CSC336S Numerical Methods Spring 2016

Lecturer : Christina C. Christara (ccc@cs.toronto.edu)
Lectures : Tuesday 7-9 p.m. Room BA 1180
Tutors : Jonathan Calver, Yuwei Chen, Michael Chiu, Lin Gao
Tutorial : Tuesday 6-7 p.m. Room BA 1180 (some tutorial times may be used for lectures)
Office Hours : Tuesday 5-6 Room BA 4226
Textbook : Michael Heath, Scientific Computing: an introductory survey, McGraw-Hill Inc. 2002,
a reduced version, appropriate for the course, is available in Bookstore (Custom Publishing)
Web site : `http://www.cs.toronto.edu/~ccc/Courses/336.html`
Bulletin board : `https://csc.cdf.toronto.edu/csc336h1s`

Aims of course

Introduce numerical methods for solving (linear, nonlinear, differential) equations, approximation problems and integration problems.
Evaluate numerical methods with respect to their accuracy, time and memory complexity.
Develop and practice computer skills in implementing numerical methods efficiently on the computer.
Use high level software for studying numerical methods.

Skills / Knowledge testing in the course

Apply basic principles, not recall lecture notes in detail
Problem recognition
Method recognition
Apply a given method correctly
Solve a numerical problem efficiently and reliably using high level mathematical software.

Prerequisite Mathematics and other

Ability to handle notation and to do algebraic manipulation
Matrix and vector addition and multiplication, elementary row operations, linear (in)dependence
Differentiation and integration of polynomial, trigonometric, exponential, logarithmic and rational functions
Elementary calculus including
Taylor series, Rolle's and mean value theorems, functions graphs, continuity, limits, de l' Hospital's rule, etc.
Induction
Other: knowledge of some programming language, such as MATLAB.

Computer accounts

You will get (or have already) a computer account on the CDF Unix system. Consoles/workstations are located in the Bahen building. You must log-in frequently and read mail, news and other messages relating to the course through your account.

Marks distribution

Assignment 1	Due Tuesday, February 9, 2016	12%
Term test	Tuesday, March 1, 2016	24%
Assignment 2	Due Tuesday, March 15, 2016	12%
Assignment 3	Due Wednesday, April 6, 2016	12%
Final exam	2 hours	40%

- Must get at least 33% in the final exam.
- Must get at least 33% average in the computer assignments.
- **Midterm test and Final exam**: calculators are the only aids permitted.

Problem sets / Computer assignments

problem sets: please write as clearly as possible.

Capitalize or underline your last name in the front page of your paper.

computer assignments: don't leave it to the last minute - think of the following
- − the machine being down, when you need it.
- − the workstation room being crowded.
- − the printer being stuck, when you are just at the time to get your final listing.
- − accidentally deleting an important file.
  overcome this by using backup procedures (for the source and data files only).

The above are not good reasons for extension of the assignment due date.

Late assignment policy

Assignments are due the day posted, during class time. Assignments submitted late have a reduction of marks based on the maximum total marks the assignment could get had it been submitted on time (and not on the total marks the assignment actually got). Each day costs 10%, to a maximum of 5 days. Assignments submitted later than 5 days after the due date do not receive any marks. Weekends and holidays count as regular days for the purpose of late assignment policy.

Topics to be covered

- Computer Arithmetic and Computational Errors (Ch 1) − 3 hours
  - Representation of numbers, machine arithmetic
  - Round-off error, error propagation, conditioning, stability
- Square linear systems of equations (Ch. 2) − 8 hours
  - Gauss elimination, LU factorisation, pivoting, scaling, forward and back substitution
  - Vector & matrix norms
  - Condition numbers for systems
- Nonlinear equations / systems (Ch. 5) − 6 hours
  - Bisection, secant
  - Fixed point iteration, Newton's method
  - Convergence
- Interpolation (Ch. 7) − 5 hours
  - Polynomial interpolation
  - Piecewise polynomial interpolation
  - Spline interpolation

Other references

Conte, S. D. and Carl de Boor
Elementary Numerical Analysis
McGraw-Hill Inc.

Johnson, L. W. and R. D. Riess
Numerical Analysis
Addison Wesley

D. Kahaner, C. Moler, S. Nash
Numerical Methods and Software
Prentice Hall

Stoer, J. and R. Bulirsch
Introduction to Numerical Analysis
Springer Verlag

Richard L. Burden and J. Douglas Faires
Numerical Analysis
Brooks/Cole

Hager, William
Applied Numerical Linear Algebra
Prentice Hall

Moler, Cleve
Numerical Computing with MATLAB
Cambridge Univ. Press

I have ordered a custom-made copy of the Heath book that costs about $70, at the UT Bookstore. This is the same book used for CSC436. The custom-made copy is a reduced version of the book, but includes all the chapters needed for CSC336 and the other numerical courses.