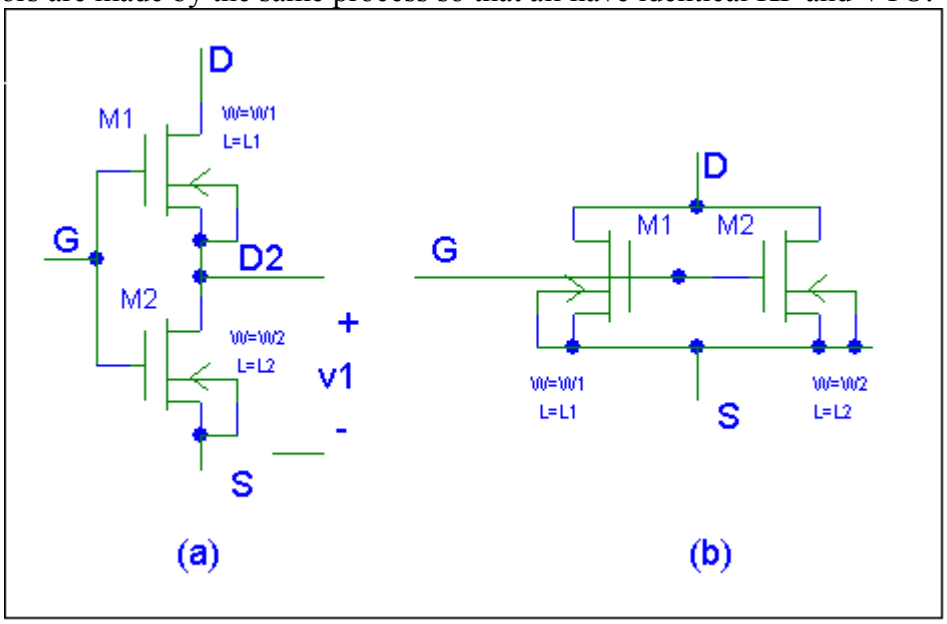
File: E:/courses/spring2008/303/hmwrk2.doc RWN 02/16/08

Homework Set 2 due Tuesday 02/26/08

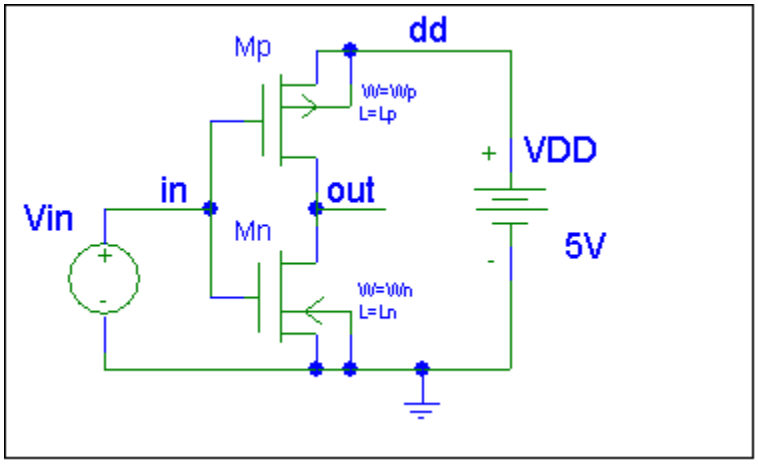
1. [50 points] (theory of multiple MOS connections useful for laboratory with 4007s)

For the following two circuits let iD=i, vGS=vG, vDS=v and that this latter, v, is large enough to force at least one transistor in (a) to be in saturation. Assume also that all transistors are made by the same process so that all have identical KP and VTO.



a) For the circuit in (a) assume W1=W2=W and L1=L2=L and determine v1 and the possible states of M1 & M2 (one being in saturation). Then give i=fvG,v).
b) For the circuit of (b) give i=f(vG,v).
c) Discuss the results in terms of flexibility of what can be obtained with the 4007 transistors (consider also the bulk connection of M1 in (a)).

2. [50 points] (inverter circuit in Spice)



a) In PSpice connect a CMOS inverter using the 4007 transistors as above. Do a DC sweep with Vin running from 0 to VDD and record the value of Vout (measured from out to ground) when Vin=VDD/2. Submit the full curves.
b) Modify Vin to be an AC source and do a sweep from 100Hz to 100MEGHz and submit curves of the magnitude frequency response.
c) Make the circuit with mpmosis and mnmosis transistors using default W=L=10u and record the value of Vout when Vin=VDD/2.
d) In the circuit of part b) make Wp to be a parameter and do parametric runs to find the value of Wp needed to achieve Vout=Vin=VDD/2.
e) On the mp-mnmosis circuit repeat the AC sweep done on the 4007 circuit and comment on how the two compare.