Mathematics 465/565
Numerical Methods I
Fall 2017 (TuTh 10:30-11:45, MB 139)

Instructor: Dr. Grady Wright
Phone: 426-4674
Office: MB-140B
E-mail: gradywright{at}boisestate{dot}edu
Office Hours: Wednesday: 1:00-3:00pm, or by appointment

Text:  A First Course in Numerical Methods by Ascher and Greif, SIAM 2011

Website:  http://math.boisestate.edu/~wright/courses/m565

Course description: This is the first half of a year long introductory course on numerical methods. The topics covered this semester include floating point arithmetic, scalar nonlinear equations, direct methods for linear systems of equations, interpolation, approximation theory, and numerical integration. In the second semester (MATH 566), we cover more advanced numerical linear algebra topics (e.g. eigenvalues/eigenvectors, over/underdetermined linear systems, singular value decomposition), discrete Fourier analysis, and the solution of nonlinear systems of equations.

Prerequisites: MATH 365: Introduction to Computational Math.

Homework: Homework is posted on the class website every other week. The problems involve a mix of theory and computing. Regarding the latter, please read the text below the Programming heading. Students register for MATH 565 (the graduate course) will be assigned more detailed problems and will be held to a higher standard than those in MATH 465.

Your submitted homework should show all necessary work you used to solve the problems; mathematical statements should be complete (or nearly complete) sentences; and the reasoning and logic underlying all arguments should be clearly spelled out. Computer programs should be included along with numerical results presented in a readable format (e.g., in a table with headings or in a plot with labels). Please see the document “How to Present your Work” on the course web page for tips on meeting these requirements. Failure to adhere to the above requirements may result in a loss of points.

Late homework assignments are accepted up to three days beyond their due date. However, a 10% penalty is applied for each twenty four hour period they are late. This means that if an assignment is turned in after 12:00pm on Thursday, but before 12:00pm on Friday, then 10% is automatically deducted. Late homework assignments need to be brought to my office or, if you have the means, e-mailed to me. Please indicate the date and time you put the homework in my box or I will assume it was turned in moments before I retrieved it from my box.

Grading Policy: The final grade for the course is based on homework assignments, a midterm exam, and a final exam. The breakdown for the course grade is as follows:
  • Homework and midterm: 70%
  • Final (Thursday, Dec. 14, 2017, 10:00-12:00am): 30%

The midterm counts as two homework assignments. The lowest homework score is discarded (half of the midterm can be discarded).

Programming: I highly recommend that you use MATLAB for all programming assignments involving numerical computations. An important part of numerical analysis today is the use of commercial or public domain software packages for solving particular problems. In order to gain exposure to this side of
numerical analysis, students need to practice using such packages. MATLAB offers the perfect opportunity for such practice; it is one of the most dominant commercial computing environments. The MATLAB language is intended to be easy to learn and use, while still being extremely powerful. Three other reasons for using MATLAB for the programming assignments is that: 1) The book contains a MATLAB implementation of several algorithms discussed; 2) My examples and homework assignments will use MATLAB code; 3) I can help debug your MATLAB code; the same may not be true of other languages.

If you have not used MATLAB previously, help resources are available on the course website and from the instructor. MATLAB is available in the Undergraduate mathematics computing lab (as well as various other locations on campus). You can also obtain a free version of MATLAB to install your own personal machine from OIT.

Problems involving symbolic computations can be done using Maple or Mathematica, both of which are available in the Undergraduate student mathematics computing lab. Please do not use these software packages for the numerical computing problems.

Important Dates:
• See the registrar for a complete list important dates regarding dropping the course, and holidays.
• December 8 – Classes end
• Final exam – Thursday, December 14, 2017 from 10:00am to 12:00pm.

Material to Cover: We will cover the following material (in roughly this order):

1. Introductory material, floating point arithmetic (Ch. 1-2)
2. Nonlinear equations (Ch. 3)
3. Linear equations (Ch. 4-5)
4. Interpolation (Ch. 10-11 and my notes)
5. Approximation theory (Ch. 12 and my notes)
6. Numerical integration (Ch. 15)

Other suggested references:
• Driscoll, Learning MATLAB, SIAM 2009 (Available electronically from the BSU Library)
• Atkinson, An Introduction to Numerical Analysis (John Wiley and Sons)
• Dahlquist and Björck, Numerical Methods (Dover reprint 2003)
• Henrici, Essentials of Numerical Analysis (John Wiley and Sons)
• Fröberg, Introduction to Numerical Analysis (Addison-Wesley)
• Trefethen and Bau, Numerical linear algebra (SIAM)
• Golub and Van Loan, Matrix Computations (Johns Hopkins University Press)
• Demmel, Applied Numerical Linear Algebra (SIAM)
• Fornberg, A Practical Guide to Pseudospectral methods (Cambridge University Press)

MATH 401 Senior Project:
Applied Math majors can complete a project related to the topics of this course for one credit of Math 401 (Senior Project). Completion of Math 401 is a requirement for the Applied Math degree. Please talk to me about signing up this course. Details on the project will be discussed later, but will consist of a proposal, report, and oral presentation.

The purpose of computing is insight, not numbers! –Richard Hamming