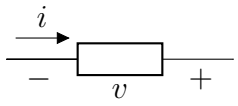
NAME:

Midterm
-
Circuits

Duration: 75 minutes

Except when stated otherwise, you should justify all your answers.
Your application of circuit analysis methods will be evaluated and it will reward you with more points than the final answer.
All the values should be given with a unit.

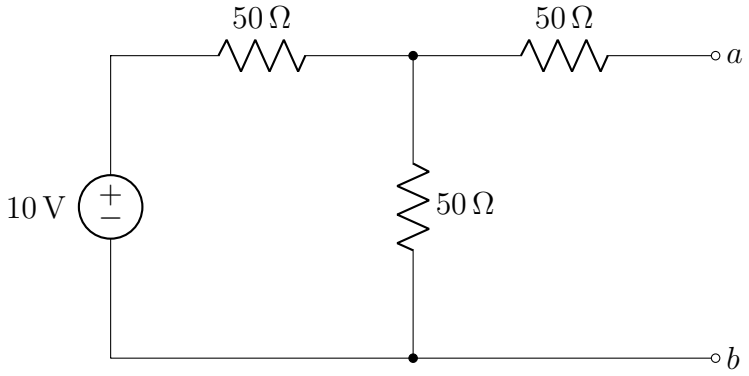
Exercise 1 - Simple questions



This generic element as been labeled with voltage v and current i.
Tick the correct answers to the following questions (some questions may have multiple answers):

- The element is producing power:
  ☐ Yes ☐ No ☐ Cannot tell
- If $v = -5\,\text{V}$ and $i = 10\,\text{mA}$, which element type could it be:
  ☐ Resistor ☐ Voltage source ☐ Current source
- If $v = 3\,\text{V}$ and $i = 5\,\text{mA}$, which element type could it be:
  ☐ Resistor ☐ Voltage source ☐ Current source
- If $v = -1\,\text{V}$ and $i = 2\,\text{mA}$, passive sign convention is satisfied:
  ☐ Yes ☐ No ☐ Cannot tell
- If the element is a resistor (resistance value R), the absorbed power p is expressed by:
  ☐ $p = v \cdot i$ ☐ $p = -R \cdot i^2$ ☐ $p = \dfrac{v^2}{R}$
- If any other element is connected in series with it, it will exhibit the same:
  ☐ voltage ☐ current ☐ absorbed power
- If any other element is connected in parallel with it, it will exhibit the same:
  ☐ voltage ☐ current ☐ absorbed power
- If the element is a voltage source with $v = 2\,\text{V}$, then the current i is necessarily:
  ☐ positive ☐ negative ☐ either positive or negative

Exercise 2 - Thévenin/Norton equivalence

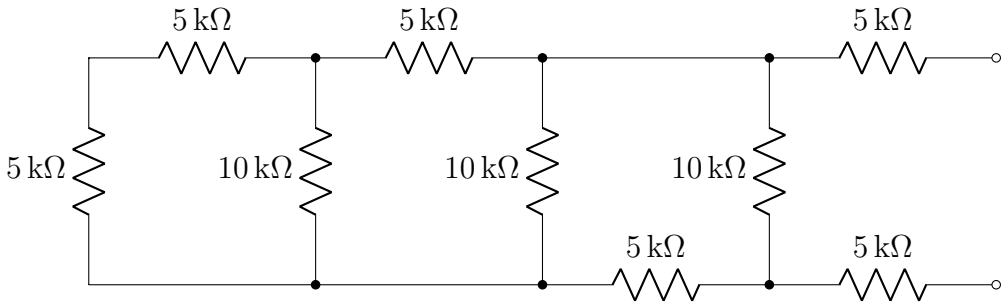


• Determine the Thévenin equivalence **and** the Norton equivalence for the terminal ab.

Exercise 3 - Equivalent resistors

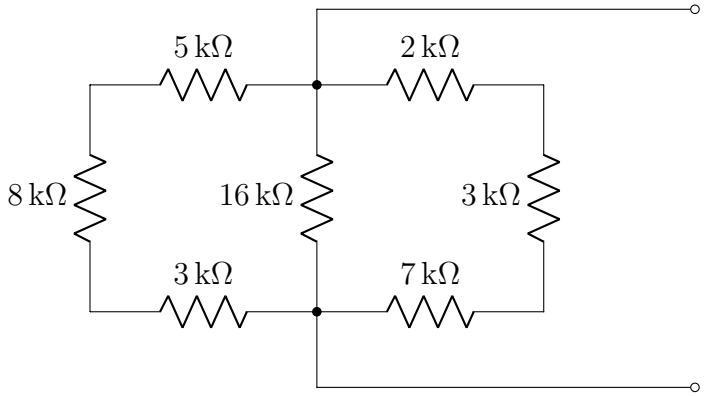
Determine the resistance values of the equivalent resistors for the following networks.
Be careful, the values of the resistors may change between the networks.
No justification is needed.

3.1 Resistive network 1



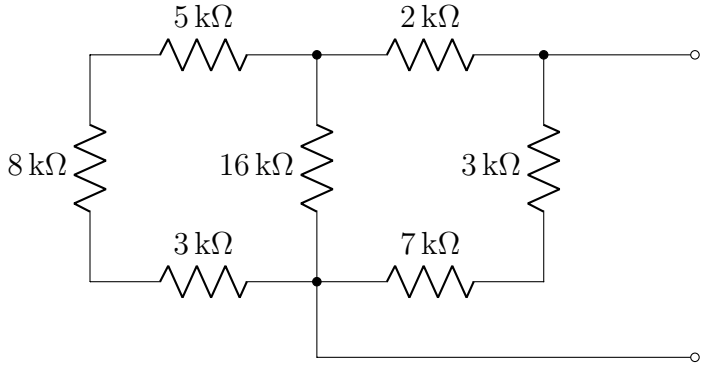
$R_{eq} =$ _____

3.2 Resistive network 2



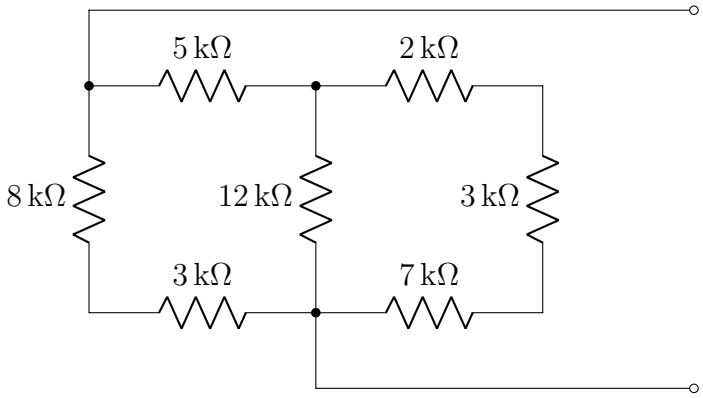
$R_{eq} =$ _____

3.3 Resistive network 3



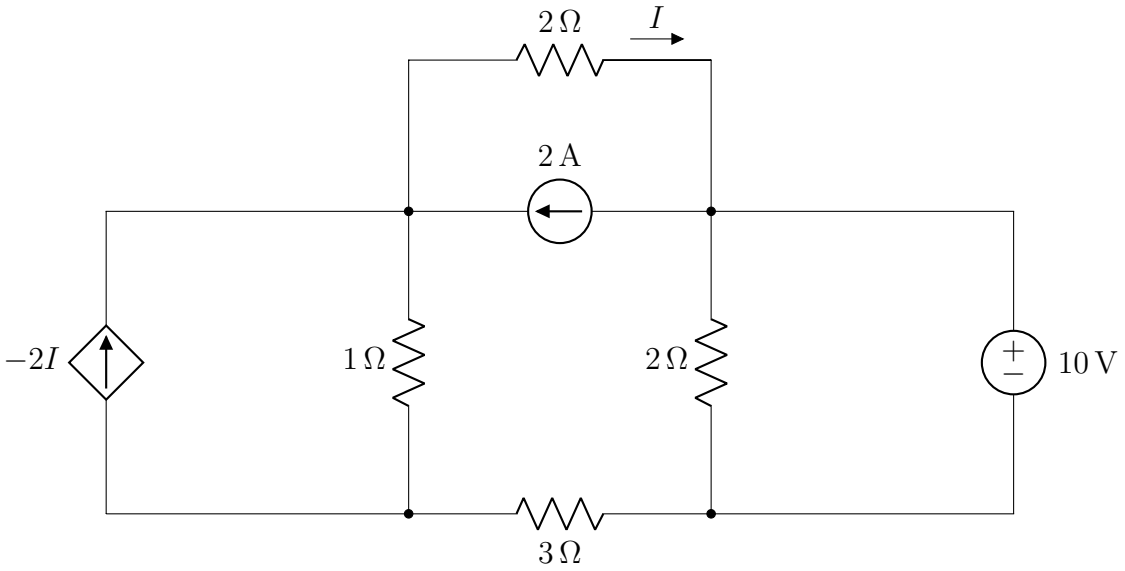
$R_{eq} =$ _____

3.4 Resistive network 4



$R_{eq} =$ _____

Exercise 4 - Circuit analysis



By the method of your choice (mesh analysis or nodal analysis), determine I and the **power of the dependent source**.

1. Label the circuit properly.
2. Write the equations from the analysis.
3. Solve the system of equations. (**time consuming**, maybe keep it for last)
4. Post-process the results.