Final Exam
Preparation Guide

Linear Algebra

December 12, 2017

The final exam will focus on Sections 4.7, 4.9, 5.1–5.4 and 6.1 – 6.5 of Lay's *Linear Algebra*.

The list of topics below is not exhaustive, but should get you "most of the way there."

The exam occurs on Wednesday, December 13 7–10pm in our usual room of Warner Science Hall. **Please do not bring any materials other than pen and pencil to the exam room. Do not bring bags, paper, books, cell phones, pagers, toys, music.** Please occupy every other row of seats.

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 least-squares problem and compute the least-squares error,