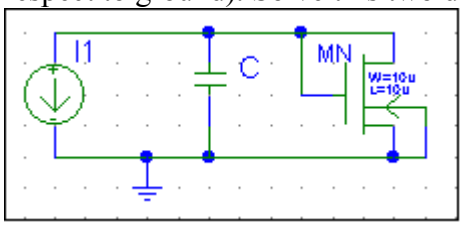
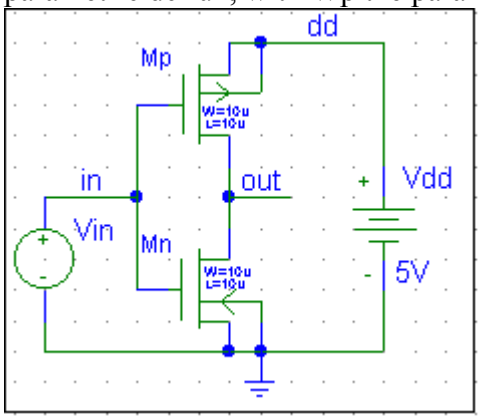
File: 302f0_03 RWN 09/08/00
ENEE 302 Possible to do items #3.

1. For the following circuit set up the differential equation for the capacitor voltage (with respect to ground). Solve this two different ways, at least one of which uses Spice.



2. Using the MOSIS 2u transistors design the following inverter so that the output voltage is Vdd/2 when the input voltage is Vdd/2; check this by doing a dc simulation in Spice. For this it may be useful to proceed by a) obtaining an analytic formula for Vout when Vin=Vdd as a function of the PMOS width, Wp, and then b) refine the result by doing a parametric dc run, with Wp the parameter swept around the value chosen in a).



3. Place a 1 pico Farad capacitor from out to ground in the inverter of 2. above and do a Spice transient response with Vin a pulse going between 0 and 5 Volts. Note the delay. Do parametric Spice runs with the capacitance as a parameter to see the effects on the delay of the capacitor.

4. Connect three of the inverters designed in 2. above in the following ring to form a ring oscillator, [text, p. 1112]. Do a Spice transient analysis. Then insert 2 pFd capacitors at each "in" node to ground and note the result when one initial condition is set to Vdd. Once this is oscillating extend it from 3 sections to 5 sections and note the difference in oscillations. Give possible uses for this circuit.