MATH 152 MATLAB Computer Lab 3

Row Echelon Form and Solving Linear Systems

Instructions

- Make sure to save the variable for each exercise with the correct variable name
- Download `data3.mat` and upload to your MATLAB environment
- Save all variables to a file called `lab3.mat` and submit the file to Canvas
- Attend your scheduled lab section and visit MATLAB TA office hours for extra help

Exercise 1

Load the matrix A from the data file `data3.mat`.

(a) Add 2 times row 1 to row 2 (in the matrix A). Save the result as `Ex1Amat`.

(b) Add -3 times row 1 to row 3 (of the matrix `Ex1Amat`). Save the result as `Ex1Bmat`.

(c) Add -1 times row 2 to row 3 (of the matrix `Ex1Bmat`). Save the result as `Ex1Cmat`.

The end result should be the (nonreduced) row echelon form of A.

Exercise 2

Find the point of intersection of the planes

$$\begin{array}{rcrcrcr} x & + & y & + & z & = & 2 \\ x & - & y & + & z & = & -1 \\ x & + & y & - & z & = & -4 \end{array}$$

Save the point as `Ex2vec`.

Exercise 3

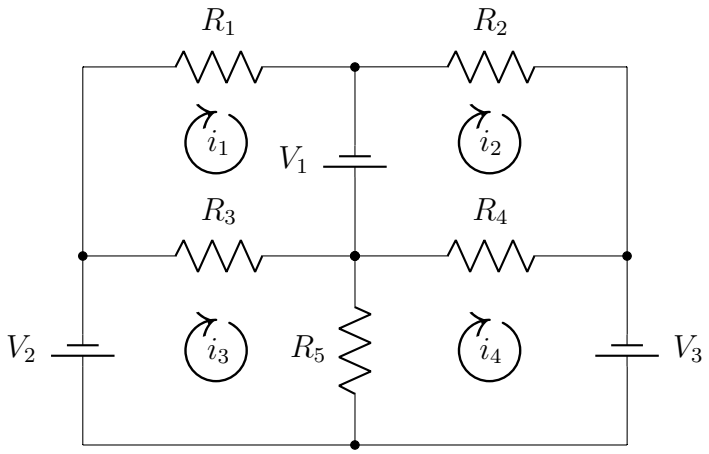
Load the matrix B from the data file `data3.mat`.

(a) Compute the reduced row echelon form of B. Save the result as `Ex3Amat`.

(b) Determine whether the columns of B are linearly independent. Enter your response as `"yes"` or `"no"`. Save your response as `Ex3Btext`.

Exercise 4

Consider the resistor network



The loop current equations are

$$\begin{aligned} R_1 i_1 - V_1 + R_3(i_1 - i_3) &= 0 \\ R_2 i_2 + R_4(i_2 - i_4) + V_1 &= 0 \\ R_3(i_3 - i_1) + R_5(i_3 - i_4) + V_2 &= 0 \\ R_4(i_4 - i_2) - V_3 + R_5(i_4 - i_3) &= 0 \end{aligned}$$

The equations in matrix form are given by

$$\left[\begin{array}{cccc|c} R_1 + R_3 & 0 & -R_3 & 0 & V_1 \\ 0 & R_2 + R_4 & 0 & -R_4 & -V_1 \\ -R_3 & 0 & R_3 + R_5 & -R_5 & -V_2 \\ 0 & -R_4 & -R_5 & R_4 + R_5 & V_3 \end{array}\right]$$

(a) Compute the vector of loop currents when $R_1 = R_2 = 3\Omega$, $R_3 = R_4 = R_5 = 6\Omega$ and $V_1 = V_2 = V_3 = 6V$. Save the result as `Ex4Avec`.

(b) Suppose all resistors are equal to 1Ω and $V_2 = V_3 = 12V$. Use trial and error to find the minimum value V_1 (up to 1 decimal place) such that $i_1 > 20$. Save the result as `Ex4Bnum`.