

CSCI 5400: Scientific Computing (3)

Calvin Deutschbein

2025 Summer, MS Computer Science Mini-Term I

E-mail: cdeutschbein@lagrange.edu
07/07/25 - 08/08/25

Web: <https://cd-public.github.io/scicom/>
Asynchronous

Modality and Credit Hour Compliance

Residency

We will meet in person at LaGrange College from 8 AM to 6 PM on 6/6-7/25 and from 8 AM to 12 Noon on 6/8/2025. These lectures will also be recorded and posted on the course website. This is 22 of the 37.5 contact hours resulting in 3 credit hour course.

Asynchronity

I will upload a weekly lecture video to YouTube, with link posted to the course website on GitHub pages, every Monday from 7/13/25 to 3/3/25. This is 15.5 of the 37.5 contact hours resulting in a 3 credit hour course. Separately, I will be available asynchronous via email

Dates

While instruction will be conducted 07/07/25 - 08/08/25, there are a few relevant dates outside of that range related to the academic calendar. Additional, students may begin working on the course at any time, with deadlines only falling in the 07/07/25 - 08/08/25 range.

- Fri, June 20, 2025 Last Day of Add/Drop at 5:00pm
- Wed, July 23, 2025 Last Day to Withdraw with a "W" at 5:00pm
- Fri, August 08, 2025 Last Day

Deliverables

Students will be responsible for submitting a scientific report using (1) scientific computing taught during the residency and (2) a scientific publishing technology taught asynchronously. Assignments will be due weekly from 6/16/25 to 7/25/25. Assignments will be due every Monday at 12 midnight AOE following the residency. I will target 12 hours of effort each across

weekly problem sets resulting in a 2-3 hours homework per contact hour ratio in accordance with my understanding of credit hour policy.

Course Description

A study of high-performance computing for advanced scientific research on modern processors. Topics include high-performance computing techniques, floating point properties, and advanced numerical methods.

Course Materials

- Course materials including e-book at <https://cd-public.github.io/scicom>
- Optional Textbooks:
 - [PHY 546: Python for Scientific Computing](#)
 - [Numerical Methods: An Inquiry-Based Approach With Python](#)

Prerequisite

B.S. Computer Science or equivalent.

Course Objectives

LaGrange College Student Learning Outcomes (LC SLO):

1. Students will demonstrate creativity by approaching complex problems with innovation and from
2. Students will demonstrate critical thinking by acquiring, interpreting, synthesizing, and evaluating information to reason out conclusions appropriately.
3. Students will demonstrate proficiency in communication skills that are applicable to any field of study.

Student Learning Outcomes (SLO) for CISC 5300

All learning objectives pursuant to LC SLO {1,2,3} are to be assessed by homework assignments.

1. Core Scientific Computing Environment and Tools

- **SLO 1:** Utilize fundamental command-line tools (Bash) and a text editor (Neovim) for efficient scientific programming and workflow management.
- **SLO 2:** Write and execute Python scripts for scientific computing tasks, demonstrating proficiency in basic Python syntax and structures.

2. Numerical Computation and Data Analysis

- **SLO 3:** Apply advanced numerical methods and understand the properties of floating-point arithmetic for accurate scientific computations.
- **SLO 4:** Implement and analyze high-performance computing techniques using Python libraries such as NumPy, SciPy, and SymPy for numerical analysis and symbolic mathematics.
- **SLO 5:** Process, analyze, and visualize scientific datasets effectively using Pandas and Matplotlib.

3. Performance Optimization for Scientific Code

- **SLO 6:** Optimize the performance of scientific code using techniques like Just-In-Time (JIT) compilation with Numba, static compilation with Cython, and integration with Fortran.
- **SLO 7:** Compare and contrast the strengths and weaknesses of different programming languages and tools for high-performance scientific computing.

4. Scientific Publishing and Communication

- **SLO 8:** Create professional scientific documents and presentations using markup languages and tools such as Markdown, HTML/CSS, LaTeX, Quarto, Typst, and Sphinx.

Assignments and Assessment

- Students begin the term with a default grade of "A".
- This course utilizes objective, automated, binary grading on five weekly assignments.
 - Every assignments comes furnished with an autograder.
 - * It is provided to students with the assignment specification.
 - * It is documented and preserved under version control.
 - * There are special allowances for the fourth assignment.
 - Students submit C language source code that accomplishes the goals of the autograder.
 - * Students may use any resources but,
 - * Students are responsible for knowing the content of the course.
 - * We accept the autograder as ground truth.
 - Automated assessment will score student work.
 - * Late assignments earn zero points.
 - * Assignments that do not fulfill the autograder requirements earn zero points.
 - * Students lose one letter grade per failed assignment.

College Policies

ADA Statement

In compliance with Section 504 of the Rehabilitation Act and the Americans with Disabilities Act, LaGrange College will provide reasonable accommodation of all medically documented disabilities. If you have a disability and would like the College to provide reasonable accommodations of

the disability during this course, please notify Ms. Lindsay Shaughnessy, Director of the Panther Academic Center for Excellence (PACE) and Coordinator of Accessibility Services at accessability@lagrange.edu or 706-880-8652. PACE is located in the Moshell Learning Center & Tutoring Lab in the Lewis Library.

Academic Support

Academic Support Academic support at LaGrange is provided through Panther Academic Center for Excellence (PACE), the Writing Center, and the advising deans. PACE provides peer tutoring, testing services, accessibility services, and other academic support as needed. For more information about PACE, please contact Mr. Steve Kenner (skenner@lagrange.edu). The Writing Center gives all writers a space to explore the potential of their ideas via peer review. For information about the Writing Center, contact Dr. Justin Thurman (jthurman@lagrange.edu).

Academic Integrity Policy

Each student is bound by the LaGrange College Honor Code which is stated as follows:

As a member of the student body of LaGrange College, I confirm my commitment to the ideals of civility, diversity, service, and excellence. Recognizing the significance of personal integrity in establishing these ideals within our community, I pledge that I will not lie, cheat, steal, nor tolerate these unethical behaviors in others.

The full text of the LaGrange College Honor Code along with policies and procedures in cases of academic dishonesty can be found at <http://www.lagrange.edu/resources/pdf/honorcode12-13.pdf>.

Academic Integrity Policy

Email and LaGrange college accounts will be used in accordance with the following student handbook statement:

“Students are expected to treat their campus [email] accounts as a business account. Faculty and administrators rely on these accounts to disseminate important information regarding College protocol and events. Therefore, students are responsible for any College information sent out over campus email.”

Consequently, personal email addresses will not be used for instructor/student email contact except in event a service interruption. The preferred method of contact will instead be by the official campus email. I target a 24 hour maximum response time on school days and 48 hours maximum response time on all emails while the course is active.

As an adjunct, my LaGrange email may not persistent indefinitely. I maintain a persistent professional email at <mailto:calvindeu@gmail.com> which can also be used in event service interrupts to the campus network or for professional references after the conclusion of the course.

Netiquette

When leaving comments or asking questions in the forums of an online course, one is reminded to observe a few rules of internet etiquette:

- All caps locks and/or multiple exclamation points typically imply anger. You should not use such emphases unless it accomplishes a learning objective.
- Vulgarity, rudeness, and/or disrespect are complete unacceptable and will not be tolerated.
- Emoticons (such as ':)' for a 'smiley face') are fine for use in relaxed submissions (forum threads and posts).
- In general, do your best to use proper spelling, grammar, and punctuation. Writing correctly works to ensure that your meaning is conveyed.

Technology Requirements

To achieve the learning objectives of this course, the following development environment is required, and available free of charge and open-source on any computing platform:

- A Linux distribution (I recommend Ubuntu) with the following utilities:
 - The "gcc" C compiler
 - The "vim" modal text editor.
 - The "git" version control system.
 - The "podman" container management tool.

Technical Support

I will independently offer technology support for the technology stack used to support this course. Contact me directly unless you have technical issues arising within LaGrange.edu realms, in which case you should reach out via email to <mailto:support@lagrange.edu> or call 706.880.8053. Precise technical writing is a core learning objective (LC SLO 3) for this course, and should be modeled in all technical support interactions.

Agreement by Continued Enrollment

By remaining enrolled in the course, each student agrees to the terms of the syllabus as a binding contract between the student, the instructor, and LaGrange College.

Note on attending asynchronous attendance:

I am confident I have formulated the assessment tools such that attendance or non-attendance by individuals, as measured by viewing of asynchronous lectures, will be obvious to me as an instructor. As such, I have folded my attendance considerations into the assessment formulation. It is trivial as an instructor to assess the level of engagement with asynchronous learning resources, and you should regard it as more, not less, clear what a student's level of participation is for asynchronous instruction.

J1 Retention

J1 Retention is a tool used by LaGrange College faculty and staff to promote student academic and extra-curricular success. Expect us to use it to report information about attendance, engagement, or academic performance on specific assignments throughout the semester. Faculty and staff, such as coaches, the PACE Director, and advising deans, will be notified of relevant concerns. Based on provided information, you may receive automated messages from J1 Retention, referrals to the Tutoring or Writing Centers, or request to meet with your advising dean or the PACE director if there are indicators that you might benefit from additional support.