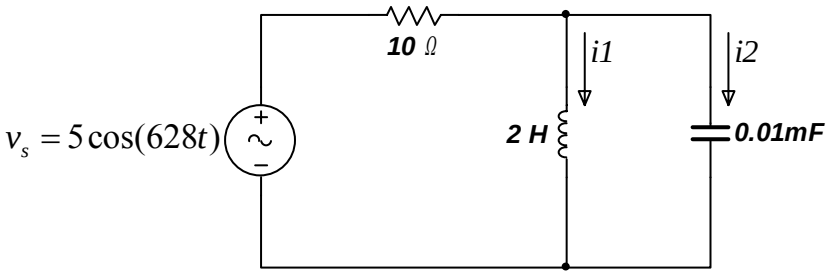
Massachusetts institute of Technology
Department of Nuclear Science and Engineering
Department of Electrical Engineering and Computer Science

22.071/6.071 - Introduction to Electronics, Signals and Measurement
Spring 2006

Homework 6
Due 3/22/06

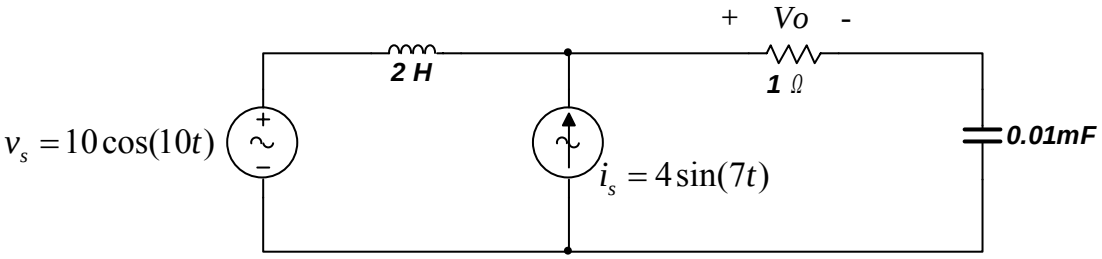
Problem 1.

Calculate the currents *i1(t)* and *i2(t)* as shown on the following circuit



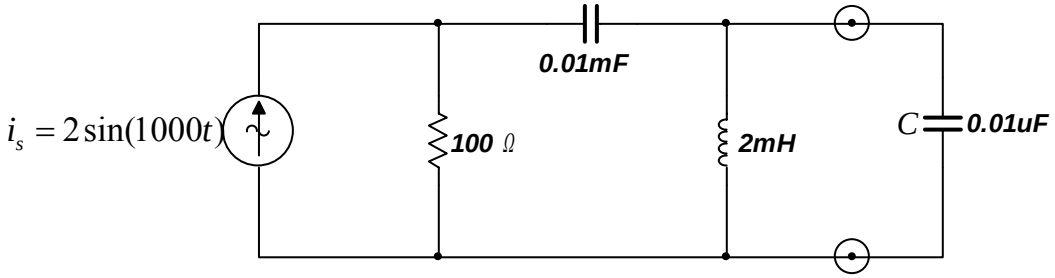
Problem 2.

Determine the voltage *Vo* for the following circuit. (Hint: superposition)



Problem 3.

For the circuit below, determine the Thevenin equivalent circuit seen by capacitor C. (Hint: it helps if you work out the problem symbolically and then substitute for the element values.)

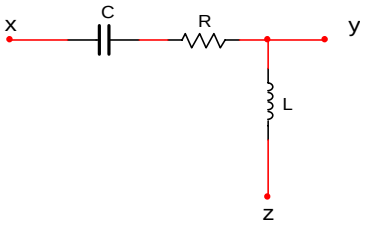


Problem 4.

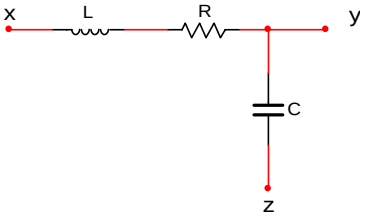
Tau finds a black box with 3 terminals labeled X, Y, Z. Tau, who took 6.071 last year, decides to make resistance measurements across the terminals at DC ($\omega = 0$ Hz) and at high frequency (ω large). She observes the following results:

	Resistance (Ω) at	
Measure resistance across	DC	High-Freq.
X – Y	∞	40
Y – Z	0	∞
X - Z	∞	∞

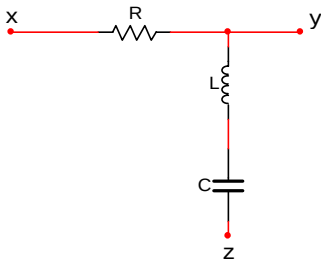
Which of the following equivalent circuits is inside Tau's black box?



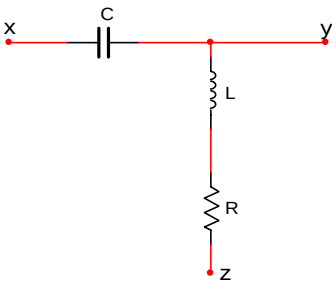
Circuit A



Circuit B



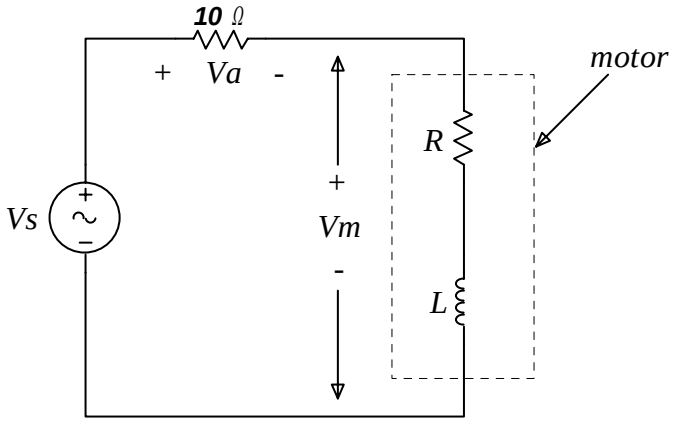
Circuit C



Circuit D

Problem 5.

A motor is made up of a coil which has a resistance R and an inductance L. We will set up an experiment to measure the values of R and L. The circuit is shown below.



The motor runs with 60Hz power and all measurements will be performed with the real source power connected to it and operating at a constant load (steady state). Using a voltmeter set in AC mode (i.e measure the RMS value of a sinusoidal voltage) we perform the following measurements.

$Vs = 220\ Volts$, $Va = 75\ Volts$, $Vm = 110\ Volts$

Use these measurements to determine R and L