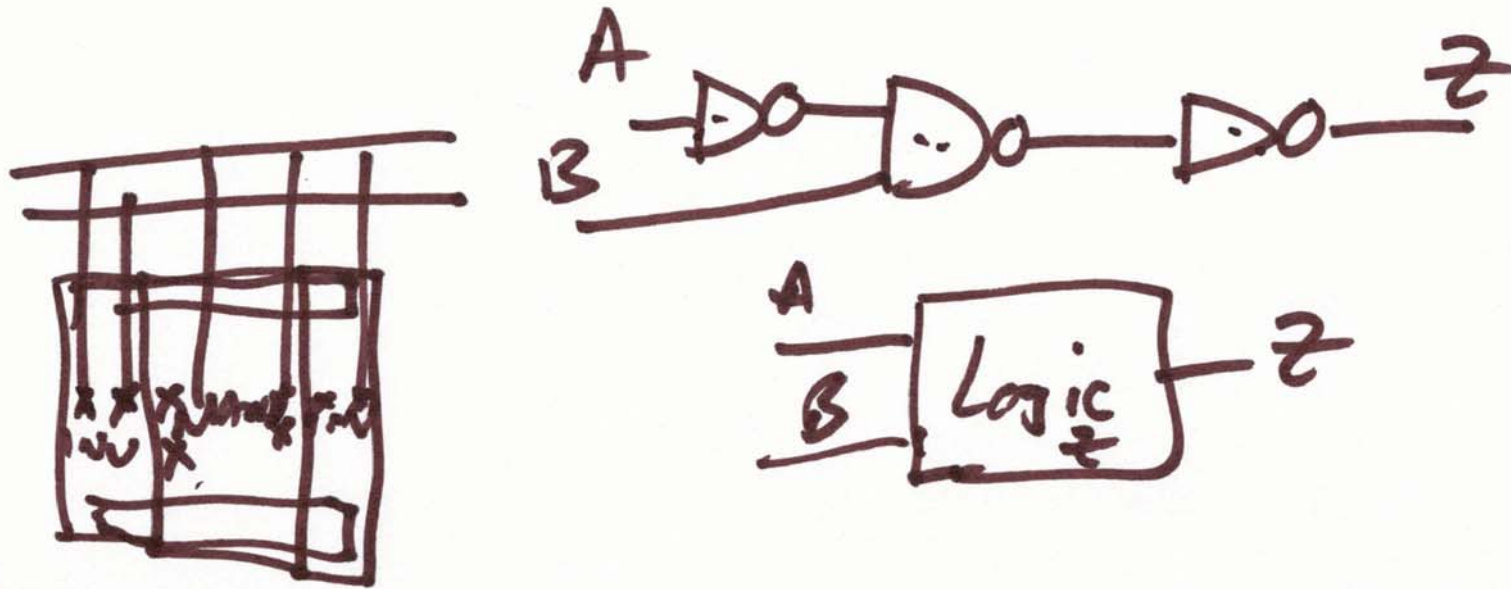


# Lecture 15

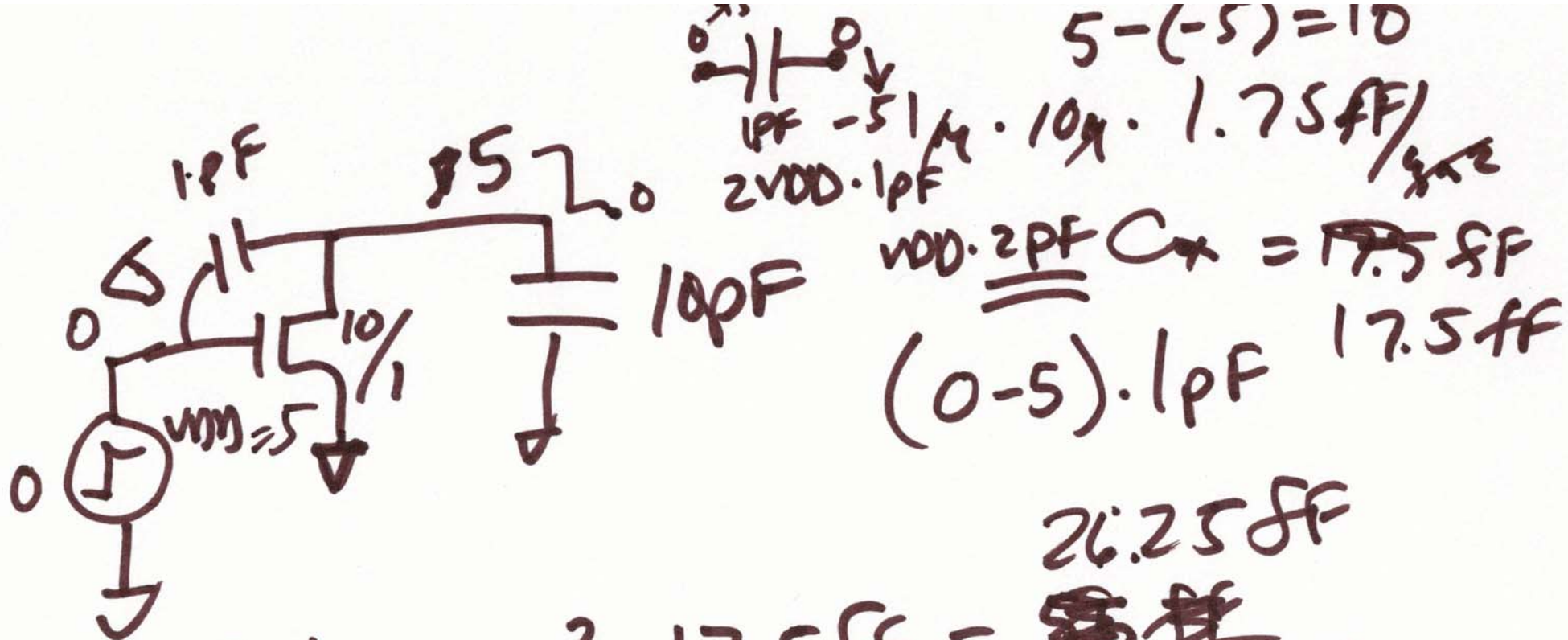
EE 421 / ECG 621

## Digital IC Design

OCT. 19, 2015



1)



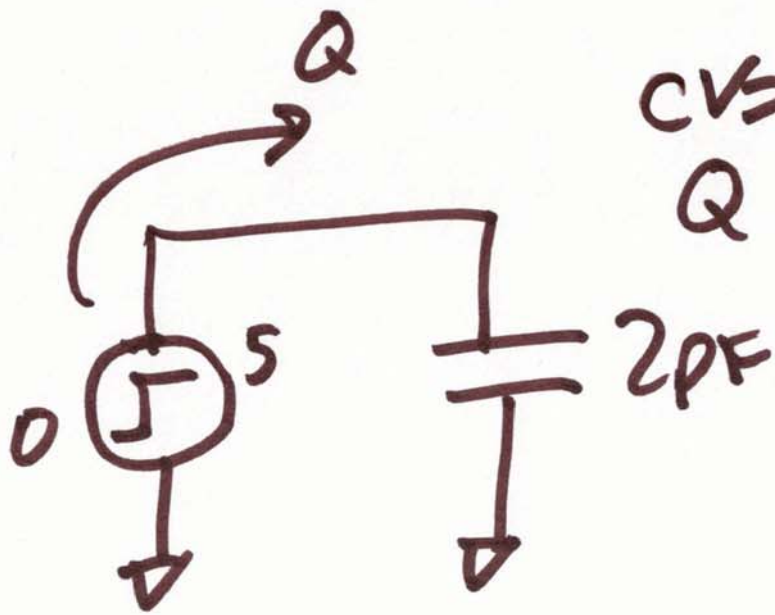
$$C_{in} = \frac{3}{2} \cdot 17.5 fF = 26.25 fF$$

$Q = CV$

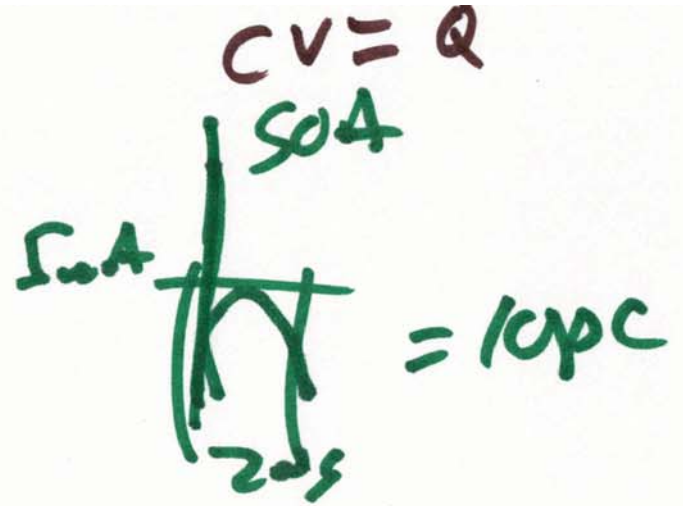
$$C_{in} = 2pF \quad Q_{in} = 5 \cdot 2.02625 pF = 10.13125 pC$$

$$C_{in\ total} = 2.02625 pF \approx 2pF$$

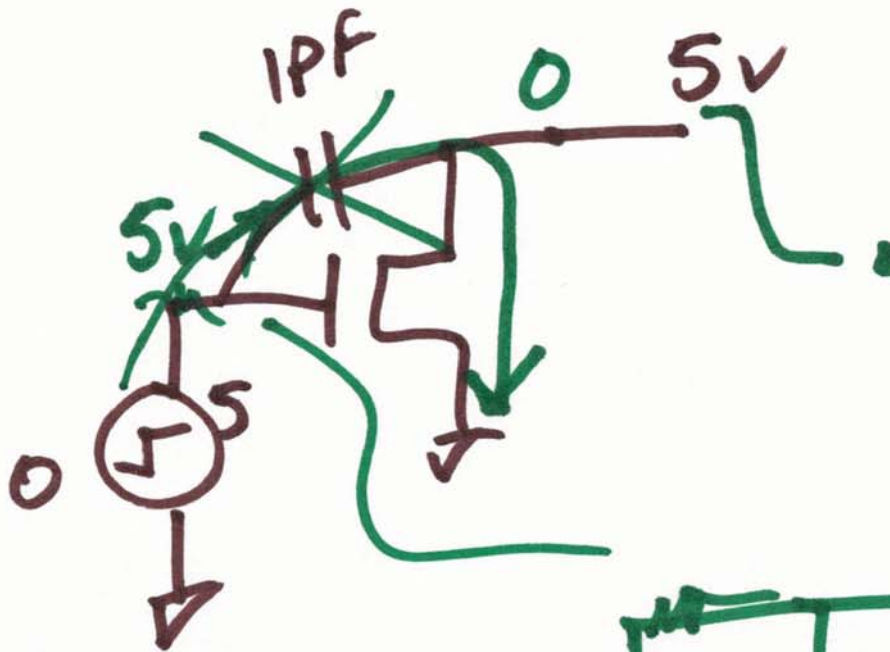
2)



$CV = Q$   
 $Q = 10pC$



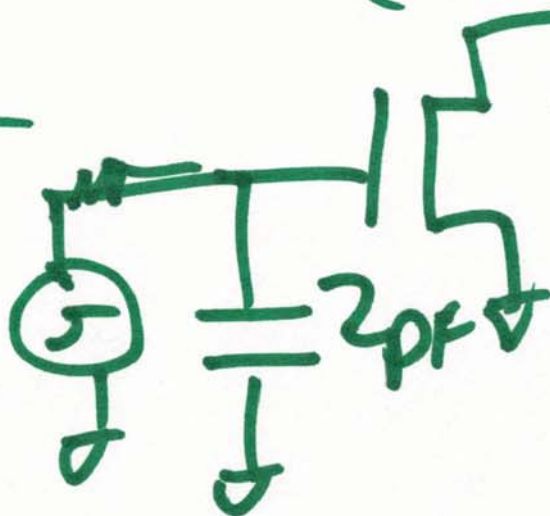
Before switching,



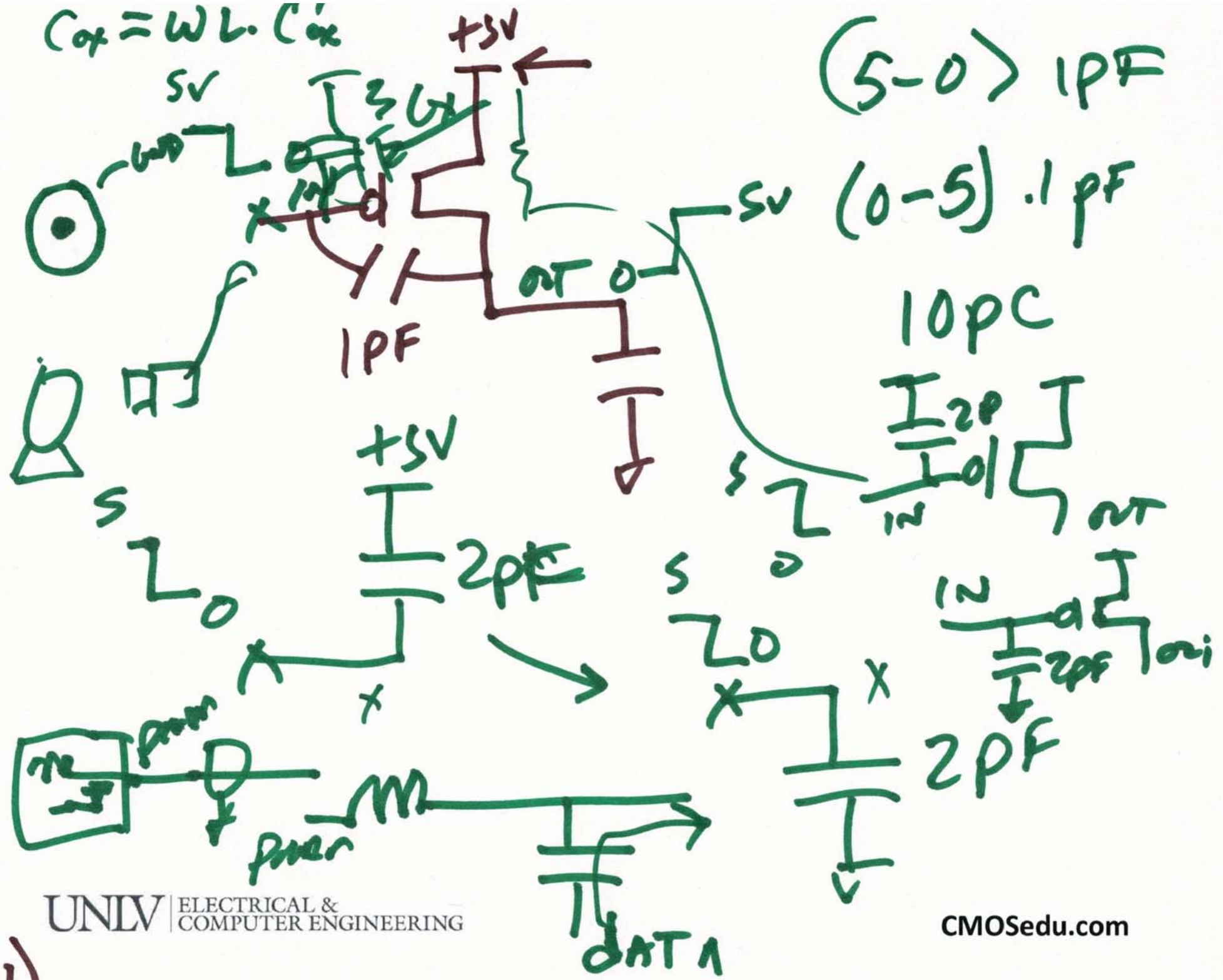
$(0 - 5) \cdot 1pF = -5pC$

$(5 - 0) \cdot 1pF = 5pC$

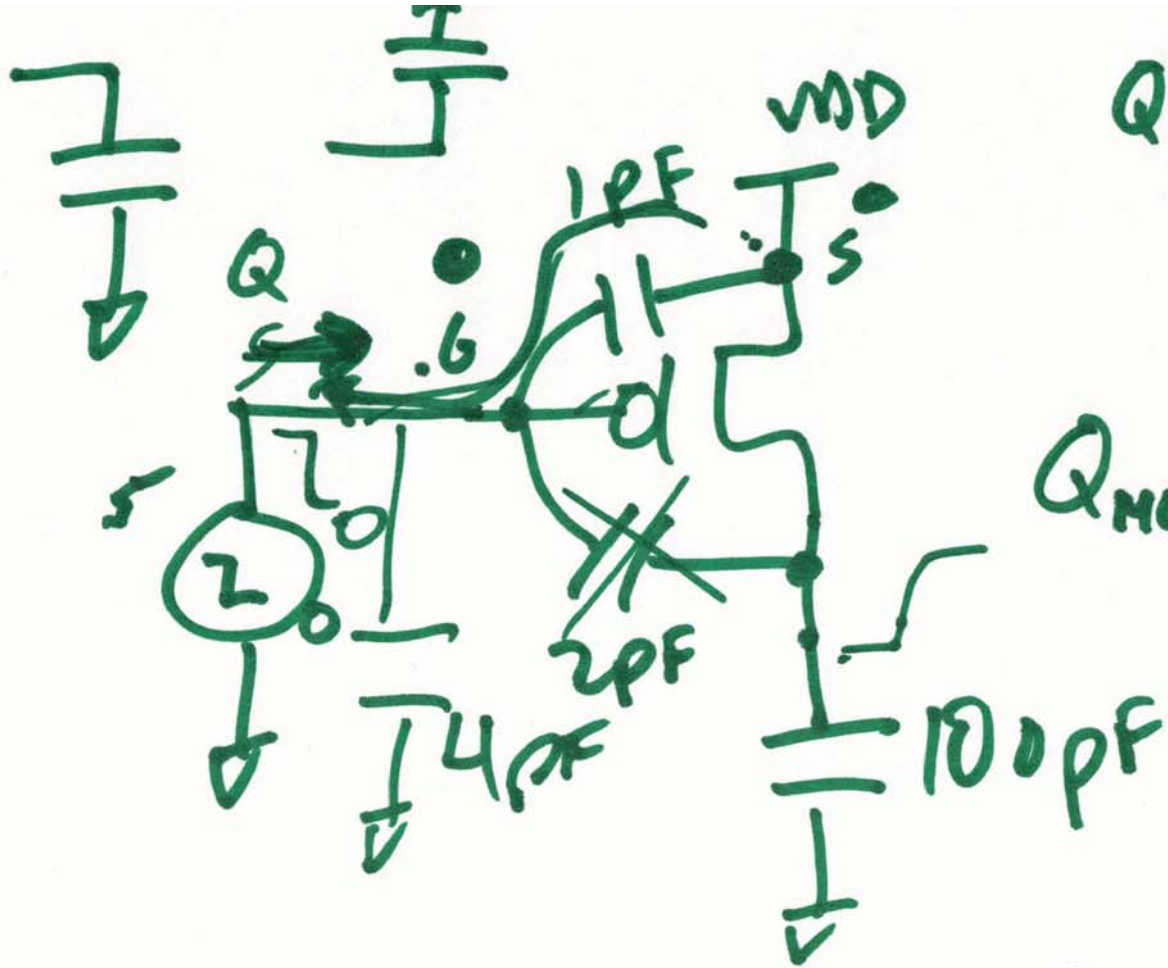
$5pC - (-5pC)$   
 $= 10pC$



3)



4)



$$Q_{1pF, G-S} \stackrel{(0-5pF)}{=} 5pF \\ = (0-5)1pF$$

$$Q_{MOSFF} \stackrel{(0-3)}{=} \frac{3}{2} (C_{ox} \cdot S) \\ = (0 - \frac{3}{2} (C_{ox} \cdot W \cdot L \cdot S))$$

$$Q_{f.b.} = (0-5) \cdot 4pF \\ = -20pF$$

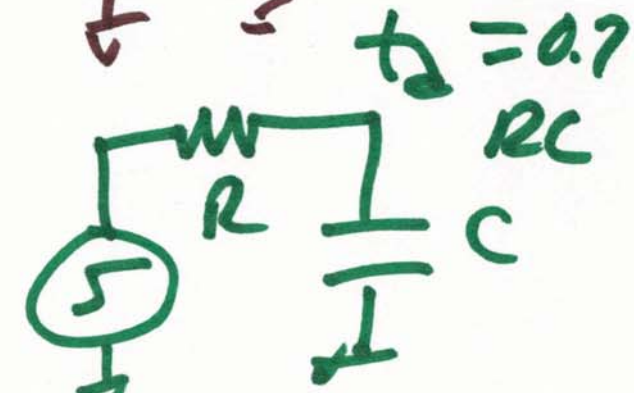
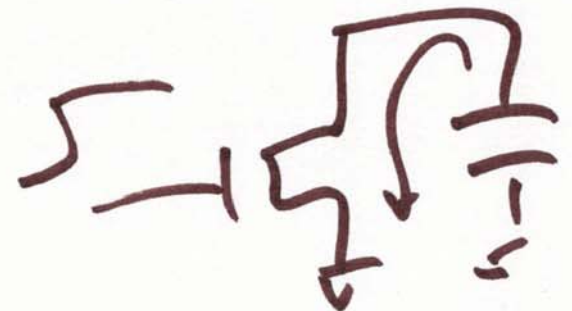
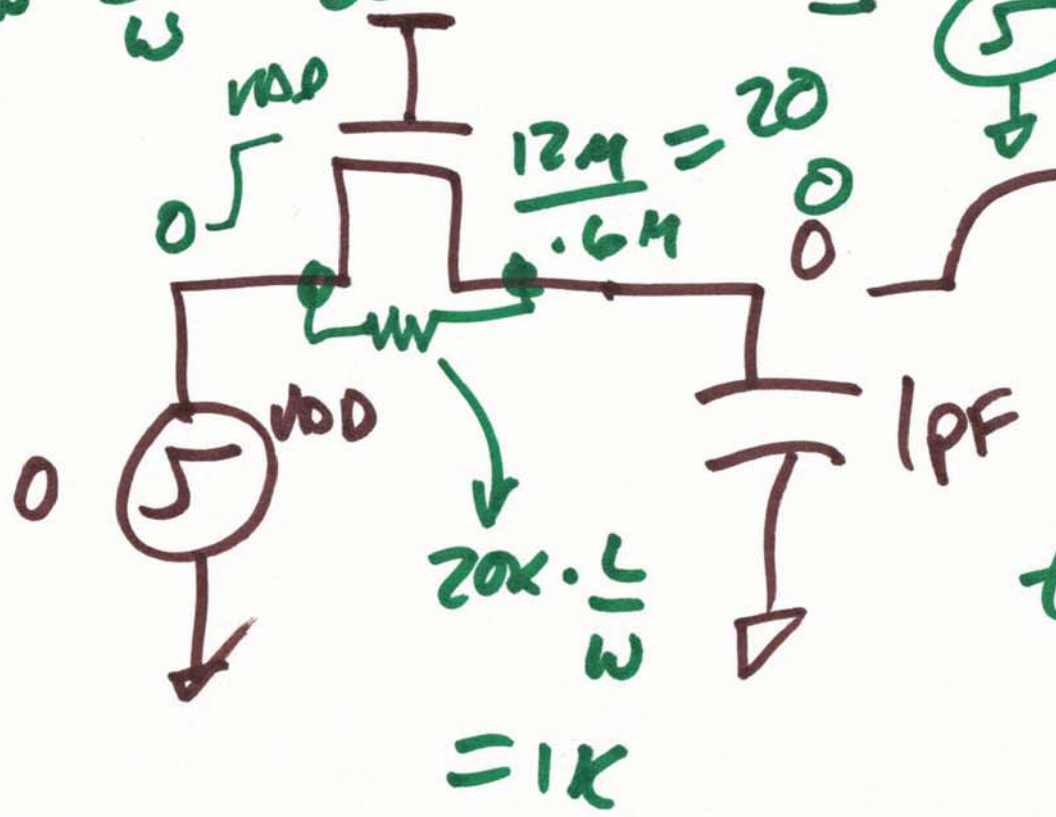
$$Q = -5pC - \frac{3}{2} C_{ox} W \cdot L$$

$$-20pF \approx \underline{\underline{-25pC}}$$

$$R_w' = 20k$$

$$R_f' = 40k$$

$$R_w = R_w' \cdot \frac{L}{W} = \frac{20k}{20} = 1k$$

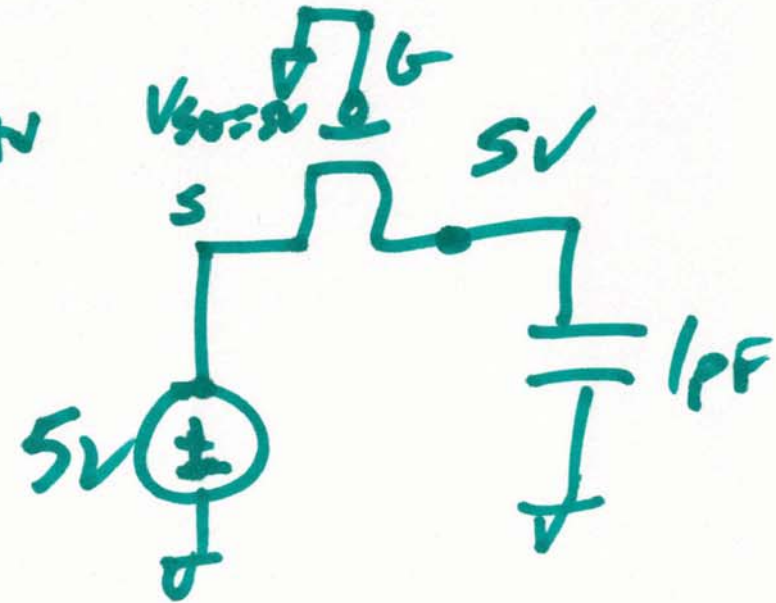
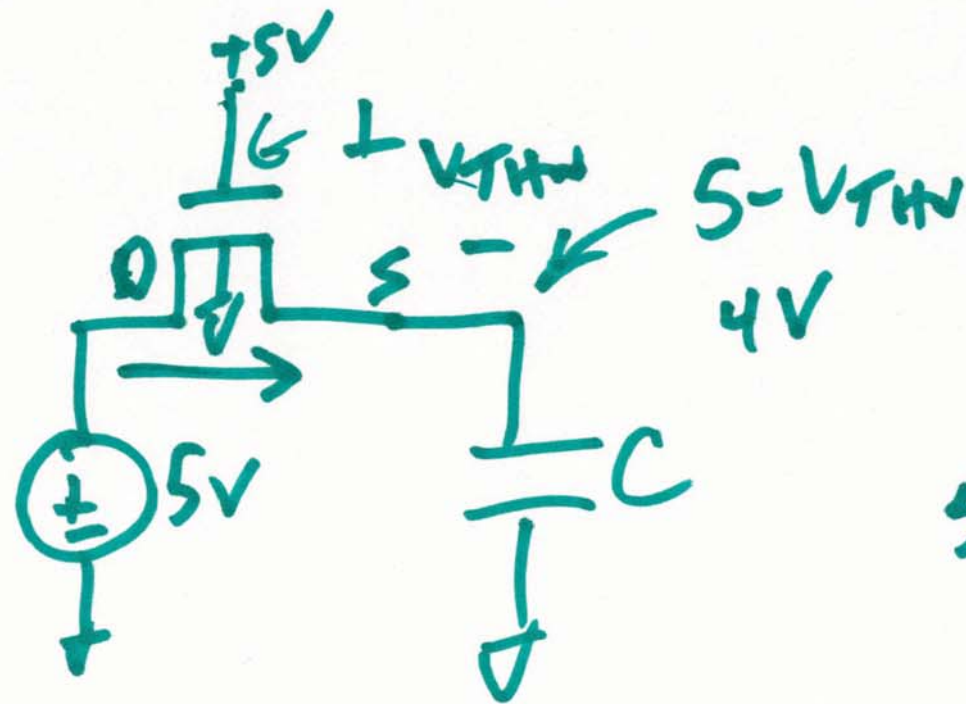


$$t_d = 0.7 RC$$

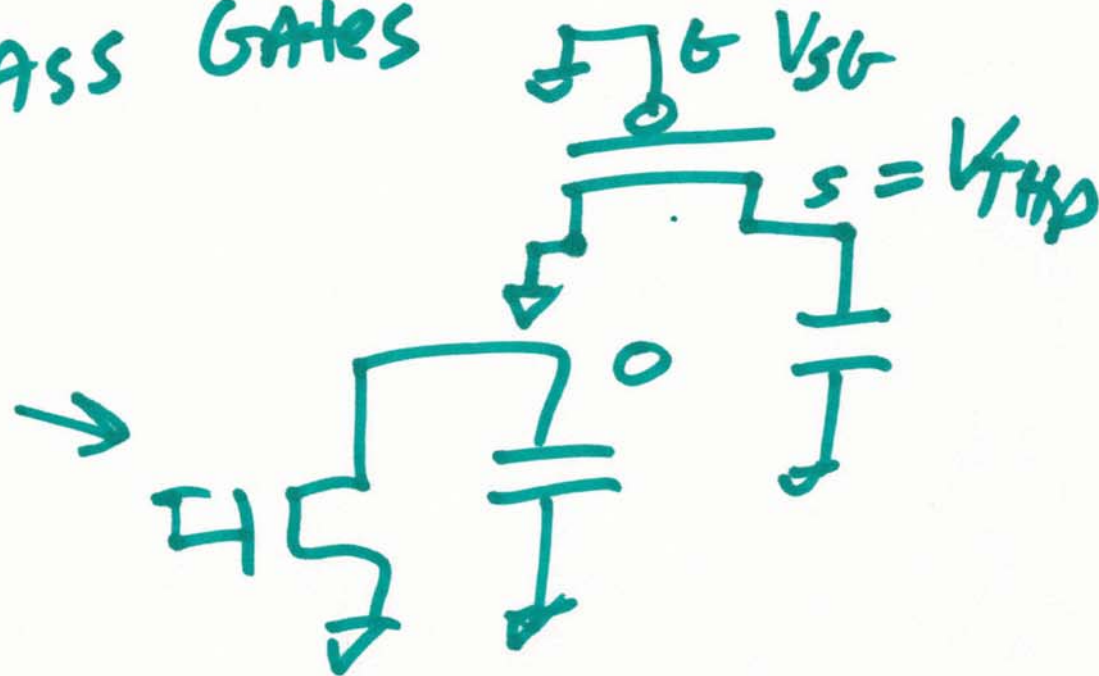
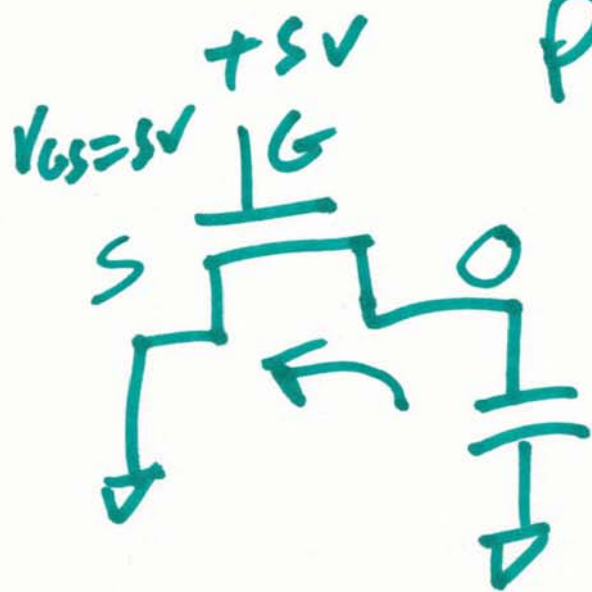
$$t_d = RC$$

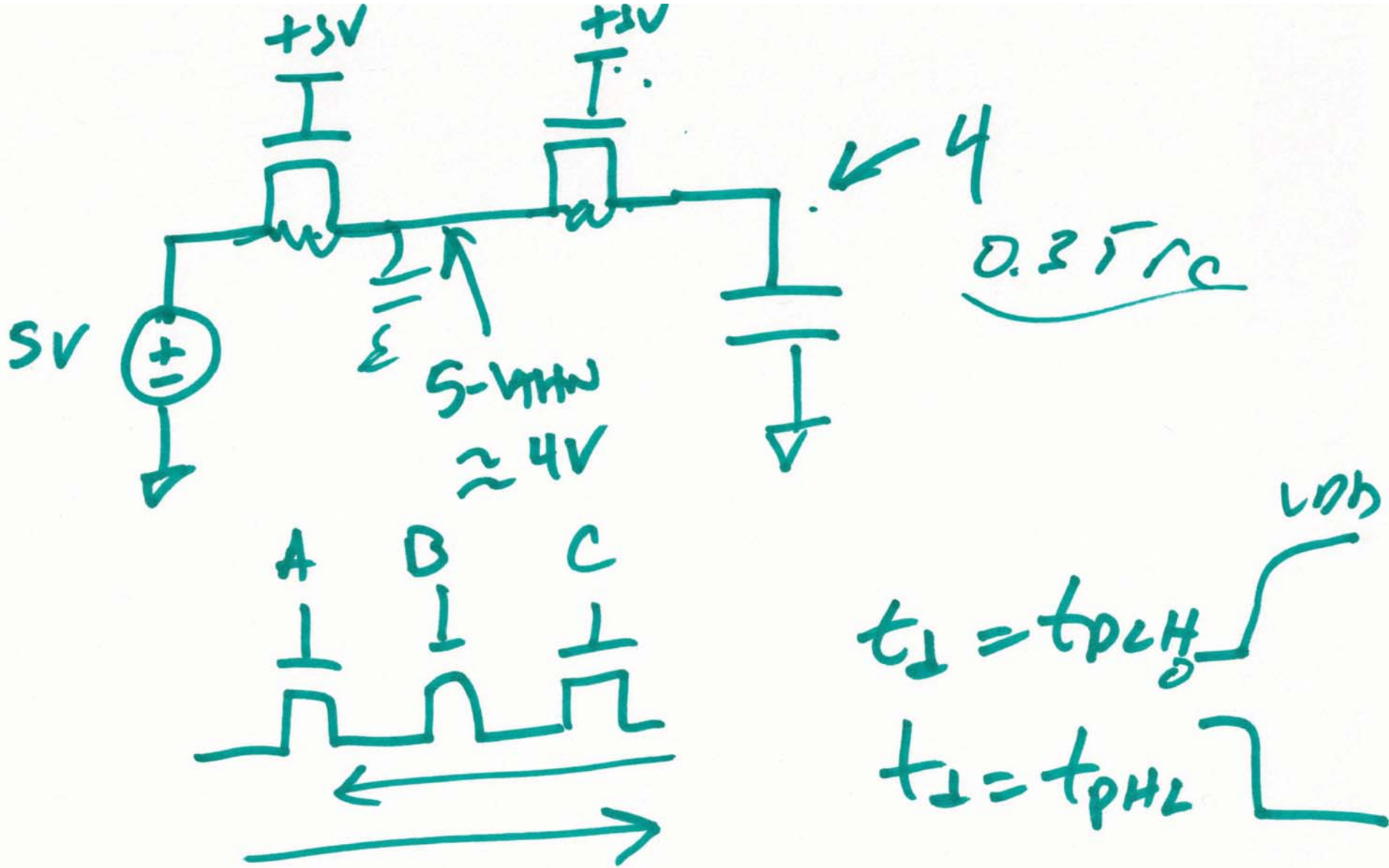
$$t_d = 1ns$$

b)



PASS GATES





8)