Programming Language Concepts (22c:111)

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Spring 2013

Welcome to Programming Language Concepts (PLC). This class has three main goals. First, we will study tools and techniques used to implement programming languages (and other languages as well). We will study how to describe the syntax of languages using grammars. Grammars can be translated automatically by commonly available tools into code for parsing the expressions of the language. We will look at features like scoped variables, types, and higher-order functions, all from the perspective of how to implement them. The second main goal is to see some alternative programming paradigms (different from the standard object-oriented paradigm). We will study declarative programming in the form of a language called Datalog, which allows us to write recursive definitions of certain kinds of properties in a very elegant way. We will also study functional programming, where the central abstraction provided by the language is the function. This leads to the third goal of the course, which is for students to master a new programming language, which for our class will be the OCaml functional programming language. By learning in depth how to write functional programs, which requires a different way of thinking about code, your ability to program in the familiar language of your choice will be strengthened. No prior familiarity with any of these topics or OCaml is assumed in this class, but students are expected to have passed the prerequisite classes 22c:021 and either 22c:022 or 22c:060.

There is no required book, but you may find the optional book "Programming Languages: Principles and Paradigms", by Gabbrielli and Martini, helpful for coverage of grammars and implementation techniques.

There will be a total of 1000 points of **graded work** for the course:
- 4 programming assignments, 100 points each: 1/30-2/15, 2/20-3/8, 3/27-4/12, 4/17-5/3.
- 8 micro assignments, 12.5 points each: 1/24, 1/31, 2/7, 2/28, 3/28, 4/4, 4/18, 4/25.
- An in-class midterm exam, 200 points: 3/14
- A final exam, 300 points: 5/13, 7:30am-9:30am, EPB 107 (last name A-L) and EPB 109 (M-Z).

Programming assignments will generally have a late deadline of a week. The penalty for turning in a programming assignment late is 10%. After that, solutions will be posted and no late work accepted. A micro is a very small assignment, intended to take 20-30 minutes at most. Think of it as a take-home quiz, intended to reinforce concepts from class. Micro assignments will be posted on Tuesdays and due right at the start of class (within first 3 minutes) on Thursdays, in weeks when programming assignments are not due. Micros will not be accepted late. Programming assignments will be graded within 1 week of submission. Micro assignments will be graded by the next class.

The **collaboration policy** for programming assignments is that high-level discussion of problems is ok, but detailed collaboration on solutions is prohibited unless explicitly allowed. This means that unless explicitly allowed, you should not look over another person's code from the class (this includes writing the code together). You are not allowed to check that your solution makes sense by reading another person's code. Solutions whose similarity is too great to be a coincidence will be considered for possible academic integrity violation. No collaboration at all is allowed on micro assignments. I will protect your rights to a fair evaluation in this course through enforcement: cases of suspected cheating will be reported to the Dean's office, as required by CLAS policy.

Office hours. Office hours begin 1/28.

Mondays	Tuesdays	Wednesdays	Thursdays	Fridays
11am-12:30pm Prof. Stump			9:15am-10:45am Amit Jain	8:30am-10am Prof. Stump
				10am-11:25am Frank Fu
		4pm-5:30pm Frank Fu		1pm-2:30pm Amit Jain

Prof. Stump's office hours are held in 201F MacLean Hall. Frank Fu's are in 201C MacLean and Amit Jain's in 201G MacLean.

Subversion repository. Most course materials, including notes from class, assignments, and this syllabus, will be made available via the following world-readable subversion repository:

https://svn.divms.uiowa.edu/repos/clc/class/2013/111-pub/

The Windows machines in the CS lab in 301 MacLean Hall have the TortoiseSVN client on them, which you can use to check out this repository: open the Windows file explorer, go to your home directory, and right click in a blank area in the explorer window. You should see "SVN Checkout..." as an option. Enter the URL above, keep all the default other options, and select "Ok". This should create a copy of the directory from the svn repository. You can update that copy by right-clicking on the folder and selecting "SVN Update".   On your own computer, you will need to install TortoiseSVN first. Subversion clients are also available for Mac and Linux. The repository will be updated from time to time with new material.

Course software. We will be making use of a number of software packages in this class, starting with OCaml (version 3.11 or higher). These software packages are all available on the CS lab machines in 301 MacLean Hall. The Windows machines have OCaml version 3.11, while CS Linux machines have 3.12 or 4.00. We will try to provide you code which compiles with 3.11, and accept code which compiles with 4.00. You are also welcome to install OCaml on your own computers.

Please contact me if you have a disability accommodation, or any related matter to discuss.

Schedule of topics:
1. Parsing
   * Regular expressions and finite automata
   * EBNF grammars and syntax trees
2. Declarative programming
   * Programming in OCaml
   * Tries and scoped variables
   * Datalog
   * A taste of Haskell
3. Run-time systems and compilation
   * Memory management and garbage collection
   * Compiling to C

Standard Policies from the College of Liberal Arts & Sciences (CLAS)

Administrative Home
 The College of Liberal Arts and Sciences is the administrative home of this course and governs matters such as the add/drop deadlines, the second-grade-only option, and other related issues. Different colleges may have different policies. Questions may be addressed to 120 Schaeffer Hall, or see the CLAS Student Academic Handbook.

Electronic Communication
University policy specifies that students are responsible for all official correspondences sent to their University of Iowa e-mail address (@uiowa.edu). Faculty and students should use this account for correspondences. (Operations Manual, III.15.2. Scroll down to k.11.)

Accommodations for Disabilities
A student seeking academic accommodations should first register with Student Disability Services and then meet privately with the course instructor to make particular arrangements. See www.uiowa.edu/~sds/ for more information.

Academic Honesty
The College of Liberal Arts and Sciences expects all students to do their own work, as stated in the CLAS Code of Academic Honesty. Instructors fail any assignment that shows evidence of plagiarism or other forms of cheating, also reporting the student's name to the College. A student reported to the College for cheating is placed on disciplinary probation; a student reported twice is suspended or expelled.

CLAS Final Examination Policies
Final exams may be offered only during finals week. No exams of any kind are allowed during the last week of classes. Students should not ask their instructor to reschedule a final exam since the College does not permit rescheduling of a final exam once the semester has begun. Questions should be addressed to the Associate Dean for Undergraduate Programs and Curriculum.

Making a Suggestion or a Complaint
Students with a suggestion or complaint should first visit the instructor, then the course supervisor, and then the departmental DEO. Complaints must be made within six months of the incident. See the CLAS Student Academic Handbook.

Understanding Sexual Harassment
Sexual harassment subverts the mission of the University and threatens the well-being of students, faculty, and staff. All members of the UI community have a responsibility to uphold this mission and to contribute to a safe environment that enhances learning. Incidents of sexual harassment should be reported immediately. See the UI Comprehensive Guide on Sexual Harassment for assistance, definitions, and the full University policy.

Reacting Safely to Severe Weather
In severe weather, class members should seek appropriate shelter immediately, leaving the classroom if necessary. The class will continue if possible when the event is over. For more information on Hawk Alert and the siren warning system, visit the Public Safety web site.

 *These CLAS policy and procedural statements have been summarized from the web pages of the College of Liberal Arts and Sciences and The University of Iowa Operations Manual.