General Information

Instructor: Matthew Fluet  
E-mail: mtf@cs.rit.edu  
Office hours: T 3:00pm – 5:00pm; GOL(70)-3555  
R 9:00am – 11:00am; GOL(70)-3555  
F 1:00pm – 3:00pm; GOL(70)-3555  
or by appointment

Lectures: Section 70  
MW 6:00pm – 7:50pm; GOL(70)-3455

Website: www.cs.rit.edu/~mtf/teaching/20101/plc  
mycourses.rit.edu

Course Description

A study of the syntax and semantics of a diverse set of high-level programming languages. The languages chosen are compared and contrasted in order to demonstrate general principles of programming language design. This course emphasizes the concepts underpinning modern languages rather than the mastery of particular language details. Programming projects will be required.

Prerequisites

- 4003-334 (Computer Science 4) and 1016-265 (Discrete Math I)
- or permission of instructor

Course Goals

At the end of the introductory sequence, Computer Science 1-4, students can be expected to be capable programmers, with a solid background in basic programming techniques and knowledge of a couple of languages. Their perspective, however, is narrow and their understanding of programming languages uncritical. The main goal of this course is to widen their perspective by learning the power of alternative paradigms, thus becoming more critical and self-aware as software designers.

The goal is achieved in two ways. First, the course exposes students to programming paradigms different from the one that they experienced in the foundational courses. Second, it gives them insight into the theory that underlies many of the mechanisms that, up to now, they have taken for granted. It presents the implementation choices available to language designers and compiler writers, and discusses the range of consequences arising from these choices.
Text Books

Required:
Title: Programming Language Pragmatics (Third Edition)
Author: Michael L. Scott
Publisher: Morgan Kaufmann Publishers
ISBN: 978-0123745149
Website: http://www.cs.rochester.edu/u/scott/pragmatics/
RIT Library e-book: http://albert.rit.edu/record=b2675915~S3

Topics

Concepts of Programming Languages (20 hours)

• Background
  – why study programming languages
  – history of programming languages
  – language classification
  – language design issues
  – translation including compilers and interpreters
  – basics of language specification: syntax and semantics.

• Syntax
  – scanning and parsing
  – regular expressions
  – Backus-Naur Form (BNF) and extended BNF
  – concrete parse tree and abstract syntax

• Semantics
  – informal: attributes; binding (static and dynamic); scope
  – formal: operational semantics; denotational semantics; axiomatic semantics; attribute grammars

• Data Types
  – primitive
  – structured
  – abstract
  – modules
  – type systems

• Control Structures
  – sequencing (straight, conditional, iterative, . . .)
  – subroutines (calls, recursive calls, parameters, . . .)
  – other control structures (exceptions, iterators, coroutines, continuations, . . .)

• Memory management
  – activation records
  – garbage collection

Language Studies and Comparisons (16 hours)

• functional languages (Scheme, Lisp, Haskell, ML, . . .)
• logic languages (Prolog, . . .)
• scripting and/or string-processing languages (JavaScript, Lua, Perl, Python, . . .)
• object-oriented languages (Smalltalk, Java, C#, Objective C, Eiffel, . . .)

Note: The order in which topics are discussed in lectures will likely differ from that given above. Furthermore, not all topics will receive equal (or, possibly, any) time. Exams will only cover topics explicitly discussed in lecture or in an assigned reading.

Grades, Exams, and Assignments

Grades will be assigned based on the following grading scheme:

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Attendance &amp; Participation</td>
<td>10.0%</td>
</tr>
<tr>
<td>Reflection Essay Assignments (≈ 5)</td>
<td>15.0%</td>
</tr>
<tr>
<td>Programming Assignments (≈ 5)</td>
<td>40.0%</td>
</tr>
<tr>
<td>Mid-term Exam</td>
<td>15.0%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>20.0%</td>
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Attendance & Participation

Students are required to attend and expected to participate in class. Participation means being an engaged student: asking and answering questions, not simply attending class.

The use of cell phones and audio players is prohibited during class. If you must take a phone call, please leave the classroom immediately and do not return until you have ended the phone call.

The use of a laptop (or notebook or netbook) computer is permitted during class only for the purpose of taking notes. Persistent use of a laptop for other activities will result in 0 credit for your Attendance & participation grade.

Assigned readings should be completed before the lecture section. You are responsible for the material in assigned readings, whether covered during lecture or not.

Mid-term Exam

There will be one mid-term exam; see below for date.

The mid-term exam must be taken at its scheduled time. Make-up mid-term exams will not be administered, unless exceptional circumstances have been discussed with the instructor in advance of the exam date and/or other arrangements have been made.

Final Exam

There will be a final exam; see below for the date. The final will be comprehensive and will cover material from the entire course, including readings, lectures, and assignments.

The final exam must be taken at its scheduled time. Any exam conflicts must be reported to the instructor by the end of Week 6 (see the RIT Final Examination Policies).
Reflection Essay Assignments

A key goal of this course (and collegiate education) is to develop critical-thinking skills. In order to exercise these skills, there will be a small number of reflection essay assignments. You will be given one or more readings on a subject related to the current course topic, along with some questions to guide your reflection. In response to the readings and questions, write a one-page reflection essay. (If you have a choice among readings, then be sure to identify the readings that you read.)

A reflection essay should demonstrate your understanding of the readings and an ability to integrate the readings with your own opinions and experiences. For example, the following might serve as good topic sentences to introduce the main body of your reflection:

- “I completely agree with the author’s assertion that ⟨some important claim from the reading⟩, because I encountered exactly the same thing when ⟨some experience from a previous course or co-op⟩.”
- “I completely disagree with the author’s assertion that ⟨some important claim from the reading⟩, because, as was discussed in lecture, ⟨some example that refutes the claim⟩.
- “While ⟨some important assumption from the reading⟩ may have been true when the article was written, times have changed.”
- “I found the author’s discussion of ⟨some important topic from the reading⟩ to be very interesting. Although I used to believe ⟨some opinion⟩, I think that I need to change my opinion.”
- “I found it difficult to understand ⟨some important example from the reading⟩, because it is very different from ⟨some seemingly similar example from another context⟩.”

Your essay must be typed, single-spaced, 12pt font, 1 in margins, 3/4 page minimum length, 1 1/2 page maximum length, and submitted in PDF format. At most 1/3 of your essay may be used to summarize the readings. The majority of your essay should be a critical reflection on the readings. Your essay must be in clear English prose, utilizing proper spelling and grammar.

Late Policy

Assignments that are submitted electronically (most assignments) will generally be due at 11:59PM on the due date. Assignments that are submitted in person will generally be due at the beginning of a class period.

Assignments are to be submitted on time. However, to accommodate the occasional difficulty with meeting an assignment due date, each student begins the term with five “extension tokens.” By spending an extension token, you will receive a 24-hour extension on a single assignment. To spend an extension token, you must e-mail the instructor before the assignment is due; you cannot spend an extension token after an assignment’s due date has passed. You may spend at most two extension tokens on a single assignment (and you may spend the second extension token at any time before the first extension expires). After spending five extension tokens, late assignments will not be accepted.

Regrading

After a graded exam or assignment has been returned, you have one week to bring any questions about grading to the instructor’s attention. No grade adjustments will be made after this time.
Important Dates

October 6 (Wed.): Mid-term Exam (in class, 110min)
November 15 (Mon.): Final Exam (6:00pm – 8:00pm; GOL(70)-3455; Section 70)

Academic Integrity

As with all courses, the RIT Honor Code and the RIT Academic Honesty Policy apply. See the Department of Computer Science’s statement on academic integrity for more details.

In this course, all submitted work must be your own work (i.e., written or programmed by you alone, unless explicitly stated otherwise) and must include acknowledgments of any collaborators or sources (other than course text books or handouts) used to produce your submission.

You are encouraged to discuss course material with other students. Discussion of assignments is also allowed, but sharing solutions or code is not allowed.

Disclaimer

I reserve the right to make any changes to the syllabus as I deem necessary throughout the course. Minor changes, such as assignment due dates, will be announced orally during class and posted on the course mailing list and home page. Major changes, such as grading percentages, will additionally be provided in writing.