University of Rhode Island

Department of Computer Science and Statistics
CSC493, An Introduction to Multi-Paradigm Programming, Spring 2023

Instructor:	Lutz Hamel
Office Location:	Tyler Hall 251
Email:	lutzhamel@uri.edu
Class Days/Time:	MWF 11-11:50am
Classroom:	Engineering Building Room 040
Prerequisites:	None
Webpage:	https://lutzhamel.github.io/CSC493 or BrightSpace

Course Description

Most modern programming languages now integrate features from various programming paradigms allowing for novel approaches to problem solving. This includes higher-order programming, pattern-matching on user defined objects, and functions with multiple-dispatch to name but a few. In this course we explore many of these topics in depth using Asteroid, a modern, multi-paradigm programming language supporting first-class patterns developed at the University of Rhode Island. We also examine how these features are implemented in other languages such as Python and Rust.

This course assumes that you know how to program. There are no formal prerequisites, but you must be fluent in at least one high-level programming language such as C++, Java, Python, or JavaScript. Being fluent means that you implemented at least one non-trivial project in one of those languages. In order to deepen our understanding of programming in different paradigms there will be weekly programming exercises and assignments. Some of those will be done as teams and some of them as individual work.

Course Goals

The goal of this course is to give you a solid foundation in identifying and applying various programming paradigms such as,

- Imperative,
- Functional, and

- Object-Oriented,

programming in the context of first-class patterns. Different programming paradigms provide different tools to tackle programming challenges and picking the right paradigm for the job at hand is an essential skill of every software developer.

Upon successful completion of this course, each student will be able to:

- Understand what a programming paradigm is.
- Understand the differences and communalities between various programming paradigms.
- Use programming paradigms effectively as a way to solve programming challenges.

Required Texts/Readings

Textbook

none – online Asteroid documentation.

Exams, Assignments, and Grading Policy

Course Grade Composition:

Assignments	40%
Midterm	20%
Final	20%
Attendance	20%

Class attendance is mandatory. You will be given one unexcused absence per semester otherwise an unexcused absence will count against your attendance grade.

Grading Key

Symbol*	Start %*
F	0
D	60
D+	67
C-	70
C	73
C+	77
B-	80
B	83
B+	87
A-	90
A	93

Homework consists of exercises to familiarize you with common tools and concepts in programming language implementation. Programming assignments are typically projects that can be completed within a couple of days. The midterm and the final comprise major projects and you should budget your time accordingly. Assignments are given on a weekly basis.

Classroom Protocol

- Check the website (often)! I will try to keep the website as up-to-date as possible.
- **Promptness, participation,** and **adequate preparation** for each class are expected. If you are absent, it is your responsibility to find out what you missed (e.g. handouts, announcements, assignments, new material, etc.)
- **Late assignments/project** will **not** be accepted without a valid excuse, such as illness etc. If you find that you are unable to submit an assignment/project please get in touch with me as soon as possible **before** the deadline expires.
- All work is to be the result of your own individual efforts unless explicitly stated otherwise. **Plagiarism, unauthorized cooperation or any form of cheating** will be handled according to the University Man- ual section 8.27.10 through 8.27.21 (see www.uri.edu/facsen/8.20-8.27.html). The penalty for cheating or plagiarism can range from a zero score on the assignment to a failing grade for the course.
- **Software piracy** will be dealt with exactly like stealing of university or departmental property. Any abuse of computer or software equipment will subject to disciplinary action.
- 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 302 Memorial Union, Phone 401-874-2098.

Anti-Bias 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 Response Team at www.uri.edu/brt. There you will also find people and resources to help.

***Disability Services for Students Statement*:** Your access in this course is important. Please send me your Disability Services for Students (DSS) 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 DSS, please contact them to engage in a confidential conversation about the process for requesting reasonable accommodations in the classroom. DSS can be reached by calling: 401-874-2098, visiting: web.uri.edu/disability, or emailing: dss@etal.uri.edu. We are available to meet with students enrolled in Kingston as well as Providence courses.

***Academic Enhancement Center*:** Located in Roosevelt Hall, the AEC offers free face-to-face and web-based services to undergraduate students seeking academic support. Peer tutoring is available for STEM- related courses by appointment online and in-person. The Writing Center offers peer tutoring focused on supporting undergraduate writers at any stage of a writing assignment. The UCS160 course and academic skills consultations offer students strategies and activities aimed at improving their studying and test-taking skills. Complete details about each of these programs, up-to-date schedules, contact information and self-service study resources are all available on the AEC website, uri.edu/aec.

Disability Accommodations and Opportunities

Any student with a documented disability should contact me early in the semester so that we can make reasonable accommodations to support your success in this course. You should also contact Disability Services for Students, Office of Student Life, 330 Memorial Union, 874-2098

Tentative Course Schedule

Week	Topic
1	What is a programming paradigm? Multi-paradigm languages • Python • Rust • Asteroid
2 & 3	Imperative programming • with Asteroid
4 & 5	Object-oriented programming • with Asteroid Polymorphism Multiple inheritance
6	Pattern matching • structural and regular expression • advanced pattern matching
7 & 8	Functional programming • with Asteroid • “everything is a value” • higher order programming
9 & 10	Pattern matching and first-class patterns • programming with first-class patterns • “patterns as values and values as patterns”
11	Putting everything together Multi-paradigm = Imperative + OO + Pattern-Matching + Functional