Circuit Simulation Tool

Course: Electric Circuits I

Class: First year – Computer Dept – Faculty of Engineering – Cairo University

Semester: Fall 2016

Assigned by: Dr. Ahmad Gomaa

1. Project Overview

Using circuit theories, analysis tools, and simplification methods presented in this course, the student is required to write a computer program that can do the following:

1. Accept the elements and connections of any arbitrary electric circuits as input
2. Compute the required circuit response (Current, Voltage, Power, …) at any arbitrary location specified by the program user

The computer program is required to be completed without any call or use of any circuit simulation tool (e.g. PSpice).

2. Project Details

1. The program should expect the circuit to be composed of any combination of the following elements
   - Resistors
   - Actual independent voltage sources
   - Actual independent current sources

   The program is not required to deal with ideal sources nor dependent sources.

2. The program is not required to handle other types of electric components other than those mentioned above
3. The user is required to enter the values in Ohms, Volts, and Amperes. Conversion from Pico, Micro, Milli, Kilo, Mega shall be done by the user
4. The user is required to assign numbers to the circuit nodes and enter the elements connected to each node
5. The user is required to label the circuit elements as follows:
   - Resistors ➔ R1, R2, R3, ……
   - Voltage sources ➔ E1, E2, E3, …….
   - Current sources ➔ J1, J2, J3, ……

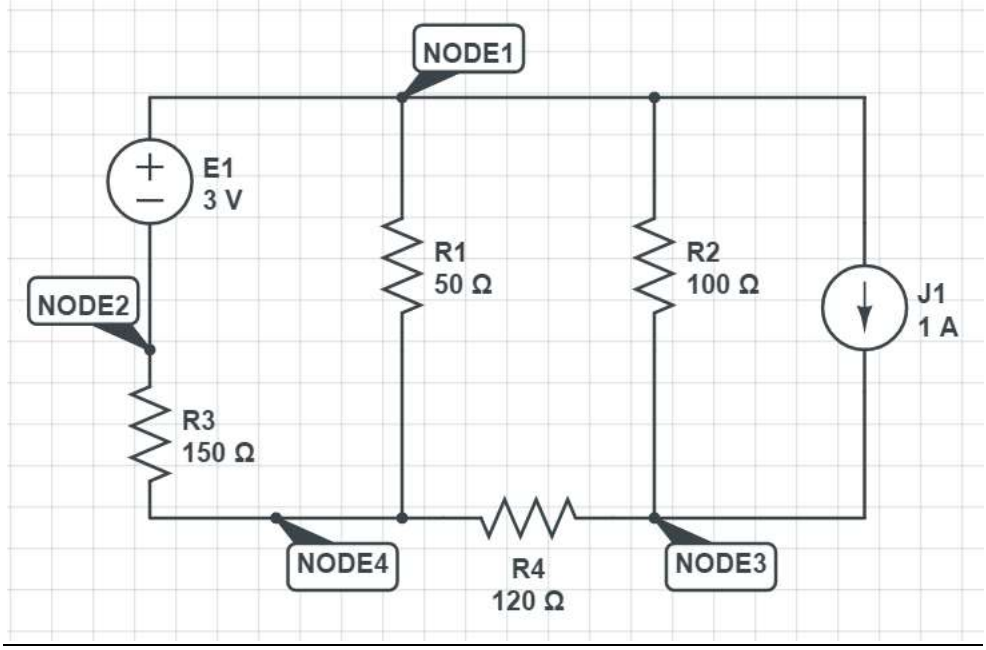

Figure 1: Example circuit

Example: For the circuit shown in Figure 1, the interaction between the user and the program shall be as follows:

Program: Please enter all elements connected to Node 1 and press ….. when finished

User:

E1 3 (Positive because its +ve terminal is connected to Node 1)

R1 50

R2 100

J1 -1 (Negative because it's *leaving* Node 1)

Program: Please enter all elements connected to Node 2 and press ….. when finished

User:

E1 -3

R3 150

Program: Please enter all elements connected to Node 3 and press ….. when finished

User:

J1 -1

R4 120

R2 100

Program: Please enter all elements connected to Node 4 and press ….. when finished

User:

R1 50

R4 120

R3 150

Program: Enter the type and location of the required response (I, V and P for current, voltage and power, respectively). For I and P, specify the element name. For V, specify the nodes numbers

User Input	Description
I R1	(This means that the user requires the current passing in R1)
P E1	(This means that the user requires the power supplied by E1)
V 2 3	(The user requires the voltage difference between Node 2 and Node 3)
I R4 J1	(This means that the user requires the current passing in R4 due to the current source J1 only)
V 3 1 E1	(The user requires the voltage difference between Node 3 and Node 1 due to the voltage source E1 only)

I E1 (This means that the user requires the current passing in E1)

Rmax Pmax R4 (This means that the user requires Rmax (the value of R4 such that it receives maximum power from the circuit). The user also requires Pmax which is the value of this maximum power)

The program can check the connections and issue error messages if incorrect connections are detected, e.g., if a voltage/current source appears at two nodes with the same sign, or if a certain element appears at one node only.

6. Simplification methods (Series, Parallel, Source transformation, Delta-Star transformation, …..) may be used in order to reduce the number of simultaneous equations to be solved.
7. ***The program is required to compute the total dissipated power and total supplied power and make sure that the power balance condition is met!***

3. Regulations

Group size: 3 to 5 students

Deliverables: One zipped file (emailed to aarg_2010@yahoo.com) containing:

- All source code files
- One page describing how the user can run the program and enter the circuit elements and requirements
- Flow chart describing the overall program flow and steps
- One page listing the names of group members
- An EXE file

Discipline: Any sort of plagiarism or cheating will be confronted with severe punishment!

Deadlines:

- Submission of group members names: **November 4th 2016**
- Project submission deadline: **Tuesday Jan 31st, 2017 11:59pm Cairo time.**
  - **Projects submitted after the deadline and before Wednesday February 1st 2017 11:59pm will have 5 marks deducted**
  - **Projects submitted after Wednesday February 1st 2017 11:59pm will NOT be accepted**