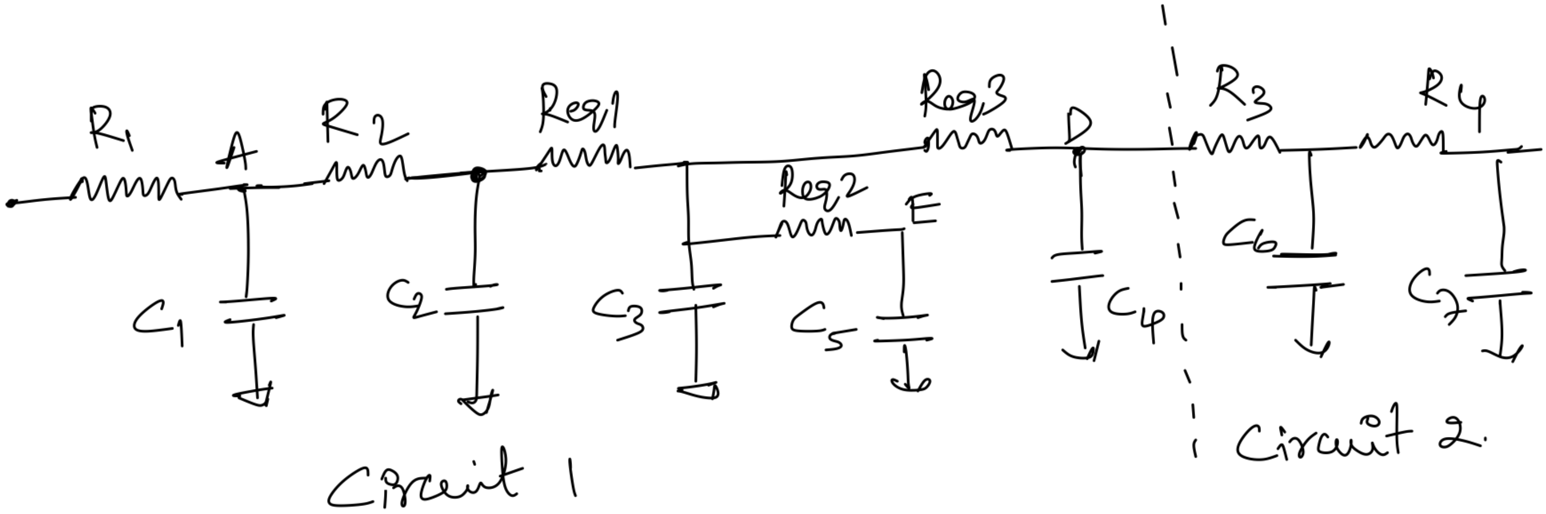
HW-3



Resistance tree diagram

Resistances are connected in parallel when on

$$\Rightarrow \frac{1}{Req.} = \frac{1}{R_1} + \frac{1}{R_2} \qquad \left[\begin{array}{c} R_{ON} = 10K\,\Omega \\ R_1 = R_2 \end{array} \right]$$

$$\frac{1}{Req} = \frac{1}{10^4} + \frac{1}{10^4} = \frac{10^4 + 10^4}{10^4 \times 10^4} = \frac{2 \times 10^4}{10^4 \times 10^4} = \frac{2}{10^4} = \frac{1}{5000}$$

$$\Rightarrow Req = 5000\,\Omega$$

For circuit 1, Elmore delay

$$T_{e1} = R_1C_1 + (R_1+R_2)C_2 + (R_1+R_2+Req_1)C_3 + (R_1+R_2+Req_1+Req_3)C_4$$

$$+ (R_1 + R_2 + Req_1)C_5$$

$$= 10 \times 10^3 \times 0.01 \times 10^{-12} + (20) \times 10^3 \times 0.02 \times 10^{-12} + 2 \times 10^3 \times 0.03 \times 10^{-12}$$

$$+ 30 \times 10^3 \times 0.02 \times 10^{-12} + 25 \times 10^3 \times 0.01 \times 10^{-12}$$

$$\Rightarrow 210 \times 10^{-11}$$

$= 2.1\, nS$

For circuit 2,

Elmore delay $T_{e_2} = R_3 \times C_6 + (R_3 + R_4) \times C_7$

$= 10 \times 10^3 \times 0.01 \times 10^{-12} + (10+10) \times 10^3 \times 0.02 \times 10^{-12}$

$= 50 \times 10^{-11}$

$= 0.5\, nS$

Given elmore delay for circuit 1 is required for 90% of load swing

$T_{e_1} = 2.1 \times 2.3$

$= 4.83\, nS$

Elmore delay for circuit 2 is required for 50% of logic swing.

$T_{e_2} = 0.5 \times 0.69$

$= 0.345\, nS$

Total elmore delay $= T_{e_1} + T_{e_2}$

$= 4.83 + 0.345$

$\boxed{\text{Total elmore delay} = 5.175\, nS}$