電路學(EE2210)第五次隨堂考

2015年10月21日
時間：10 分鐘
Close Book

學號：_____

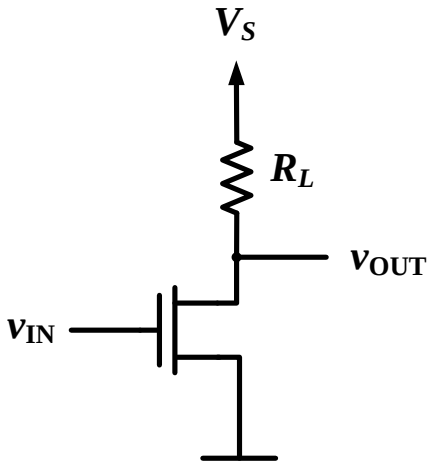
姓名：_____

An inverter circuit using a MOSFET and a resistor is shown in the figure below. The MOSFET has a threshold voltage V_T = 2 V.Assume that V_S = 5 V and R_L = 9 kΩ. For this program, model the MOSFET using its switch-resistor model. Assume that the on-state resistance of the MOSFET is R_{ON} = 1 kΩ

(a) Draw the voltage transfer characteristics for the inverter. (20%)

(b) Does the inverter satisfy the static discipline, which has voltage thresholds given by V_{IL} = 0.3 V, V_{OL} = 0.2 V, V_{IH} = 1.7 V, and V_{OH} = 4.8 V ? (40%)

(c) Does the inverter satisfy the static discipline, which has voltage thresholds given by V_{IL} = 2.5 V, V_{OL} = 1 V, V_{IH} = 3.5 V, and V_{OH} = 4 V ? (40%)

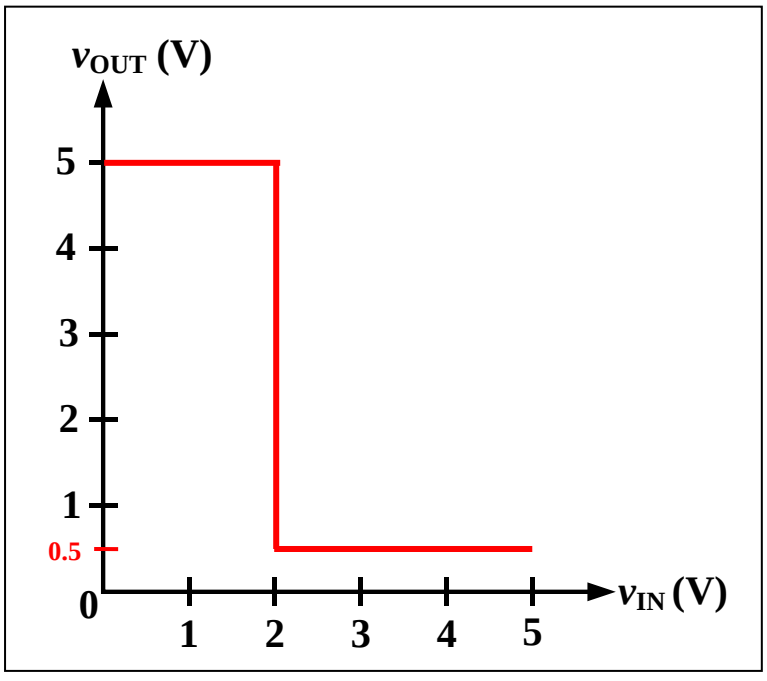


(a)The output high voltage V_{OH} for the inverter is 5 V.

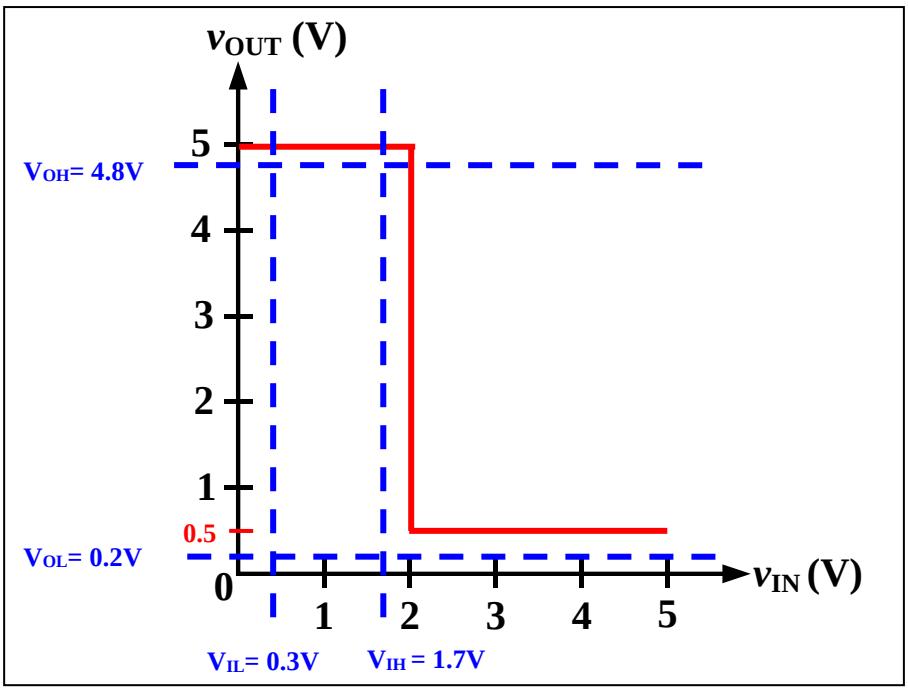
The output low voltage V_{OL} for the inverter is

$$V_S \times (\frac{R_{ON}}{R_L + R_{ON}}) = 5 \times \frac{1}{9+1} \Rightarrow V_{OUT} = 0.5\text{V}$$

The lowest input voltage recognized as a logical 1 is $V_T = 2\text{V}$

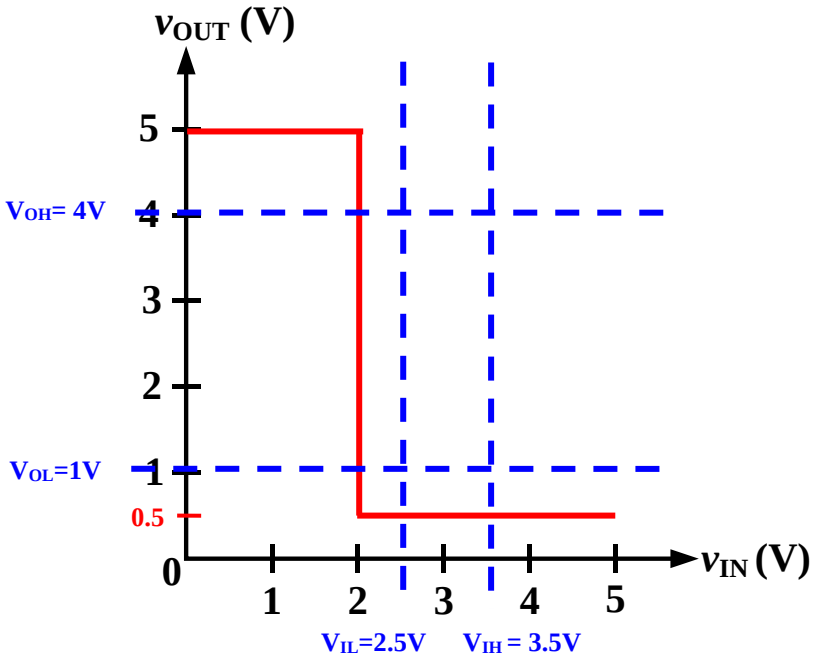


(b)



(i) V_{IL} ：satisfy
(ii) V_{OL} ：not satisfy
(iii) V_{IH} ：not satisfy
(iv) V_{OH} ：satisfy

(c)



(i) V_{IL} ：not satisfy
(ii) V_{OL} ： satisfy
(iii) V_{IH} ： satisfy
(iv) V_{OH} ：satisfy

(O : satisfy, X : not satisfy)

(b)
(i) V_{IL} : O , (ii) V_{OL} : X , (iii) V_{IH} : X , (iv) V_{OH} : O .
(c)
(i) V_{IL} : X , (ii) V_{OL} : O , (iii) V_{IH} : O , (iv) V_{OH} : O .