

# MA162: Finite mathematics

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## SCHEDULE:

- Third Web Assign assignment (Chapter 2.1) due on Friday, September 13 by 6:00 pm.
- Fourth Web Assign assignment (Chapter 2.2) due on Tuesday, September 17 by 6:00 pm.

Today we cover chapter 2.2. This section develops the Gauss-Jordan Method, a systematic method for solving systems of linear equations.

# Gauss-Jordan Method

- Given a system of linear equations, the Gauss-Jordan Method will replace our system with another system.
- The new system will be
  - equivalent to the original system, i.e., the two systems will have the same solutions
  - easier to solve than the original system
- This is accomplished by performing row operations

# Row Operations

Performing these operations on a system of linear equations will not change the solution set:

- Swap the order of any two equations
- Replace any equation by a nonzero constant multiple of itself
- Replace an equation by the sum of that equations with a constant multiple of any other equation

# The Challenge

- We could apply the row operations in an ad hoc manner to convert our system into another, equivalent system.
  
  
  
  
  
  
  
  
  
  
- But the goal is to choose the "right" row operations so that the resulting system is very easy to solve.

## Using Gauss Jordan: 3 equations, 3 unknowns

Solve the system of equations:

$$x + y + z = 2$$

$$x + 2y + 3z = 4$$

$$x + 4y + 9z = 6$$

## Augmented Matrices: 3 equations, 3 unknowns

Solve the system of equations:

$$x + 2y + z = 1$$

$$3x + y + 4z = 0$$

$$2x + 2y + 3z = 2$$

Book-keeping device: Use an augmented matrix (you'll write down a lot less!)

$$\left[ \begin{array}{ccc|c} 1 & 2 & 1 & 1 \\ 3 & 1 & 4 & 0 \\ 2 & 2 & 3 & 2 \end{array} \right]$$

# Communicating Solutions

- There are a lot of steps involved in the Gauss-Jordan Method.
- You must clearly indicate which row operations you are performing.
- It is your responsibility to make sure that your solution is clearly communicated.
- The person reading your work should not have to make guesses about what you are doing.
- On exams and recitation quizzes, you will lose points if you do not clearly communicate your solutions!

## Tan, Chapter 2.2, Exercise 58 I

Michael Perez has a total of \$2000 on deposit with two savings institutions. One pays interest at the rate of 6%/year, whereas the other pays interest at the rate of 8%/year. If Michael earned a total of \$144 in interest during a single year, how much does he have on deposit in each institution?

## Tan, Chapter 2.2, Exercise 65 I

Lawnco produces three grades of commercial fertilizers. A 100-lb bag of grade A fertilizer contains 18 lb of nitrogen, 4 lb of phosphate, and 5 lb of potassium. A 100-lb bag of grade B fertilizer contains 20 lb of nitrogen, 4 lb of phosphate, and 4 lb of potassium. A 100-lb bag of fertilizer C contains 24 lb of nitrogen, 3 lb of phosphate, and 6 lb of potassium. How many 100-lb bags of each of the three grades of fertilizers should Lawnco produce if 26,400 lb of nitrogen, 4900 lb of phosphate, and 6200 lb of potassium are available and all the nutrients are used?

## Tan, Chapter 2.2, Exercise 67 I

The management of Hartman Rent-A-Car has allocated \$2.25 million to buy a fleet of new automobiles consisting of compact, intermediate-size, and full-size cars. Compacts cost \$18,000 each, intermediate-size cars cost \$27,000 each, and full-size cars cost \$36,000 each. If Hartman purchases twice as many compacts as intermediate-size cars and the total number of cars to be purchased is 100, determine how many cars of each type will be purchased. (Assume that the entire budget will be used.)