

Final: Wed May 2nd, 2012
Time: 10:00 am -1:00 pm

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 5 questions and maximum score will be 100 points.

Preparing for the Final:

1. The syllabus will be everything covered in class upto Tuesday, April 17th, 2012. 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.
 - v. curve fitting: method of least squares, normal equations
 - vi. Interpolation: Lagrange interpolation, Newton's basis, cubic splines (boundary conditions), divided difference table, Error estimates.
 - vii. Methods to solve integration: Simpson's rule, Trapezoidal rule, Gauss-Legendre Quadrature, composite rule and Adaptive method, Error estimates.
 - viii. Methods to solve a first order differential equation numerically: mid point, Euler, Runge-Kutta.
 - (b) You should know the following OCTAVE 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
 - v. Reconstruct m-files from the given prologue
 - (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,

- 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 .
 - xi. Set up and Perform Least square line fit
 - xii. Solve examples by hand for simple Interpolation problems using above listed methods.
 - xiii. Solve examples by hand for simple integration problems using above listed methods and also the relationship between them.
 - xiv. Solve examples of first order differential equation numerically using above listed methods.
2. Go through all homework problems, quizzes and worksheets given in class.