Programming Language Concepts (CS:3820), Fall 2017
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Welcome to Programming Language Concepts (PLC). In this class we will study the design of programming languages. We will largely do this through learning how to implement features from modern languages like scoped local variables, expression evaluation, and garbage collection. We will also learn about the functional programming paradigm, where programs must behave like mathematical functions: given the same input, they must produce the same output. While this prevents a direct treatment of implicit state (think about a function like gettimeofday(), which returns a different answer for every call), it also enables powerful reasoning principles to be applied to programs. We will study functional programming through two advanced languages: Haskell, for the first part of the course, and Agda for the second. Both languages are designed to facilitate writing concise code for which many properties can be checked at compile-time. Agda goes the farthest on the latter point, allowing programmers to write proofs of logical properties of those programs, in the same language one uses to write programs. This powerful verification capability makes it possible to write provably correct code, an exciting engineering proposition.

No prior familiarity with Haskell, Agda, or functional programming is assumed in this class, but students are expected to have passed the prerequisite classes CS:2230, CS:2210 and one of CS:2630, ECE:3330, CS:2820, or ECE:3350, all with grade at least C-.

Course Materials and Repository
The required textbook for the course is "Programming in Haskell", 2nd edition, by Graham Hutton. We will also use a textbook I have written called "Verified Functional Programming in Agda". It is freely available to U. Iowa students in PDF and epub formats through the Main Library, at this link:

http://dl.acm.org.proxy.lib.uiowa.edu/citation.cfm?id=2841316&CFID=712814136&CFTOKEN=44576216

Both books are on reserve in the Engineering library, for this class.

The class will use Subversion repositories heavily. You can get started by following these directions:

https://svn.divms.uiowa.edu/repos/clc/class/3820-fall17/using-subversion.txt

You will use these instructions in homework 0, which is assigned now and due Wednesday August 30th:

https://svn.divms.uiowa.edu/repos/clc/class/3820-fall17/hw0/hw0.pdf

Enter **guest** and **guest** for username and password if asked.

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

Collaboration Policy
For most assignments and the project, you can work with one other person (no more), if you wish. You may also work by yourself. You should not share code or work together on code with anyone except the course staff or your partner. Other than these exceptions, you may not exchange solutions (e.g., by email) or work together on solutions with other students or others outside the class. Possible instances of cheating will be investigated and may be reported to the Dean's office, as required by CLAS policy. In addition, I am offering a bounty of 100 points for information leading to the identification of any students posting class homeworks to coding-for-hire web sites. This is an execrable violation of academic integrity that I will do my best to stamp out if it arises (as it has in past semesters).

Course Platforms and Software
We expect most students will use Windows (though the course staff is also using Linux), and we will ensure that our assignments and courseware work on Windows. We will be using several programs in this class, which you will probably want to download and install on your computer. These programs will also be available on the CS lab Windows machines in 301 MacLean. The first of these are Haskell and Emacs. Homework 0 will get you started.

Piazza and Course Help
We welcome you to discuss your homework with us, even if you just want to make sure you are doing it correctly! You can come to office hours, or ask a question on the Piazza course-discussion web service, which we will use to field questions about the class, and make announcements:

https://piazza.com/the_university_of_iowa/fall2017/cs3820/home

You can ask questions on Piazza privately or publicly (and anonymously if you wish, although note that you will only be anonymous to other students, not the course staff). We reserve the right to make private questions public and vice versa. You will get faster help if you post on Piazza than if you email us directly. This is because amazingly, your peers will answer your questions, usually even faster than we will! But you are indeed welcome to email us, particularly with personal matters (illness, expected absence from class, etc.).

We do not expect to use ICON for this class very much, except for keeping track of grades. Everything else will be on the course subversion repository and Piazza. We also have a Google Calendar for the course, which you can use to see our exact office hours, and course deadlines. The calendar may be found under Resources, on the Piazza page. Office hours may change, but we will avoid doing so at the last minute.

Late Policy
We do not accept late homework. Instead, we offer bonus points for turning homeworks in early.

Graded Work and Schedule
A perfect score in this class is 1000 total points. The plan for the graded work is the following (these dates are also on the course calendar):

HW 0. Getting started with Haskell, due 8/30 (50 points)
HW 1. Haskell basics, due 9/6 (90 points)
HW 2. Higher-order programming in Haskell, due 9/13 (90 points)
HW 3. Evaluators, due 9/20 (90 points)

Quiz in class, 9/28 (80 points)

HW 4. Agda basics, due 10/4 (90 points)
HW 5. Proofs in Agda, due 10/11 (90 points)
HW 6. Advanced Agda, due 10/18 (90 points)

week off (nothing due)

HW 7. Grammars, due 11/1 (90 points)
HW 8. Garbage collection 11/8 (90 points)
Project proposal. Due 11/15 (25 points)

11/19-11/26 Thanksgiving Break

Project progress report. Due 11/29 (25 points)
Final project submission. Due 12/13 (100 points)

Also, we will blindly select 14 willing projects for presentation based on the progress report. Presentations yield 15 bonus points. Presentations will be 10 minutes each 11/30 and 12/5.

I plan to offer an extra credit opportunity the week of 10/23-10/27 for those who have less than what I expect will be a C- according to class grades filed on ICON as of 10/20. I will email students who are eligible individually, on 10/20 or that weekend.

See Piazza for additional standard policies from the College of Liberal Arts and Sciences (under Syllabus).

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.