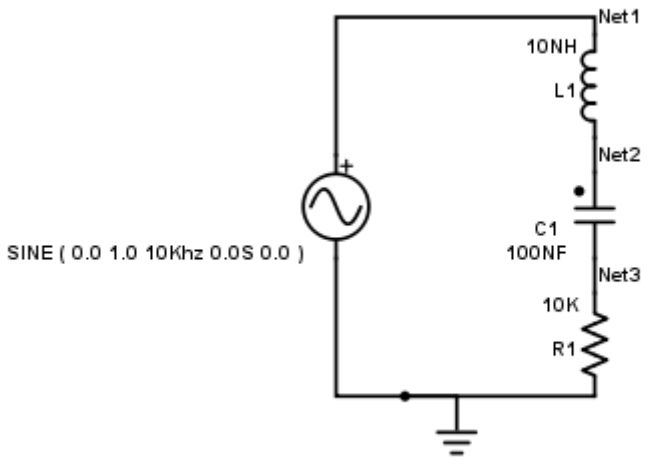
DESIGN PRACTICES

AC Circuit solver (Part 1)

Problem: Given the netlist, display (draw) an AC circuit and find the current/voltage values.
Tools to use: Flex, Bison
Bonus Point: Display a "zoomable" image.

The assignment is divided into two parts (for ease of debugging). In the first part, we will draw the AC circuit and in the second, we will do an AC circuit analysis.

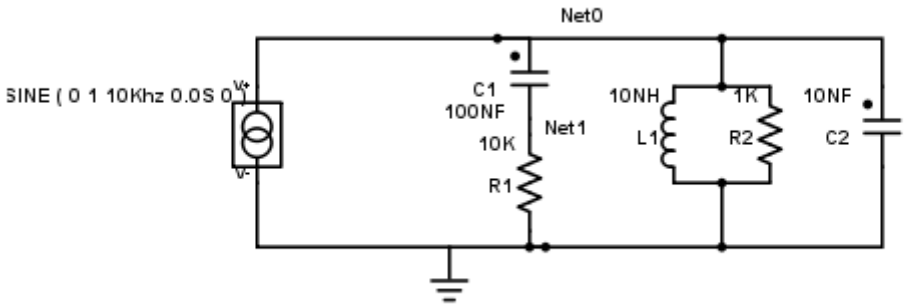
PART 1: DRAWING AN SVG IMAGE
Input Netlist Format:
Let us use an example to explain the net listing format. Consider the circuit below(using voltage source),



Netlist:
R1 Net3 0 10K
C1 Net2 Net3 100NF
L1 Net1 Net2 10NH
V1 Net1 0 SINE (0.0 1.0 10Khz 0.0S 0.0)
Link to: Netlist, Circuit Drawing (SVG, PNG)
Note:

1. Ground net is always numbered 0.
2. N - nano, K - Kilo
3. Resistance does not require ohm. Whereas, inductance is NH- Nanohenry .

Consider, another example(using current source):



Netlist:
R1 Net1 0 10K
C1 Net0 Net1 100NF
L1 Net0 0 10NH
R2 Net0 0 1K
C2 Net0 0 10NF
I1 Net0 0 SINE (0 1 10Khz 0.0S 0)

Link to: Netlist, Circuit Drawing (SVG, PNG)

For the resistor R, inductor L, capacitor C the netlisting format is:
<Name> <Net_Connected_to_terminal> <Net_Connected_to_other_terminal> <V alue>
For the voltage source V , current source I:
<Name> <Net_Connected_to_terminal> <Net_Connected_to_other_terminal> SINE (<DC Of fset>
<Amplitude> <Frequency> <Delay> <Damping Factor>)
You can assume for now that current source start with I and voltage source starts with V. The netlisting format is similar to the SPICE netlisting format.

Input:

top.cir: Netlist file describing circuit components and their connectivity (as described above).

To do:

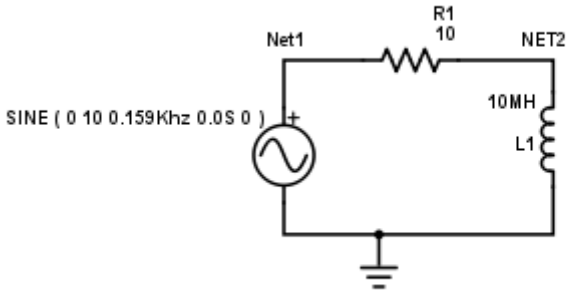
Parse top.cir and render them as SVG drawing. Further, display net names in the SVG. Also, make sure the circuit should scale in terms of nodes.
Identify nets - and create them. That is if the same signal is sent to 3 outputs, instead of drawing 3 wires, draw a net that has one source and 3 wire segments branching towards the 3 destinations. Find invalid circuits and flag errors - syntax or semantic errors. Define & enforce design rules.

Output:

top.svg: SVG (displayable in browser) files for top.cir
Use standard symbols for the R,L,C,V ,I.

PART 2: AC CIRCUIT ANAL YSIS

In Part 2 of the assignment, we will design an AC circuit simulator , which reports, current (flowing through) and voltage values (across) the circuit components (R, L, C, V , I). For the AC source, assume the Damping Factor is zero. Consider the circuit below ,



Netlist:
V1 Net1 0 SINE (0 10 0.159Khz 0.0S)
R1 NET2 Net1 10
L1 NET2 0 10MH
Note:

1. 10MH is 10 milli-henry
2. Link to: Netlist, Circuit Drawing (SVG, PNG)

AC Circuit Analysis(Theoretical):
Frequency(F) = 0.159Khz.
Thus, $\omega = 2\pi F = 2\pi * 0.159K = 999.02 \sim 1000$ (approximating for ease of explanation)
Now, $Z = R + j\omega L = 10 + j * 1000 * (10mH) = 10 + 10j = 10\sqrt{2} \angle 45$
Now,
$V1 = 10\angle 0$
Current from voltage source, $I = (V1) / Z = 10 \angle 0 / 10\sqrt{2} \angle 45 = 1/\sqrt{2} \angle -45$
Voltage across resistance $R1 = I * R1 = 1/\sqrt{2} \angle -45 * 10 = 10/\sqrt{2} \angle -45$
Voltage across inductance $L1 = I * j\omega L = 1/\sqrt{2} \angle -45 * j10 = 10/\sqrt{2} \angle 45$

Output File(results.txt):
VOLTAGES
V1 10.000 0.000
R1 7.071 -45.000
L1 7.071 45.000

CURRENTS
V1 0.707 -45.000
R1 0.707 -45.000
L1 0.707 -45.000
Note:

1. The convention is current flows left to right, top to bottom. Please make sure you use this convention while reporting the current and voltage values.
2. Also, magnitude/phase values are required up to 3 decimal places(always).

SVG Files:

Scalable Vector Graphics (SVG) is an X ML-based vector image format for two-dimensional graphics. SVG images and their behaviors are defined in XML text files. This means that they can be searched, indexed, scripted, and compressed. As XML files, SVG images can be created and edited with any text editor , as well as with drawing software. All major modern web browsers—including Mozilla Firefox, Internet Explorer, Google Chrome, Opera, Safa ri, and Microsoft Edge—have SVG rendering support.
Basic examples for SVG code Here

If you wish you can use SVG code for the R,L,C,V,I. In case you want to write your own code that's also fine.

Zoomable SVG image:

Bonus points will be awarded for a zoomable SVG image. Use your creativity . However, it is advisable to complete Part1, 2 and then, attempt bonus part.

Pointers to Help:

1. MIT AC Circuit analysis notes. Here
2. Refer SVG Primer for basic SVG help.
3. A nice Lex & Yacc Tutorial
4. Online AC Circuit simulator . Here
5. Book: Levine, John R., Tony Mason and Doug Brown [1992]. Lex & Yacc. O'Reilly & Associates, Inc. Sebastopol, California.
6. (optional) Yacc with C++ How-To

Deadline:

Part 1: Drawing an SVG image. Sunday , 19 February 2017,10:00 PM
Part 2: AC circuit analysis. T uesday, 7 March 2017,10:00 AM

Accepting file input and testcases folder (Part1):
Your program should accept file input and should generate the result in a file. The command for running your program:

```
ac_circuit_solver <input_file> <output_file>
```

Example: Consider testcase1 in the testcases folder(attached). T o run the pro gram:

```
ac_circuit_solver top.cir top.svg
```

It accepts input from top.cir and generates top.svg.
The test case input are mentioned in the testcases folder . Please make sure you go through each of the testcase folders.

Submit: Before submitting make sure for no input condition the program crashes. If you are not handling some cases, make sure you inform the user and then exit. Also, make sure that the program is scalable and is able to handle large inputs.

- Complete source code (only source code!) in folder (no subfolders): src
- Executable - file name : ac_circuit_solver
- If you have made any assumptions. Please mention in results.txt.
- Upload zip file containing the above three, named [your_entry_number_assignment].zip

Testcases.zip

Submission status

Submission status	Submitted for grading
Grading status	Not graded
Due date	Sunday, 19 February 2017, 10:00 PM
Time remaining	Assignment was submitted 4 hours 28 mins early
Last modified	Sunday, 19 February 2017, 5:31 PM

File submissions	2015CS10667_assignment.zip
Submission comments	Comments (0)

NAVIGATION

My home
- Site home
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  - Current course
    - 1602-COP290
      - Participants
      - General
      - 1 January - 7 January
      - 8 January - 14 January
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      - 22 January - 28 January
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      - 5 February - 11 February
      - **AC Circuit solver (Part 1)**
      - 12 February - 18 February
      - 19 February - 25 February
      - 26 February - 4 March
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      - 12 March - 18 March
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      - 2 April - 8 April
      - 9 April - 15 April
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      - 7 May - 13 May
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      - 21 May - 27 May
      - 28 May - 3 June
      - 4 June - 10 June
      - 11 June - 17 June
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ADMINISTRATION