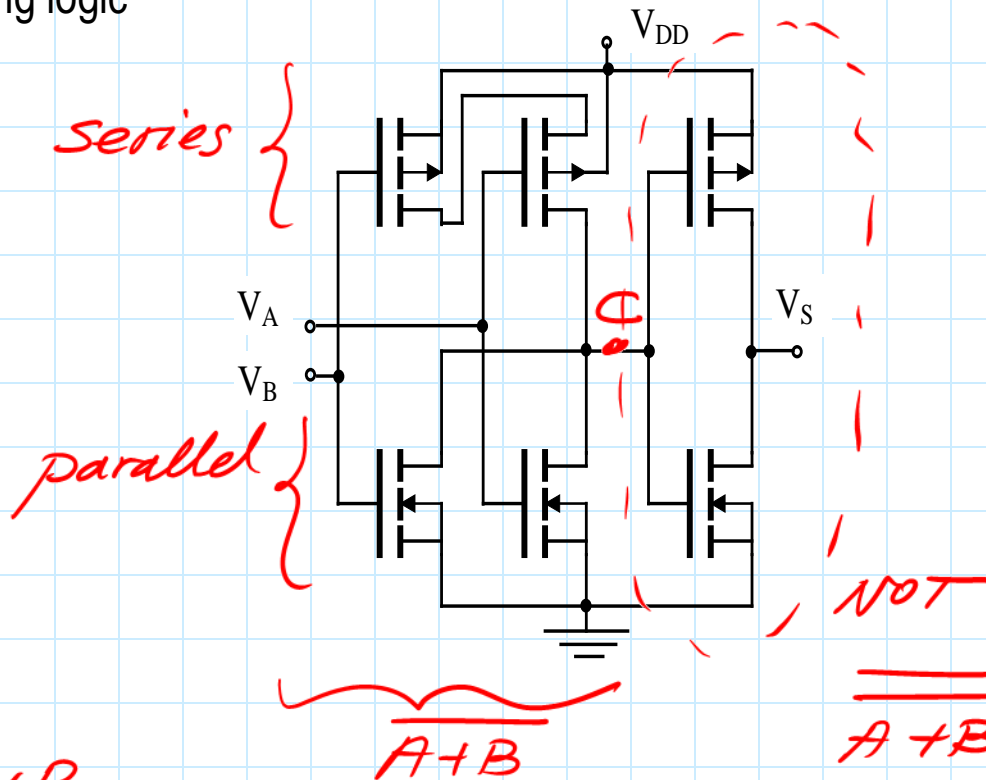


UNIT 4. CMOS

1.1 ¿ What function does the following logic gate?

- A) AND
B) NAND
C) OR
D) NOR



NMOS net: $\overline{C} = A + B$

$$C = \overline{A+B} ; S = \overline{C} = A+B$$

PMOS net $C = A \cdot B = \overline{\overline{A} \cdot B} = \overline{A + B}$

$$S = \bar{C} = A + B$$

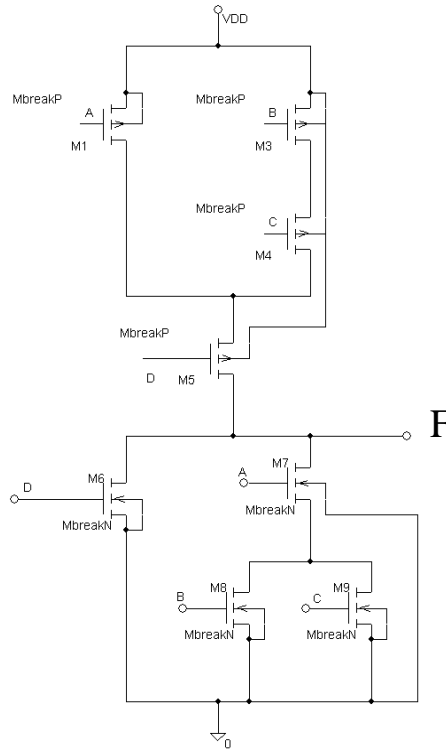
UNIT 4. CMOS

1.2. Find the Boolean expression for F in terms of A, B, C y D.

$$\text{NMOS: } F = D + A \cdot (B + C)$$

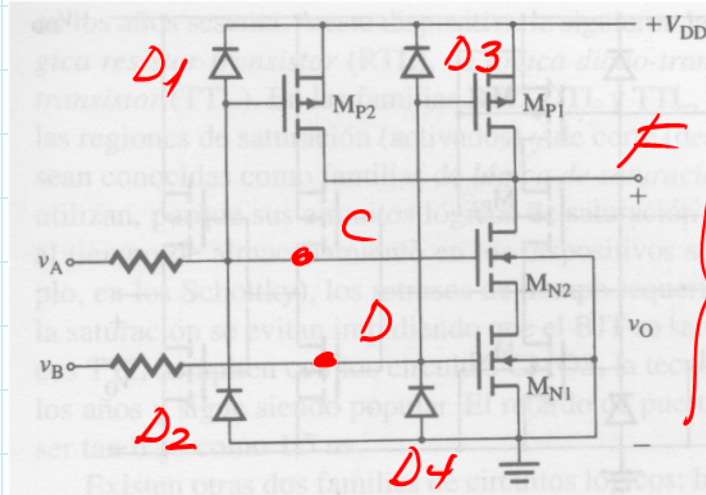
$$\text{PMOS: } F = \overline{D}(\overline{A} + \overline{B}\overline{C}) =$$

$$= \overline{D + (\overline{A} + \overline{B}\overline{C})} =$$
$$\overline{D + (A \cdot (\overline{B}\overline{C}))} =$$
$$D + A \cdot (B + C)$$



UNIT 4. CMOS

1.3. A) What type of logic gate is the following? B) For $V_{DD} = 15V$, what would be the output if $V_A = V_B = 100V$? C) What is the output if $V_A = V_B = -120V$? (assume a $V_\gamma = 0.7V$ for the diodes)



A) Series \Rightarrow NAND

$$B) -V_\gamma \leq \left\{ \frac{V_C}{V_D} \right\} \leq V_{DD} + V_\gamma$$

$$V_A = 100V = V_B \Rightarrow \left\{ \begin{matrix} D_1 \\ D_3 \end{matrix} \right\} \text{ ON} \Rightarrow V_C = V_D = 15.7V \Rightarrow C = D = 1 \Rightarrow \underline{\underline{F = "0"}}$$

$$C) V_A = V_B = -120V \Rightarrow \left\{ \begin{matrix} D_2 \\ D_4 \end{matrix} \right\} \text{ ON} \Rightarrow V_C = V_D = -0.7V$$

$$C = D = 0 \Rightarrow \underline{\underline{F = "1"}}$$