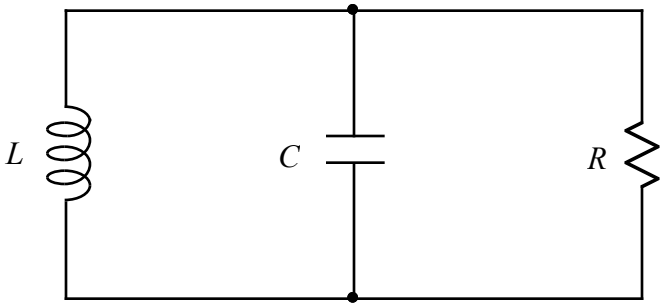
# HOMEWORK #1

1.



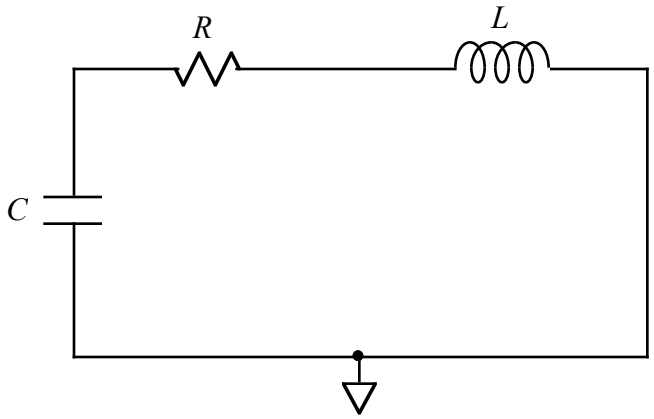

$L = 2.5$ nH $\quad C = 1.6$ nF $\quad R = 0.625\ \Omega$

a) Find the characteristic roots, $s_1$ and $s_2$, for the above circuit.

b) Is the circuit over-damped, critically-damped, or under-damped? Explain your answer.

c) If the $L$ and $C$ values in the circuit are increased by a factor of 10, (and $R$ remains the same), will the circuit be over-damped, critically-damped, or under-damped? Justify your answer with calculations.

2.



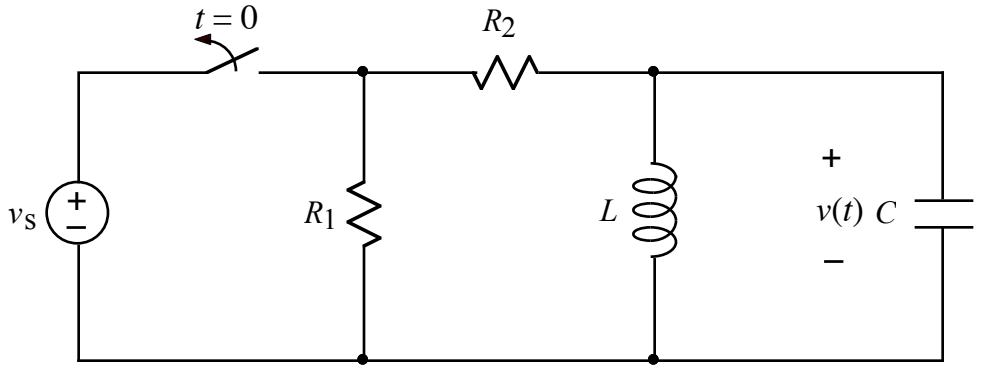

$L = 100\ \mu$H $\quad C = 400\ \mu$F

The above circuit may be used to generate a note for an electronic synthesizer.

a) Find the value of $R$ that will make the circuit oscillate at 440 Hz, (corresponding to an 'A' note). Remember to convert Hz to rad/s.

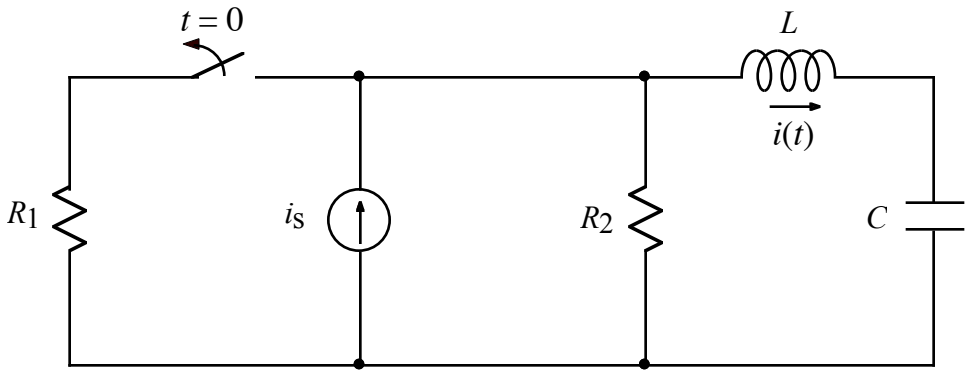
b) Find the value of the damping factor, $\alpha$, for your circuit.

3.



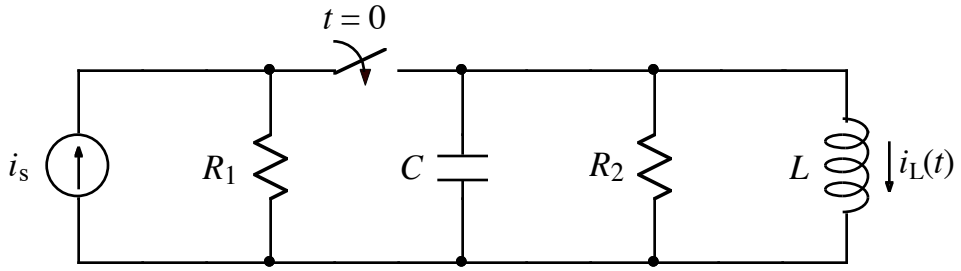

After being closed for a long time, the switch opens at $t = 0$.
$L = 10$ nH $C = 250$ nF $R_1 = 0.1\ \Omega$ $R_2 = 0.025\ \Omega$
If $v_s = 10$ V, find $v(t)$ for $t > 0$.

4.




After being closed for a long time, the switch opens at $t = 0$.
$L = 1\ \mu$H $C = 16\ \mu$F $R_1 = 0.15\ \Omega$ $R_2 = 0.1\ \Omega$
If $i_s = 30$ mA, f ind $i(t)$ for $t > 0$.

5.




After being open for a long time, the switch closes at $t = 0$.
$i_s = 4$ mA $C = 2\ \mu$F $R_1 = 200\ \Omega$ $R_2 = 200\ \Omega$

a) If $L = 125$ mH, find the characteristic roots, $s_1$ and $s_2$, for the above circuit.

b) If $L = 11.834$ mH, find the damping frequency, $\omega_d$.

c) Find the value of $L$ that makes the circuit critically-damped, and find $i_L(t)$ for that value of $L$.