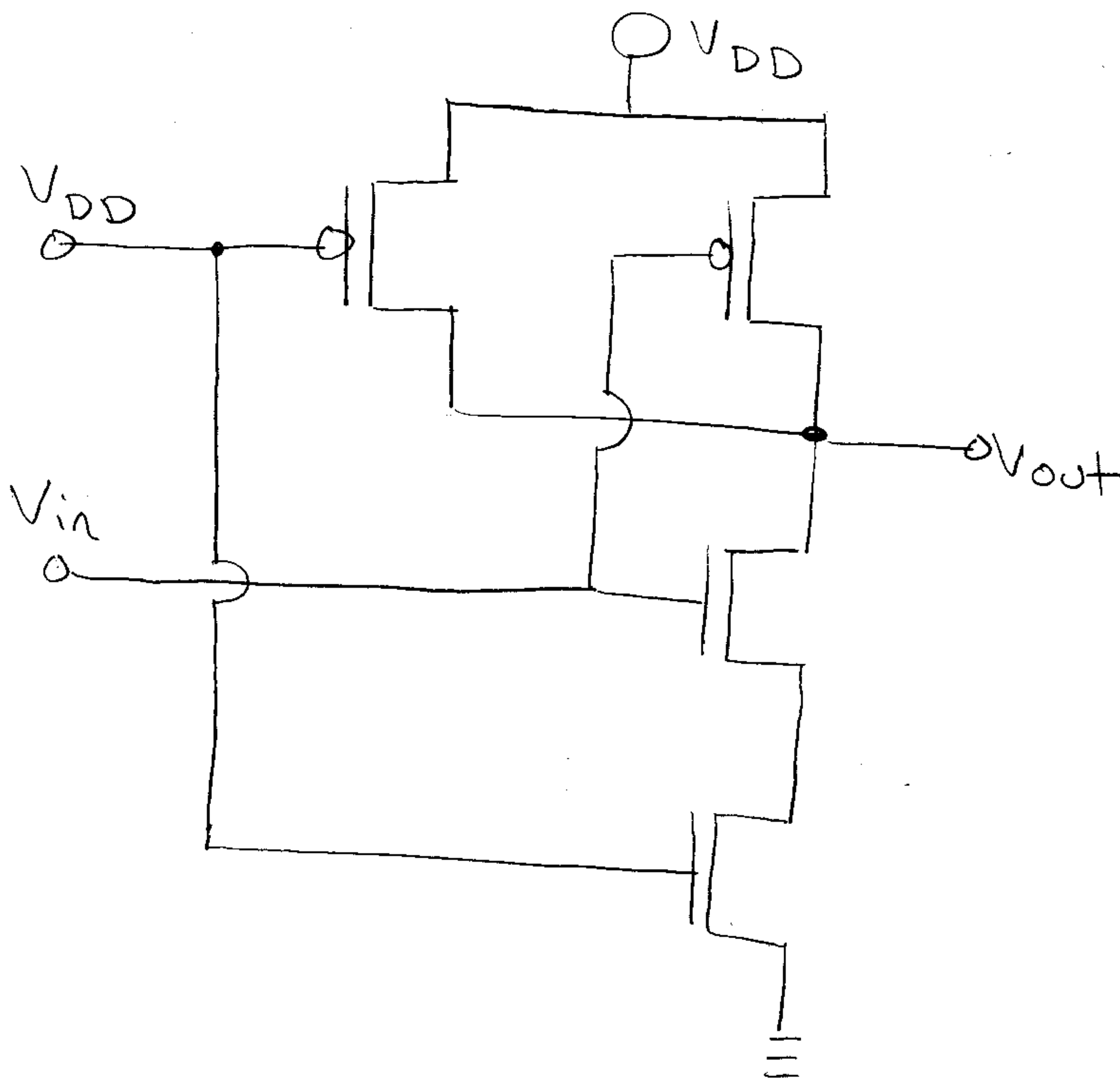
Suggestion: Use the "switch" model for the transistors.

## Problem 2°

Assume all transistors have identical characteristics (same  $|V_T|$ )

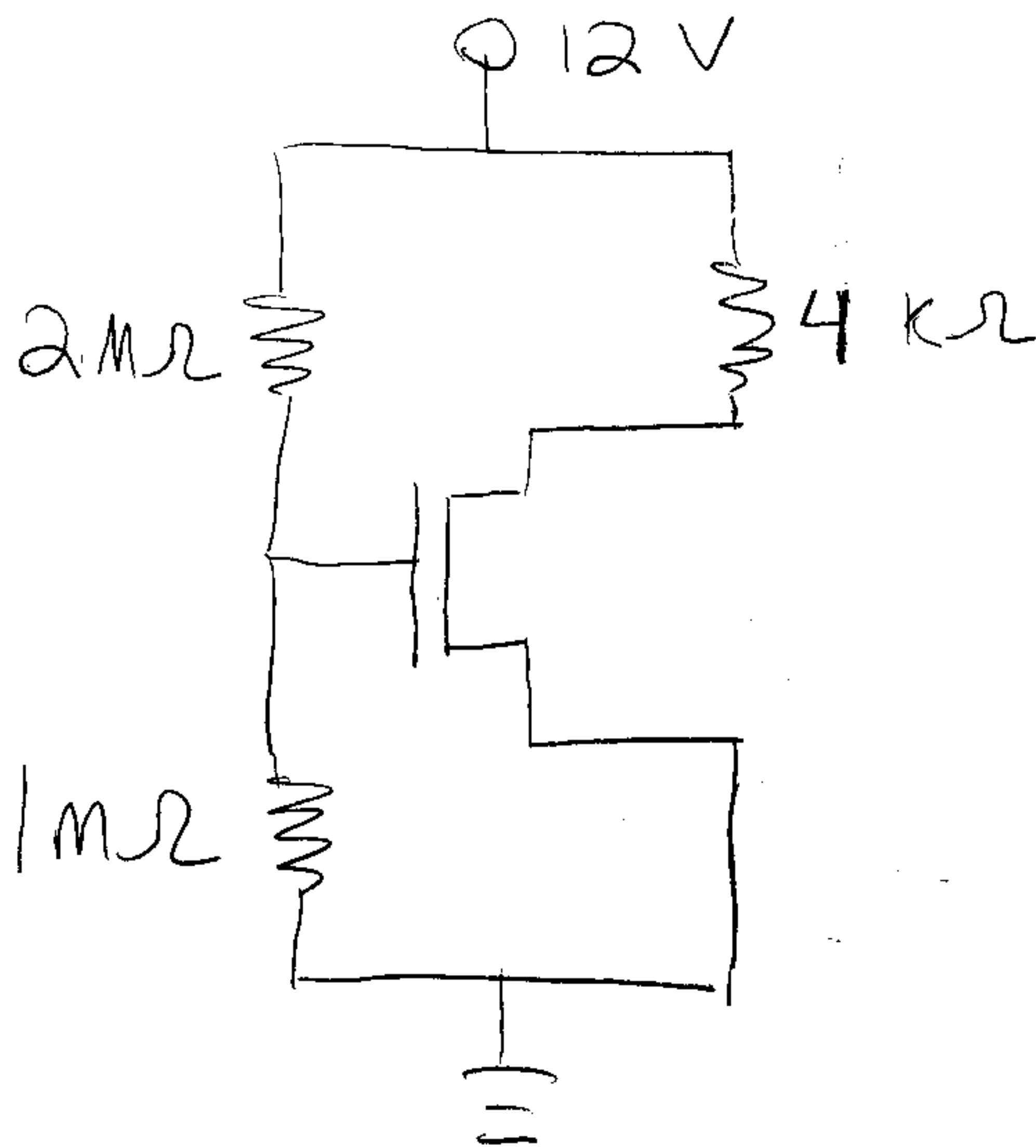
For the CMOS logic circuit below, determine the mode of operation for each transistor

- when  $V_{in}$  is just above  $V_T$
- when  $V_{in}$  is just below  $V_{DD} - V_T$



### Problem 3:

Find  $V_{DS}$  and  $I_D$  for the transistor below, and find the power absorbed by the transistor.

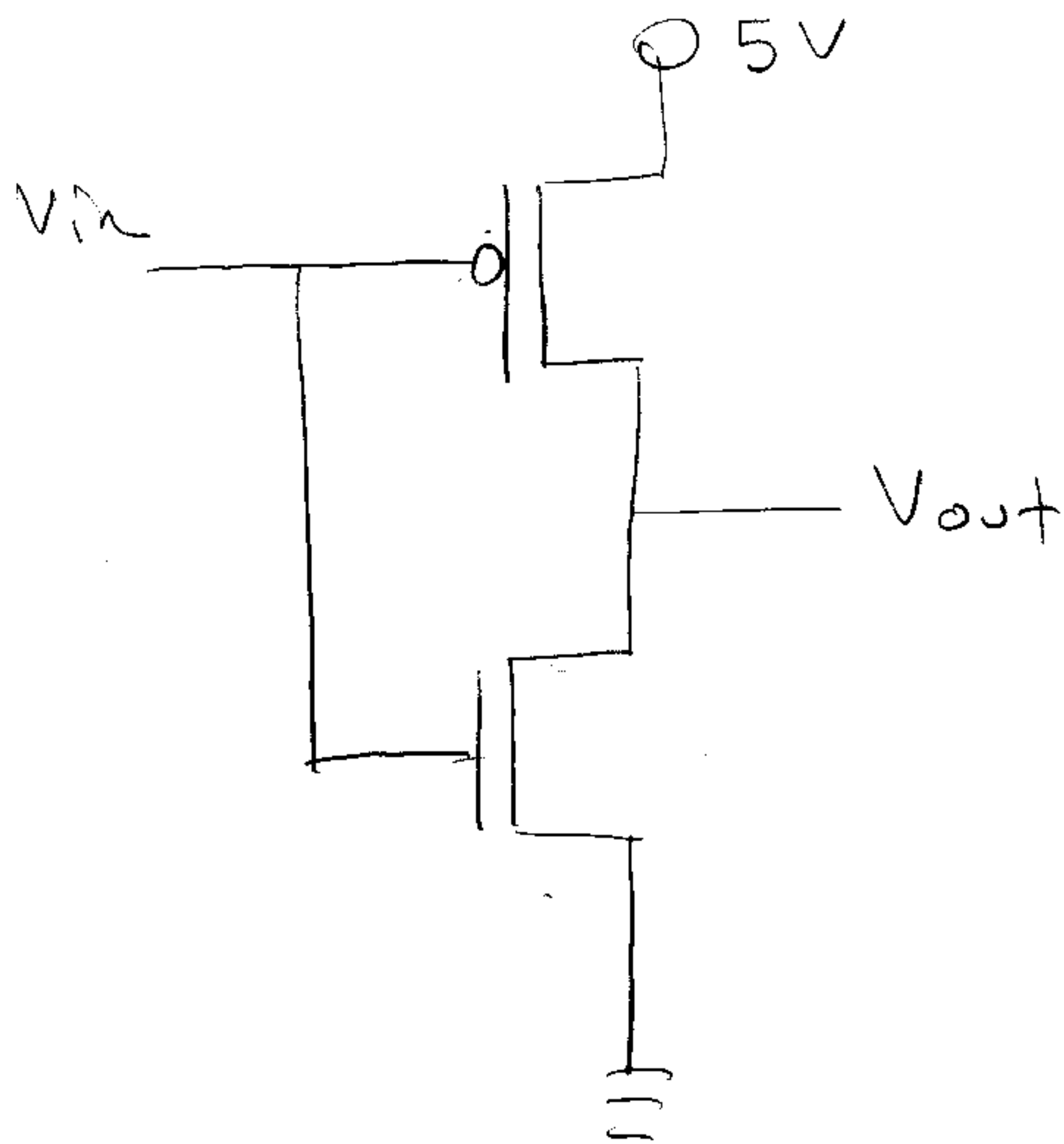


$$\lambda = 0.01$$

$$V_T = 1V$$

$$I_{D_{SAT}} = 2 \times 10^{-3} (V_{GS} - V_T)^2$$

Problem 4 Find the output of the inverter below for an input voltage of 3V.



NMOS:

$$\lambda = 0$$

$$V_T = 1V$$

$$I_{DSAT} = 2 \times 10^{-5} (V_{GS} - V_T)^2$$

PMOS:

$$\lambda = 0$$

$$V_T = -1V$$

$$I_{DSAT} = -2 \times 10^{-5} (V_{GS} - V_T)^2$$