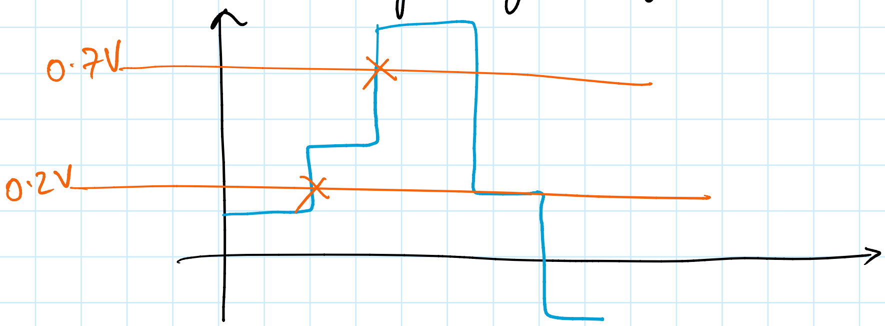
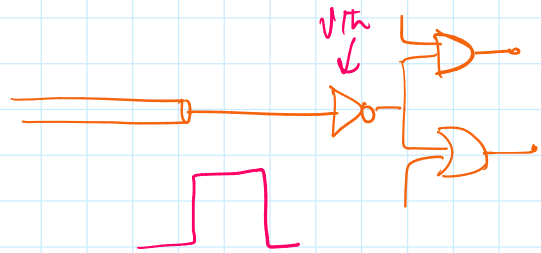
Lec-7

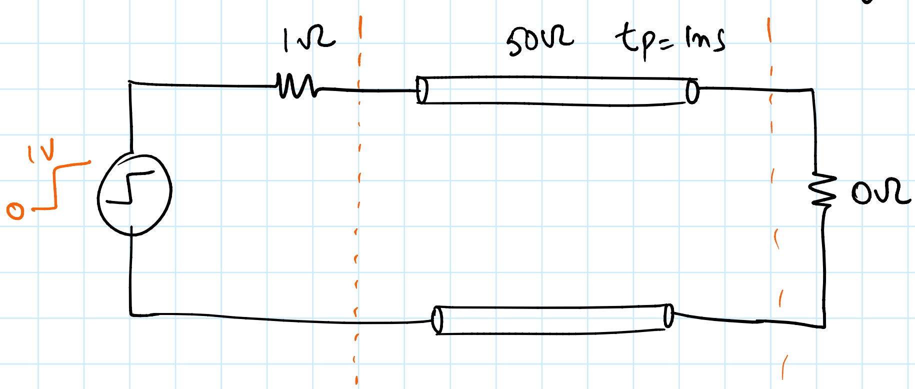
Friday, January 24, 2020 8:59 AM

Problem of digital logic due to reflections





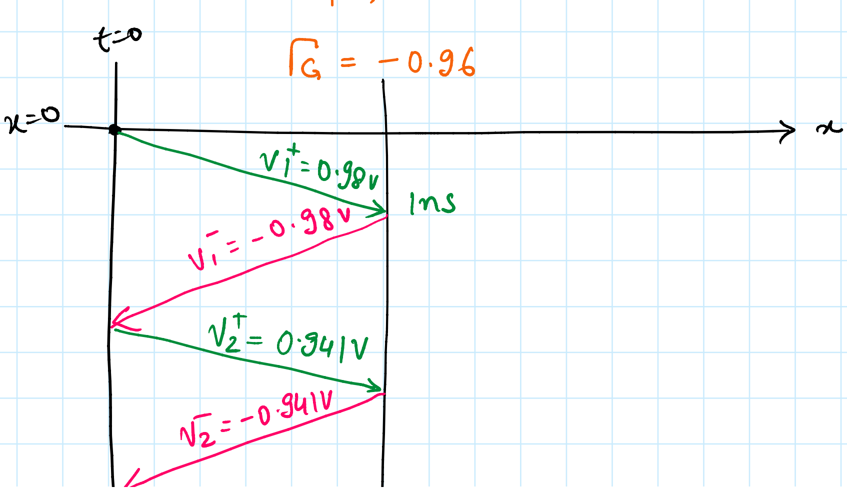
Transmission Line Terminated by a short.



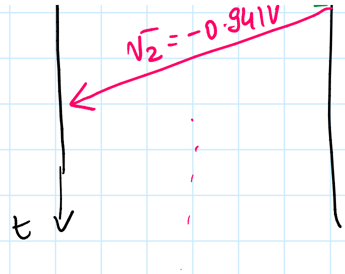
$$\Gamma_G = \frac{1-50}{1+50} = -\frac{49}{51}$$

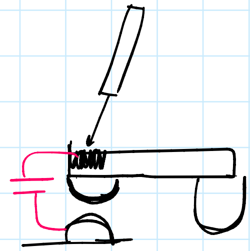
$$\Gamma_L = -1$$

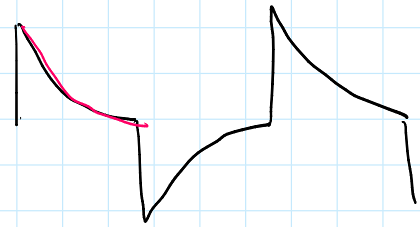
$$\Gamma_G = -0.96$$



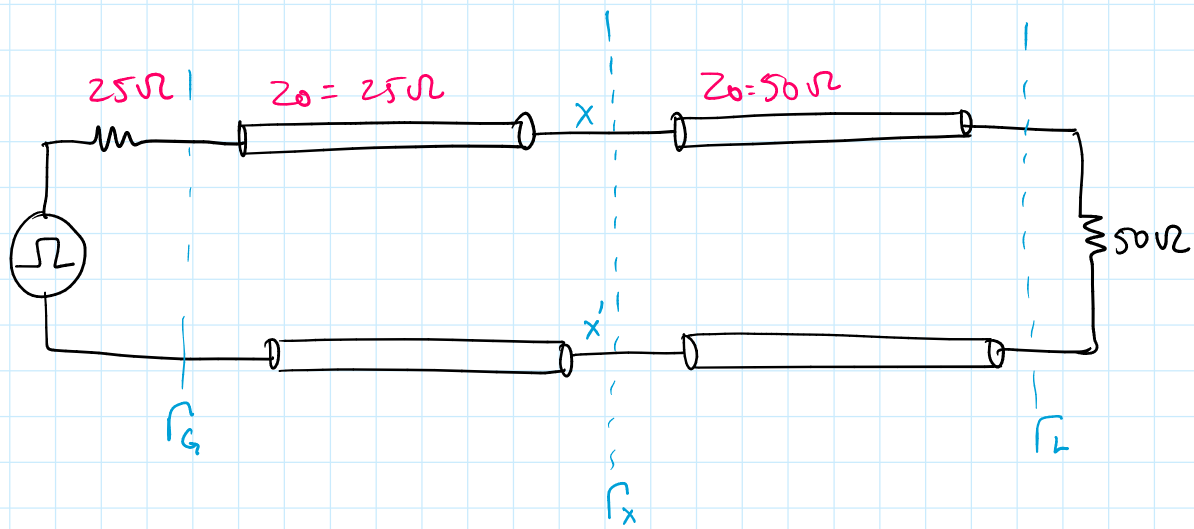
$$V_1^+ = \frac{50}{51} \cdot 1V$$







Connection of Tx Lines with different characteristic impedance



Estimating V & I at any point in a transmission line

$$V(l) = V^+ e^{\gamma l} \left\{ 1 + \Gamma(l) \right\} \quad — (1)$$

$$I(l) = \frac{I^+}{Z_0} e^{\gamma l} \left\{ 1 - \Gamma(l) \right\} \quad — (2)$$

$$\boxed{\Gamma(l) = \frac{V^+ e^{-\gamma l}}{V^- e^{\gamma l}}}$$

Divide eq (1) & (2)

$V^{-} e^{\gamma \ell}$

$\Gamma(\ell) = \Gamma_L e^{-2\gamma \ell}$

Divide eq (1) & (2)

$\Gamma_L = \frac{V^+}{V^-}$

Reflection coefficient at the load end

$$Z(\ell) = \frac{V(\ell)}{I(\ell)} = Z_0 \left\{ \frac{1 + \Gamma(\ell)}{1 - \Gamma(\ell)} \right\} \quad -(3)$$

Impedance seen at any point in a transmission line.

$$\Gamma(\ell) = \frac{Z(\ell) - Z_0}{Z(\ell) + Z_0} \quad -(4)$$

$$Z(\ell) = Z_0 \left\{ \frac{1 + \Gamma_L e^{-2\gamma \ell}}{1 - \Gamma_L e^{-2\gamma \ell}} \right\}$$

$$\boxed{\Gamma_L = \frac{Z_L - Z_0}{Z_L + Z_0}}$$

$$\boxed{Z(\ell) = Z_0 \left\{ \frac{1 + \frac{Z_L - Z_0}{Z_L + Z_0} \cdot e^{-2\gamma \ell}}{1 - \frac{Z_L - Z_0}{Z_L + Z_0} e^{-2\gamma \ell}} \right\}}$$

Impedance Transformation Relation.

$$\boxed{Z(\ell) = Z_0 \left\{ \frac{Z_L \cosh \gamma \ell + Z_0 \sinh \gamma \ell}{Z_0 \cosh \gamma \ell + Z_L \sinh \gamma \ell} \right\}}$$

$$\cosh \gamma \ell = \frac{e^{\gamma \ell} + e^{-\gamma \ell}}{2}$$

$$\sinh \gamma \ell = \frac{e^{\gamma \ell} - e^{-\gamma \ell}}{}$$

$$\sinh \gamma l = \frac{e^{\gamma l} - e^{-\gamma l}}{2}$$