MATLAB Marina: Linear Algebraic Equations

1. Perform the following matrix operations by hand and verify your results using MATLAB's matrix operations.
   a) Transpose of W, i.e. determine W'.
   b) Multiply V and U, i.e. determine V*U.
   c) Multiply W and V, i.e. determine W*V.
   d) Determine the inverse of V (do this with MATLAB only), i.e. determine inv(V).
   e) Multiply the inverse of V and U, i.e. determine inv(V)*U.

$$U = \begin{pmatrix} 9 \\ 1 \end{pmatrix} \qquad V = \begin{pmatrix} 2 & -1 \\ 1 & 0 \end{pmatrix} \qquad W = \begin{pmatrix} 5 & -2 \\ 1 & 4 \\ 8 & 2 \end{pmatrix}$$

2. Write a MATLAB program that will solve the following system of equations for the unknowns x using both matrix inverse and Gaussian elimination (back division).

$$5.7x_1 - 2.3x_2 + 0.9x_3 = 30.1$$
$$-2.5x_1 + 1.3x_2 = -12.6$$
$$8.0x_1 + 4.2x_2 - 7.5x_3 = 1.1$$

3. Analysis of electric circuits consisting of linear time-invariant elements yields systems of linear equations that need to be solved to determine the voltages and currents in the circuit. Write a MATLAB program to determine the node voltages with respect to reference for the circuit of Figure 1.

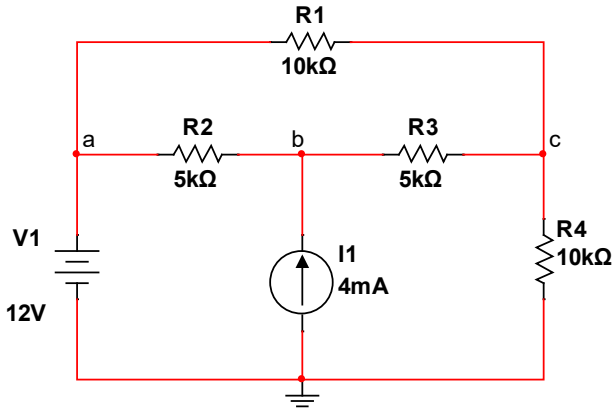

Figure 1. Electric Circuit

Node voltage analysis resulted in the following equations.

$$v_a = V_1 = 12V$$
$$\frac{v_a - v_b}{R_2} + I_1 + \frac{v_c - v_b}{R_3} = 0$$

$$\frac{v_a - v_c}{R_1} + \frac{v_b - v_c}{R_3} + \frac{0 - v_c}{R_4} = 0$$

$$I_1 = 4mA$$

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