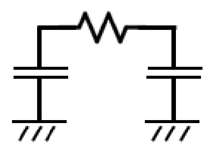
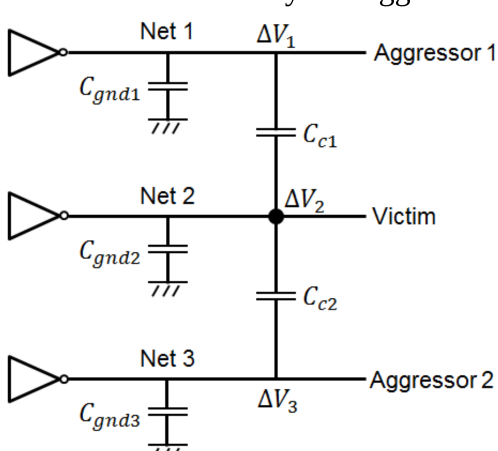
Homework Assignment 6

(Due Mar. 30th at the beginning of the class)

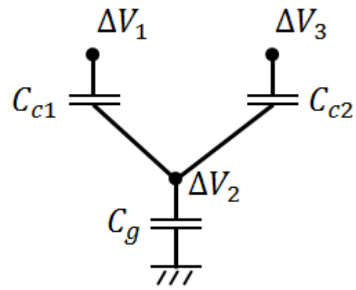
1. [Wire Resistance and Capacitance, **20 points**]
    - [**Submit**] Compute the resistance of the following wire:
        - $\rho = 2.0 \cdot 10^{-8}\ \Omega \cdot m$
        - $\varepsilon_{OX} = 2.0 \cdot 10^{-11}\ F/m$
        - width: 0.14µm
        - spacing between the wire and the ground plane: 0.28µm
        - length: 100µm
        - thickness: 0.28µm
        - spacing between two laterally-adjacent wires: 0.14µm
    - [**Submit**] Compute the area capacitance of the above wire:
    - [**Submit**] Compute the lateral capacitance of the above wire.
    - [**Submit**] Compute the fringe capacitance of the above wire.
    - [**Submit**] The above wire is driven by a buffer whose output resistance is 1kΩ. The other end of the wire is connected to a gate whose input capacitance is 5fF. Compute Elmore delay at the load. $C_{wire} = 2 * C_{area} + 2 * C_{lateral} + 4 * C_{fringe}$. Use the PI model to model the above wire.



2. [Coupling, **10 points**]
    - In real designs, a victim net is usually surrounded by multiple aggressors. The following models a victim net surrounded by two aggressors.

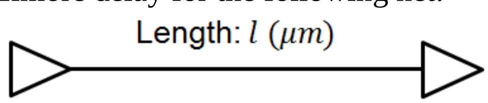


- To compute ΔV_2, we can use the following model:

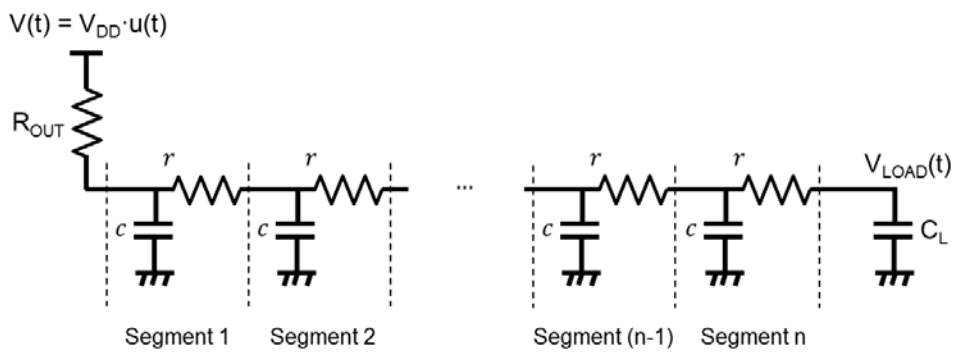


- [**Submit**] Represent ΔV_2 as a function of $\Delta V_1, \Delta V_3, C_{c1}, C_{c2}, and\ C_g$.

3. [Elmore Delay, **10 points**]
    - We want to compute Elmore delay for the following net:



    - This net is modeled as follows:



    - R_w: Total wire resistance
    - C_w: Total wire capacitance
    - $r = \frac{R_w}{n}, c = \frac{C_w}{n}$
    - [**Submit**] Compute Elmore Delay at the load when n goes to infinity. Represent the delay as a function of R_{OUT}, C_L, R_w, and C_w.