LUMS

A Not-for-Profit University

School of Science and Engineering

EE 240 Circuits-I

ASSIGNMENT 2

Due Date: 1 pm, Thursday, October 17, 2024.
Format: 4 problems, for a total of 100 marks
Instructions:

- You are allowed to collaborate with your peers but copying your colleague's solution is strictly prohibited. This is not a group assignment. Each student must submit his/her own assignment.

- Solve the assignment on blank A4 sheets and staple them before submitting.

- Submit in-class or in the dropbox labeled EE-240 outside the instructor's office.

- **Write your name and roll no. on the first page.**

- Feel free to contact the instructor or the teaching assistants if you have any concerns.

- You represent the most competent individuals in the country, do not let plagiarism come in between your learning. In case any instance of plagiarism is detected, the disciplinary case will be dealt with according to the university's rules and regulations.

- We require you to acknowledge any use or contributions from generative AI tools. Include the following statement to acknowledge the use of AI where applicable.

  I have used [insert Tool Name] to [write, generate, plot or compute; explain specific use of generative AI] [number of times].
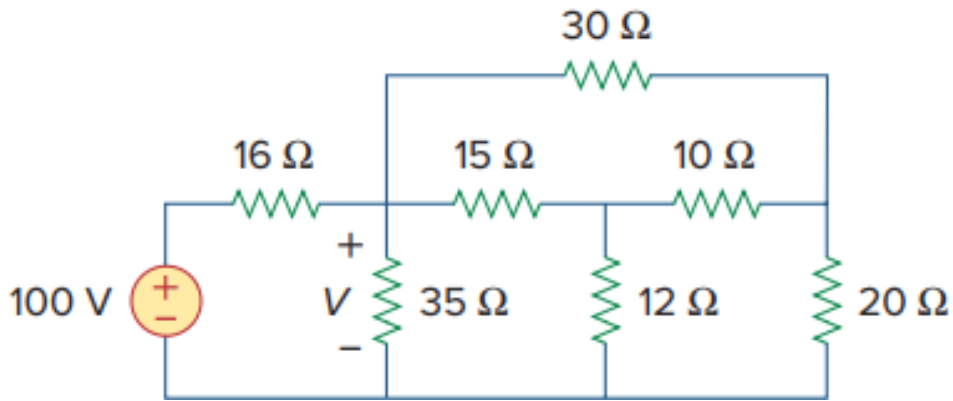
Problem 1 (20 marks)

This question is related to using Wye-Delta transformation to simplify the circuit. Do not apply nodal or loop analysis to determine the unknown voltage in part (b).

(a) [**10 marks**] Obtain the equivalent resistance R_{ab} in the circuit shown below. All resistors have a value of 30 Ω.
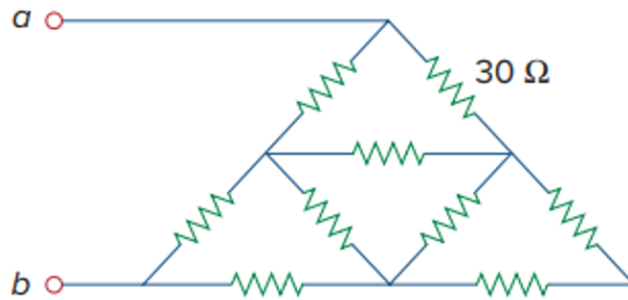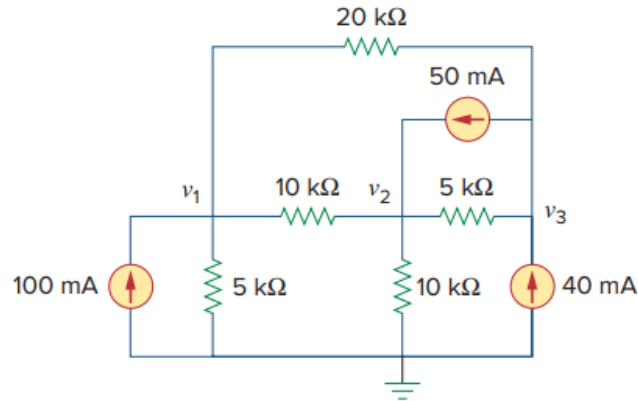

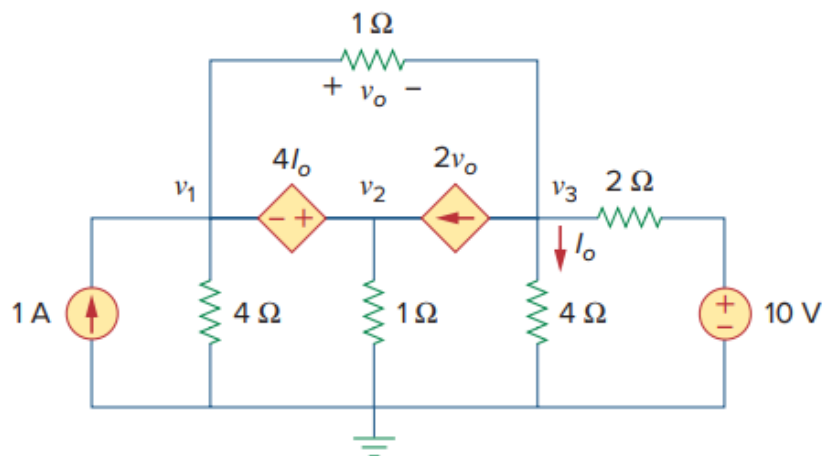(b) [**10 marks**] Determine V in the circuit shown.

Problem 2 (40 marks)

Find node voltages for each of the circuits in the following parts using nodal analysis. For each part, we require you to formulate the circuit equations, preferably in matrix form, provide a brief interpretation of the structure of the matrix form, and determine the nodal voltages by solving the matrix equation using a Calculator or Matlab.
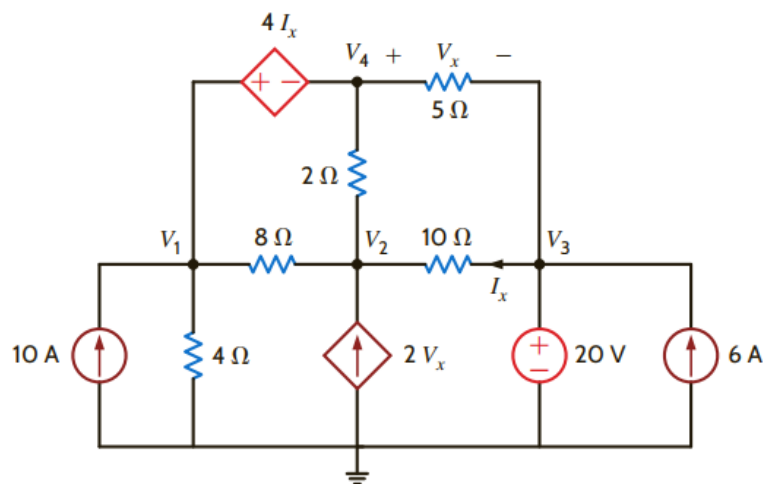
(a) [**10 marks**] Network 1:

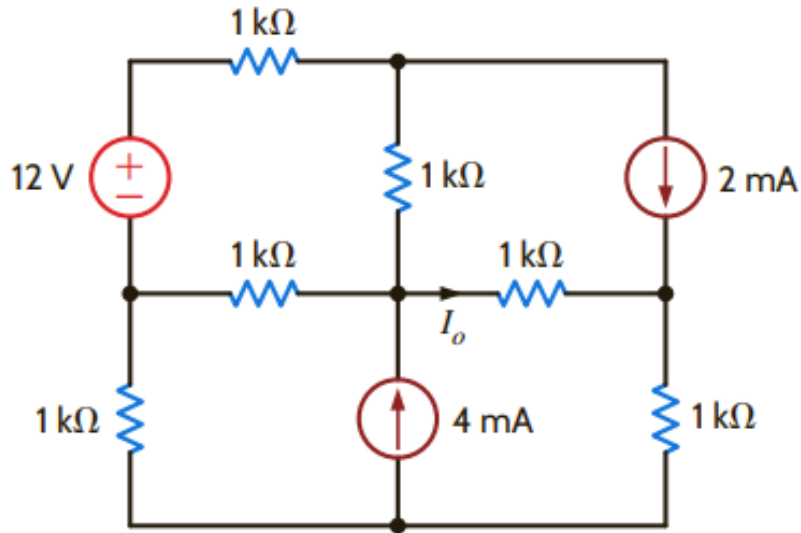(b) [**15 marks**] Network 2:


(c) [**15 marks**] Network 3:

Problem 3 (30 marks)

Find I_o for each of the circuits in the following parts using loop analysis. For each part, we require you to formulate the circuit equations, preferably in matrix form, provide a brief interpretation of the structure of the matrix form, determine the loop currents by solving the matrix equation, and finally determine I_o. Given your training in class, we expect you to choose the loop currents such that you exploit the sources in the circuit to minimize the number of unknowns.

(a) [**15 marks**] Network 1:

(b) [**15 marks**] Network 2:
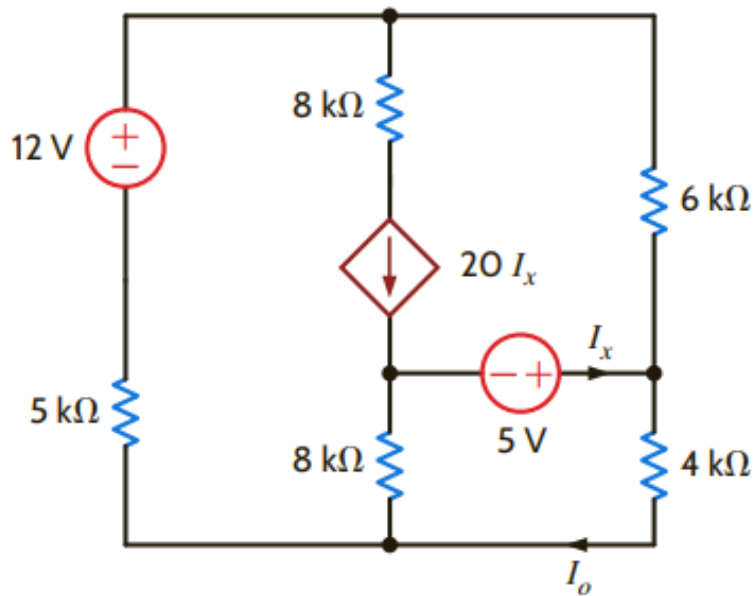
Problem 4 (10 marks)

Find the unknown currents I_1, I_2 and I_3 in the circuit shown. You can use either nodal or loop analysis.