ECE 320 - Homework #9

CMOS Logic, Op-Amps, Schmitt Triggers. Due Monday, October 26th

Assume an n-channel MOSFET with the following characteristics:

- Vt = 2V
- Rds = 1 Ohm @ Vgs = 10V @ Ids = 100mA

and a corresponding p-channel MOSFET with

- Vt = -2V
- Rds = 1 Ohm @ Vgs = -10V @ Ids = 100mA

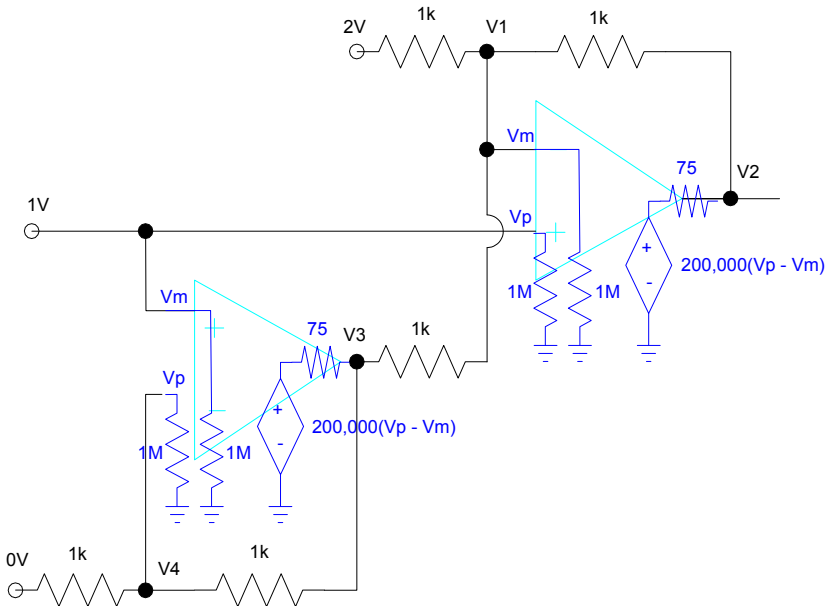
1) Determine the constant Kn

2) Determine the resistance when Vgs = 5V

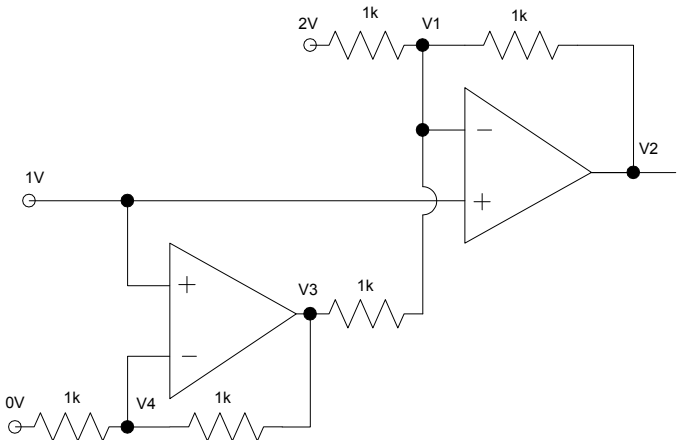
3) Design a CMOS gate to impliment

Y = AB+C

4) Write the voltage node equations for the following op-amp circuit.



5) Assume ideal op-amps. Write the voltage node equations for the following op-amp circuit (same as problem 4 but with ideal op-amps)



6) Comparitor: Design a circuit which outputs

- 10V for Vin < 3V
- 0V for Vin > 3V

7) Schmitt Trigger: Design a circuit which outputs

- 10V when Vin > 4V
- 0V when Vin < 3V
- No change for 3V < Vin < 4V

8) Schmitt Trigger: Design a circuit for a night-light which outputs

- 0V when the light level is more than 10 Lux and
- 10V when the light level is less than 7 Lux

Assume a light sensor with $R = \frac{100{,}000}{Lux}\Omega$

Lab: (term project)

Take one section of your term project.

7) Requirements: Specify what your circuit is going to do

- Inputs
- Outputs
- Relationship

8) Analysis. Calculations for votlages, currents, resistors, capacitors, etc

9) Test: Check you analysis in simulation.

10) Validation: Build your circuit and check that it meets the reqruiements.