Math 130 Linear Algebra

Prof. D. Joyce, Clark University

Monday, 31 Aug 2009, first class

Welcome to the course! Much of today we'll discuss the administration of the course. The course web page is at

`http://aleph0.clarku.edu/~djoyce/ma130/`

We will discuss the general description of the course, its goals and objectives, the syllabus, the textbook, assignments, quizzes, tests, course grade, and various sundry items.

Systems of linear equations. After discussing the course in general, we'll move on the subject matter. We're starting out with something you already know, systems of linear equations. You've looked at these before in various algebra classes, so this is really a summary. There are many ways to solve such a system, but we'll concentrate on a systematic method called *elimination*.

We'll begin by looking at the the method of elimination as the ancient Chinese did it. See *The Chinese method of elimination* at

`http://aleph0.clarku.edu/~djoyce/ma105/simultaneous.html`

It's a standard algorithm that's been rediscovered over and over. For this algorithm, a matrix of numbers is formed from the system of linear equations. For the time being, the word "matrix" just means a rectangular array of numbers. As we add operations on matrices ("matrices" is the plural of "matrix"), the concept of matrix will mean more than just a rectangular array.

Once the matrix of numbers is formed from the system of linear equations, we will Then it's converted into what's called "echelon form," and converted further into what's sometimes called "reduced echelon form." From that, the solution can be read directly off the resulting matrix.

When there are the same number of equations as there are unknowns, frequently the system of equations has exactly one solution. But sometimes such a system has no solutions, and sometimes it has infinitely many solutions.

MATLAB. We'll use MATLAB to illustrate topics in linear algebra. It's available in the computer lab. For the MATLAB tutorial, see

`http://www.mathworks.com/academia/student_center/tutorials/launchpad.html`

Our text discusses MATLAB in Chapter 12. Read the first couple of sections for an introduction.

Below is a short MATLAB session to solve the following system of linear equations.

$$\begin{cases} 2x - 3y + 4z = -12 \\ x - 2y + z = -5 \\ 3x + y + 2z = 1 \end{cases}$$

In the session, a matrix `A` is created that holds the coefficients, and a column vector `b` holds the constants. The solution is computed with the instruction `x = A\b` which says the solution is $(x, y, z) = (1, 2, -2)$.

```
$ matlab
                < M A T L A B >
   Copyright 1984-2007 The MathWorks, Inc.
         Version 7.5.0.338 (R2007b)
               August 9, 2007

>> A = [2 -3 4; 1 -2 1; 3 1 2]

A =
     2    -3     4
     1    -2     1
     3     1     2

>> b=[-12; -5; 1]

b =
   -12
    -5
     1

>> x = A\b

x =
    1.0000
    2.0000
   -2.0000

>> exit
$
```

Due Wednesday. Exercises from section 1.1, page 8, numbers 1–4, 13–14, 21–22, 23, and T4.

Read for Wednesday sections 1.1 on linear systems and 1.2 on matrices.

Due Friday. Exercises from section 1.2: 1–2, 4–7 parts a–d each, 8, 9, T1, T5a.