

## University of Rhode Island

### Department of Computer Science and Statistics CSC402, Programming Language Implementation, Fall 2020

<b>Instructor:</b>	Lutz Hamel
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<b>Class Days/Time:</b>	MWF 9-9:50am
<b>Classroom:</b>	Online
<b>Prerequisites:</b>	CSC301
<b>Webpage:</b>	<a href="http://homepage.cs.uri.edu/faculty/hamel/courses/home/csc402">homepage.cs.uri.edu/faculty/hamel/courses/home/csc402</a>

#### Course Description

- Have you ever wondered how the syntax highlighter in Eclipse works?
- Have you ever wondered how your favorite programming language is implemented?
- How about Python and JavaScript?
- What is the difference between interpreting a programming language and translating/compiling it?
- What is the difference between an interpreter and a virtual machine?

If any of these questions interest you, then CSC402 is for you. We will spend the semester looking at programming language implementations: from syntax highlighters to code analyzers, from interpreters and virtual machines to compilers.

As part of the course we will construct interpreters and translators for domain specific languages such as calculator languages and command line languages for steering your favorite game character. The course will also include one large semester project of a language implementation project of your choosing. This could be a graphics language, a new programming language (think Ruby), a domain specific language such as PHP or a new command line shell interpreter for Unix/DOS.

#### Course Goals

The goal of the course is to give you a solid foundation with respect to programming language implementation that includes:

- grammar construction
- parsing techniques
- intermediate representations
- abstract syntax tree construction
- tree pattern matching techniques

We will study a number of different programming language implementation techniques including,

- compilers
- interpreters, and
- virtual machines.

These tools will enable you to add domain specific and general programming language implementations to your tool chest to solve difficult engineering problems.

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

- Understand the difference between compilers and interpreters.
- Use grammar specification tools effectively.
- Design and implement domain specific and general purpose programming languages.

## Required Texts/Readings

### Textbook

*none – free online text book available*

### Classroom Protocol

- Check the website (often)! I will try to keep the website as up-to-date as possible.
- Class **attendance, 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** will **not** be accepted.
- **Make-up quizzes and exams** will **not** be given without a valid excuse, such as illness. If you are unable to attend a scheduled examination due to valid reasons, please inform myself, or the department office in Tyler Hall, prior to the exam time. Under such circumstances, you are not to discuss the exam with any other class member until after a make-up exam has been completed.
- 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 Manual section 8.27.10 through 8.27.21 (see [www.uri.edu/facsen/8.20-8.27.html](http://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.

### **Special Covid-19 related statements:**

The University is committed to delivering its educational mission while protecting the health and safety of our students. At this uncertain time, those concerns include minimizing the potential spread of COVID-19 within our community. While the university has worked this summer to create a healthy learning environment for all, it is up to all of us to ensure our campus stays that way.

As members of the URI community, students are required to comply with standards of conduct and take precautions to keep themselves and others safe. Students are required to comply with Rhode Island state laws, including the Rhode Island Executive Orders related to health and safety, ordinances, regulations, and guidance adopted by the University as it relates to public health crises, such as COVID-19.

An addendum on policies and guidelines concerning your obligations during this crisis has recently been integrated into the Student Handbook. These obligations include:

- Wearing of face masks by all community members when on a URI campus in the presence of others
- Maintaining physical distancing of at least six feet at all times
- Following state rules on the number of individuals allowed in a group gathering
- Completing a daily health self-assessment also available through the Rhody Connect app before coming to campus
- Submitting to COVID-19 testing as the University monitors the health of our community
- Following the University's quarantine and isolation requirements

If you answer yes to any of the questions on the daily health assessment, do not come to class. **YOU MUST STAY HOME/IN YOUR ROOM** and notify URI Health Services via phone at 401-874-2246 immediately.

If you are already on campus and start to feel ill, you need to remove yourself from the public and notify URI Health Services via phone immediately at 401-874-2246 and go home/back to your room and self-isolate while you await direction from Health Services.

If you are unable to attend class, please let me know and we will work together to ensure that course instruction and work is completed for the semester.

### **Exams, Assignments, and Grading Policy**

Course Grade Composition:

Homework and Programming Assignments	40%
Midterm	30%
Final	30%

Grading Scale:

95 - 100	A
90 - 94.9	A-
85 - 89.9	B+
80 - 84.9	B

75 - 79.9 B-  
70 - 74.9 C+  
65 - 69.9 C  
60 - 64.9 C-  
55 - 59.9 D+  
50 - 54.9 D  
0 - 49.9 F

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. Homework and programming assignments are assigned on a weekly basis.

### **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**

<b>Week 1</b>	Programming Languages and their Processors
<b>Week 2</b>	Language tools
<b>Week 3</b>	Program Analysis
<b>Week 4</b>	Tree Walking
<b>Week 5</b>	Optimizing Compilers
<b>Week 6</b>	Scope & Symbol Tables
<b>Week 7</b>	Functions
<b>Week 8</b>	Type systems
<b>Week 9</b>	Structured data types
<b>Week 10</b>	Higher-Order Programming
<b>Week 11</b>	Compiling for Real Machines