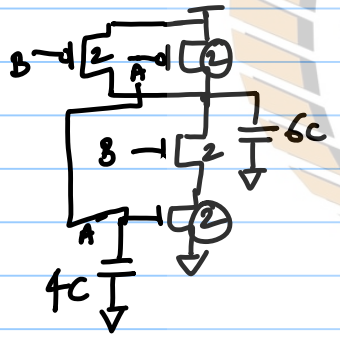
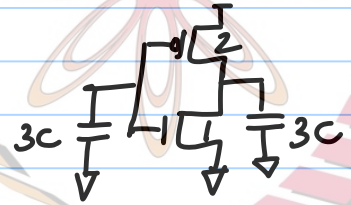
27/09/2019

EE5311

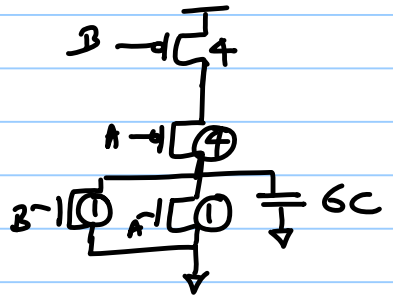
MODULE-4 - COMB CKTS





$g = \frac{4}{3}$ (LOGICAL EFFORT)

$p = \frac{6C}{3C} = 2$ (PARASITIC EFFORT)

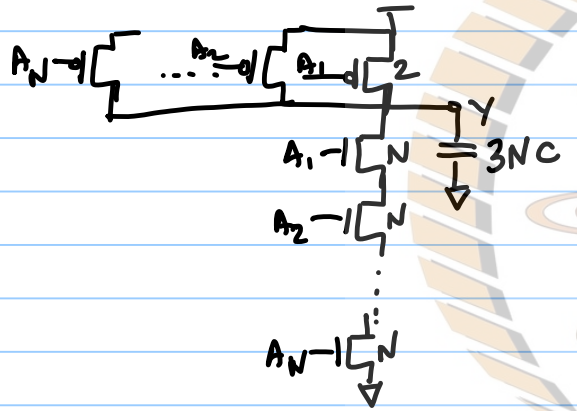


$C_A = C_B = 5C$

$g_A = g_B = 5C/3C = 5/3$

$p = 6C/3C = 2$

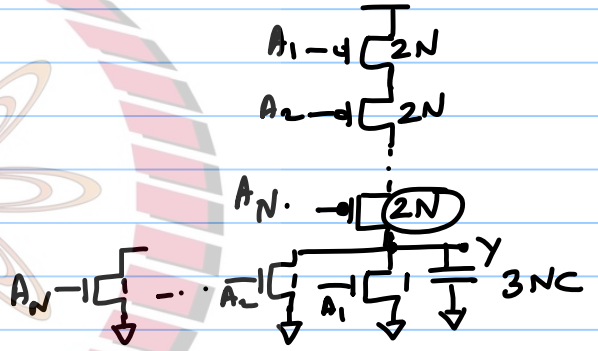
N input NAND & NOR.



$C_{A_K} = (N+2)C$

$\therefore \quad g_{A_K} = \frac{(N+2)C}{3C} = \left(\frac{N+2}{3}\right)$

$p = \frac{3NC}{3C} = N$



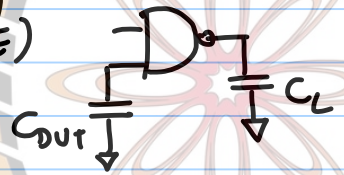
$C_{A_K} = (2N+1)C$

$g_{A_K} = \frac{(2N+1)C}{3C} = \frac{(2N+1)}{3}$

$p = \frac{3NC}{3C} = N$

$$\text{delay} = \left(\frac{C_L}{C_{OUT}}\right)\cdot\left(\frac{C_{UNIT}}{C_{INV}}\right) + p$$

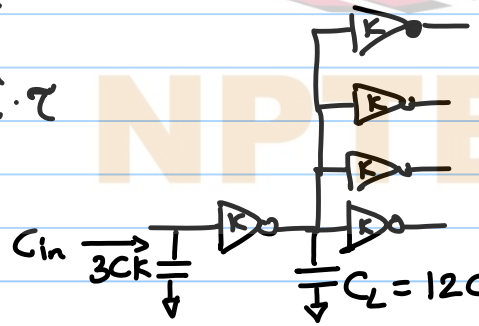
h (E·E) $\quad$ g (L·E) $\quad$ p (P·E)



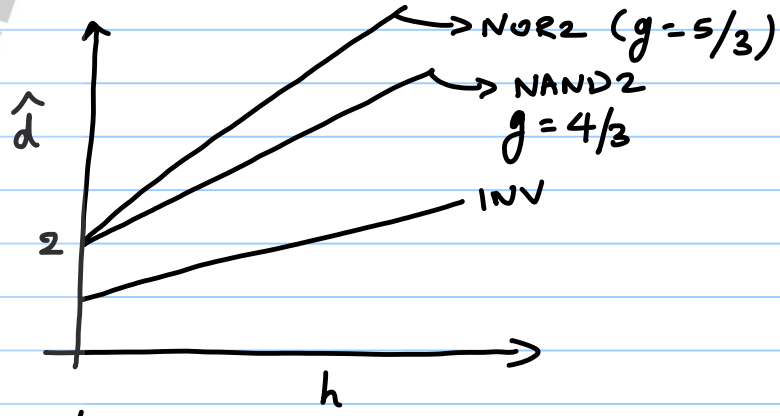
$$\hat{d} = gh + p \quad \text{(NORM. DELAY)}$$

$$\tau = 3RC$$

$$d = \hat{d}\cdot\tau$$

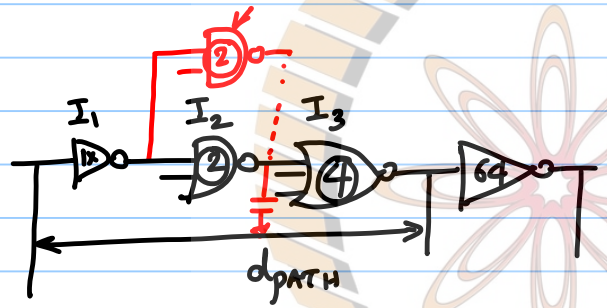


$h = 12KC/3KC = 4$



$h = C_L/C_{in} = 12C/3C = 4$

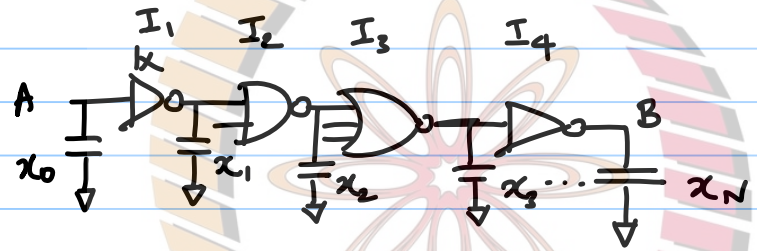
FOG DELAY = $(gh+p)\tau = (1\times4+1)\tau = 5\tau$



$d_{PATH} = \sum d_i$

	I_1	I_2	I_3
C_{in}	3C	8C	28C
C_L	(8C+8C)	28C	192C
h	(8/3)	(7/2)	(48/7)
g	1	4/3	7/3
p	1	2	3
d $(gh+p)$	(11/3)	(20/3)	19

PATH DELAY OPTIMIZATION



MINIMIZE DELAY b/w A & B.

Let $x_k \rightarrow$ Input cap of gate $(k+1)$

$$d_i = g_i h_i + p_i$$

$$h_1 = x_1/x_0.$$

$$h_k = (x_k/x_{k-1})$$

$$d = \sum g_k h_k + p_k.$$

$$= \sum g_k h_k + \underbrace{\sum p_k}_{\text{Constant number} = P = \text{PATH PARASITIC EFFORT}}$$

$$\min \left(\sum_{k=1}^{N} g_k \left(\frac{x_k}{x_{k-1}} \right) \right)$$

$$F = \prod_{k=1}^{N} g_k h_k. = \underbrace{\prod_{k=1}^{N} g_k}_{G} \cdot \underbrace{\prod_{k=1}^{N} h_k}_{H}$$

$$\frac{x_1}{x_0} \cdot \frac{x_2}{x_1} \cdot \frac{x_3}{x_2} \cdots \frac{x_N}{x_{N-1}}$$

$$= \frac{x_N}{x_0}$$

Let $f_k = g_k h_k$. $\quad \min \sum f_k. \quad \prod f_k = \text{Const}$

$$\frac{\sum f_k}{N} \geq \left(\prod f_k\right)^{1/N}$$

$$A.M \geq G.M$$