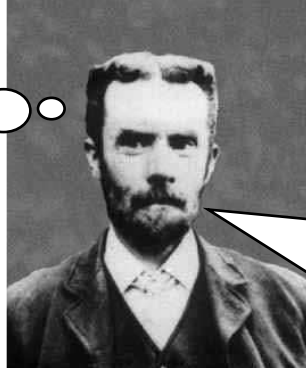*University of Portland*
School of Engineering

EE 301-Electromagnetic Fields-3 cr. hrs.
Spring 2011

You will pay a heavy price for giving these students such tough tests and scaring them to death Inaaan! @*$*#&ΧΘχ@*§ξ!

Best of luck to you EE 301 students and please, demonstrate to Inan that unlike what everyone might think, his tests are nothing but simply a piece of cake! (Bring his fame down about giving challenging exams!)

Midterm Exam # 1
(Prepared by Professor A. S. Inan)

(Friday, March 4, 2011)
(Closed Book Exam; 1 Formula Sheet Allowed)
(Total Time: 55 mins.)

Name:_____ ☺

*Signature:*_____ ☺

"Honesty is the best policy."
Aesop (~ 620B.C. −?)

"An honest mind possesses a kingdom."
Lucius Annaeus Seneca (4B.C.–65A.D.)

"Honest people are the true winners of the universe."
Anonymous

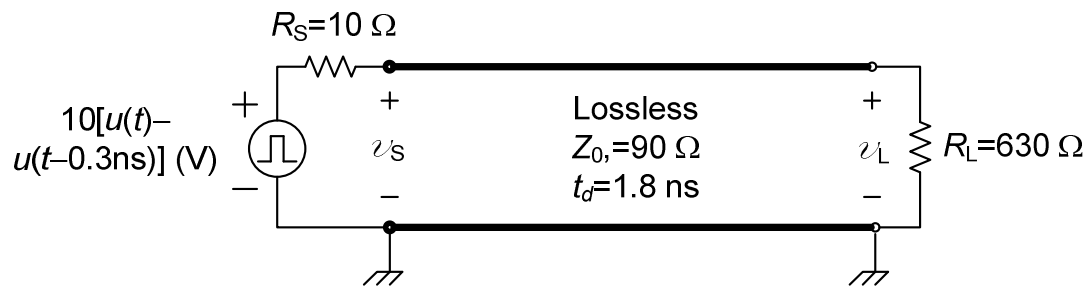*"Honesty is not for sale."*
A. Inan

(1) (15 mins., Total: 32.5 points) **Step excitation of a lossless line.** A uniform, lossless transmission line is excited with a step source as shown.
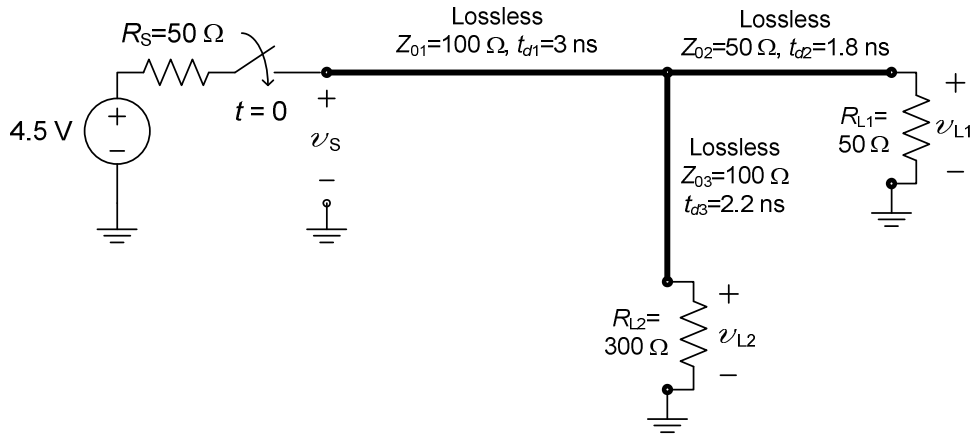
(a) (20 points) Provide an appropriate bounce diagram and use it to sketch both the source-end voltage v_S and the load-end voltage v_L as a function of time between 0 and 10 ns. Provide all the pertinent values on your sketches.

R_S=10 Ω

10$u(t)$ (V)

v_S

+

−

Lossless
Z_0,=90 Ω
t_d=1.8 ns

+

v_L

−

R_L=630 Ω
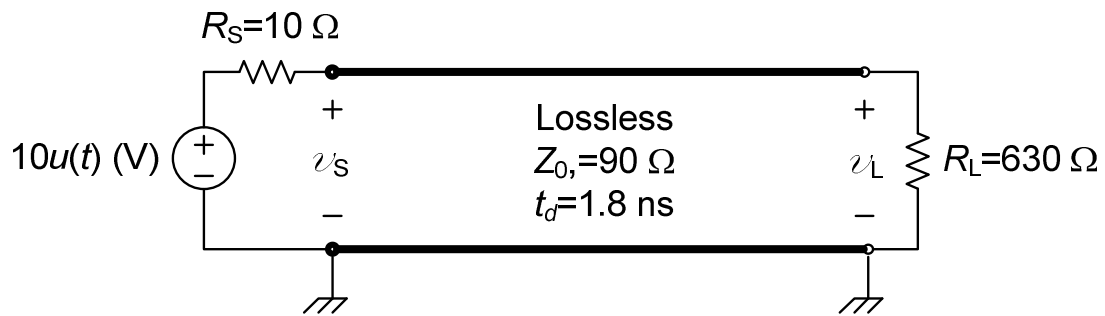
(b) (12.5 points) Redo part (a) if the step source was a pulse source with 0.3 ns pulse width as shown.

$R_S = 10\ \Omega$

$10[u(t)-u(t-0.3\text{ns})]\ (V)$

$+$

v_S

$+$

Lossless
$Z_0 = 90\ \Omega$
$t_d = 1.8$ ns

$+$

v_L

$R_L = 630\ \Omega$

(2) (15 mins., 32.5 points) **Multiple transmission lines.** For the three transmission-line circuit shown, the switch closes at $t = 0$. Assuming all the lines to be uncharged before $t = 0$, sketch voltages $\mathcal{v}_S$, $\mathcal{v}_{L1}$ and $\mathcal{v}_{L2}$ between $t = 0$ to 10 ns. Use bounce diagram. Provide all the pertinent values on your sketch.

Lossless
$Z_{01}=100\,\Omega,\ t_{d1}=3$ ns

Lossless
$Z_{02}=50\,\Omega,\ t_{d2}=1.8$ ns

$R_S=50\,\Omega$

4.5 V

$t = 0$

$+$
$\mathcal{v}_S$
$-$

$R_{L1}=$
$50\,\Omega$

$+$
$\mathcal{v}_{L1}$
$-$

Lossless
$Z_{03}=100\,\Omega$
$t_{d3}=2.2$ ns

$R_{L2}=$
$300\,\Omega$

$+$
$\mathcal{v}_{L2}$
$-$

(3) (15 mins., 35 points) **Reactive element at the junction.** In the transmission-line circuit shown, find the complete mathematical expressions and sketch both the source-end voltage v_S and the load-end voltage v_L as a function of time. Sketch the two waveforms separately. Provide all the pertinent values on each sketch.