MA/CS 321:001
MWF 11:00–11:50
FB 213
Fall 2004

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Announcements.
The exam will be rescheduled for Wednesday, 10 November 2004.
I hope to cover all of section 7.1.
HOMEWORK 7.
This assignment will be due on Wednesday, 17 November 2004.

1. (15 points) Write a matlab function to solve a linear system $Ax = b$ by naive Gaussian elimination and back-substitution.

   The function, `function x = mygauss(a,b)` will accept a $n \times 1$ vector `b` and a $n \times n$ matrix `a` and return a vector `x` which should be a solution of the system of equations `ax=b`.

   You should check for division by zero and report an error if this is attempted.

   You may test your code by comparing with the matlab operation `x = a\ b`. You may use `a = rand(n,n), x=ones(n,1), b =a*x` to produce systems with a known solution for testing.

   Because matlab operates naturally on vectors, rather than scalars, our solution can be a bit simpler than what appears in the book. Generally, there will be one less for loop. To help you get started and to introduce the matlab syntax necessary for this exercise, an example file is available at www.math.uky.edu/∼rbrown/courses/ma321.f.04/. The file `samplegauss.m` will eliminate entries in the first column.

   Test your function with the script `vandertest.m` which may be found at www.math.uky.edu/∼rbrown/courses/ma321.f.04

   To hand in: Your function mygauss.m and the result of running the script vandertest.m.

2. (5 points) #3d, page 275.

3. (5 points) Consider the system

$$\begin{aligned} 10^{-4}x + 1y + 0z &= 1 \\ x + y + 2z &= 1 \\ x + 0y + z &= 1 \end{aligned}$$

Carry out naive Gaussian elimination to find the solution. Assume that the result of each arithmetic operation is rounded to 3 significant figures. [1]

Now, consider the same system written in the form

$$\begin{aligned} x + y + 2z &= 1 \\ 10^{-4}x + 1y + 0z &= 1 \\ x + 0y + z &= 1 \end{aligned}$$

and solve in the same way.

Compare your answers. Which solution is right?

November 15, 2004

[1] A decimal number has three significant figures if can be written in the form $0.d_1d_2d_3 \times 10^k$ where the digit d_1 is not zero and k is an integer. For example, 9999 would round to $10^4 = 0.100 \times 10^5$.