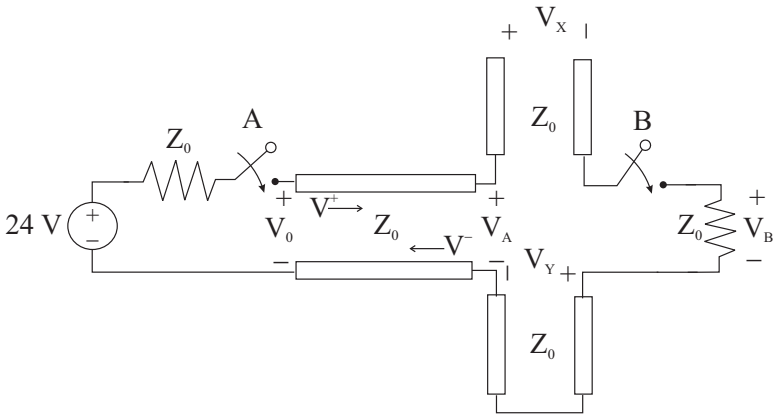
ECE 3025 Homework 3: Charged Lines and Short Pulses

1. **Switching Network 1:** The circuit below is switched according to these sequential switching states:

   - State 0: Both switches are open and all lines are uncharged.
   - State 1: Immediately after switch A is closed.
   - State 2: Switch A has been closed for a while.
   - State 3: Immediately after switch B is closed.
   - State 4: Switch B has been closed for a while.
   - State 5: Immediately after switch A is opened.
   - State 6: Switch A has been open for a while.

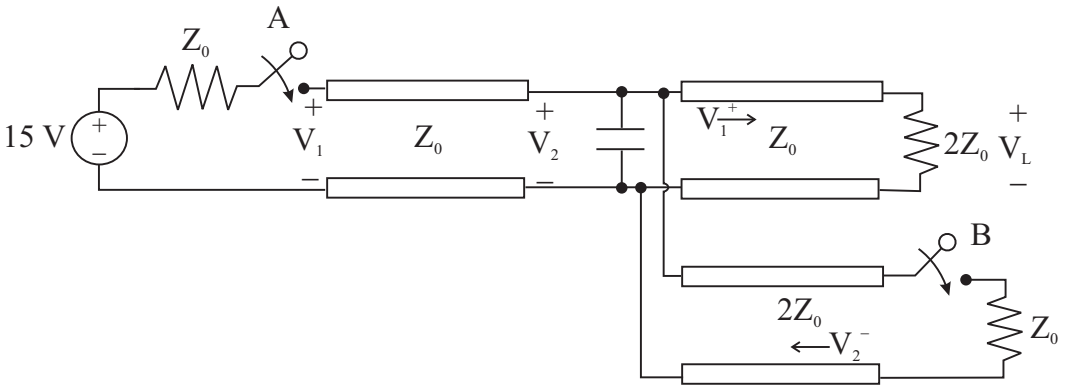


Fill out the following table according to these switching states. Note that V^+ is measured at the generator side and V^- is measured at the load side:

	V_0	V^+	V^-	V_A	V_B	V_X	V_Y
State 0	0	0	0	0	0	0	0
State 1							
State 2							
State 3							
State 4							
State 5							
State 6	0	0	0	0	0	0	0

2. **Switching Network 2:** The circuit below represents a high-speed digital interconnect that is switched according to the following states:

   - State 0: Both switches are open and both lines are uncharged.
   - State 1: Immediately after switch A is closed.
   - State 2: Switch A has been closed for a while.
   - State 3: Immediately after switch B is closed.
   - State 4: Switch B has been closed for a while.

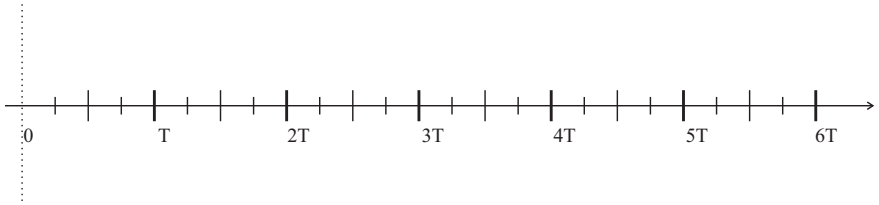


Fill out the following table according to these switching states. Assume all backwards propagating waves are measured from the right-most side of the transmission line. Assume all forward propagating waves are measured from the left-most side of the transmission line.

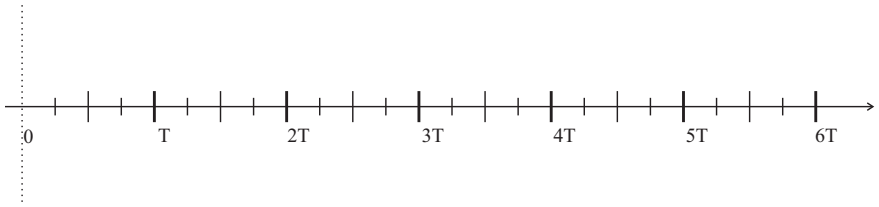
	V_1	V_L	V_2	V_1^+	V_2^-
State 0	0	0	0	0	0
State 1		0	0		0
State 2					
State 3					
State 4					

3. **Reflection Sketches:** There is an uncharged transmission line with transit time T, length D, and reflection coefficients $\Gamma_G = \frac{1}{2}$ and $\Gamma_L = -\frac{2}{3}$. At $t = 0$ an **ideal impulse**, $f(t) = 18\delta(t)$, enters the source-side of the line. Sketch the following functions of time in the space provided below. Please label the amplitudes of your pulses and show the appropriate modulus (sign) and relative increasing/decreasing behavior of amplitudes.

   a. The voltage observed at the load side of the transmission line:



   b. The voltage observed at the source side of the transmission line:



   c. The voltage observed exactly **three-quarters** ($z = \frac{3D}{4}$) down the transmission line: