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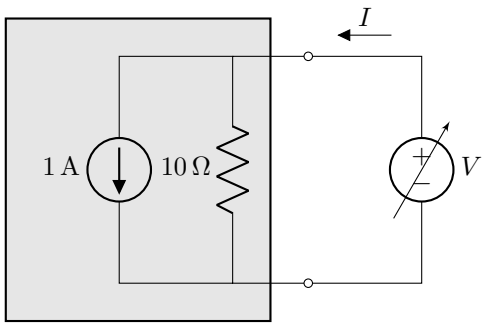
Brac University
Semester: Spring 2023
Course Code: CSE250
Circuits And Electronics

Assessment: *Midterm*
Duration: 1 hour 30 minutes
Date: February 30, 2024
Full Marks (incl. bonus 6): 56

- ✓ No washroom breaks. Phones must be turned off. Using/carrying any notes during the exam is not allowed.
- ✓ At the end of the exam, both the **answer script** and the **question paper** must be returned to invigilator.
- ✓ All **3 questions** are compulsory. Marks allotted for each question are mentioned beside each question.
- ✓ Write your answers inside the indicated boxes where applicable.
- ✓ Symbols have their usual meanings.

■ Question 1 of 3 *[CO1, CO3] [20 marks]*

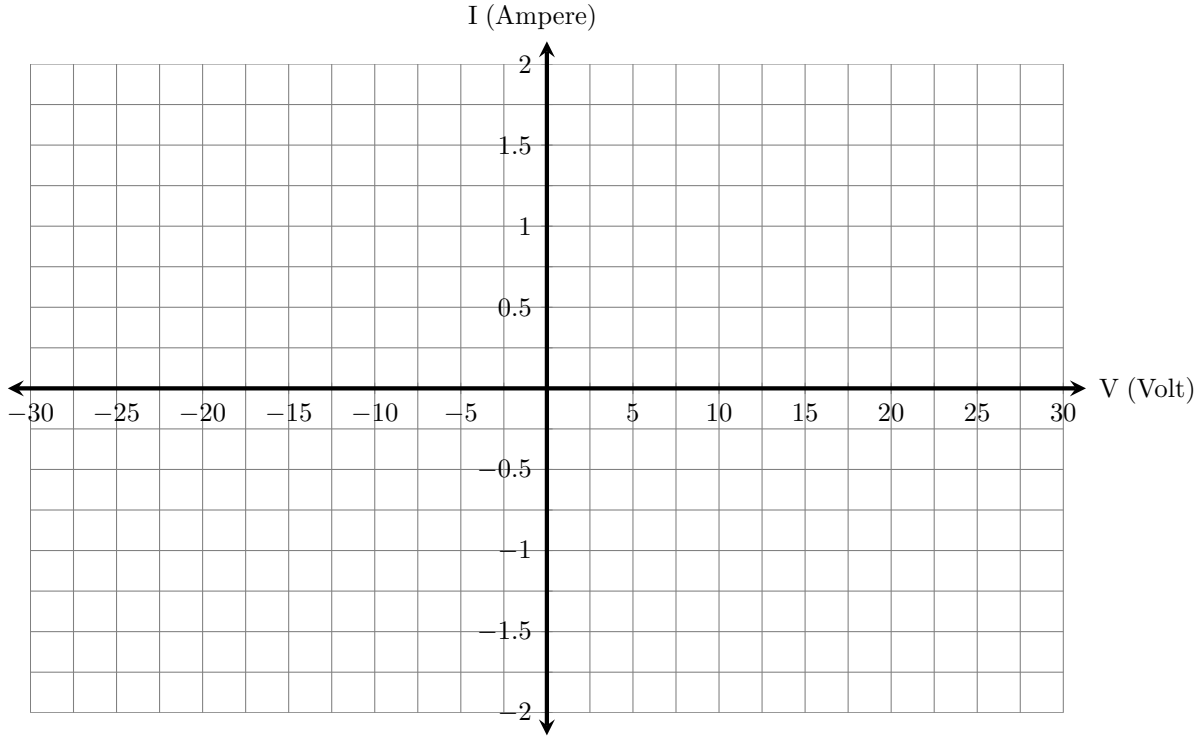
(a) In order to test the $I - V$ characteristics of a two-terminal linear circuit (inside the gray box), the following circuit was constructed.



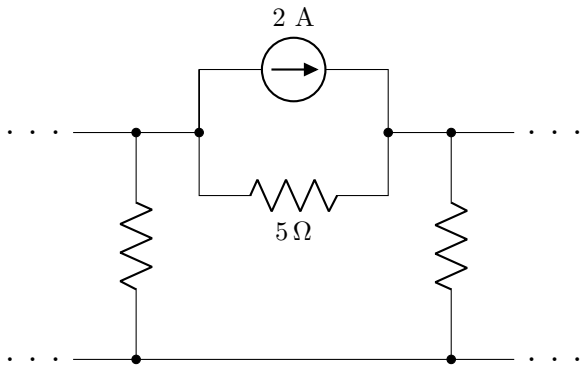
(i) *[1 mark]* **Determine** the relationship between I and V, where V is the applied voltage difference across the test circuit that is varied and I is the current through it. In the following box write I in terms of V.

$I =$

(ii) *[2 marks]* Based on your answer in (i), plot the $I - V$ characteristics of the test circuit in the following grid.



(b) ***[2 marks]*** Which one is the correct **Source Transformation** of the following circuitry?



Cross-out or fill-in the checkbox (☐) at the top-left corner of the correct answer.

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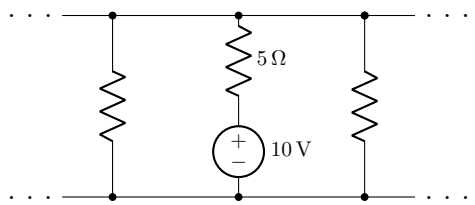

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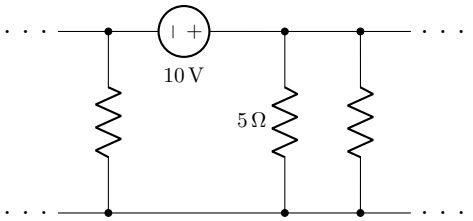

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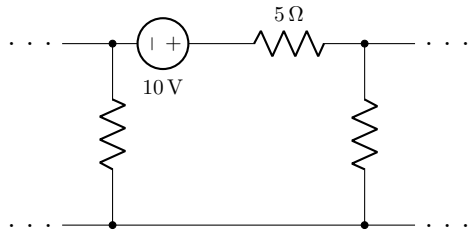

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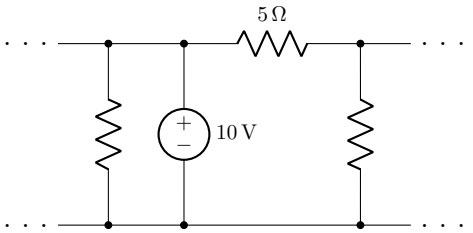
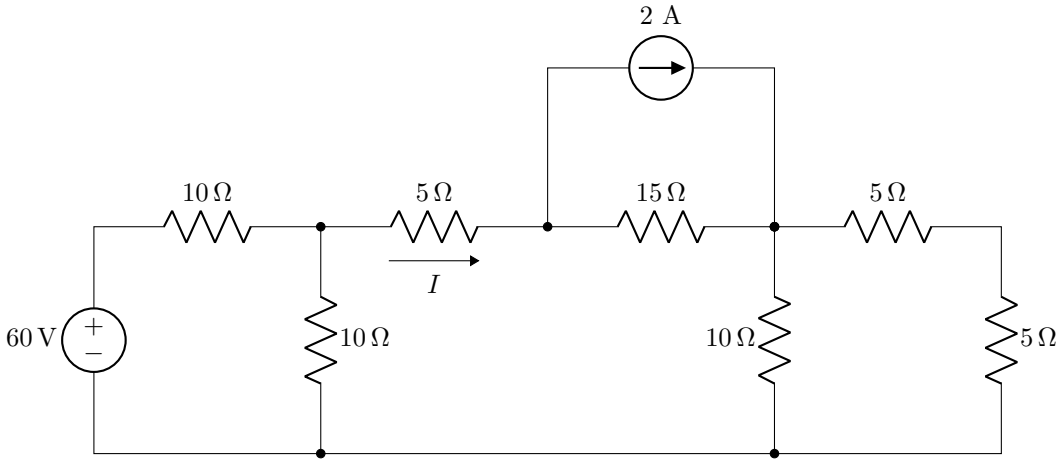
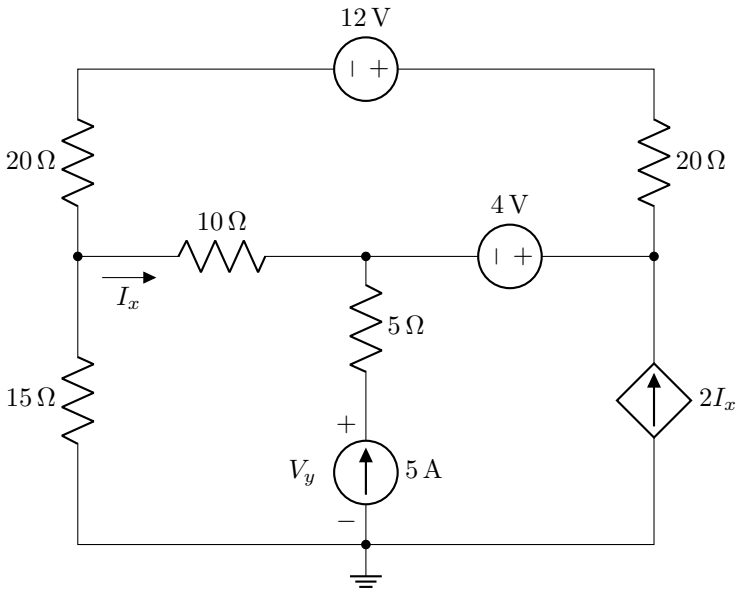


(c) ***[15 marks]*** **Determine** the current I as shown in the circuit below using **Superposition Principle** and/or **Source Transformation**.



■ Question 2 of 3 *[CO2, CO4] [20 marks]*



Apply Nodal/Mesh analysis to answer the following questions:

(a) ***[1 mark]*** Which analysis method should be more advantageous in solving the above circuit?

Solution: Mesh analysis

(b) ***[15 marks]*** Find all the node voltages/mesh currents in the circuit.

Solution:

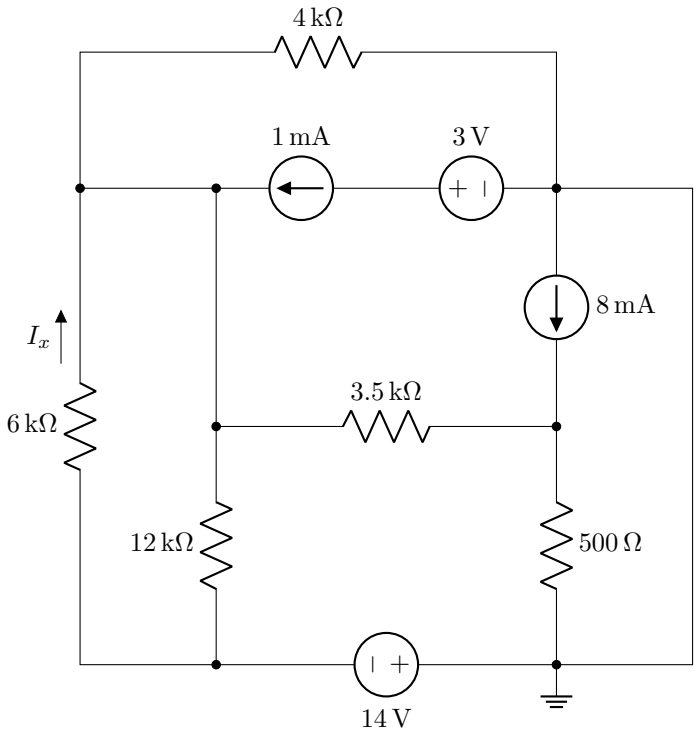
(c) ***[2 marks]*** Find V_y, the voltage across the 5 A current source.

Solution:

(d) ***[2 marks]*** How much **power** is the 5 A current source consuming/supplying to the circuit? Also mention whether the source is supplying or consuming power.

Solution:

■ Question 3 of 3 *[CO2, CO4] [16 marks]*



Apply Nodal/Mesh analysis to answer the following questions:

(a) ***[1 mark]*** Which analysis method should be more advantageous in solving the above circuit?

Solution: Nodal analysis

(b) ***[14 marks]*** Find all the node voltages/mesh currents in the circuit.

Solution: ./questions/mid_nodal_soln.png

(c) ***[1 mark]*** Find I_x, the amount of current through the 6 kΩ resistor.

Solution: -2 mA