

Homework III : Systems of linear equations and Kirchoff's rules

Guidelines for Homework III : Please read carefully!

1. Homework III is due Thursday, 08/11 by 22:00.
2. Homework will be submitted via email to ustunel@metu.edu.tr.
3. **VERY IMPORTANT!** The subject line of your email MUST read Phys343 Homework – nothing more, nothing less.
4. **VERY IMPORTANT!** Homework turned in between 22:00 on 08/11 and 8:00 on 09/10 will only receive 50% of the full credit. Homework turned in later than that will NOT be accepted.
5. There's a single function that you need to write for this homework so I'm expecting a single file from you. Please send your function as an attachment.

Goal of the assignment : In this assignment, you will practice forming matrices with a periodic pattern like we have done in lab and solving a circuit with arbitrary number of loops using the matrix inversion technique that we have learnt in lab.

Exercise : You DO NOT need to turn in this part of the homework. It is for you to practice creating periodic arrays.

Suppose you would like to create a vector that has a repeating pattern, $a=[1 \ 2 \ 3 \ 1 \ 2 \ 3 \ 1 \ 2 \ 3 \ 1 \ 2 \ 3]$. You can do the following

```
octave:1> n=4
n = 4
octave:2> b=[1 2 3]'*ones(1,n)
b =

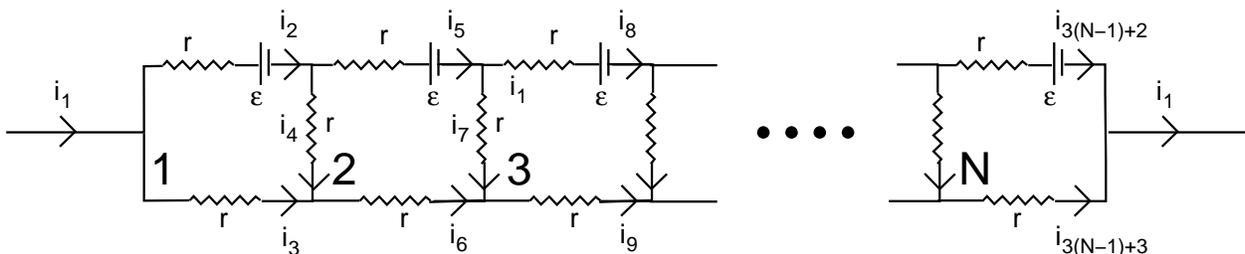
 1  1  1  1
 2  2  2  2
 3  3  3  3

octave:3> reshape(b,1,n*3)
ans =

 1  2  3  1  2  3  1  2  3  1  2  3
```

While the first operation (multiplication with ones) replicates the given pattern, the function `reshape` converts the $3 \times n$ matrix to a $1 \times 3n$ vector. The function `reshape` must be used with care since it can generate matrices or vectors with the wrong periodicity and shape. You can read more about rearranging matrices at http://www.network-theory.co.uk/docs/octave/octave_126.html.

Question 1 : In this question, you will write a function called `kirchoff_arbitrary.m` that takes in as argument the value of the resistance r , the emf of the batteries ϵ s and the number of loops N in the following circuit and returns the array of currents.

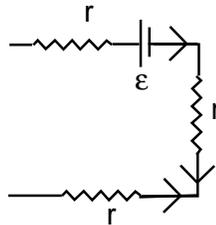


This circuit is extendable and has an adjustable number of loops, given by N . Your function should thus have the following declaration.

```
function Is=kirchoff_arbitrary(ep,r,N)
.
.
.
.
endfunction
```

You can follow these steps to help you along. **This is just a guideline, you don't have to do it this way.**

- Choose a repeating unit for the system. I suggest the following :



- Write *two* junction and *one* loop equation for the following.
- Place it in your matrix and shift it to obtain the periodically repeating part.
- Group the upper and lower nonzero diagonals and repeat the `diag` operations done in lab.
- Place by hand the nonperiodic part, i.e. the first loop and the last loop into your matrix.
- Multiply the inverse by the inhomogeneous part.