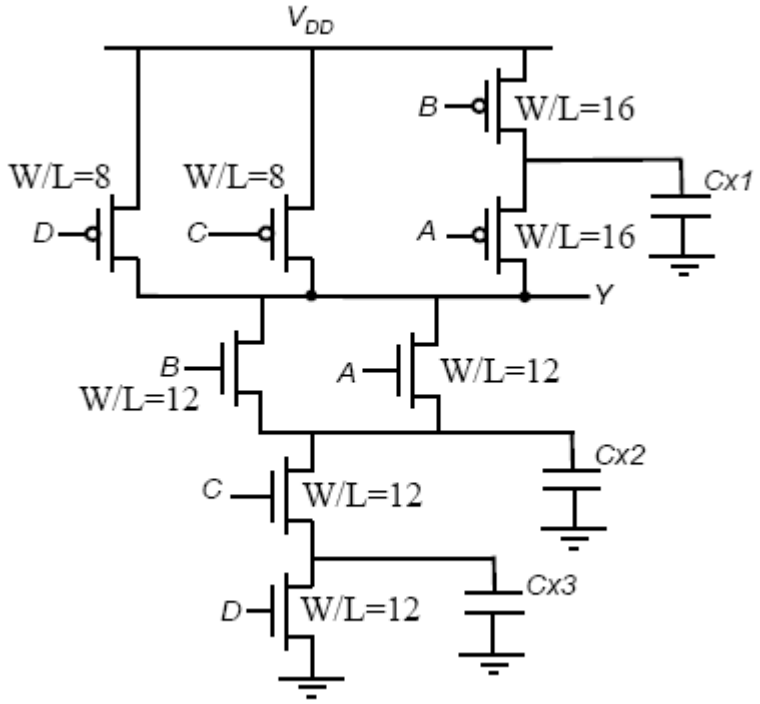
Assignment 4 Analytical Solutions

2)

(a)



(b) Worst case t_{pHL} happens when Cx2 and Cx3 have to be discharged. Input pattern before transition should be ABCD = [1010, 1110, 0110] and the final vector should be ABCD = [1011, 0111].

The worst case t_{pLH} happens when C_X1 has to be charged when the output makes a low to high transition. The input pattern before transition should be ABCD = [0111] and the final vector is ABCD = [0011].

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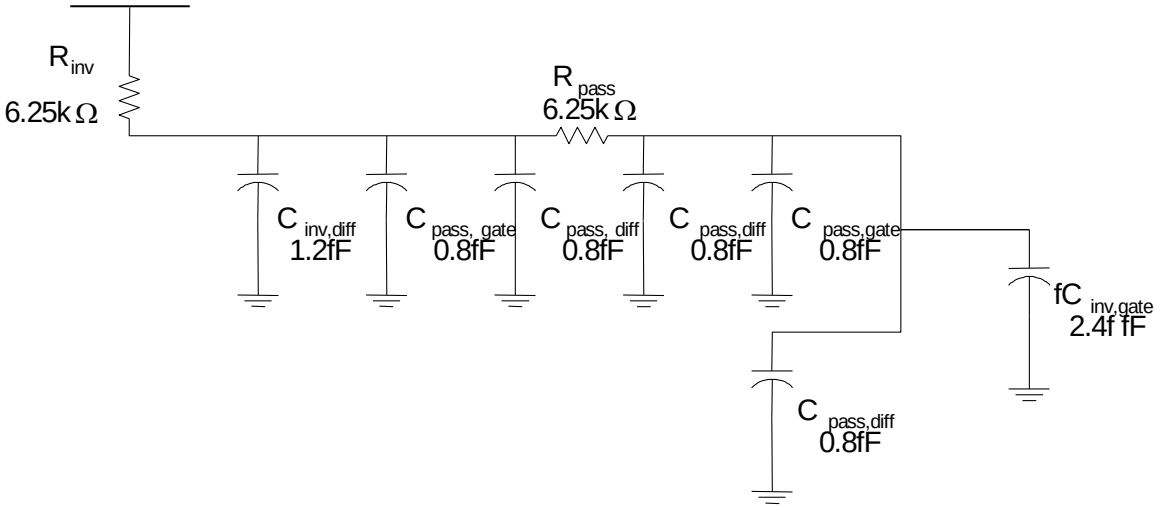
3)

a. $Out = A \cdot sel + B \cdot \overline{sel}$

b.



c. $t_{A-C} = R_{inv}\left(C_{inv,diff} + C_{pass,gate} + C_{pass,diff}\right) + \left(R_{inv} + R_{pass}\right)\left(fC_{inv,gate} + C_{pass,gate} + 2C_{pass,diff}\right)$

d. $t_{C-out} = \frac{R_{inv}}{f}\left(fC_{inv,diff} + C_{LOAD}\right) = R_{inv}C_{inv,diff} + \frac{R_{inv}C_{LOAD}}{f}$

e.

$$t = R_{inv}\left(C_{inv,diff} + C_{pass,gate} + C_{pass,diff}\right) + \left(R_{inv} + R_{pass}\right)\left(fC_{inv,gate} + C_{pass,gate} + 2C_{pass,diff}\right)$$
$$+ R_{inv}C_{inv,diff} + \frac{R_{inv}C_{LOAD}}{f}$$

$$\frac{dt}{df} = \left(R_{inv} + R_{pass}\right)\left(C_{inv,gate}\right) - \frac{R_{inv}C_{LOAD}}{f^2} = 0$$

$$f = \sqrt{\frac{R_{inv}C_{LOAD}}{\left(R_{inv} + R_{pass}\right)\left(C_{inv,gate}\right)}} = \sqrt{\frac{(6.25k)50\,fF}{\left(6.25k + 6.25k\right)\left(2.4\,fF\right)}}$$
$$= 3.2$$