MATH 5660-E01 – Numerical Analysis I

Summer 2024
Department of Mathematical and Statistical Sciences, University of Colorado Denver

Instructor information

Instructor: Julien Langou, email: julien.langou@ucdenver.edu or through Canvas.

Office hours: By appointment. I will try to be as flexible as possible while trying to maximize the attendance at my office hour.

Course catalog description and requisites

MATH 5660 - Numerical Analysis I - 3 Credits

A first semester course in numerical methods and analysis fundamental to many algorithms encountered in scientific computing, data science, machine learning, and computational models in science and engineering. Rounding errors and numerical stability of algorithms; solution of linear and nonlinear equations; data modeling with interpolation and least-squares; and optimization methods.

This course assumes that students have the equivalent of differential and integral calculus (e.g., MATH 2411), linear algebra (e.g., MATH 3191 or 3195), and computer programming (e.g., MATH 1376 or CSCI 1410).

Prereq: Graduate standing in Applied Mathematics.

Course Goals

Completion of this course will provide you with

1. an understanding of the basic theory of solving mathematical problems with computers while being cognizant of floating-point arithmetic including issues of overflow and underflow.
2. knowledge of the different issues surrounding errors in using numerical methods including machine epsilon, error analysis, convergence, rounding error, truncation error, and norms.
3. an appreciation of the difficulties involved in finding reliable solutions as well as be able to apply various methods for estimating errors in solutions in order to judge how reliable those solutions are.
4. an awareness of conditioning of problems and stability of algorithms and the distinguish between the two.

Programming Language

We will be using Python through Google Colab Jupyter Notebook (https://colab.research.google.com/).

Course materials and procedures

Textbook. Numerical Analysis, 3rd edition by Tim Sauer, ISBN-13: 9780134697376, published by Pearson, in 2018. The link to the textbook is https://www.pearson.com/en-us/subject-catalog/p/numerical-analysis/P200000006340/9780134697376.
More procedures. Assignments and additional course materials will be posted on Canvas. Announcements, including any revisions to this syllabus, will be announced and posted on Canvas.

Evaluation

During the semester, grades will be posted on Canvas. Students should regularly check their recorded grades, and immediately bring any discrepancies or disputes to the attention of the instructor. Note that the grade calculation capabilities of Canvas are limited and may not be accurate. Use the grading scheme as described in this syllabus to compute your course grade.

You are encouraged to work together in groups outside of class, as well as consult other resources. However, your solutions must be your own. Any submitted solutions that I feel have been mostly copied from other sources, including classmates, textbooks, or the web, will receive no credit. See also the later discussion on academic honesty.

Homework (10% × 7 = 70%). There will be 7 homework during the semester. Each homework is worth 10% of the final grade. For each homework, you need to turn in a "Google Colab Jupyter Notebook shared link" and a PDF with handwritten or typed solutions. The homework will be made with some questions from the textbook, some "reality check" from the textbook, and/or some questions written by your instructors.

Project (10% × 3 = 30%). There will be 3 "reality check" projects during the semester. Each project is worth 10% of the final grade. For each reality check, you need to turn in a "Google Colab Jupyter Notebook shared link" and a PDF with handwritten or typed solutions.

Final course grade scale. Final course letter grades will be assigned according to a student's total course score (calculated as described above). Letter grades for specific scores are given in the following table.

≥ 93%	A	≥ 87%	B+	≥ 77%	C+	≥ 60%	D	< 60%	F
≥ 90%	A-	≥ 83%	B	≥ 70%	C				
		≥ 80%	B-						

Due Dates.

Homework #1	Monday June 10th 2024	at 11:59pm
Homework #2	Monday June 17th 2024	at 11:59pm
Homework #3	Monday June 24th 2024	at 11:59pm
Homework #4	Monday July 1st 2024	at 11:59pm
Homework #5	Monday July 8th 2024	at 11:59pm
Homework #6	Monday July 15th 2024	at 11:59pm
Homework #7	Monday July 22nd 2024	at 11:59pm
Reality Checks #1, #2 and #4	Friday July 26th 2024	at 11:59pm