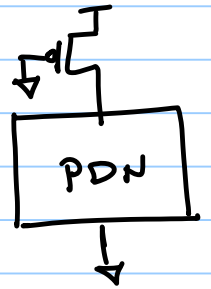
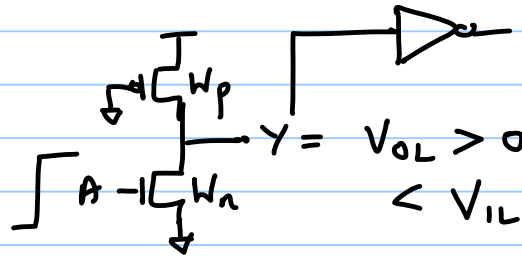
14/10/2019

EE5311

MODULE - 4 - COMBINATIONAL CIRCUITS

RATIO'ED CIRCUIT / PSEUDO NMOS LOGIC

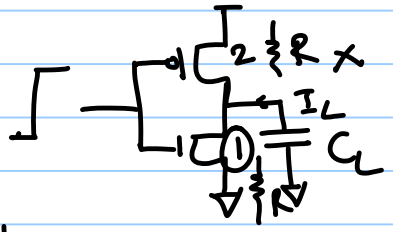


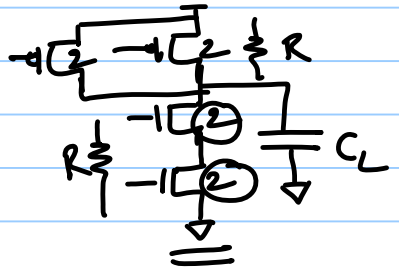


$V_{OL} \propto \frac{W_p}{W_n}$; Let $\frac{W_p}{W_n} = \alpha < 1$.

UNIT INVERTER

$$\tau = \frac{3}{4}\frac{V_{DD}}{I} \times 0.693 \cdot C$$



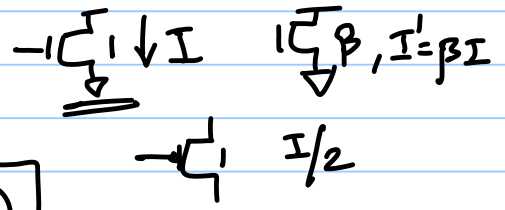


$$\tau = \frac{C\Delta V}{I}$$

$I_L = |I_n|$
OR
$I_L = |I_p|$

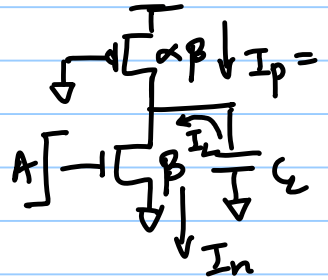
UNIT INV

PULL UP / DOWN RES = R



Let $W_n = \beta$

$\Rightarrow W_p = \alpha\beta$



$\beta = 1$??

$I_n = I_p + I_L$

$I_n = \beta I$

$I_p = (\alpha\beta/2) I$

I

$$\beta t = \frac{\alpha\beta t}{2} + t$$

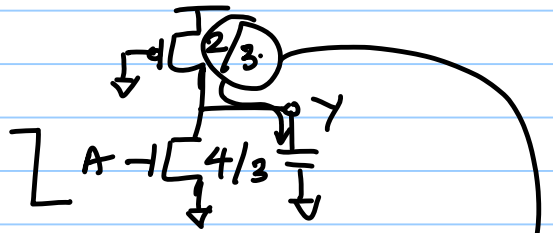
$$\Rightarrow \quad \beta(1 - \alpha/2) = 1$$

$$\therefore \quad \beta = 1/(1 - \alpha/2)$$

$$\alpha = 1/2$$

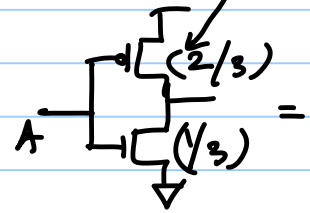
$$\Rightarrow \quad \beta = 4/3$$

UNIT INV : (PSEUDO NMOS)



$$C_A = \frac{4}{3} C$$

PULL UP :



$$C_A = C$$

$$\therefore \quad g_{pu} = 4/3 > 1$$

PULL DOWN:

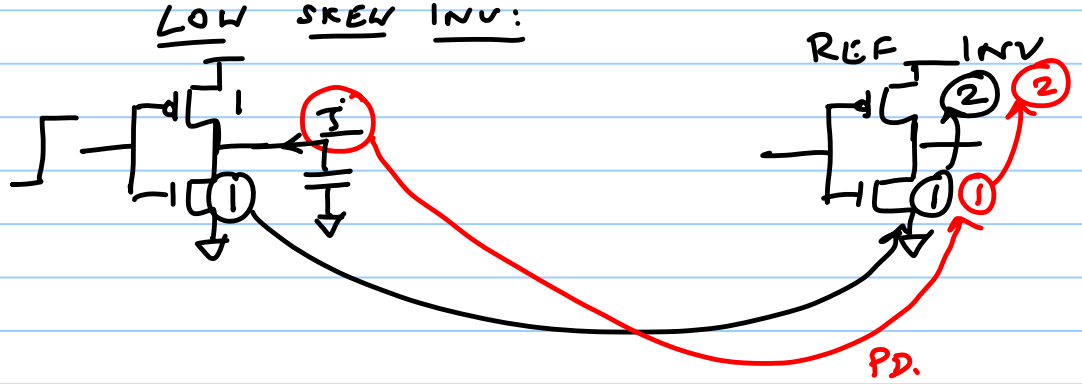
REF INV:

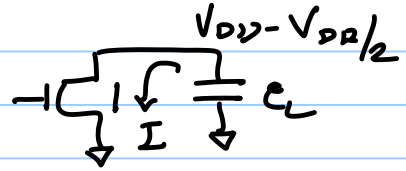
$C_A = \frac{4}{3}C$

$C_A = 3 \cdot C$

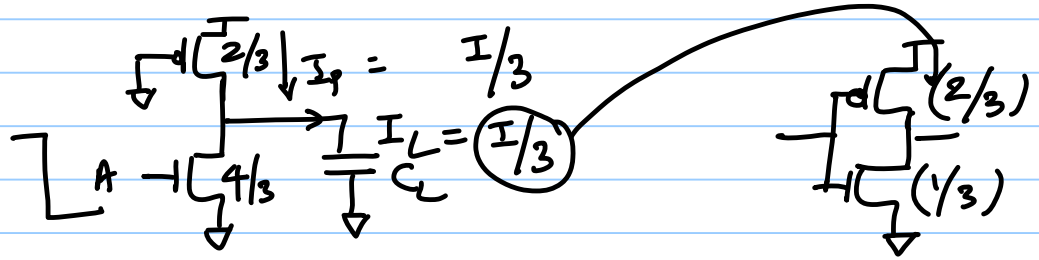
$\therefore \quad g_{pd} = 4/3 \quad < 1$

LOW SKEW INV:



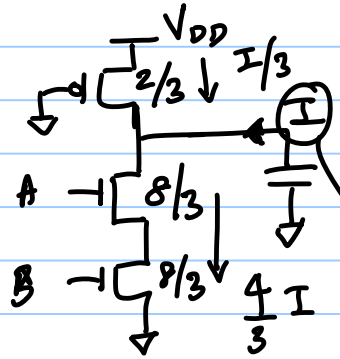


PSEUDO NMOS: PULL UP



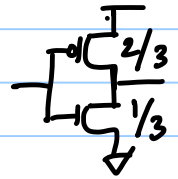
$I_L = I_p$

NAND-2 (PSEUDO NMOS)



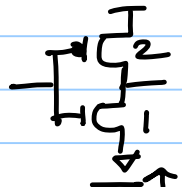
$C_A = C_B = \frac{8}{3} C$

PU



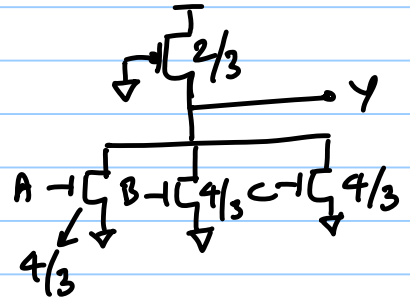
$\therefore g_u = \frac{8}{3}$

PD



$g_d = \frac{8}{9}$

NOR 3

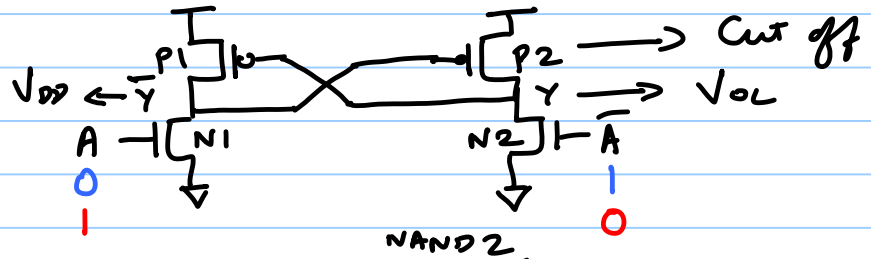


$g_u = 4/3$

$g_d = 4/9$

CASCODE VOLTAGE SWITCH LOGIC

INVERTER



NAND2