MAT2040: Linear Algebra

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Abstract

Here is the compilation of Yuming's homework submissions in MAT2040: Linear Algebra.

Things to note:

1. Assessment Scheme
   - 10% Homework and some of them are optional
   - 30% Mid-term in the 3rd week
   - 60% Final (Avg. 70%-80%)
2. Tutorial
   - Matlab training sessions after the 2nd week

If you find something stupid, feel free to contact him @ yumingzhou@link.cuhk.edu.cn

Glossary

augmented matrix a matrix obtained by appending the columns of two given matrices, usually for the purpose of performing the same elementary row operations on each of the given matrices. denoted as $[A|B]$. 2

coefficient matrix a matrix consisting of the coefficients of the variables in a set of linear equations. The matrix is used in solving systems of linear equations. *Note:* denoted as A . 2

constant vector denoted as B. 2

linear system a mathematical model of a system based on the use of a linear operator. 2

row operation involving three elementary types: interchange, scaling, replacement. 2

solution set the set containing every solution of the system. denoted as x. 2

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MAT2040 **Summer 2022**

Assignment 1: 1.1-

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1.1 Question 1

For the following system of linear systems

$$\begin{cases} x_1 + 2x_2 + x_3 = 3 & \text{(1.1a)} \\ -x_1 + x_2 + x_3 = 2 & \text{(1.1b)} \\ x_1 + x_2 - x_3 = 1 & \text{(1.1c)} \end{cases}$$

1. Write down the coefficient matrices, the constant vector and the augmented matrix. Answer:

$$A = \begin{bmatrix} 1 & 2 & 1 \\ -1 & 1 & 2 \\ 1 & 1 & -1 \end{bmatrix} \tag{1.2}$$

$$B = \begin{bmatrix} 3 \\ 2 \\ 1 \end{bmatrix} \tag{1.3}$$

$$[A|B] = \left[\begin{array}{ccc|c} 1 & 2 & 1 & 3 \\ -1 & 1 & 2 & 2 \\ 1 & 1 & -1 & 1 \end{array}\right] \tag{1.4}$$

2. Applying row operations on the augmented matrix, find the solution set. Answer:

$$[A|B] \overset{\substack{R_1+R_2 \\ -R_1+R_3}}{\rightarrow} \left[\begin{array}{ccc|c} 1 & 2 & 1 & 3 \\ 0 & 3 & 3 & 5 \\ 0 & -1 & -2 & -2 \end{array}\right] \overset{R_2 \to \frac{1}{3}R_2}{\rightarrow} \left[\begin{array}{ccc|c} ccc|c1 & 2 & 1 & 3 \\ 0 & 1 & 1 & \frac{5}{3} \\ 0 & -1 & -2 & -\frac{5}{2} \end{array}\right] \tag{1.5}$$