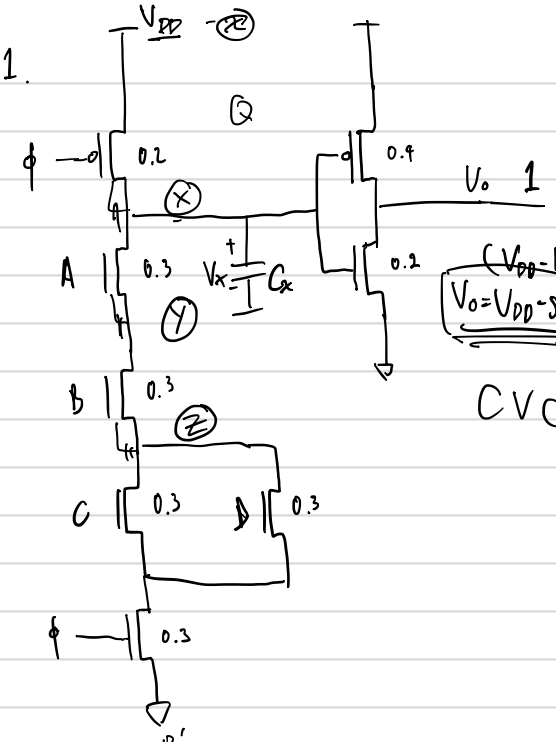
1.



AB(C+D)

$(V_{DD}-V_o)$ $CV = Q$

$V_o = V_{DD} - S$ $(V_{DD}-V_o) = ?$

$CV_{(on)} = CV_{(off)}$

$V_x = V_y = V_z = \frac{C_x V_{DD}}{C_x + C_y + C_z} =$

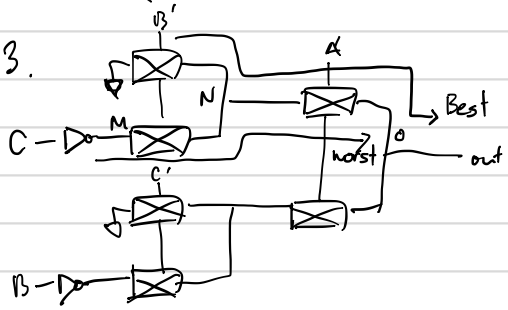
$C_x = 1(0.3+0.2) + 2(0.4+0.2) = 1.7fF$

$C_y = 1(0.3) = 0.3fF$

$C_z = 1(0.3+0.3) = 0.6fF$

Assuming $V_{DD} = 1.2V$, $V_x = 0.785\,V$

3.



Worst : $C_M = C_{eff}(6\lambda) + 2(C_{eff}(2\lambda) + C_g(2\lambda))$

$= 10\lambda \cdot C_{eff} + 2\lambda C_{eff}$

$C_N = 3C_{eff}(2\lambda)\times 2 + 2C_g(2\lambda)$

$= 12\lambda C_{eff} + 4\lambda \cdot C_g$

$C_o = 2\times 2 \times C_{eff}(2\lambda) + C_g(2\lambda)$

$= 8\lambda C_{eff} + 2\lambda C_g$

$R_{inv} = 0.5\,R_{eq}$

$\frac{1}{2}RC_M + \frac{3}{2}RC_N + \frac{5}{2}RC_o$

Assuming $L = 0.1mm$,

$\lambda = 0.05mm$

$R = 12.5k\Omega$

$= 56.25ps$

Best

Just C_N & C_o

$R(C_N + 2C_o)$

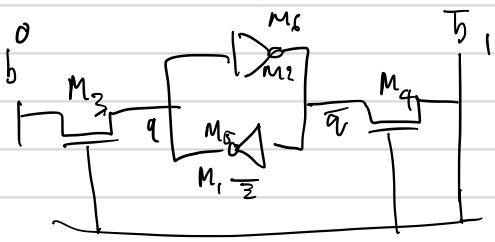
$R = 12.5k\Omega$

$= R(12\lambda C_{eff} + 4\lambda C_g + 2\times(8\lambda C_{eff} + 2\lambda C_g))$

$= R(28\lambda C_{eff} + 8\lambda C_g)$

$= 27.5ps$

4.



M_1 linear, M_3 sat

$I = 300\mu A$ Assuming $V_{dd} = 1.2$, $V_t = 0.4$, $L = 0.1\mu m$

$V_{GS1} = V_{DD} - V_{t1} = 0.8$

$V_{DS1} = V_q = 0.4$

$V_{GS2} = V_{DD} - V_q = 0.8$

$$\frac{W_1}{L_1}\frac{\mu_n C_{ox}}{1+\frac{V_{DS1}}{0.6}}\left(0.32 - 0.08\right) = \frac{W_3}{0.4+0.6} V_{sat}(0.4)^2$$

$$\frac{W_1}{W_3} = 0.329 \quad \cdots \quad (1)$$

$$W_3 = 1.466\mu m = W_4$$

$$300\mu A = \frac{W_1}{0.1\mu m}\frac{270\times 1.6}{1+\frac{0.4}{0.6}}(0.24)$$

$$W_1 = 0.482\mu m = W_2 \quad \cdots \quad (2)$$

Say $\bar{q} = 0.4$ ($V_{TS} < V_S$),

$M_{4'}$ linear

M_6 sat

$$\frac{W_{4'}}{L_{4'}}\frac{\mu_n C_{ox}}{1+\frac{0.4}{0.4}}(0.24) = \frac{W_6}{0.4+24} V_{sat}(0.4)^2$$

$$\frac{W_{4'}}{W_6} = 0.118$$

$W_{4'} = 1.466\mu m$ $W_6 = 12.45\mu m = W_5$

5. 3-LUT (>1, PLB)