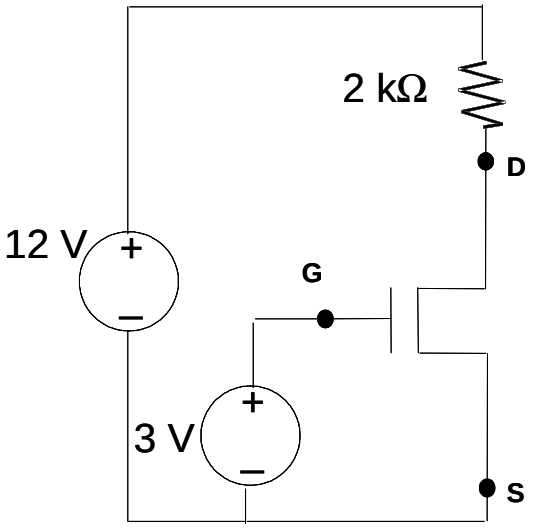
EE 40

Homework 5

Due Tuesday, April 15, 2003 at start of class (3:30 PM)

40 Total Points Possible

Problem 1: 8 Points Possible

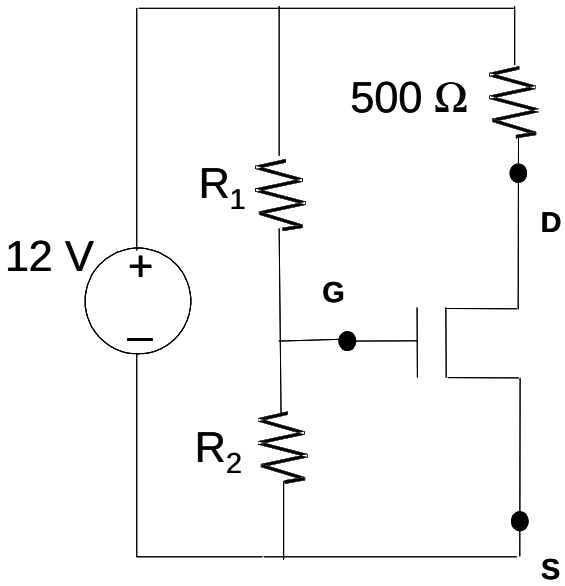


For the NMOS transistor circuit at left, let

$V_{TH(N)}$ = 1 V,
W/L $\mu_N C_{OX}$ = 1 mA/V^2,
λ = 0 V^{-1}.

Find V_{DS} and I_D for the transistor.

Problem 2: 8 Points Possible

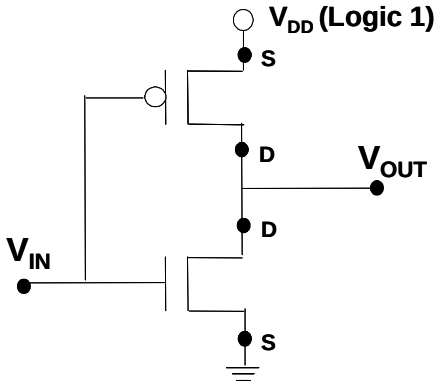


For the NMOS transistor circuit at left, let

$V_{TH(N)}$ = 1 V,
W/L $\mu_N C_{OX}$ = 1 mA/V^2,
λ = 0 V^{-1}.

Find values for R_1 and R_2 so that the circuit will supply a constant 8 mA to the resistor when the transistor is in saturation mode.

Problem 3: 8 Points Possible

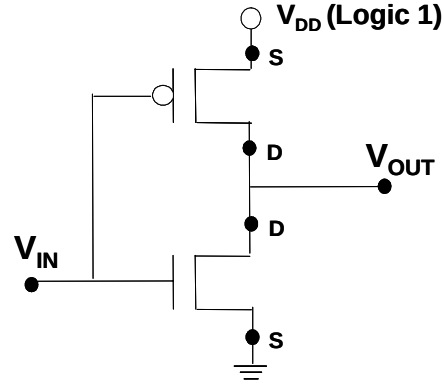


Consider the unloaded CMOS inverter at right with

V_{DD} = 5 V
$V_{TH(N)} = -V_{TH(P)}$ = 1 V
C_{OX} = 5 fF/μm^2 for both transistors
L = 2.5 μm for both transistors
λ = 0 for both transistors
μ_N= 50000 mm^2 / (V s)
μ_P= 25000 mm^2 / (V s)

Find a width W_N for the NMOS transistor channel and width W_P for the PMOS transistor channel that together will make V_M = 2 V.

Problem 4: 8 Points Possible

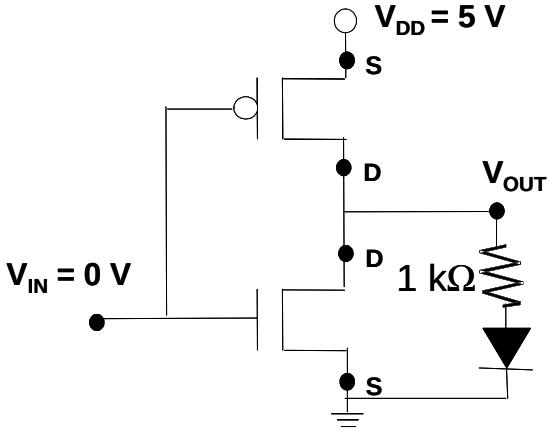


Consider the unloaded CMOS inverter at right with

V_{DD} = 5 V,
W/L μ C_{OX} = 1 mA,
$V_{TH(N)} = -V_{TH(P)}$ = 1 V,
λ = 0.

Find $V_{DS(N)}$, $I_{D(N)}$, $V_{DS(P)}$, and $I_{D(P)}$ corresponding to V_{IN} = 3.5 V.

Problem 5: 8 Points Possible



Consider the CMOS inverter at right with

W/L μ C_{OX} = 1 mA,
$V_{TH(N)} = -V_{TH(P)}$ = 1 V,
λ = 0

and diode (large-signal model) with V_F = 0.7 V.

Find the power absorbed by the transistor, resistor, and diode.