

Notes for ECE269 - Linear Algebra

Chapter 1

Sam Cowin

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1 Linear Equations in Linear Algebra

This first chapter will go over the basics of linear equations and foundations of formulating systems of linear equations into networks of vectors and matrices for more substantial analysis later in the text.

1.1 Systems of Linear Equations

A linear equation is described as follows:

$$a_1x_1 + a_2x_2 + \cdots + a_nx_n = b \quad (1)$$

A system of linear equations is one or more linear equations as described above involving the same variables. Two linear systems are equivalent if the solution set for the two systems is identical. Linear systems are either consistent (have one or infinitely many solutions) or inconsistent (no solution).

A matrix is shown below:

$$\begin{bmatrix} 2 & 4 & 6 & 0 \\ 1 & 3 & 5 & 1 \\ 7 & 8 & 9 & 2 \end{bmatrix}$$

This is an augmented matrix as the values the equations solve to are included as the right most column. The linear equations are represented by the other columns in the matrix, starting with the second to right most column being constant coefficients. From there, the degree of the variables increases by one per column. An $\mathbf{m} \times \mathbf{n}$ matrix indicates m rows and n columns.

To solve a system of linear equations, there are three methods in simplifying system:

- Replacing an equation with the sum of itself and the multiple of another equation
- Interchanging two equations
- Multiplying an equation by a nonzero constant

Two matrices are said to be row equivalent if these operations can be used to equate one matrix to another. This translates into the two row equivalent matrices having the same solution set. If in reduced form, there is a contradiction in the solution set, then the system of equations is inconsistent (no solution).

2 Supplementary Exercises