UNIVERSITY OF RHODE ISLAND
SCHOOL OF OCEANOGRAPHY

COURSE NUMBER: CSC 593, OCG, NRS, GEO 404

COURSE TITLE: Intro to Scientific Computing, Environmental Data Acquisition, and Analysis

COURSE DESCRIPTION

Introduction to Scientific Computing concepts, including data types, File I/O, array and data frame handling, algorithm development, and programming styles. The course is taught with Processing, Unix Shell commands, and Python (Julia, R or Matlab can also be used). We use instrument prototyping and measurements in environmental science by programming microcontrollers, interfacing hardware and software, and code execution in different compute environments. Data analysis can be implemented in Python, Julia, R, or Matlab. Responsible use of generative AI as a coding support tool will be a part of both instruction and assessment portions of the course.

WEBSITE: https://bloose.github.io/data_prototyping_scientific_computing/
LMS: https://brightspace.uri.edu/d2l/home/328450

PREREQUISITES: MTH 131, MTH 141 or permission of instructor.

NUMBER OF CREDITS: 3

CLASS TIMES AND LOCATION: Tuesdays, 3:30 – 7:30 pm in Library Room 166 (Zoom as needed)

INSTRUCTOR: Brice Loose
bloose@uri.edu
401.874.6676
321 CACS Building

COURSE SYLLABUS:

The course will follow a problem-based approach, with focus on topics in environmental science. A short selection of presentations will serve to support the hands' on work with software and hardware. Class meets in person (or by Zoom if mandated) for discussion and lab. Class will begin with 30-60 minutes instructor-guided discussion to help students begin the laboratory activity of that week. Some weeks will be devoted exclusively to assignments or work on the term project.

COURSE GOALS:

1. Learn basic principles of algorithm design, efficient coding practices including the use of generative AI, and good documentation habits.

2. Learn how to use scientific computing environments for data acquisition, analysis and visualization.
3. Explore coding in several environments including, Unix/Linux Shell, Arduino IDE, etc.
4. Design, prototype and execute an experiment prototype based upon observational goals.
5. Use algorithms and sensors to study and analyze problems in marine, geo and environmental sciences.
6. Publish your work on a problem of your interest, in the Public Domain.
7. Learn how to use and evaluate generative AI code to ensure high-quality solutions and to ensure your own learning process remains intact.

STUDENT LEARNING OUTCOMES:
Upon satisfactory completion of the course, students will be able to:

1. Read and write large data sets in a programming environment for further analysis.
2. Display and visualize data from a wide variety of sources.
3. Gain a thorough understanding of the hardware and software resources that are available on the Internet under open source license.
4. Incorporate sensor-based observations into the physical environment.
5. Learn how to harness and scale up compute platforms like raspberry pi and high performance computing environments.
6. Explore how observations can lead to discovery and insight in the environmental sciences.

TEXTS: There are no required texts for this course, but we will read and refer to the resources below, which are available for free Online:

1. "Real World Instrumentation with Python" by J.M. Hughes. O'Reilly Media In, Sebastopol CA. 2011.
2. Murray, R. David. "Python Documentation". 2001-2015 Python Software Foundation, URL: http://docs.python.org.
3. "Arduino Libraries". 2015 Arduino Corporation. URL: http://arduino.cc/en/Reference/Libraries
4. "Python for Data Analysis" by Wes McKinney. O'Reilly Media Inc., Sebastopol, CA. 2013.
5. "Python Pocket Reference" by Mark Lutz. O'Reilly Media Inc., Cambridge, MA 2014.

REQUIRED RESOURCES:
Access to a computer (preferably laptop) for programming and code execution.

LEARNING MODALITIES:
Curriculum is oriented around in-person meetings in Library Room 166, subject to URI COVID decisions. Each student will receive a hardware kit with prototyping materials. Lab space can be scheduled for access to additional tools. Every effort will be made to record lectures, but this format may not be able to capture all the discussion that takes place in the room.

BRIGHTSPACE

There is a Brightspace site for this class. Laboratory and in-class assignments will be submitted through Brightspace. The Brightspace site will be used to conduct communications and discussions outside of class, as needed.

CLASSROOM PROTOCOL

Participate – You will be expected to be an active participate in class or virtual discussions and in-class group activities.

GRADING METHOD:

Each week will include an in-class activity involving group work and participation (25%), practicum activities (35%), quizzes (10%) and completion of an observation-based term project (30%). Students will meet individually with instructor to develop their term project idea by the fifth week of the semester. Students will hand in progress updates on term project.

Oral assessment: Each week we will discuss the prior week's in-class and practicum activities. The instructor will randomly select 3 students each week to verbally describe each line of their code and give examples of how to break the code or make it throw an error. Each practicum assignment will be work 10 points – 3 of those points will be awarded for providing a correct solution, 7 points will be awarded for an accurate description of the code.

Quizzes will be in-class only. Quizzes will be paper-based with no use of laptop or notes.

CSC593 students will complete more advanced data analysis practicum problems to meet the requirements of a graduate level course.

GRADING SCALE:

A: 94-100, A- 90-93, B+ 87-89, B 83-86, B- 80-82, C+ 77-79, C 73-77, C- 70-72, D+ 67-69, D 60-66, F < 60.

ACCOMODATIONS FOR SPECIAL NEEDS:

Any student with a documented disability is welcome to contact me as early in the semester as possible so that we may arrange reasonable accommodations. As part of this process, please be in touch with Disability Services for Students Office at 330 Memorial Union, 401-874-2098.

ACADEMIC HONESTY:

All submitted work must be your own. If you consult other sources (class readings, articles or books from the library, articles available through internet databases, or websites) these MUST be properly documented, or you risk a charge of plagiarism and an F for the work. If you have any doubt about what constitutes plagiarism, visit the following website: http://gervaseprograms.georgetown.edu/hc/plagiarism.html, the URI Student Handbook, and UNIVERSITY MANUAL sections on Plagiarism and Cheating at http://www.uri.edu/facsen/8.20-8.27.html - cheating.

Generative AI tools such as ChatGPT have added a new dimension to the standard for academic originality, and instructors at URI are adapting to this new tool. This course will not discourage the use of generative AI, but please keep in mind that your goal as a student is to expand your capabilities with skills and knowledge. It is important to ensure that internet

resources support your learning process, without short-circuiting your own process of gaining new knowledge.

Viral Illness Precautions Statement. The University is committed to delivering its educational mission while protecting the health and safety of our community. Students who are experiencing symptoms of viral illness should NOT go to class/work. The Centers for Disease Control and Prevention (CDC) recommends that all people who are experiencing viral illness should stay home and away from others until symptoms improve and they are fever free (without medications) for 24 hours. They should take added precautions for the next 5 days.

Excused Absences. Absences due to serious illness or traumatic loss, religious observances, military service, or participation in a university sanctioned event are considered excused absences. Students are responsible for work missed during an excused absence but will not be penalized by grading or assignment/exam make-up policies. Students should notify faculty in advance of absences due to religious observance or university-sanction events, and as soon as possible for other absences See University Manual sections 8.51.11-8.51.16 for details.
Anti-Bias Syllabus Statement. We respect the rights and dignity of each individual and group. We reject prejudice and intolerance, and we work to understand differences. We believe that equity and inclusion are critical components for campus community members to thrive. If you are a target or a witness of a bias incident, you are encouraged to submit a report to the URI Bias Resource Team at www.uri.edu/brt. There you will also find people and resources to help.

Disability, Access, and Inclusion Services for Students Statement. Your access in this course is important. Please send me your Disability, Access, and Inclusion (DAI) accommodation letter early in the semester so that we have adequate time to discuss and arrange your approved academic accommodations. If you have not yet established services through DAI, please contact them to engage in a confidential conversation about the process for requesting reasonable accommodations in the classroom. DAI can be reached by calling: 401-874-2098, visiting: web.uri.edu/disability, or emailing: dai@uri.edu.

Anti-Discrimination Resources
Several offices provide support to help faculty comply with the University's commitment to maintain an educational and working environment free from discrimination, and to uphold our collective obligation as a community to foster an inclusive, people-centered culture.

Office of Equal Opportunity (OEO). The Office of Equal Opportunity (OEO) leads institutional civil rights compliance efforts and supports the belief that all individuals have a right to enjoy equal opportunity in employment and equal access to all university programs, services, and activities, without regard to their protected status. OEO's primary focus areas include: anti-discrimination, affirmative action, equal opportunity, Americans with Disabilities Act (ADA) and Rehabilitation Act Compliance, education & training, and language access. OEO is available to address inquiries from faculty, staff, students, and service recipients and to work with departments to promote compliance with the university's Policy on Nondiscrimination, Policy on Language Access, the University's Language Access Plan, and applicable civil rights laws and regulations.

Title IX. Any student, faculty, or staff member with questions or concerns about the Policy on Sexual Misconduct or who believes that they have been the victim of sex discrimination, sexual harassment, or sexual violence, as defined under Title IX, is encouraged to contact the University's Title IX Coordinator. Matters involving employees that do not meet the burden of proof under Title IX are forwarded to the Office of Equal Opportunity and the Office of Human

Resources. The Title IX Office, in collaboration with the Dean of Students, provides support for and ensures enforcement of the University's Policy on Sexual Misconduct. The Title IX Coordinator also provides support to pregnant and parenting students, in collaboration with the Dean of Students, and to pregnant and parenting employees, in collaboration with the Office of Human Resources. Faculty with questions or concerns about potential sex-based discrimination or sex-based harassment violations, or departments seeking training, should contact the Title IX Coordinator at tixc@etal.uri.edu. More information is available at: Know your Title IX – Sexual Violence Prevention and Response.

Providing equal access for students with disabilities. Every qualified student with a disability has the right to equal access to educational programs, services, activities, and facilities. Documentation-supported accommodations are communicated to faculty through a letter from Disability, Access and Inclusion (DAI), delivered by the student. Faculty are required by law to provide these accommodations and are encouraged to review the information on the DAI website. The Academic Testing Center is available to support testing accommodation needs. Students seeking accommodations in their roles as internal payroll employees should contact the Office of Human Resources. This includes Graduate Assistants and Graduate Research Assistants. Students seeking accommodations in their roles as Federal Work-Study recipients should contact the Office of Human Resources and their placement supervisor. Testing accommodations are administered by the Academic Testing Center and must be coordinated by the faculty. Visit ADA Compliance – Office of Equal Opportunity for a list of ADA Liaisons at the University of Rhode Island.

Disability, Access, and Inclusion Drop-In Hour. Questions about student DAI accommodations? DAI staff are available each weekday from 2-4pm in their webex room, or call 874-2098. DAI leadership also provides special Faculty WebEx Drop-in Hours, for the first month of the Fall and Spring semesters on Mondays from 11AM-1PM and Wednesdays from 8-10AM. Please also reach out to us at dai@uri.edu if you would like to discuss a Workshop for your department or colleagues, we can work with you to tailor this to your individual needs and interests.

If you are unable to attend class, please notify me prior to the start of class at 874-6676 or bloose@uri.edu or through the medium we have established for the class.