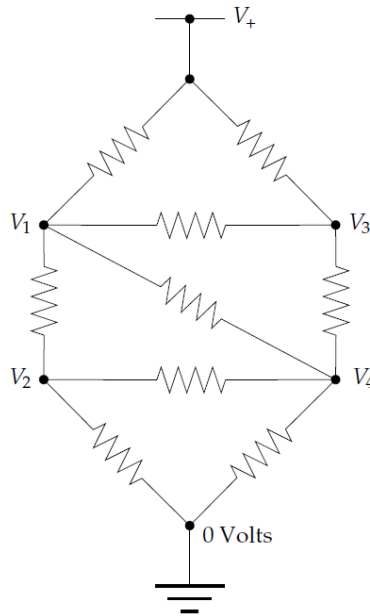


**Universidad de Puerto Rico  
Recinto Universitario de Mayagüez  
Departamento de Física  
Asignación 7**

**Instrucciones:** Para entregar en o antes del martes, 6 de abril de 2021 antes de las 11:59 PM. (10 puntos = 100%).

**Exercise 6.1: A circuit of resistors**

Consider the following circuit of resistors:



All the resistors have the same resistance  $R$ . The power rail at the top is at voltage  $V_+ = 5\text{ V}$ . What are the other four voltages,  $V_1$  to  $V_4$ ?

To answer this question we use Ohm's law and the Kirchhoff current law, which says that the total net current flow out of (or into) any junction in a circuit must be zero. Thus for the junction at voltage  $V_1$ , for instance, we have

$$\frac{V_1 - V_2}{R} + \frac{V_1 - V_3}{R} + \frac{V_1 - V_4}{R} + \frac{V_1 - V_+}{R} = 0,$$

or equivalently

$$4V_1 - V_2 - V_3 - V_4 = V_+.$$

- Write similar equations for the other three junctions with unknown voltages.
- Write a program to solve the four resulting equations using Gaussian elimination and hence find the four voltages (or you can modify a program you already have, such as the program `gausselim.py` in Example 6.1).

**Exercise 6.2:**

- a) Modify the program `gausselim.py` in Example 6.1 to incorporate partial pivoting (or you can write your own program from scratch if you prefer). Run your program and demonstrate that it gives the same answers as the original program when applied to Eq. (6.1)
- b) Modify the program to solve the equations in (6.17) and show that it can find the solution to these as well, even though Gaussian elimination without pivoting fails.

**Exercise 6.4:** Write a program to solve the resistor network problem of Exercise 6.1 on page 220 using the function `solve` from `numpy.linalg`. If you also did Exercise 6.1, you should check that you get the same answer both times.

**Instrucciones para Entregar sus Asignaciones**

- 1) Prepare un archivo en pdf con la información que pide el ejercicio. Por ejemplo, si el ejercicio pide que escriba un programa, deberá mostrar su programa. Si el ejercicio pide output para un input dado, deberá mostrar el input y el output. Este archivo lo subirá a la plataforma Moodle del curso.
- 2) Suba también en archivos separados los programas usados para la hacer la asignación a la plataforma Moodle.