

Họ tên: Phan Công Danh

MSSV: 19119160

Chữ kí: *Phan Công Danh*



TRƯỜNG ĐẠI HỌC SƯ PHẠM KỸ THUẬT TP. HCM  
HCMC University of Technology and Education



THẺ SINH VIÊN  
Student ID Card



Họ tên: PHAN CÔNG DANH  
Full name:  
Ngày sinh: 21/12/2001  
Date:  
Ngành học: Công nghệ kỹ thuật máy tính  
Major: Computer Engineering Technology  
Năm nhập học: 2019 - 2023  
Year of admission:

9704 1801 1211 7833

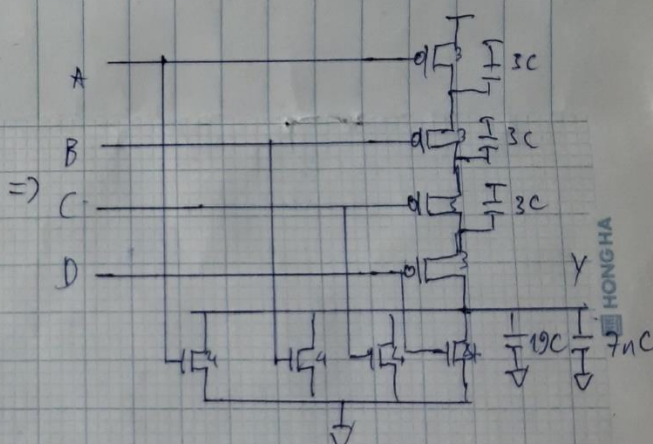
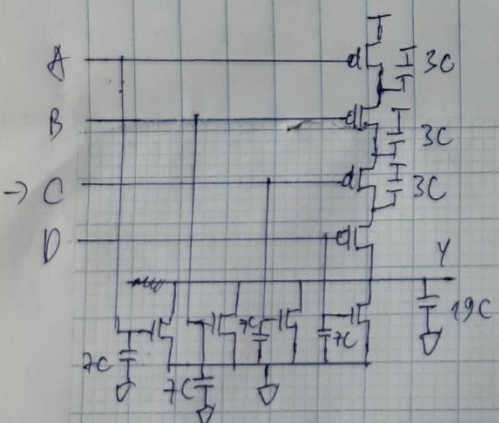
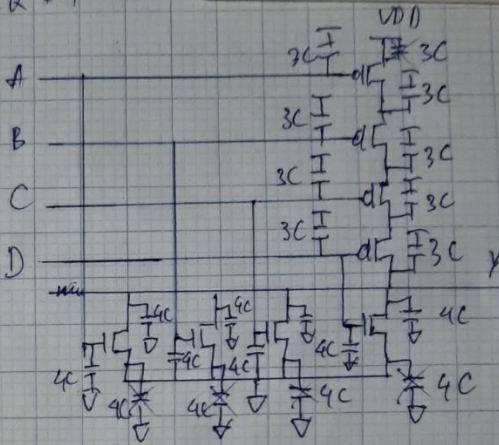
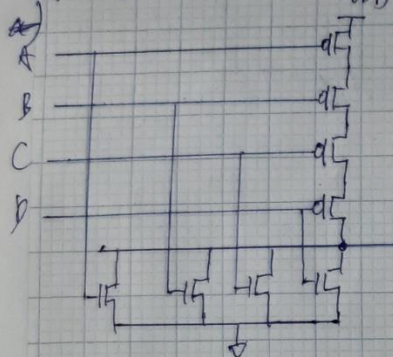
Mã số/ID  
19119160



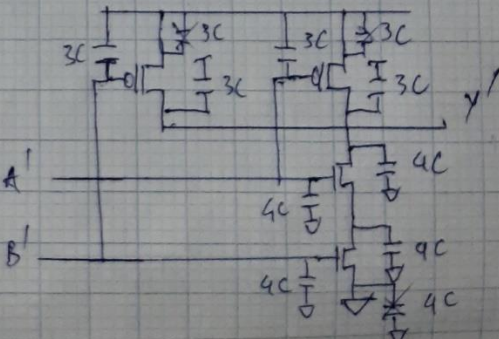
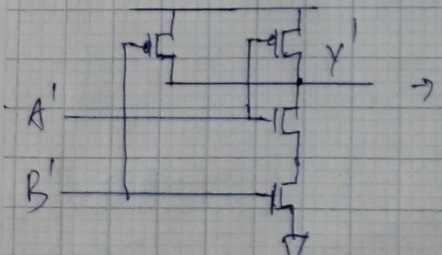
09/19

Kiểm tra ổn thì  
CK  $\neq 1$

Câu 1:  $K_p = 3$ ,  $K_n = 9$



Cổng NAND 2 ngõ ra:



Họ tên: Phan Công Danh  
MSSV: 19119160  
Chữ kí: ĐD



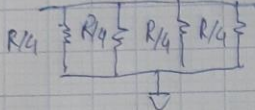
a)  $A=1, B=0, C=1, D=0 \Rightarrow Y=0$



$$\rightarrow R_{td} = \frac{R/4 \cdot R/4}{R/4 + R/4} = \frac{R}{8}$$

$$\Rightarrow \tau_{pdf} = \frac{R}{8} \cdot (19 + 7n)C$$

b)  $A=1, B=1, C=1, D=1 \Rightarrow Y=0$

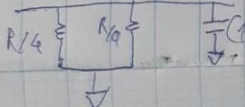


$$\rightarrow \frac{1}{R_{td}} = \frac{1}{R/4} + \frac{1}{R/4} + \frac{1}{R/4} + \frac{1}{R/4} = \frac{16}{R}$$

$$\rightarrow R_{td} = R/16$$

$$\Rightarrow \tau_{pdf} = \frac{R}{16} \cdot (19 + 7n)C$$

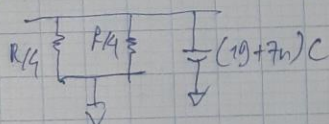
c)  $A=0, B=1, C=1, D=0 \Rightarrow Y=0$



$$\rightarrow R_{td} = \frac{R/4 \cdot R/4}{R/4 + R/4} = \frac{R}{8}$$

$$\Rightarrow \tau_{pdf} = \frac{R}{8} \cdot (19 + 7n)C$$

d)  $A=0, B=1, C=0, D=1 \Rightarrow Y=0$



$$\rightarrow R_{td} = \frac{R/4 \cdot R/4}{R/4 + R/4} = \frac{R}{8}$$

$$\Rightarrow \tau_{pdf} = \frac{R}{8} \cdot (19 + 7n)C$$

Câu 2:

a)  $\tau_{ox} = 60 \text{ \AA}, \mu = 400 \text{ cm}^2/\text{V}\cdot\text{s}, \epsilon = 3.9 \epsilon_0, \epsilon_0 = 8.85 \cdot 10^{-14} \text{ F/cm}, V_t = 0.9 \text{ V}$

$$\beta = \mu \cdot C_{ox} \cdot \frac{W}{L} = \mu \cdot \frac{\epsilon}{\tau_{ox}} \cdot \frac{W}{L} = 400 \cdot \frac{(3.9 \cdot 8.85 \cdot 10^{-14})}{60 \cdot 10^{-8}} \cdot \frac{4}{2} = 345.15 \frac{\mu\text{A}}{\text{V}^2}$$

b) Ta có  $V_{gs} > V_t$  ( $1.5 \text{ V} > 0.9 \text{ V}$ )  $\rightarrow V_{dsat} = 1.5 - 0.9 = 0.6 \text{ V}$

$$\Rightarrow I_{ds} = \frac{\beta}{2} (V_{gs} - V_t)^2 (V_{ds} < V_{dsat})$$

$$= \frac{345.15}{2} (1.5 - 0.9)^2$$

$$= 208.815 \mu\text{A}$$

Khi  $V_{ds} < V_{dsat}$ :

$$I_{ds} = \beta (V_{gs} - V_t - \frac{V_{ds}}{2}) \cdot V_{ds}$$

