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This TI-83 plus calculator program is created by **David Zhang** to simulate simple DC and AC circuits.

The reason why I created this program is because I couldn't find a program like this over the internet for my TI-83. Having no choice, I was forced to write one. I don't want others who are also looking for a program like this going through the same trouble as I have, therefore, you can distribute, modify or do whatever you want with this program (the level of programming is pretty basic because I don't know how to program in assembly language for TI-83 yet, so if you can, GREAT!)

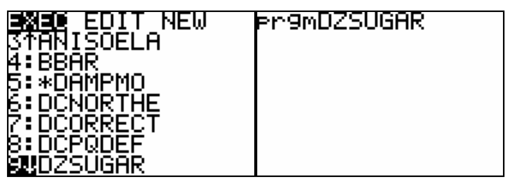
All I'm asking for is, if you distribute or modify this program, please include this README file with the program; or you can give a portion of the credit to me as the original creator or the 'forefather' of the program.

Send comments and suggestions to dazhang@ucsd.edu

Instruction:

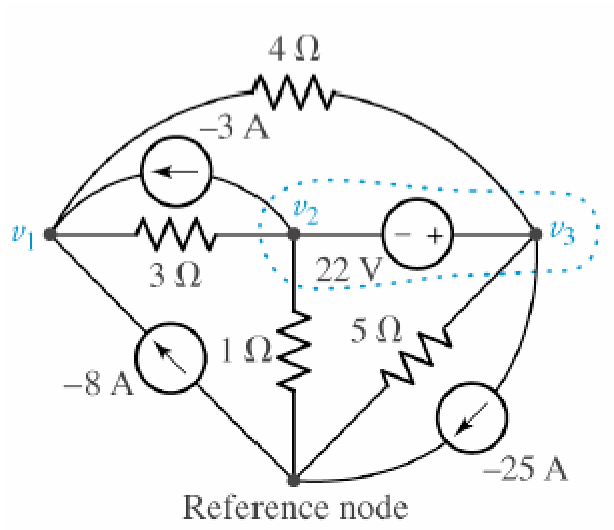
- How to run DZSUGAR

After you transferred all 10 files needed to run DZSUGAR into your calculator, and unachieved them if they are achieved, go to the program menu and select DZSUGAR to run the program. (Note the asterisk next to a program name means it is achieved).



- Define the circuit

After selecting the program, it will ask you how many elements and nodes are in the circuit. Take the following circuit as an example:

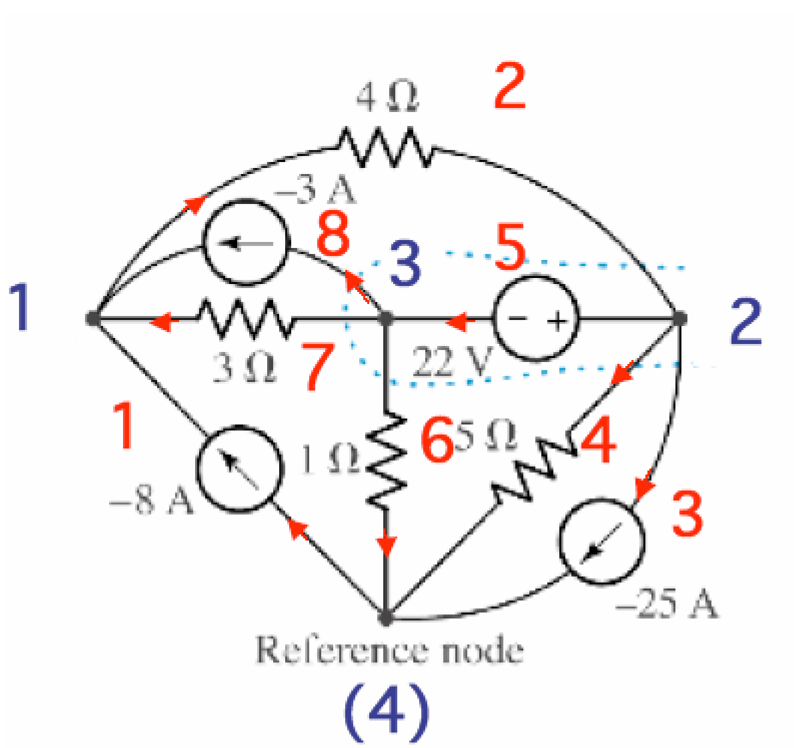


(*a*)

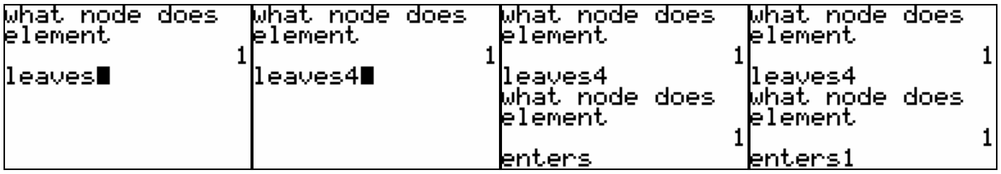
There are 4 nodes (including reference node) and 8 elements.

```
how many element
8
how many nodes:
4
```

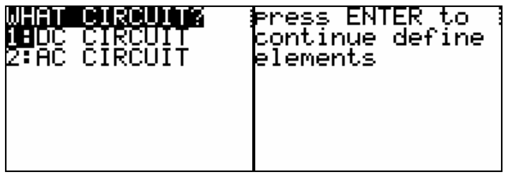
Now label the circuit to assign numbers to each node and element, and assign direction of current at each branch



Now you are ready to define the incident matrix. Let's start with element 1. Sincere element 1 leaves node 4 and enter node 1:



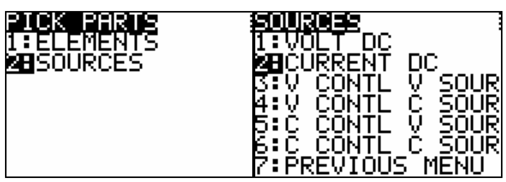
Do the same thing with the other 7 elements, and the next screen you will see is asking if you want to solve a DC or an AC circuit. Select the appropriate one. In our example, this will be a DC circuit.



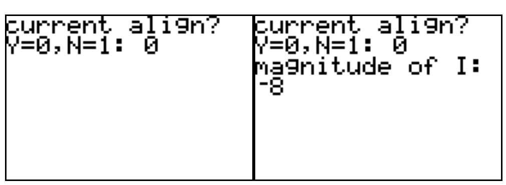
- Define elements

Now you are ready to define elements. There are two categories of elements, one is element and the other is source. Elements consist of resistor, capacitor and inductor*, while sources consist of dependent and independent sources. Since element 1 is an independent current source, we select CURRENT DC under the SOURCES menu.

* In DC circuit, an inductor is assumed to be a close-circuit and a capacitor is assumed to be an open-circuit.

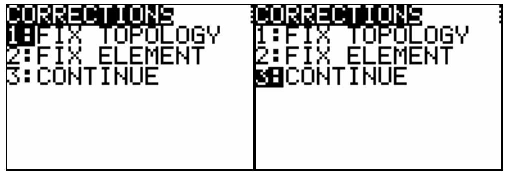


After selecting the current source, the first question is asking you if the current is align. This refers to if the current flow defined by you is aligning with the current flowing from the current source. Since we defined the current flow is indeed aligning with the current source (see schematic above), the answer is yes. The next question is asking for the magnitude of the current source, our answer in this case would be -8. (Note that you can go back to the previous menu if you made a mistake in selecting the wrong menu).



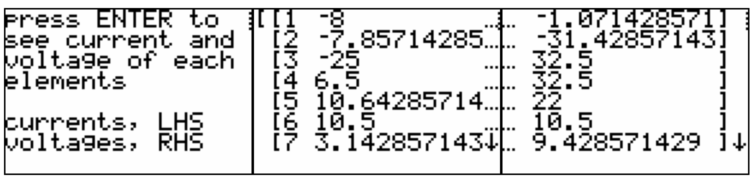
- Making corrections

Do the same thing for the rest of the elements. The question the calculator will ask you is very similar to the question PSugar asks you. After all the elements have been defined the next screen you will see is the CORRECTIONS menu. This is where you can change the topology of the circuit or redefine the elements if you made a mistake in defining the topology or elements earlier on. (**CAUTION**: you can only change your topology in such a way that the number of nodes (including reference node) of the circuit doesn't change from the original circuit). Assuming that you didn't make a mistake, we choose the option CONTINUE to continue the calculation.



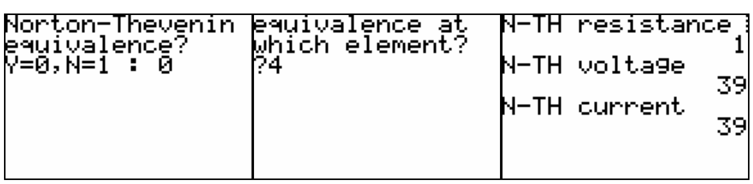
- Interpret the output

Now everything is defined and ready to go. The next screen you will see would be a brief description of how the results are going to be presented. In short, there are 3 columns of numbers to be displayed. The first column tells you which element number (according to the number you assigned to each element) you are looking at. The second column would be the current, and the third is the voltage. (Note that if the screen can't include all the results, you can scroll left and right, up and down using the arrow key to see the full result).



Suppose you want to see the voltage across the 3Ω resistor. According to the schematic, that's element #7. If you look at the output of the result, find the number 7 in the first column and look across it. Since voltage is defined at the third column, the voltage of the 3Ω resistor would be 9.429 Volts.

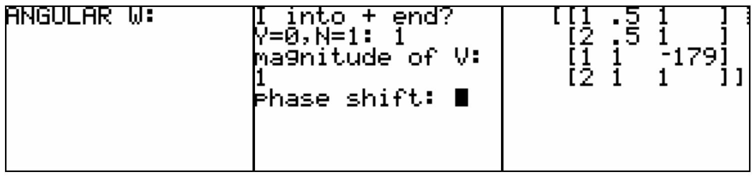
The result output is paused, you can continue by pressing the ENTER key on your calculator. The next thing you will see would be a prompt asking you if you want to find the Norton-Thevenin equivalence of the circuit about a particular element. Suppose you want to find the equivalence at element #4, the 5Ω resistor. Simply answer 'yes' to the prompt by entering 0, and enter the element number where you want to find the equivalence at. In our case, this would be 4. After that, the equivalent resistance, voltage, and current are displayed.



Again, the output is paused; press ENTER again to exit DZSUGAR.

- Define AC elements

The defining of the circuit topology is exactly the same for AC circuit as DC circuit. The only difference is how each element is defined*. Instead of selecting DC circuit in the circuit selection menu, if you selected AC circuit, the first thing the calculator is going to ask you is the circuit frequency (in RADIAN, not Hz!). As for element definition, the calculator would still ask you if the CFOP current is going into the + terminal of the voltage or align with the current source. The only addition is it also asks you if there is a phase shift (in degrees) from the sources. The output of the results for AC circuits consists of 3 columns. The first column, again, is for element numbers, the second column is the magnitude, while the last column is the phase shift. Note that since both the current and voltage of an AC element may have different phase shifts, the output of the currents and voltages are separate. The top half of the output is for current, while the bottom half is for voltage. (For more in depth explanation, email me)



*please note that in the source selection for AC circuits, there are no dependent sources. You're more than welcome to make the addition, and please send me the new program so that I can use it, too. In addition, due to capability of TI-83 plus calculator constraint, the finding of Norton-Thevenin equivalence is not available.

Reference:

1. Goddard, J.D. "Reduction of General Circuit Equations", MAE 140 notes, winter quarter, 2005.

2. Ehrlich, L.W. "Complex Matrix Inversion Versus Real", Communications of the ACM, volume 13, number 9, September, 1970.