

Course Information

Course: COS 374/574 Scientific Computing
Call #: 42358 (COS 574 #48761)
Credit Hours: 3
Room: Payson Smith 204
Day/Times: T/R 9:30 A.M.– 10:45 A.M.
Prerequisites: Grade of C or higher in COS 160, MAT 252, and MAT 295.
Textbook: Lambers et al. (2018). *Explorations in Numerical Analysis*.
World Scientific. ISBN: 978-9813209978.

Instructor Information

Name: James Quinlan, Ph.D.
Office: 228 ScienceBuilding
Phone: (207) 780 – 4499
Email: james.quinlan@maine.edu
Office Hours: T/R 11:00 A.M.- 12:00 P.M.

Course description

A study of the theory and application of computational algorithms for interpolation, equation solving, matrix methods, integration, and error analysis. Prerequisites: grades of C or better in COS 160, MAT 252, and MAT 295, or permission of instructor.

Topics¹

- Julia Programming Language
 - Linear algebra review
 - Understanding error
 - Computer arithmetic and floating-point system(s)
 - Direct methods
 - Iterative refinement
 - Least-squares approximations
 - Indirect methods
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Learning Outcomes

By the end of this course, students will be able to:

- Define the basic terminology of numerical analysis, including round-off error, iterative refinement, and indirect solution methods.

¹Subject to change (see Disclaimer below)

- Explain the potential impact of round-off error on numerical solutions.
- Discuss computer floating-point arithmetic and its implications.
- Implement matrix operations, Gaussian elimination, and least squares solutions in Julia.
- Use indirect methods like Jacobi and Gauss-Seidel to solve systems of equations.
- Compare direct and indirect solution methods for systems of equations.
- Examine the convergence behavior of iterative methods.
- Assess iterative techniques for solving problems based on properties like convergence rate.
- Determine appropriate solution methods for different problem types.
- Develop Julia functions/programs for matrix computations and numerical solutions.

Software

We will use The Julia Programming Language (Julia for short). Julia can be installed at the terminal (Linux/Mac) with the command:

```
curl -fsSL https://install.julialang.org | sh
```

I also recommend downloading Octave. If you wish to refrain from downloading and installing either locally, both can be used in the cloud at [Cocalc.com](https://cocalc.com).

A collection of mathematical software, papers, and databases maintained by Oak Ridge National Laboratory can be downloaded from Netlib Repository, particularly LAPACK, LINPACK, and BLAS (Basic Linear Algebra Subprograms) packages/libraries.

Course Evaluation and Grading Policies

Attendance and Participation (10%)

Regular attendance and fully engaged participation is expected of all students. You should complete all assigned readings before each class session.

Explorations and Exercises (50%)

Exploration exercises and end-of-chapter exercises will be collected regularly through Brightspace. Prepare assignments in (.tex) or Markdown (.md) and submit them through Brightspace under the associated assignment. You may use the LaTeX template (<https://cs.usm.maine.edu/~james.quinlan/cos280/latex/LaTeX-template.txt>). Submit code in plain text (.txt). Another option to include code is the verbatim environment. For example,

```
for i = 1:10
    println(i)
end
```

Surveys, Suggestions, Summaries, & Lists (30%)

During the semester, you must respond to surveys and submit suggestions and other items, including topic summaries and lists.

Exams (10%)

Final exam with an emphasis on material covered during the semester.

In summary, grades are based on the following weighted items:

Item	% Weight
Attendance/Participation	10%
Assignments	50%
Surveys, Suggestions, Summaries, & Lists	30%
Final exam	10%
Total	100%

Grade Ranges

Letter grades are assigned based on the final percent using the interval values:

Grade	% bound
A	93 - 100
A-	90 - 92.9
B+	87 - 89.9
B	83 - 86.9
B-	80 - 82.9
C+	77 - 79.9
C	73 - 76.9
C-	70 - 72.9
D	60 - 69.9
F	<60

The grade, “I” (incomplete), can be given ONLY when a student, who is doing otherwise acceptable work (passing grade), is unable to complete a part of work (e.g., the final exam) because of documented illness or other conditions beyond the student’s control. In the latter case, the student must discuss with the instructor and complete an application form from the department before the part of work is due or as soon as the circumstances are known.

Student Success Tips

- attend all class meetings
- read the material before coming to class
- complete assignments by the due dates specified
- create a study and/or assignment schedule to stay on track
- read announcements
- communicate regularly with your instructor and peers
- read and respond to course email messages as needed
- access USM Online Student Resources

Support Services

- Request disability accommodations | (207) 780-4706 | dsc-usm@maine.edu
- Report interpersonal violence | (207) 780-5767 | usm.titleix@maine.edu

- **Report on-campus emergencies and safety concerns** | (207) 780-5211 or your local police agency.
- **Get academic help** | mycampus.maine.edu/group/usm/learning-commons
- **Get technology help** | usm.maine.edu/computing/helpdesk
- **Meet with an academic advisor** | usm.maine.edu/advising

For USM's most complete and current information on services available to students, as well as academic policies, use the QR Code to go to the Student Services and Policies Hub webpage.



Figure 1: <https://mycampus.maine.edu/group/usm/student-services-and-policies-hub>

Disclaimer

The syllabus is a statement of intent and serves as an implicit agreement between the instructor and the student. Every effort will be made to avoid changing the course schedule but the possibility exists that unforeseen events will make syllabus changes necessary. Remember to check Brightspace site often.
