# Math 22 – Linear Algebra and its applications

## - Lecture 5 -

**Instructor:** Bjoern Muetzel

# GENERAL INFORMATION

- **<u>Office hours:</u>** Tu 1-3 pm, Th, **Sun** 2-4 pm in KH 229

- **<u>Tutorial:</u>** Tu, Th, **Sun** 7-9 pm in KH 105

- **<u>Homework:</u>** <u>Homework 2</u> due **next Wednesday** at 4 pm in the boxes outside Kemeny 008. Separate your homework into **part A, part B, part C** and **part D** and staple it.

# 1

# Linear Equations in Linear Algebra

## 1.6

## APPLICATIONS OF LINEAR SYSTEMS

LINEAR ALGEBRA
AND ITS APPLICATIONS

FIFTH EDITION

DAVID C. LAY • STEVEN R. LAY • JUDI J. MCDONALD
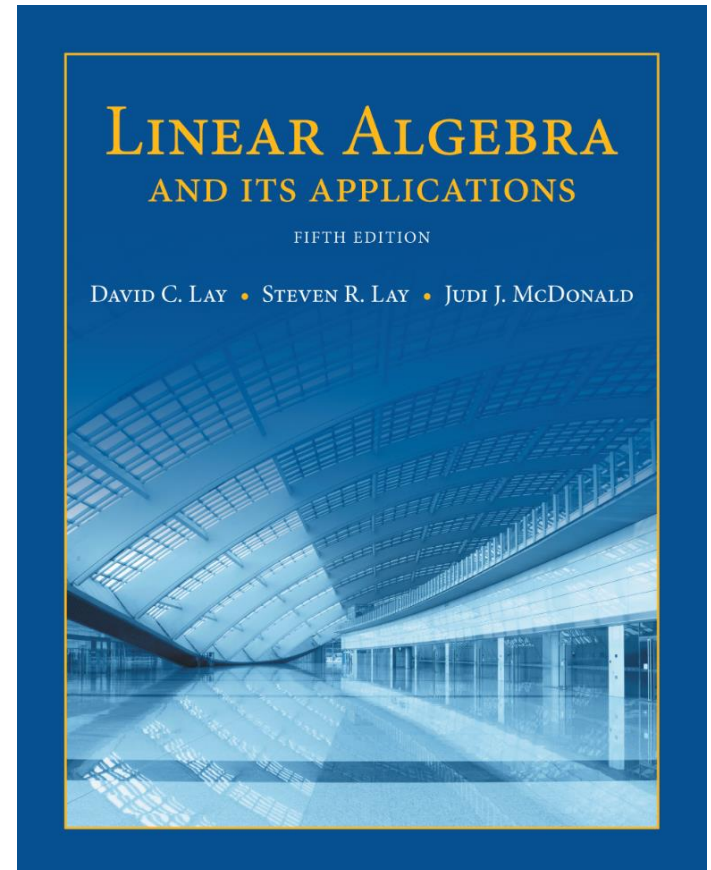
# WHY LINEAR ALGEBRA?

- **1.)** Almost **all functions** can be **approximated** by piecewise **linear functions**

- **2.) 20 % of all CPU time** goes into solving **linear equations**

- **3.) Mastering** Linear Algebra is **essential** for **all basic sciences**

# A SIMPLE ECONOMY

- **Example:** Our sandbox economy has a three sectors:

  Coal (**C**), Electricity (**E**) and Steel (**S**).

Let $\mathbf{p}c$ = price of the total amount of output of **coal**

  $\mathbf{p}e$ = price of the total amount of output of **electricity**

  $\mathbf{p}s$ = price of the total amount of output of **steel**
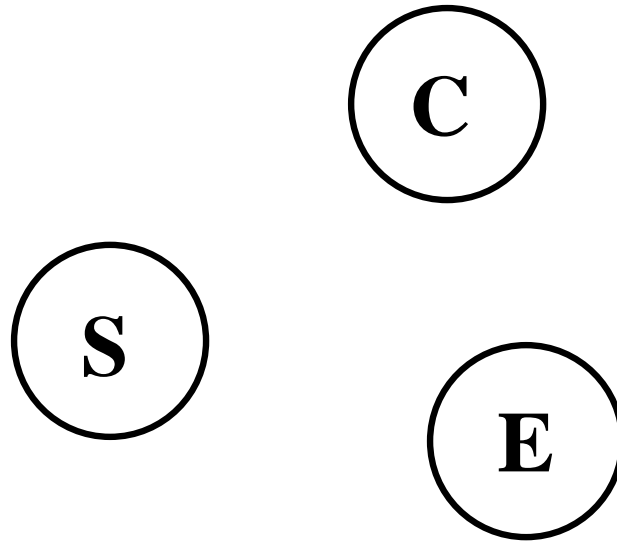
- We know that the **output of goods** is distributed in the following way:

**TABLE 1   A Simple Economy**

| Distribution of Output from: | | | |
|---|---|---|---|
| Coal | Electric | Steel | Purchased by: |
| .0 | .4 | .6 | Coal |
| .6 | .1 | .2 | Electric |
| .4 | .5 | .2 | Steel |

**Exercise:** Draw a flow diagram for the output of goods.



**Goal:** Set up the equations for $\mathbf{p}c$, $\mathbf{p}e$ and $\mathbf{p}s$ under the assumption that the system is closed i.e. no money leaves the system.

# A SIMPLE ECONOMY

# BALANCING A CHEMICAL EQUATION

**Example:** Burning propane.

$$(x_1)C_3H_8 + (x_2)O_2 \rightarrow (x_3)CO_2 + (x_4)H_2O$$
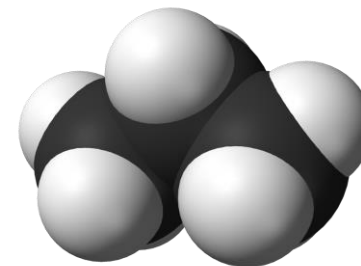
**Goal:** We want to balance this equation.

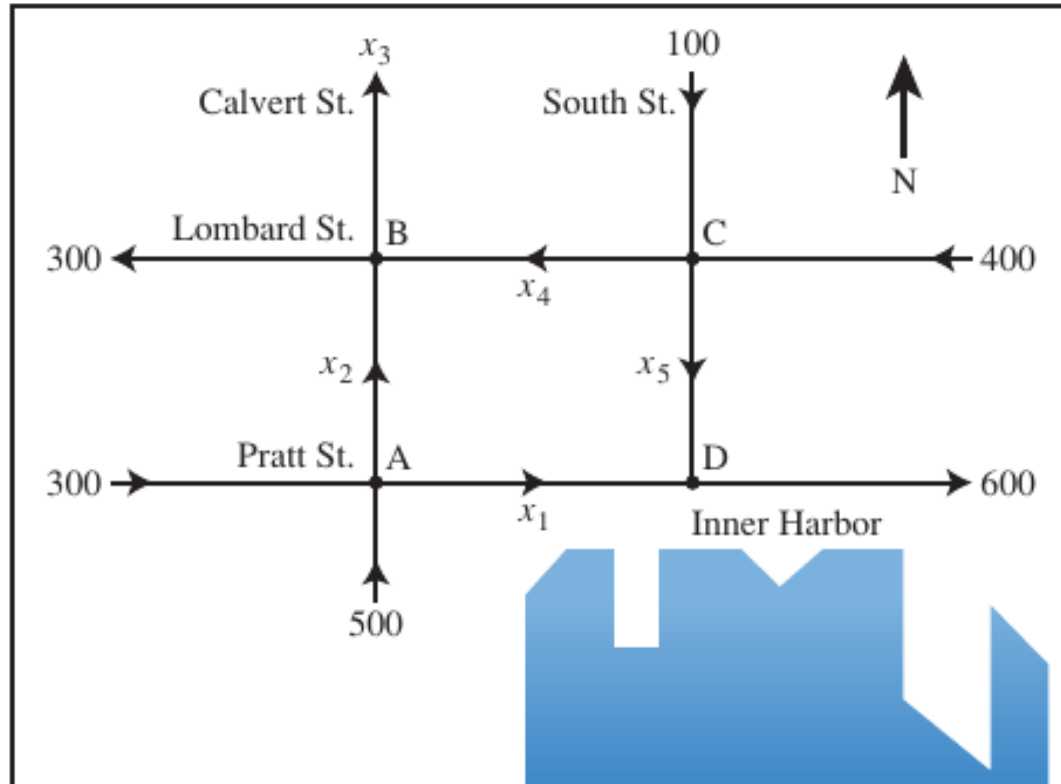**Example:** One way streets in Baltimore.



**FIGURE 2** Baltimore streets.

**Goal:** Examine the flow of cars.

# NETWORK FLOW

**Example:** One way streets in Baltimore.

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