ECSE 2010
Electric Circuits
Fall 2006 - **Millard**
Exam 2

Name ________________________

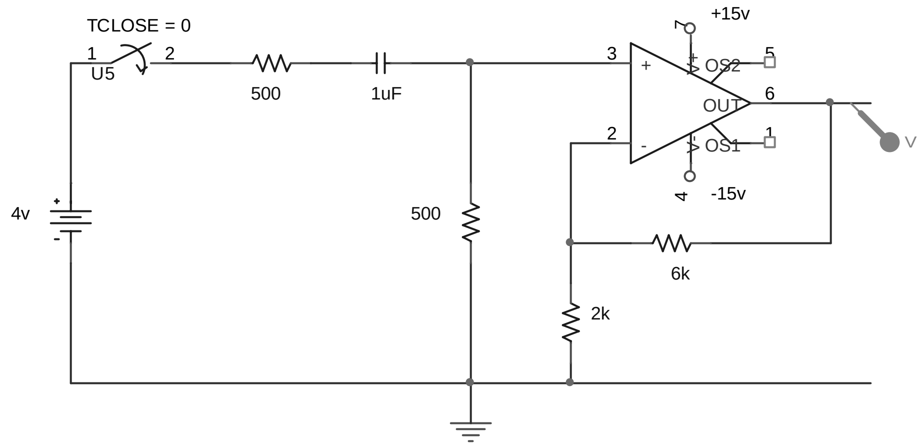
Problem No.	Pts.	Score
1	10pts	
2	25pts	
3	25pts	
4	20pts	
5	20pts	
Total	100pts	

Please Note:

* Please place your answers in the spaces provided.
* You must show your work to receive credit.

<u>Problem 1</u> (10pts)

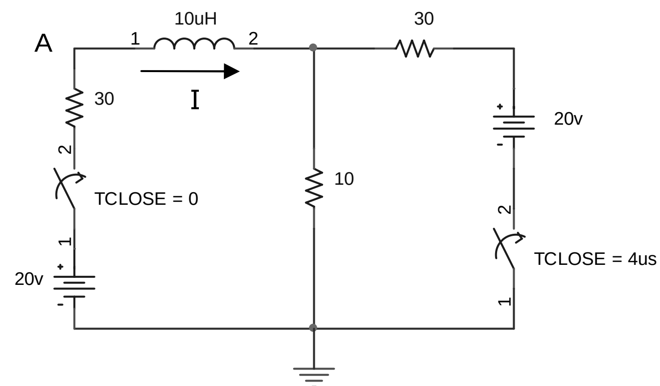
Find V(t) in the circuit shown for t ≥ 0.



V(t)	

Problem 2 (25pts)

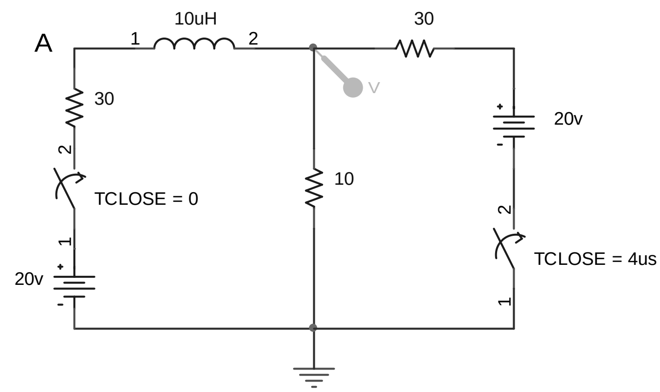
a.) Find I (through the 10uH inductor) at each of the times indicated for the circuit shown. (15pts)

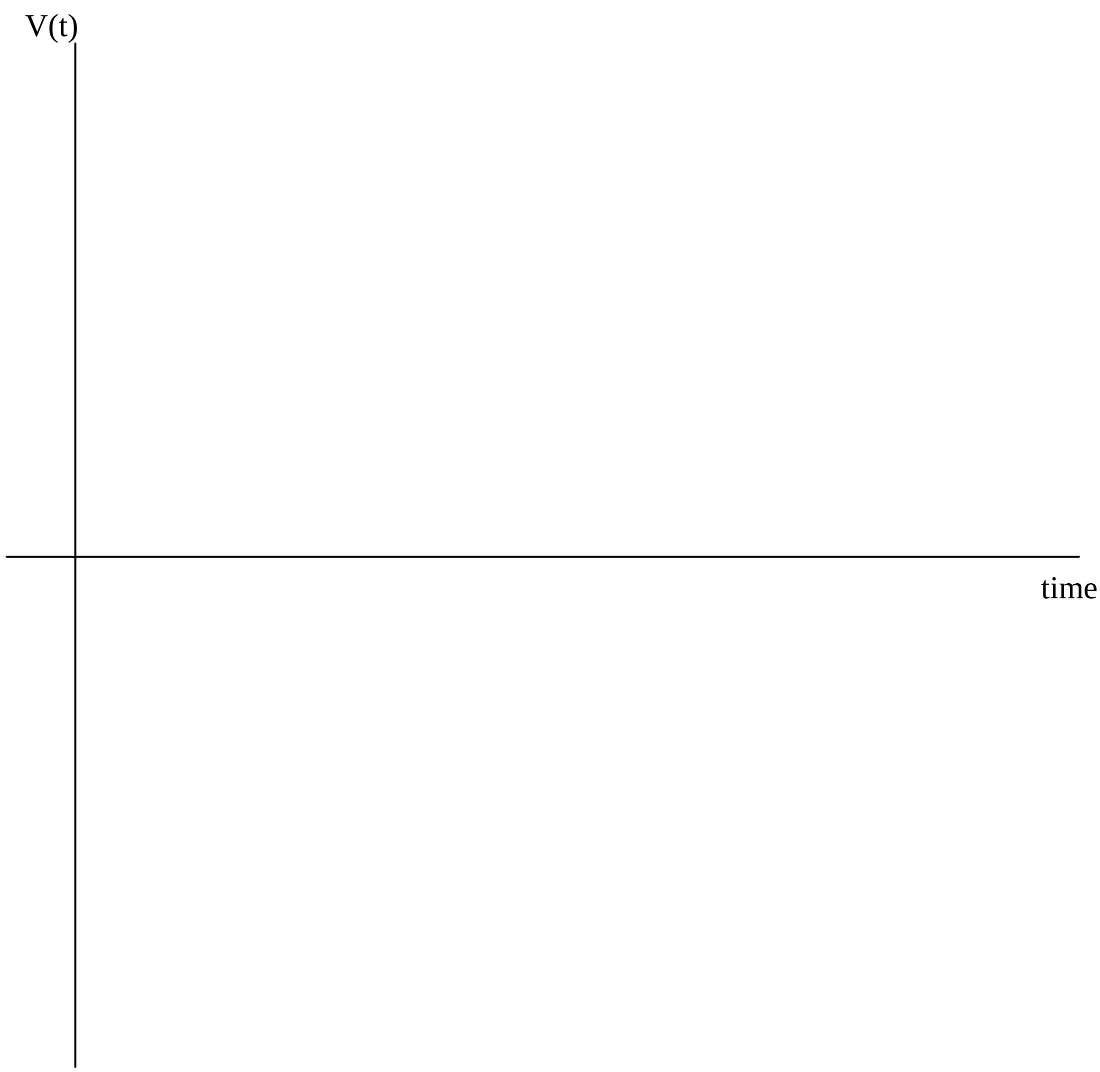


I (1us)	
I (4us)	
I (8us)	

Problem 2 (cont)

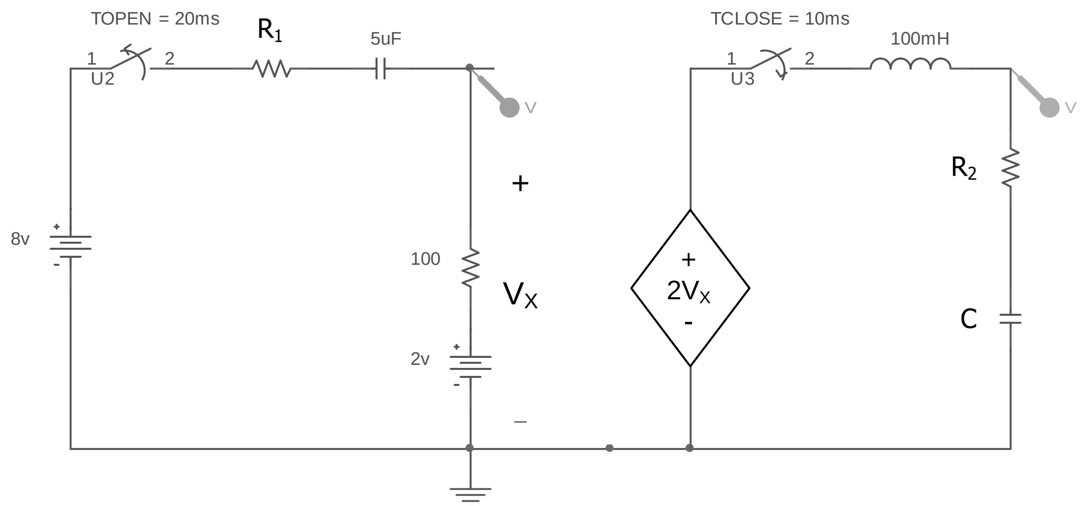
b.) Sketch V(t) (across the 10ohm resistor) for 0 ≤ t < 10us; showing ALL pertinent values at the critical points in time. (10pts)

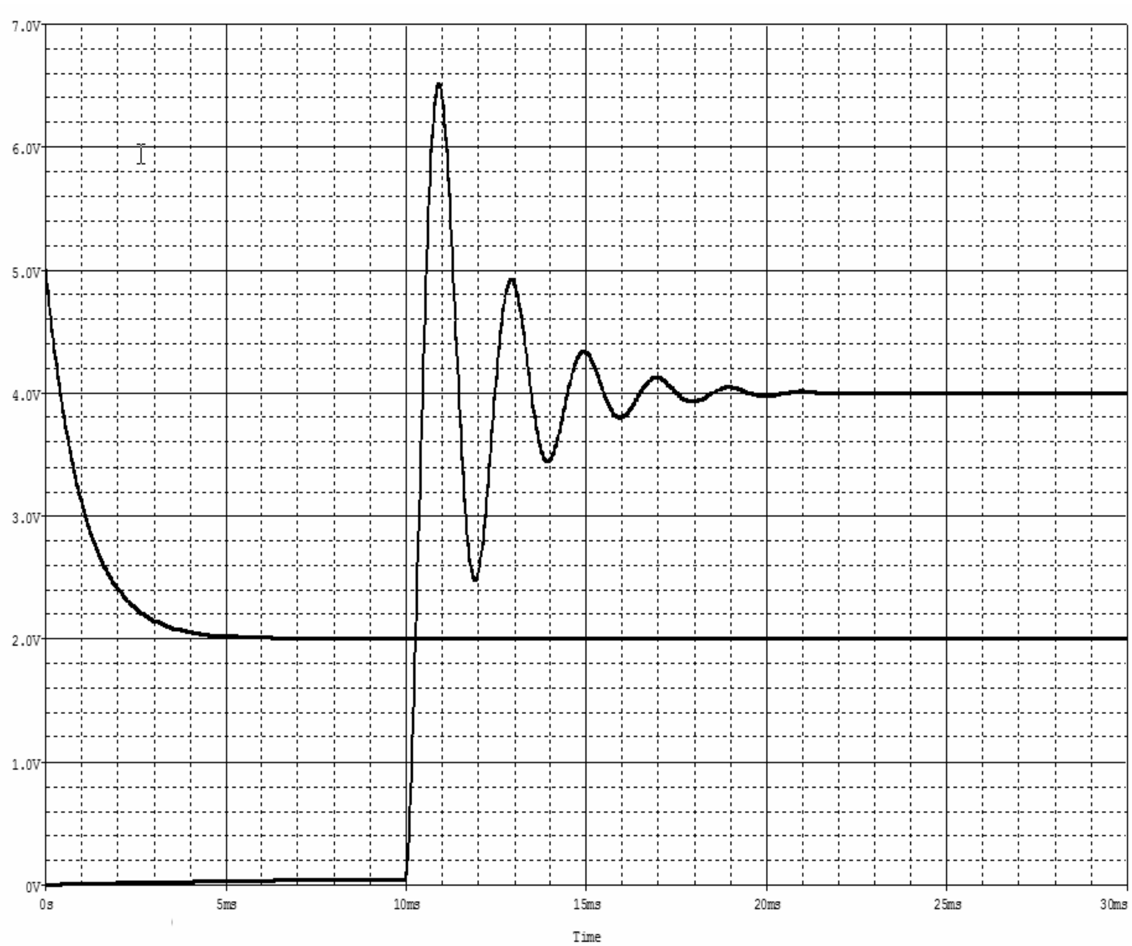




Problem 3 (25pts)

Given the corresponding plots for the circuit shown; find the values of the circuit's components (R_1, R_2, and C).



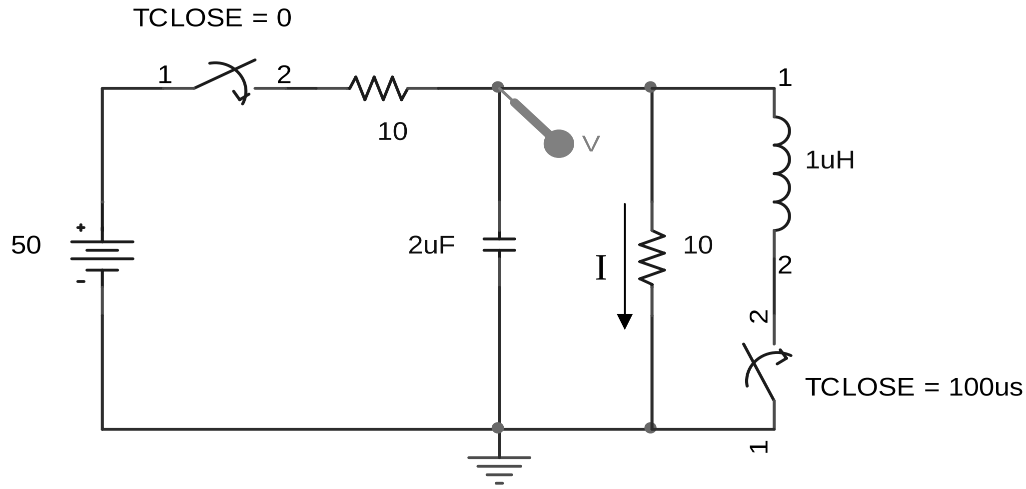


Problem 3 (cont)

R_1 (5pts)	
R_2 (10pts)	
C (10pts)	

Problem 4 (20pts)

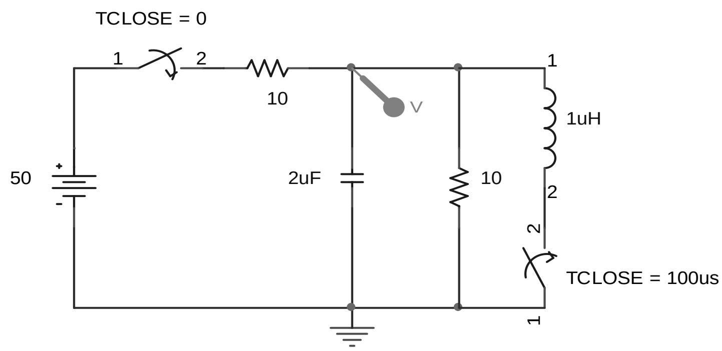
Given the following circuit find I(100_{us}^-), V(100_{us}^+), I(∞) and V(∞). Please provide justification for your responses.



I(0^-)	
V(0^-)	
I(∞)	
V(∞)	

Problem 5 (20pts)

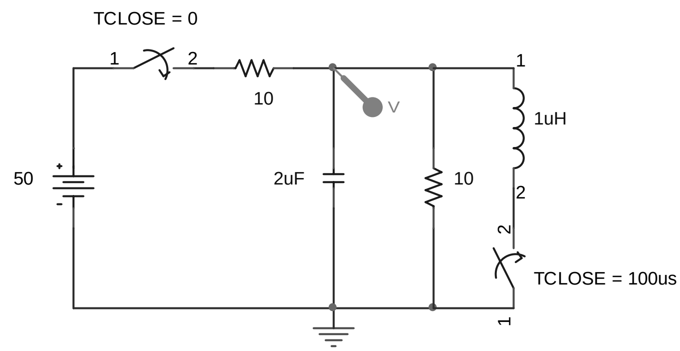
a.) Find V(t) (across the capacitor) in the circuit shown for t<100us. (5pts)



V (t)	

Problem 5 (cont)

b.) Find the response type (over, critically, or under) and V(t) (across the capacitor) in the circuit shown for t >100us. (15pts)



Type	
V (t)	

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Extra space (if needed) Name ________________________

Item no.	f(t)	F(s)
1.	$\delta(t)$	1
2.	$u(t)$	$\frac{1}{s}$
3.	$tu(t)$	$\frac{1}{s^2}$
4.	$t^n u(t)$	$\frac{n!}{s^{n+1}}$
5.	$e^{-at}u(t)$	$\frac{1}{s+a}$
6.	$\sin \omega t u(t)$	$\frac{\omega}{s^2+\omega^2}$
7.	$\cos \omega t u(t)$	$\frac{s}{s^2+\omega^2}$

Item no.	Theorem	Name
1.	$\mathscr{L}[f(t)] = F(s) = \int_{0-}^{\infty} f(t)e^{-st}dt$	Definition
2.	$\mathscr{L}[kf(t)] = kF(s)$	Linearity theorem
3.	$\mathscr{L}[f_1(t)+f_2(t)] = F_1(s)+F_2(s)$	Linearity theorem
4.	$\mathscr{L}[e^{-at}f(t)] = F(s+a)$	Frequency shift theorem
5.	$\mathscr{L}[f(t-T)] = e^{-sT}F(s)$	Time shift theorem
6.	$\mathscr{L}[f(at)] = \frac{1}{a}F\left(\frac{s}{a}\right)$	Scaling theorem
7.	$\mathscr{L}\left[\frac{df}{dt}\right] = sF(s) - f(0-)$	Differentiation theorem
8.	$\mathscr{L}\left[\frac{d^2f}{dt^2}\right] = s^2F(s) - sf(0-) - \dot{f}(0-)$	Differentiation theorem
9.	$\mathscr{L}\left[\frac{d^nf}{dt^n}\right] = s^nF(s) - \sum_{k=1}^{n} s^{n-k}f^{k-1}(0-)$	Differentiation theorem
10.	$\mathscr{L}\left[\int_{0-}^{t} f(\tau)\,d\tau\right] = \frac{F(s)}{s}$	Integration theorem
11.	$f(\infty) = \lim_{s\to 0} sF(s)$	Final value theorem[1]
12.	$f(0+) = \lim_{s\to\infty} sF(s)$	Initial value theorem[2]

[1] For this theorem to yield correct finite results, all roots of the denominator of $F(s)$ must have negative real parts and no more than one can be at the origin.
[2] For this theorem to be valid, $f(t)$ must be continuous or have a step discontinuity at $t = 0$ (i.e., no impulses or their derivatives at $t = 0$).