

Computational Methods

Assignment 1

Rasmus Hammar

Imports

```
import numpy as np
import matplotlib.pyplot as plt
```

Problem

Solve for the currents in the following circuit:

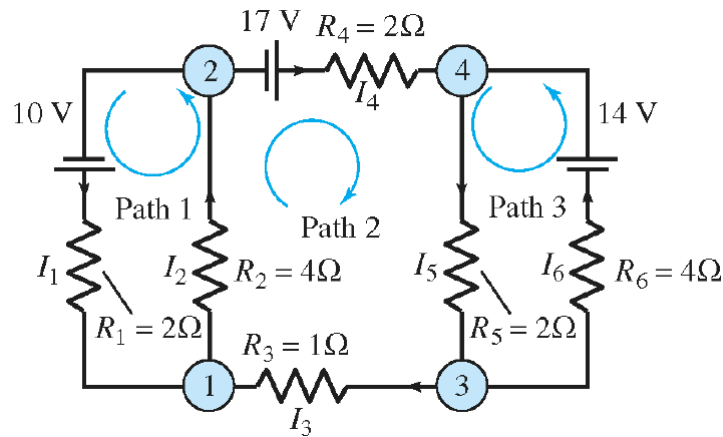


Figure 1: Electrical system

Variables

For solving the equation system:

$$\begin{pmatrix} 6I_2 - 2I_3 & = & 10 \\ 4I_2 + I_3 + 2I_4 + 2I_5 & = & 17 \\ 2I_5 + 4I_6 & = & 14 \\ I_1 - I_2 + I_4 & = & 0 \\ I_3 - I_5 + I_6 & = & 0 \\ I_4 - I_5 + I_6 & = & 0 \end{pmatrix}$$

Matrices circuit and voltages are created.

```

circuit = np.array(
    [
        [0, 6, -2, 0, 0, 0],
        [0, 4, 1, 2, 2, 0],
        [0, 0, 0, 0, 2, 4],
        [1, -1, 0, 1, 0, 0],
        [0, 0, 1, 0, -1, 1],
        [0, 0, 0, 1, -1, 1],
    ]
)
voltages = np.array([10, 100, 14, 0, 0, 0])

```

Inspecting the matrices:

```

Circuit matrix:
[[ 0  6 -2  0  0  0]
 [ 0  4  1  2  2  0]
 [ 0  0  0  0  2  4]
 [ 1 -1  0  1  0  0]
 [ 0  0  1  0 -1  1]
 [ 0  0  0  1 -1  1]]
Shape: (6, 6)
Dimensions: 2
-----
Voltages matrix:
[ 10 100  14   0   0   0]
Shape: (6,)
Dimensions: 1

```

Solution

```

currents = np.linalg.solve(circuit, voltages)

```

Currents are:

```

x_axis = ["$I_1$", "$I_2$", "$I_3$", "$I_4$", "$I_5$", "$I_6$"]
plt.figure(1)
plt.bar(x_axis, currents, color="blue")
plt.ylabel("Current [A]")
plt.title("Currents $I_1$-$I_6$ in the circuit")
plt.show()

```

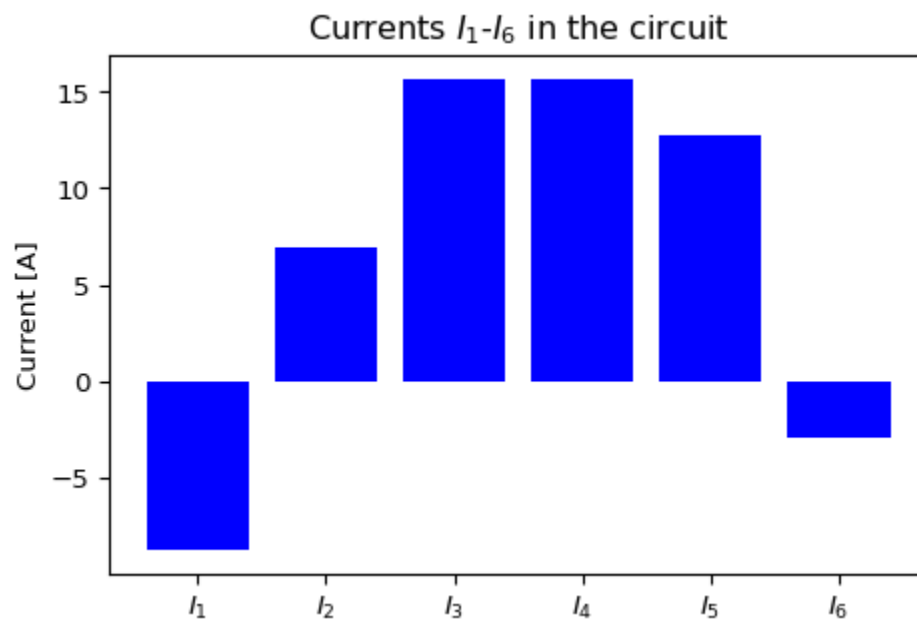


Figure 2: Theoretically estimated currents based on system in Figure 1.