

LINEAR NUMERICAL ANALYSIS

Math 356/ 556

Spring 2008

- INSTRUCTOR:** Saadat Moussavi
- ROOM:** Swart 4
- TIME:** Tuesdays, Thursdays 1:20 – 2:50
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- OFFICE HOURS:** Tuesdays, Thursdays 11:15 – 1:15
Tuesdays, Thursdays 4:35 – 5:35
Mondays, Wednesdays, Fridays By appointment
- TEXT:** “A New Approach to Numerical Linear Algebra with Maple”
(Preliminary Version), by Saadat Moussavi
- SOFTWARE:** "Maple", (This software is available on computers in Student Computer Labs)
- COURSE COVERAGE:** We will cover the following topics:
- Chapter1: Matrix Preliminaries, Dyad Operator, Direct Methods for Solving Linear systems, Pivot Strategy, LU Decomposition, Matrix Norm and Condition Number.
- Chapter2: Eigenvalues and Eigenvectors, Unitary Matrices, Hermitian Matrices, Similar Matrices, Tridiagonal Matrices, Householder Method, QR Factorization, QR Algorithm, Power Method, Deflation and Bisection Method.
- Chapter3: Lanczos Method, Givens Method, Schur Decomposition, Singular Value Decomposition, Pseudoinverse, Overdetermined and Underdetermined Systems, Orthonormal Bases, Spectral Radius and Iterative Methods.
- Appendix A: Introduction to Maple

OBJECTIVES AND GOALS:

Numerical Linear Algebra, no longer a subtopic of Numerical Analysis, has grown into an independent topic for research and teaching. Because it is crucial to scientific computing, numerical linear algebra is becoming integral to courses in mathematics, computer science, engineering and many more. Our primary objective is for the students to develop a firm grasp of the concepts of round off error, stability, condition, accuracy, and also to appreciate the core algorithms, their usefulness and implementations. We are hoping that the students will be able to handle real-life problems, which are drawn from numerous disciplines including heat transfer, fluid dynamics, signal processing, biomedical engineering, statistics, business, bioscience control theory.

To be able to pursue this description the students need to learn

1. How to take a non-mathematical problem and interpret it mathematically (modeling).
2. How to use algorithms and strategies to understand and solve the appropriate model and provide a convincing argument that the solution is consistent (problem solving and validation).
3. How to communicate effectively both individually and/or collaboratively in written and spoken discourse (communication and work environment).
4. How to use the proper software packages for computer and creating programs to solve the large problems (technology).
5. None of the above goals are accessible if the student has lack of knowledge and versatility in basics and fundamentals (connections and general skills).

EXAMS:

2 exams + 1 final exam. Dates will be announced at least one week in advance.

HOMEWORK & PROGRAMS:

Some problems will be suggested (answers will be available). Some problems will be collected to be graded. There will also be some programs to write, coding in Maple.

Remark 1: Students are encouraged to work in teams on the homework assignments. Homework teams will be the students' responsibility. All assignments turned in will be clearly marked on the top of the first page with the team member's names.

Remark 2: Homework teams are encouraged in order to generate productive discussions regarding the solutions of the assigned exercises. Discussions involving three or four people might not provide for a uniform involvement of all participants. This might lead to a student not developing the skills necessary to independently solve these problems. Therefore, homework teams should be limited to no more than four people.

Remark 3: If you will have difficulty in meeting the homework or schedule, you should tell me as soon as possible.

JOURNALS: At the end of each unit, report your critical and constructive thoughts on the covering topic. This report should include your understanding and analytical statement along with any comments and/or suggestions.

TEST

MAKE-UPS: Make-ups for missed tests will be available in very special cases. (If you intend to miss a scheduled test and expect to get any consideration with respect to a make-up, I should be notified at least 24 hours in advance.)

GRADING:	EXAM I	20%
	EXAM II	20%
	FINAL	23%
	HOMEWORK, PROGRAMMING PROJECTS, PRESENTATION & JOURNAL	37%

Note: There will be some homework, programming, and presentation opportunities just for extra credit.

SCALE:

<u>Letter</u>	<u>% Range</u>
A	[92, 100]
AB	[89, 92)
B	[80, 89)
BC	[77, 80)
C	[69, 77)
CD	[66, 69)
D	[56, 66)