Autumn 2024 – ECE 5020
Homework 2

Due: 09/18/2024 Please submit online via CarmenCanvas.

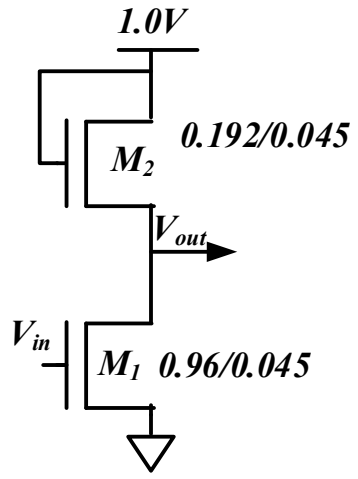
Consider the following two inverter types shown below and assume that each inverter has a fan-out of 2 (i.e. it drives a load of 2x its own size).

Static Analysis:

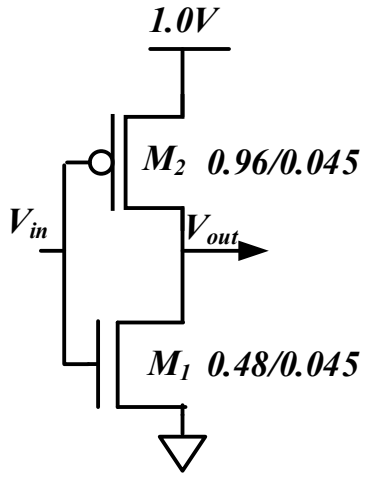
i. Simulate in Cadence the VTC of each inverter. Plot the results
ii. What is the swing range of each inverter?
iii. From the figure, calculate (approximately) V_{IH}, V_{IL}, NM_H, NM_L and V_M of each inverter.
iv. Plot the gain vs. input voltage of each inverter and calculate the max gain.
v. Given the results in i-iii, comment on advantage/disadvantage of one inverter design vs. another.

Transient Analysis:

vi. Assume a 1GHz input square wave signal with an 8ps rise and fall time is applied to each of the inverters. Simulate the output transient signal and measure the circuit rise/fall times as well as the t_{PHL}, t_{PLH} and t_P.
vii. Plot the instantaneous power and measure the average power consumed over one cycle in each inverter.
viii. Given the results in v-vi, comment on advantage/disadvantage of one inverter design vs. the other.



NMOS Only Inv.



CMOS Inv.

Note: 0.48/0.045 means W = 0.48μm = 480nm and L = 0.045μm = 45nm.