ISC 3313

Introduction to Scientific Computing

Time: Tu/Th 11:30am - 12:50pm

Location: DSL 0499

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Dirac Science Library 492E
Office Hours: Wed 11:00am-12:00pm

Course Description: This course (3 credit hours) introduces the student to the science of computations. Topics cover algorithms for standard problems in computational science, as well as the basics of an object-oriented programming language, to facilitate the students' implementation of algorithms. The programming language depends on the semester. This semester the language will be Python.

Prerequisite: MAC 2311

Note: This course satisfies the Computer Skills Competency requirement.

Credit Hours: 3

Text: All texts used for this course are availiable for free online.

- *A Whirlwind Tour of Python* by Jake VanderPlas
  (`https://jakevdp.github.io/WhirlwindTourOfPython/`)

- *Python Data Science Handbook* by Jake VanderPlas
  (`https://jakevdp.github.io/PythonDataScienceHandbook/`)

- *Object-Oriented Programming in Python* by M. Goldwasser and D. Letscher
  (`http://cs.slu.edu/~goldwamh/oopp`)

Course Objectives:

- Identify the components of scientific computing
- Identify standard problems in scientific computing

- Describe algorithms for standard problems in computational science
- Implement algorithms as computer programs
- Present results as printed text, data files or graphic illustrations/animations

Grade Distribution:

Assignments	40%
Two Exams	20%
Final Project	30%
Class Participation	10%

Course Policies:

- We will use **Canvas** to post lecture notes, assignments, exams etc. Make sure you can access it, and notify me of any problems as soon as possible.
- We will use **Zoom** to cast all lectures and question/answer part. Direct Zoom links are available via the "Zoom" link in the sidebar on the Canvas course site.
- Homeworks will be assigned on a roughly 2 week basis.
  - All assignments will be given out as Jupyter Notebooks. As we'll see these notebooks will give you specific instructions. Once you have completed the assignment, please upload Jupyter Notebook and a single PDF of that to Canvas.
  - All assignments will involve using a computer. You are free to discuss them with others, but the final submission should be unambiguously yours. If you cannot submit an assignment on time, due to a legitimate reason, please inform me as soon as you can. Assignments that are more than a week late will not be graded.
- Two take-home exams (midterm and final) will be administered via Canvas. You have 24-hours to finish these exams. These exams are designed so that a well-prepared student takes no more than 2 hours to actually finish it. Like assignments, you will turn in a Jupyter Notebook and a single PDF. Unlike assignments, discussion between students is strictly forbidden.
- In order to satisfy FSU's computer competency requirement, each student must complete a computer project. Final project has 3 components: (1) Write a proposal. (2) Write a report describing the project and the python program. (3) Present your work. More details to come.
- Grades are a necessary evil. It is advisable to **turn in all required work, even if it is imperfect**. Crudely, if you score more than 90% overall you will make an A, if you score less than 60% you will fail. .

Tentative Course Outline:
The weekly coverage might change depending on the progress of the class. Selected applications from various scientific disciplines will be chosen based on interests of students. Extra topics may include debugging, sorting algorithms, recursion, image processing, topics from statistics, or topics from basic graph theory.

Module		Topics
Python Fundamentals	Week 1	Introduction, Installation, and Basic Syntax
	Week 2	Variables, Arithmetic and Boolean Operations, Scalar and Structured Data Types
	Week 3	Conditional Flow and Loops, Defining Functions
Beyond Base Python	Week 4	Creating/Installing Modules, Docstrings, Conda vs. Pip
	Week 5	Numpy, Ndarrays, Ufuncs, Broadcasting, Aggregations
	Week 6	Matplotlib, Point/Line Plots, Contour/3D Plots, Subplots/Customization
Advanced Python	Week 7	Classes, Attributes, Methods, Polymorphism
	Week 8	List Comprehension, Flexible Arguments, Map/Filter
	Week 9	File IO, Command Line Arguments, OS and Sys modules
Scientific Python	Week 10	Scipy, Linalg, Stats, Interpolate, Optimize
	Week 11	Pandas, DataFrames, Time Series
	Week 12	Machine Learning, Scikit-Learn, Student Presentations

Computer Competency Requirement:
In order to fulfill FSU's Computer Competency Requirement, the student must earn a "C-" or better in the course, and 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.

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. This should be done during the first week of class. 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 32306-4167
(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 are 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.