Final Exam
Preparation Guide

Linear Algebra

December 9, 2008

The final exam will focus on Chapters 5 and 6 of Lay's *Linear Algebra*, along with the reading *The* $\$25,000,000,000$ *eigenvector*. The list of topics below is not exhaustive, but should get you "most of the way there."

Also, please complete the following problem from *The* $\$25,000,000,000$ *eigenvector* — Exercise 9. To complete this problem, you may use your text, the article and your notes. You may not consult any other source or collaborate with any living person. (Note that Gauss is dead, thus you may collaborate with him.) You will turn the problem in with your exam, along with a completed honor code pledge.

The exam occurs on Tuesday, December 16th, 9am-12pm in Hillcrest 103. (**The exam is NOT in Warner.**) Please do not bring any materials, other than pen, pencil and your solution to the above problem, to the exam room.

I anticipate being in my office most of December 10th, 10am-12pm December 11th and December 15th 2pm-4pm. Your are also welcome to make an appointment.

This page will also be posted to the course webpage.

Definitions to know:

- Eigenvector, eigenvalue, eigenspace,
- characteristic equation,
- inner product = dot product,
- length = norm,
- orthogonal, orthogonal basis, orthonormal set, orthonormal basis,
- least-squares solution and the normal equations,
- least-squares error

Theorems to know the proofs of:

- Theorem 1 of Chapter 5.1
- Theorems 4 and 5 of section 6.2
- The Orthogonal Decomposition Theorem
- Gram-Schmidt Process

You should know the statements of all other theorems in the sections we covered.

Be able to:

- find the eigenvalues of a matrix and corresponding eigenvectors,
- analyze the long-term behavior of a dynamical system,
- find the characteristic equation of a matrix,
- diagonalize a matrix,
- determine when a matrix is diagonalizable,
- find the matrix for T relative to the bases $\mathcal{B}$ and $\mathcal{C}$, and the $\mathcal{B}$-matrix for T,
- compute an orthogonal projection of a vector y onto a subspace L,
- apply the orthogonal decomposition theorem (and know why it is so handy),
- apply the Gram-Schmidt process to find an orthogonal basis,
- find a QR-factorization of a matrix,
- solve a leas-squares problem and compute the least-squares error.