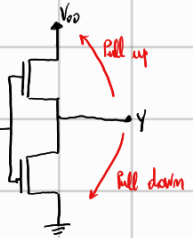


PORTA + SEMPLICE:

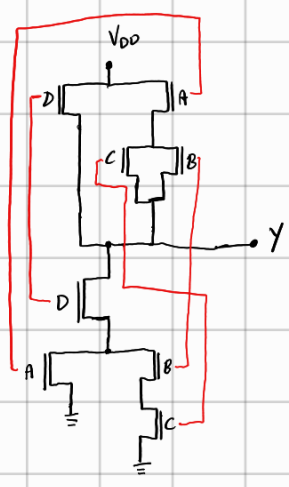
Invertitore:



Livelli logici non dipendono più da progettazione.
 Tempi di propagazione dipendono da dimensioni.
 Rapporto d'aspetto aumenta → Buss più corrente.

DATA FUNZIONE TROVA RETE

$$Y = \overline{(A+BC)D}$$



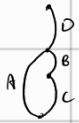
A	B	C	D	Y
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	1
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

C \ D	AB			
	00	01	11	10
00	1	1	1	1
01	1	1	0	1
11	1	0	0	1
10	1	0	0	1

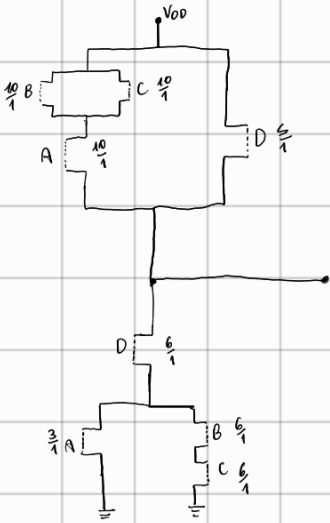
$$Y = \bar{D} + \bar{C}\bar{A} + \bar{A}\bar{B}$$

$$Y = \overline{(A+BC)D}$$

Pull down:



Pull up:



$$\frac{1}{\frac{1}{6}} + \frac{1}{x} = \frac{1}{\frac{1}{3}} \Rightarrow \frac{1}{x} = \frac{1}{3} - \frac{1}{6} \Rightarrow \frac{1}{x} = \frac{1}{6} \Rightarrow x = 6$$

A minima area: Restano i transistor nel peggiore

dei casi: $\tau_{PDN} = 3 \tau_{PUN}$

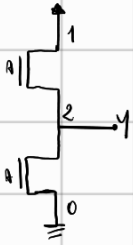
Nella rete di pull up: $\tau_{PUN} = \frac{\frac{2}{3}}{\frac{1}{\frac{1}{3}} + \frac{1}{x}} \cdot \tau_{H_I} = 5 \tau_{PUN}$

$$\tau_P = 4 \tau_{PE}$$

GRAFO: Fatto su singola rete

Nodi = nodi della rete

Anche rappresentano transistor



Grafo di pulldown:

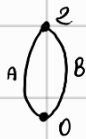


Grafo di pullup:

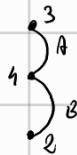


Grafo della mor?

Pull down:

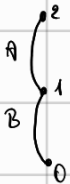


Pull up:



Grafo della mand?

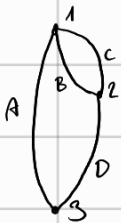
Pull down:



Pull up:



NOW: Dal grafo alla funzione



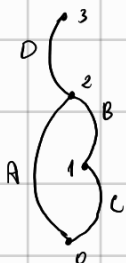
$$Y = A + (D \cdot (B + c))$$

$$Y = A + D(B + c)$$

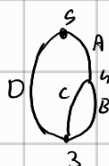
SNAP BACK:

$$Y = (A + Bc)D$$

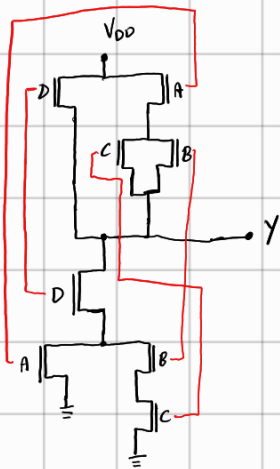
Pull Down:



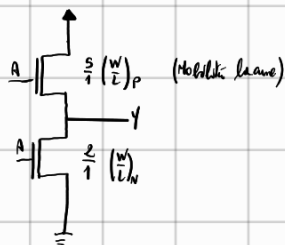
Pull up:



Punto 2 e 3



Invertitore di riferimento



Req nel caso peggiore = al riferimento.

DBC stile = Resist. del singolo?

$$1) \frac{3R}{X} = \frac{R}{\frac{2}{1}} \Rightarrow X = \frac{6}{1} \Rightarrow \text{Triplo.}$$

$$2) R_D + R_B + R_C = R_I \\ 3R = R_I \Rightarrow \frac{R_I}{3} = R$$

Per determinare A:

$$R_D + R_A = R_I$$

$$\frac{R_I}{3} + R_A = R_I \Rightarrow \frac{2}{3}R_I = R_A \Rightarrow \left(\frac{W}{L}\right)_A = \frac{3}{2} \left(\frac{W}{L}\right)_I = \frac{3}{1}$$

Rele sul pull up:

AB e BC percorsi peggiori: $\left(\frac{W}{L}\right)_{AB} = \frac{10}{1}$ doppio

D è da solo, lascia sempre $\frac{5}{1}$.

MY HONEST
REACTION
TO THAT
INFORMATION

PROGETTO A MINIMA AREA:

Percorso più oneroso è DBC.

$$\gamma_{LNT} = \frac{\left(\frac{W}{L}\right)_{NT}^{-1}}{\left(\frac{W}{L}\right)_I^{-1}} \gamma_{LNTS} = \left(\frac{2}{3}\right)^{-1} \gamma_{LNTS} = 3 \gamma_{LNTS}$$

Percorso più oneroso è AB/BC su pull up:

$$\gamma_{LNT} = \frac{\left(\frac{W}{L}\right)_{NT}^{-1}}{\left(\frac{W}{L}\right)_I^{-1}} \gamma_{LNTS} = \left(\frac{2}{3}\right)^{-1} \gamma_{LNTS} = 5 \gamma_{LNTS}$$



Come si calcola il rapporto?

$$\gamma_P = \frac{\overset{\text{Rit. down}}{\gamma_{PL}} + \overset{\text{Rit. up}}{\gamma_{PH}}}{2}$$

γ_{PI}
↓
Inadattato
di riferimento

$$\gamma_{PHI} = \frac{\frac{3}{\frac{1}{2}}}{\frac{1}{\frac{1}{2}}} \gamma_{PHI2} = 3 \gamma_{PHI2}$$

Ma si fa anche intuitivamente: dimagrisco solo le stee.
Ne ho 3 invece che 1.

Si ragiona per caso peggiore: DBC

$$\gamma_{PH} = \frac{\frac{2}{\frac{1}{2}}}{\frac{1}{\frac{1}{2}}} \gamma_{PHI2} = 5 \gamma_{PHI2}$$

$$\Rightarrow \gamma_P = \frac{3 \gamma_{PHI2} + 5 \gamma_{PHI2}}{2} = 4 \gamma_{PI}$$

NOTA: RITARDO è lo stesso perché inverte
è simmetrico.

$$\gamma_{PHI2} = \gamma_{PHI2}$$

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