

# **Linear Algebra: Math-2641 Strengths and Weaknesses Spring 2009 Book Search**

**Title: Elementary Linear Algebra, 2<sup>nd</sup> Edition**

**By Spence, Insel, Friedberg - Prentice-Hall**

***Strengths:***

- ♦ The presentation level seems to be most in line with GPC student abilities.
- ♦ Excellent set of problems.
- ♦ Very readable text
- ♦ Nice real life applications
- ♦ All computations are designed so that only “nice” numbers are involved.
- ♦ Most sections include approximately 20 True/False questions to test a student understanding of the concepts (Answers to T/F questions are given in the book)
- ♦ For a proof-oriented course, a significant number of accessible exercises requiring proofs are included. They have been ordered according to difficulty.
- ♦ The book includes a wide variety of applications
- ♦ All the materials for our course are covered adequately.

***Weaknesses:***

- ♦ As the subtitle says, it is a matrix approach, and general vector spaces are not mentioned until the last chapter.
- ♦ Exercises are oriented toward computation and algebraic manipulation. There are not many conceptual-type problems, except for some sections with True/False questions which do not delve too deeply.
- ♦ Vector spaces are at the end of the book.
- ♦ Some unusual choices in the order of topics. For example: matrices are covered before systems of linear equations and subspaces are covered much earlier than vector spaces.
- ♦ Little discussion on numerical calculations and the use of technology. There is a short, one page, discussion comparing calculations for various ways of solving a system, a handful of problems requiring a CAS; and an appendix on MATLAB use of technology is strikingly absent from the text.
- ♦ Little or no discussion of formulas that use matrix entries calculations.

## **Title: Linear Algebra and its Applications, 3<sup>rd</sup> Edition Updated**

**By Lay, - Addison-Wesley**

### ***Strengths:***

- ♦ Good, interesting applications. This book gives the student a good sense of what linear algebra is used for. One gets the impression that some of the applications presented in the book could be implemented immediately after taking the course.
- ♦ Makes good use of technology such as MATLAB, which makes it possible to cover interesting, relevant topics that require intense computations.
- ♦ Very readable text with an excellent variety of problems.
- ♦ Nice geometric visualizations.
- ♦ Nice real life applications.
- ♦ Many True/False questions
- ♦ Good, concise book. It covers the major topics, yet it is still possible to cover most of the text in a semester.
- ♦ Good illustrations of many concepts.
- ♦ A modern view of matrix multiplication. Definitions and proofs focus on the columns of a matrix rather than on the matrix entries.
- ♦ Numerical Notes give a realistic flavor to the text. Students are reminded frequently of issues that arise in the real-life use of linear algebra.
- ♦ Good variety of exercises, including applications, theory, true/false, and computer problems.

### ***Weaknesses:***

- ♦ Homework problems tend to be too easy, and even many “Show that ...”-type problems are little more than applying a definition. There are not enough challenging problems, or problems which extend the student’s knowledge.
- ♦ There is a lot of redundancy in the ordering of topics. Chapter 1 has not only elimination and row reduction, but also independence, span, and transformations, material which is repeated in Chapters 2, 3, and 4. In fact, it would be better if Chapter 2 and Chapter 4 switched places.
- ♦ Elementary concepts such as rank and dimension are deferred to the end of Chapter 2, where they are merely defined (in fact, dimension isn’t really explained at all). Explanations for these do not come until Chapter 4.
- ♦ A number of proofs are unnecessarily opaque and wordy. For instance, see the proof of the determinant representing the area of a parallelepiped spanned by its columns (Sec. 3.3, Theorems 9 and 10). The author is attempting to break the reasoning down into chunks the student can digest, but I think clarity is lost rather than gained in the process.
- ♦ Some topics are unnecessarily repeated in two places.

- ♦ It is weak on Inner Product Spaces.
- ♦ Lack of depth for several topics, for example inner product spaces.
- ♦ Not many homework problems on basic skills (Gaussian elimination, calculating inverses, finding least-squares solutions, etc.), especially for classes emphasizing hand work instead of technology
- ♦ Little or no discussion of formulae that use matrix entries calculations.

**Title: Elementary Linear Algebra, applications Version, 9th Edition**

**By: Anton, Rorres, - John Wiley & Sons**

***Strengths:***

- ♦ Very nice treatment of Inner Product Spaces
- ♦ The book covers all the material in CCO
- ♦ It has good exercises and uses technology
- ♦ Contains nice historical notes
- ♦ It is supported online. The entire text is online, with tutorial problems.
- ♦ A new improved Edition is in preparation.
- ♦ The student can read the book by themselves.
- ♦ It has 21 very interesting application topics at the end of the text.
- ♦ The book has a lot of depth on some topics that we generally just touch on, such as inner product spaces and complex vector space.
- ♦ Good exercise sets, including specific sections on technology based problems for every chapter.
- ♦ The book includes many features that enhance the text such as historical footnotes, illustrations, and many discussion/discovery examples.

***Weaknesses:***

- ♦ Some important topics like LU decomposition and Least Squares are treated in the Appendixes.
- ♦ Little or no discussion on numerical calculations.
- ♦ The 10<sup>th</sup> Edition will be available only next year.
- ♦ The online grading system has several irritating errors.
- ♦ Some topics seem unnecessarily split up: for example least squares is covered in the middle of Chapter 5, while data fitting is not until 9.3.
- ♦ Little or no discussion on numerical calculations
- ♦ Vectors are most often represented as row-vector