Reminder: By returning this homework assignment you have agreed that you, in person, are fully responsible for the consequences of violating the rules of conduct. As a university student, you are expected to act maturely and responsibly. In short, **do not cheat!** Your submission will be checked automatically (and manually, if needed) for plagiarism.

After doing - before submitting - your homework, you must write the following statement on paper by hand, include your name and the date, sign and scan the paper (into a pdf file, e.g., by using a mobile scanner application), and include the pdf file among the other files to be submitted: **"I have neither given nor received any unauthorized aid on this assignment."**

Please upload all the relevant files as a single zip archive on Moodle until December 21, 23:55.
No late homeworks!

CIRCUIT SIMULATOR

Here is a chance for you to implement your own MATLAB-based circuit simulator!

Your simulator should be capable of simulating **any** circuit with the following circuit elements:
- Resistors
- Independent voltage sources
- Independent current sources

You will write a MATLAB program that reads a *text input file* representing the circuit and determines the node voltages using the algorithm provided below on Modified Node Analysis.

The text file will include the information regarding circuits with the following rules:
- Each element is entered in a single row.
- The first column is the unique identifier for the element whose first letter indicates the type of the element: *R, I* or *V* and the rest is an integer. The second and the third columns denote the node numbers of the element. The last column denotes the value of the element in *Ohms*, *Amperes* or *Volts*.
- NodeNumber@SecondColumn < NodeNumber@ThirdColumn.
- Positive value for the current source means that the current is *entering* the Node@ThirdColumn.
- Positive value for the voltage source means:
  Voltage of Node@SecondColumn < Voltage of Node@ThirdColumn.
- For example the following circuit will be entered as follows:
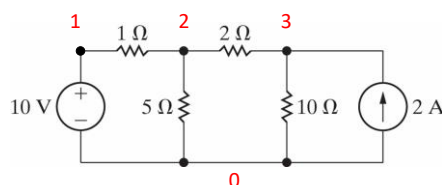
V1	0	1	10
R1	0	2	5
I1	0	3	2
R2	0	3	10
R3	1	2	1
R4	2	3	2

Your program should prompt the user for the name of the text file and display the solution (i.e. the node voltages) on screen. Your program should be modular and it should include a function that takes the file name as an input argument and returns the node voltages.

Always remember to have **comments** in your code and provide some "**help**" information to guide the users.

BONUS Write another program that calls the function in a loop to sweep the load resistance, calculates and plots the power (in Watts) dissipated in the load versus the load resistance, and displays the maximum power and the corresponding resistance on screen and on the plot as well by putting a noticeable marker. *Make the program recognize RL in the text file as the load resistor and modify your text file accordingly by changing the identifier of one of the resistors to RL.*

An algorithm for Modified Node Analysis (MNA):

(adapted from [1])

MNA applied to a circuit with only passive elements (resistors) and independent current and voltage sources results in a matrix equation of the form:

$$A \cdot x = z$$

For a circuit with n nodes and m independent voltage sources:

- The A matrix, stated above:
    - is (n+m)x(n+m) in size, and consists only of known quantities.
    - the nxn part of the matrix in the upper left:
        - ◦ has only passive elements
        - ◦ elements connected to ground appear only on the diagonal
        - ◦ elements not connected to ground are both on the diagonal and off-diagonal terms.
- The rest of the A matrix (not included in the nxn upper left part) contains only 1, -1 and 0.
- The x matrix:
    - is an (n+m)x1 vector that holds the unknown quantities (node voltages and the currents through the independent voltage sources).
    - the top n elements are the n node voltages.
    - the bottom m elements represent the currents through the m independent voltage sources in the circuit.
- The z matrix:
    - is an (n+m)x1 vector that holds only known quantities
    - the top n elements are either zero or the sum and difference of independent current sources in the circuit.
    - the bottom m elements represent the m independent voltage sources in the circuit.

The unknown quantities can be obtained by solving the linear system of equations $A \cdot x = z$.

WARNING: One aim of this project is to implement the above algorithm in MATLAB. That excludes obtaining the solution using symbolic manipulations as presented in [2]. Making use of the code in [2] will be considered as unauthorized aid.

REFERENCES:

1. http://www.swarthmore.edu/NatSci/echeeve1/Ref/mna/MNA3.html
2. http://www.swarthmore.edu/NatSci/echeeve1/Ref/mna/MNA6.html