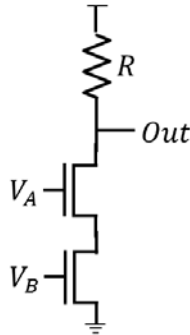


Homework Assignment 3 (Due Oct. 16, 4:15pm)

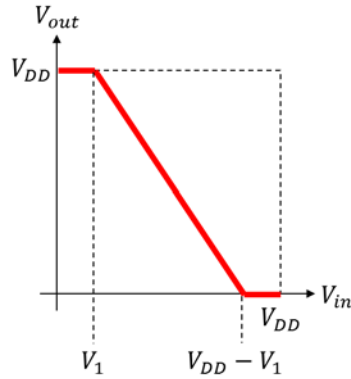
(1) [DC Analysis, 20 points] Draw a DC characteristic curve for the following circuit.



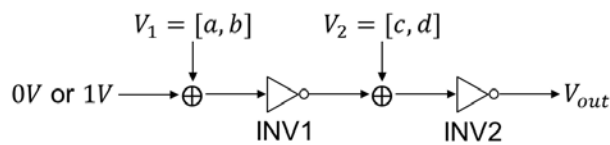
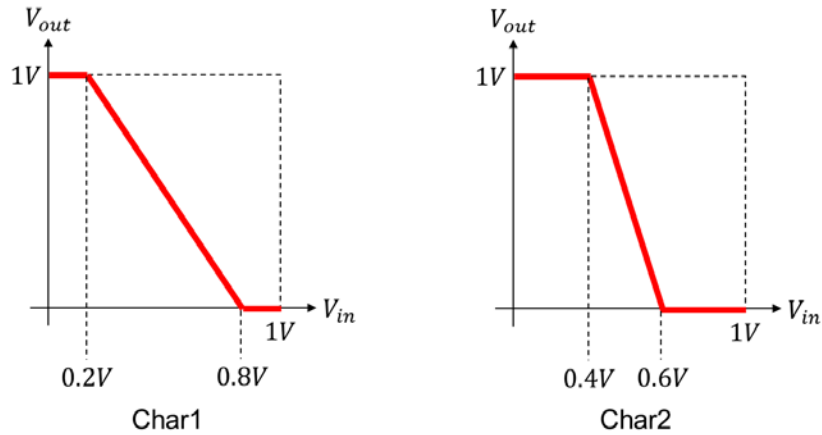
The resistance of the resistor is R and the threshold voltages of the two NFETs are V_t . Ignore the body-bias effect.

- Assume that V_A and V_B switch from 0 to V_{DD} at the same time.
- Assume that the NFETs are properly sized, so the output voltage is almost 0V when V_A and V_B are V_{DD} .
- Show the operations modes of the NFETs on the DC characteristic curve.
- Show some equations to find V_{out} as a function of $V_A (= V_B)$, R , V_{DD} , and V_t . You don't need to simplify the equations. Just show the equations.

(2) [DC Analysis, 20 points] The following shows the DC characteristic curve of an inverter INV (V_1 is a constant). Draw a DC characteristic curve of a buffer consisting of two INVs.



(3) [Noise Analysis, 40 points]



The schematic shown above shows a circuit consisting of two inverters (INV1 and INV2). V_1 and V_2 are independent noise sources. The ranges of V_1 and V_2 are $[a, b]$ and $[c, d]$, respectively ($a, c < 0$, $b, d > 0$). V_{out} should be 0V for input voltage 0V and 1V for input voltage 1V. Find the maximum value of $(25b - 15c)$ and the minimum value of $(25a - 15d)$ when Char1 is for INV1 and Char2 is for INV2.