1   Instructor

Amal Ahmed
Office: Lindley 301G
Phone: 855-4579
Email: amal at cs.indiana.edu
Office hours: Monday 2-3pm, Thursday 2-3pm

2   Time & Place

Classes meet on Tuesday and Thursday, 11:15am to 12:45pm in Lindley Hall 115.

3   Course Website

`http://www.cs.indiana.edu/classes/b522/`

4   Course Description

Programming languages are a fundamental part of computer science. This course introduces the formal tools needed to describe precisely what a program means. These tools help us answer many useful questions about program analyses and transformations, such as:

- Is this program correct?

- Will this program encounter a run-time type error?

- Is one program indistinguishable from another?

- Is this optimization a safe program transformation?

- Can programs written in this language crash?

- Is this compiler translation correct?

- Can source language A be translated into target language B?

Topics include:

- Different styles of dynamic semantics, including operational, axiomatic, and denotational semantics

- Static semantics, including type systems

- Proofs by induction on derivations and structure

- A formal treatment of important programming language features such as functions, laziness, exceptions, continuations, modules, type polymorphism, subtyping, objects and classes

5   Prerequisites

This course is aimed at Masters students, beginning PhD students, and high-level undergraduates in computer science with a keen interest in the theory and design of programming languages. The only requirement for the course is a considerable degree of mathematical maturity as obtained, for instance, through rigorous undergraduate coursework in discrete mathematics, algorithms and elementary logic. Familiarity with a higher-order functional programming language (e.g., Scheme, ML, Haskell, etc.) would be useful but is not required.

6   Textbooks

There is one required text for B522:

- Benjamin C. Pierce, Types and Programming Languages , MIT Press, 2002.

The following book is recommended but not required:

- Glynn Winskel, The Formal Semantics of Programming Languages: An Introduction , MIT Press, 1996.

These books are excellent sources for the course, so purchasing them is a good idea. If you don't have a copy, IU library has an electronic version of Pierce that can be accessed by searching the IU catalog and providing your indiana.edu username and passphrase. Winskel will be on reserve at Swain Library.

Some other useful texts that provide a different perspective or more depth in some areas are:

- Robert Harper, Practical Foundations for Programming Languages , Draft of Fall, 2009.

- Benjamin C. Pierce, ed., Advanced Topics in Types and Programming Languages , MIT Press, 2005.

- John C. Mitchell, Foundations for Programming Languages , MIT Press, 1996.

- Carl Gunter, Semantics for Programming Languages , MIT Press, 1992.

7   Exams

- There will be an in-class midterm exam on Tuesday, Oct 27th.

- There will be a 24-hour take-home final examination during the exam period at the end of the semester. (Tentative: the final will be available at noon on Dec 15th and will be due back at noon on Dec 16th.)

8   Homeworks

There will be 5 homework assignments during the course of the semester. Assignments will typically be made available on Thursdays and will be due back the following Thursday.

If a significant percentage of the class does poorly on one or more problems on the homework, the instructor may reassign those problems. Such assignments to redo a specific part of a homework will typically be announced on a Tuesday. You will have two days to submit a revised solution (due back at the beginning of lecture on the due date). The score obtained on the revised solution will replace the earlier score received for that problem. This policy is aimed at ensuring that the emphasis is properly on learning the course material, and not on simply getting through the assignments. Note that due dates for homework revisions are marked with an r suffix on the schedule (e.g., hw1r).

All homeworks are due at the beginning of lecture on the due date unless otherwise specified. Extensions are granted only in extenuating circumstances at the discretion of the instructor. All written assignments must be typeset (using LaTeX) in the interest of legibility. Instructions for submitting a programming assignment will be given with the assignment.

9   Academic Integrity

You are responsible for reading the departmental statement on academic integrity before starting the first homework.

Unless explicitly instructed otherwise, all homework and exam work is to be solely your own, and may not be shared with or borrowed from any other person in the course. You are not permitted to draw upon assignments or solutions from similar instances of the course, nor to use course materials (such as assignments or programs) obtained from any web site or other external source in preparing your work.

You are encouraged to discuss homework assignments with other students in the class, but you must adhere to the whiteboard policy. At the end of the discussion the whiteboard must be erased and you must not transcribe or take with you anything that has been written on the board (or elsewhere) during your discussion. You must be able to reproduce the results solely on your own after any such discussion.

10   Grading Policy

The final grade will be comprised of homework (60%), midterm exam (15%) and final exam (25%) scores.

11   Course Schedule

See the course website.