

INTRODUCTION TO SCIENTIFIC COMPUTING (ISC 3313)

Fall 2019

Instructor

TBA
Email: TBA

Teaching Assistant

TBA
Email: TBA

Classes

Monday, Wednesday, and Friday, time TBA, place TBA, or
Tuesday, Thursday, time TBA, place TBA

Office Hours

TBA, by appointment, or stop by TA's office

Textbook

This course does not have a textbook.

Prerequisite

MAC2311: Calculus 1 or permission of the instructor.

Course Description

This course introduces the student to the science of computation. Topics cover algorithms for standard problems in computational science, as well as the basics of an object-oriented programming language to facilitate the implementation of algorithms. This course fulfills the basic computer skills competency requirement.

Course Objectives

At the end of this course, the student will be able to

- identify the components of scientific computing;
- identify standard problems in scientific computing;
- implement basic algorithms for standard problems in computational science in the programming language taught;
- write, debug, and verify computer codes;
- format the numerical output of numerical simulations for clear presentation.

Quizzes, Assignment/Project Submission

We will have weekly quizzes on Fridays. Assignments are either weekly or biweekly. The Capstone Project replaces the two last assignments. Each assignment or project must be submitted as a PDF document and computer code in a single tar or zip file via Canvas. Assignments are late after midnight of the due date. We accept assignments up to a week late but the work will be penalized for each day late: Maximum points for delivery on the due day before midnight is 100 points, After midnight (first day late) 95, second day late 90, third 85, fourth 80, fifth 75, sixth 70, seventh 65, all later days zero. Exemptions from this rule are granted for sickness and other hardships preferably discussed with the instructor before

the due date.

Course Plan

Sequence of topics (we use C++ as a placeholder for an object-oriented language, e.g, C++, Fortran, Java):

- I. *Components of Scientific Computing*
- II. *A simple example - Using a Monte Carlo approach to approximate problems*
 1. UNIX basics
 2. Netbeans IDE: an integrated development environment for C++ programming
 3. Introduction to C++
 4. Algorithm development
 5. Program testing and documentation
 6. Visualization and analysis of results
- III. *Solving non-linear equations*
 1. Description of problem and some simple algorithms
 2. Iterative methods, required accuracy of result
 3. Implementation of the Bisection method
 4. Program testing and documentation
- IV. *Object-oriented programming concepts in detail using the non-linear equation problem and implementing more methods*
 1. Encapsulation
 2. Inheritance
 3. Polymorphism
 4. Abstract classes and datatypes
- V. *Operations on vectors and matrices*
 1. Development of general functionality that is usable in many places
 2. Vector and Matrix operations
 3. Vector norms
 4. Concurrency and parallel processing of such calculations using C++
- VI. *Solving ordinary differential equations:*
 1. Description of problem: Lotka-Volterra Predator-Prey system
 2. Algorithm discretization
 3. How to use functions from other libraries
 4. How to assess correctness of program
 5. Visualization of results
- VII. *Markov chain Monte Carlo Integration*
 1. Description of method
 2. Example application
 3. Implementation
 4. Testing and visualization of results
- VIII. *Capstone project*

Grading Policy

The student's grade for the course will be based upon classwork/quizzes, assignments, and a final Capstone Project. This work is weighted as follows:

- Quizzes - 10%
- Assignments 50%
- Capstone Project - 40%

Final grades will be given as:

A: 100-93, A-: 92-90, B+: 89-87, B: 86-83, B-:82-80, C+: 79-77, C: 76-73, C-: 72-70, D+: 69-67, D:66-63, D-:62-60, F 59-0); rounding as usual at 0.5.

Computer Competency Requirement

This course has been approved as meeting the requirements for Computer Competency.

In order to receive a "C-" or better in the course, the student must earn at least a "C-" on the computer competency component of the course. If the student does not earn a "C-" or better on the computer competency component of the course, the student will not earn an overall grade of "C-" or better in the course, no matter how well the student performs in the remaining portion of the course.

Capstone Project

This course requires a final "capstone project" in order to fulfill FSU's Computer Competency Requirement. The student, with the guidance and approval of the instructor, selects a computer project to work on. Completion of the project requires a working program, a written report, and an oral presentation. Completion of the project requires:

1. a working program in the language taught in the class
a written report (3-5 pages)
2. an oral presentation (5 minutes)

Each student will submit a one-paragraph project proposal in written form, printed, or by email by a specified date. The proposal should describe the topic to be explored, discuss the interesting features of the project, and outline the program that will be written, along with its function. Students can propose a topic of their own choosing, or pick one from a selected list. If they are unable to decide on their own, a topic will be assigned by the instructor.

The projects are due on a specified date, at the end of the semester. Once the reports are turned in, the student will present their work in an oral presentation in front of the class, using slides, the board, or via a demonstration run interactively on the computer. Whatever the method selected, the student should be able to explain the project and the program in words.

Grading of the program submitted is based on correctness, efficiency and clarity. In other words, the program must compile and run, must be a correct implementation of a procedure to solve the problem chosen by the student, and must report information about the solution to the problem that can be presented in a table or a plot.

The grade percentages for the Capstone project are as follows:

1. (30%) : working C++ program
2. (30%) : written report
3. (40%) : oral presentation

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Course Policies

- Assignments are due by midnight! You are free to discuss the labs with others, but the final submission should be unambiguously yours. Most homework will involve using a computer. If you cannot submit an assignment on time, due to a legitimate reason, please inform the TA and the instructor as soon as you can. Otherwise late submissions will be penalized.
- The “surprise tests” are mostly for diagnostic and attendance-monitoring purposes. Usually, full credit is given if a reasonable solution is attempted (no blank sheets, no random answers). Note that these tests will be administered in the first 10 minutes of class. If you attend more than 80% of the classes on time, you should not worry about these tests.
- If you think you haven’t received the credit you deserve for a homework or an exam, write up your argument, and submit for re-grading no later than 3 days after the graded assignments have been handed out.

University Attendance Policy

Excused absences include documented illness, deaths in the family and other documented crises, call to active military duty or jury duty, religious holy days, and official University activities. These absences will be accommodated in a way that does not arbitrarily penalize students who have a valid excuse. Consideration will also be given to students whose dependent children experience serious illness.

Academic Honor Policy

The Florida State University Academic Honor Policy outlines the University's expectations for the integrity of students' academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the Academic Honor Policy and for living up to their pledge to "...be honest and truthful and...[to] strive for personal and institutional integrity at Florida State University." (Florida State University Academic Honor Policy, found at <http://fda.fsu.edu/Academics/Academic-Honor-Policy>).

Americans with Disabilities Act

Students with disabilities needing academic accommodation should: (1) register with and provide documentation to the Student Disability Resource Center; and (2) bring a letter to the instructor indicating the need for accommodation and what type. Please note that instructors are not allowed

to provide classroom accommodation to a student until appropriate verification from the Student Disability Resource Center has been provided. This syllabus and other class materials are available in alternative format upon request. For more information about services available to FSU students with disabilities, contact the: Student Disability Resource Center 874 Traditions Way 108 Student Services Building Florida State University Tallahassee, FL 32306-416, (850) 644-9566 (voice), (850) 644-8504 (TDD), sdrc@admin.fsu.edu, <http://www.disabilitycenter.fsu.edu>.

Free Tutoring from FSU

On-campus tutoring and writing assistance is available for many courses at Florida State University. For more information, visit the Academic Center for Excellence (ACE) Tutoring Services' comprehensive list of on-campus tutoring options - see <http://ace.fsu.edu/tutoring> or contact tutor@fsu.edu. High-quality tutoring is available by appointment and on a walk-in basis. These services are offered by tutors trained to encourage the highest level of individual academic success while upholding personal academic integrity.

Syllabus Change Policy

Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice