Midterm: March 9th, 2005
Time: 10:00 am -1:00 pm
Room: G21

Changes in Grading

Each student will now choose from the schemes below. Scheme II is the default scheme that will be alloted. If you wish to do Scheme I please let me know in person by Thursday.

Scheme I	
Homework and Quizzes	10%
Midterm	25%
Project	15%
Final	50%

Scheme II	
Homework and Quizzes	10%
Midterm	35%
Final	55 %

Information on projects is on the back side.

Exam Instructions:

1. The Exam will be closed book. No notes.
2. Please show your work in the exam, write in complete sentences, and Indicate your answers clearly.
3. The exam will have 7 questions and shall be worth 100 points.

Preparing for the Midterm:

1. There are three references in the Library.
   (a) G.E. Recktenwald, Numerical Methods with Matlab: Implementations and Applications.
   (b) A. Ralston and P. Rabinowitz : First Course in Numerical Analysis
   (c) R.J.Schilling and S.L.Harries : Applied numerical methods for engineers using MATLAB and C.
2. The syllabus will be everything covered in class upto (and including) Tuesday March 1, 2005. This is intended as a check-list and it is **not** meant to be exhaustive. If I miss something out then please send me an email, I will added it onto the web-based copy.
   (a) You should know the definition/meaning of the following terms/notions:
      i. Floating Point number, Round-off error, overflow, Truncation error.
      ii. Bracketing, Bisection method, Secant Method, Newton's Method, Regula Falsi, Hybrid methods, Convergence criteria.
      iii. inner product, matrix operations, norms, rank, null space, column space, linear independence, consistency
      iv. Permutation matrix, Gaussian Elimination, Pivoting, Back and forward substitution, LU decomposition, Cholesky Decomposition, Well and ill conditioned matrices, condition number κ, flops, Non-linear systems.
   (b) You should know the following MATLAB commands/terms/operations:

i. function, script files.
ii. array indexing, vectorisation, Global, local variables.
iii. Built in functions discussed in class and the method of execution.
iv. Extracting columns or rows from matrices

(c) You will need to know how to accomplish the following tasks:

i. Give a definition and one example of cancellation error.
ii. Identify (at least) two important differences between symbolic and numeric computations.
iii. Use an infinite series to give an example of truncation error, with Big O notation.
iv. Be able to distinguish the effects of roundoff and truncation errors in a computed result, for example, by viewing a plot such as Figure (5.4) in G.E. Recktenwald.
v. Writing m-files , analysing the pros and cons of, and specifying convergence criteria: Bracketing, Bisection method, Secant Method, Newton's Method, Regula Falsi, Hybrid methods.
vi. Writing m-files, stating conditions required for a successful LU factorization of A and Cholesky factorization of A. Further, given a decomposition how to solve the linear system.
vii. Given L, U, and permutation matrix P from an LU factorization of A, apply these to solve $Ax = b$. Specifically, use the P appropriately.
viii. Order of flop estimates for Gaussian elimination with back substitution, LU factorization, and Cholesky factorization.
ix. Implement solutions of nonlinear systems of equations with (iterative) successive substitution and Newton's Method.
x. Describe the qualitative relationship between the magnitude of $\kappa(A)$ and the singularity of A.

Projects for this Semester

The projects as stated above are optional. I will be offering projects in one of the following topics:
(a) Algebra
(b) Probability
(c) Numerical Analysis and
(d) Linear Algebra.
If you wish to do a project in an area of your choice not listed above then please talk to me about it.

Basic Plan: The basic plan for a project is that: you will be given a brief summary of a subject, a list of key words for you to learn. Each one will be responsible for finding references, learning these key words and general aspects of the subject. Then two weeks later (say) you will be given some problems to work on. Finally, you will then assemble what you have learnt (brief description of the project and solution to the problems) into a report for submission (say after 3-4 weeks after you get the questions).

Benefits: As will be evident from the idea or otherwise, this is not like a test. You can always consult–check the solutions with me . Regular and responsible work are the keys to a successful project report. Overwhelming majority of my past students (96 out of 100 odd) really liked doing such a project, they found that learning (a bit) of a related subject quite rewarding. I have some of the past project reports with me, do drop by my office if you would like to see them. Apart from the material one will also get experience of how to submit a paper/report, always useful to have.