LAHORE UNIVERSITY OF MANAGEMENT SCIENCES
Department of Electrical Engineering

EE 240 Circuits I
Quiz 4 Solution

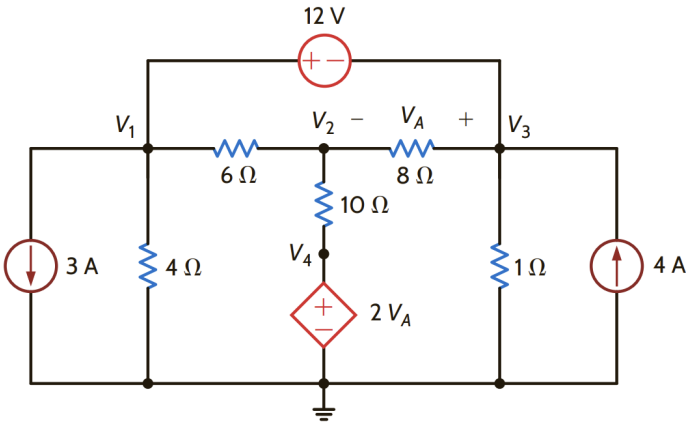
Name: _____

Campus ID: _____

Total Marks: 10
Time Duration: 15 minutes

Question 1 (7 marks)

Using nodal analysis, formulate circuit equations that can be used to solve for the node voltages V_1, V_2, V_3, and V_4 in the given circuit. We require you to formulate three equations in terms of V_1, V_2, and V_3. Note that $V_A = V_3 - V_2$.



Solution:
Node 1: $3 + \frac{V_1}{4} + \frac{V_1 - V_2}{6} - I = 0$

Node 2: $\frac{V_2 - V_1}{6} + \frac{V_2 - 2.V_A}{10} + \frac{V_2 - V_3}{8} = 0$

Node 3: $\frac{V_3}{1} + \frac{V_3 - V_2}{8} + I - 4 = 0$

Node 4: $V_4 = 2\ V_A = 2\ .\ (V_3 - V_2)$

Super node equation: $V_1 - V_2 = 12$

Add the equations for nodes 1 and 3 to eliminate I:
$3 + \frac{V_1}{4} + \frac{V_1 - V_2}{6} + \frac{V_3}{1} + \frac{V_3 - V_2}{8} - 4 = 0$

The three equations required:

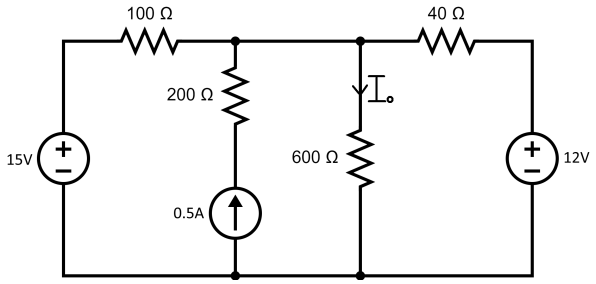
$\frac{V_1}{4} + \frac{V_1 - V_2}{6} + \frac{V_3}{1} + \frac{V_3 - V_2}{8} = 1$

$\frac{V_2-V_1}{6} + \frac{V_2-2.(V_3-V_2)}{10} + \frac{V_2-V_3}{8} = 0$

$V_1 - V_2 = 12$

Question 2 (3 marks)

Apply source transformation to calculate I_o in the following circuit.



Solution:
The resistor in series with the 0.5A current source is completely redundant, so it can be removed. Applying source transformation:

We want to calculate I_o. For that, we need V_o. To find V_o, we simplify the circuit:

$V_o = 0.95 * 27.3 = 25.9V$
$I_o = \frac{V_o}{600} = 0.043A$