Introduction and Course Organization

Principles of Programming Languages

CSE 526

Compiled at 23:43 on 2020/01/27

Course Information

Title: **CSE 526: Principles of Programming Languages**

Web Page: http://www.cs.stonybrook.edu/~cse526/

Class: **Tue., Thu. 10:00am – 11:20am**
Old CS 2311

Instructor: **C. R. Ramakrishnan**
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Office: NCS 233
Office Hours: Mon., Wed. 10:00am – 11:30pm, or by appointment
http://www.cs.stonybrook.edu/~cram

Motivation

Rigorously define the *meaning* of programs.

Essential to:

- Define implementation standards
  - High-assurance, high-performance compilers and implementation platforms
- Improve programmer understanding
- Enable software validation and verification

Fruit Flies Like a Banana

Fruit Flies Like a Banana

Time Flies Like an Arrow

Fruit Flies Like a Banana

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Time Flies Like an Arrow

Fruit Flies Like a Banana

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Ambiguity may be *fun* for some . . .

Program Semantics: Description Techniques

- Operational Semantics: How does the program work?

  Specifies program behavior with respect to an execution mechanism

- Denotational Semantics: What does the program stand for?

  Treats programs as mathematical objects, as functions mapping inputs to outputs

- Axiomatic Semantics: What properties are true in the program?

  Associates proof rules with programming constructs

We will focus primarily on *operational semantics* in this course.

Types and Type Systems

A type system provides a way to reason about programs

- Types are sets of values computed by phrases in a program
- Type systems prove the absence of certain program behaviors by classifying program phrases based on types

This classification may be done

- *statically*, i.e. before a program runs, or
- *dynamically*, i.e. when the program runs.

The Use of Type Systems

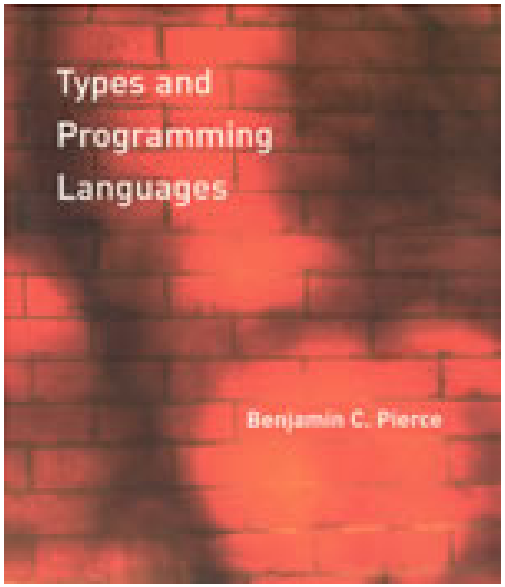
- Programmer Support
  - Error Detection
  - Maintenance
- Abstraction (modules)
- Documentation
- Language Safety
  - Guarantee that abstractions in the language are protected
- Efficiency

Organization

See schedule linked from course web page

- Course contents will follow the text reasonably closely.
- Other sources may be used to explore concepts not covered in detail in the text book.
- Homeworks will reinforce material from lectures and text book. Some may be programming homeworks.
- Grading scheme:
  - Homeworks: 20% of grade
  - Mid-Term Exam: 40% of grade
  - Final Exam: 40% of grade

Textbook



Benjamin Pierce
Types in Programming Languages
(MIT Press)

Course Content: Principles

CSE 526: **Principles** of Programming Languages

- Formally define the syntax and semantics of programming languages.
- Provide formal proofs for properties based on these definitions.

You are expected to be comfortable with mathematical logic and proofs, especially those based on induction.

Course Content: Programming

CSE 526: Principles of **Programming** Languages

- You are expected to be an experienced programmer in a procedural (e.g. C) or object-oriented (e.g. Java,C++) language.
- You will be expected to quickly pick up programming in
  - a functional programming language Objective Caml (aka OCaml). See `https://ocaml.org` for OCaml system, references and tutorials.
  - a logic programming language Prolog. See `http://www.swi-prolog.org` for a popular Prolog implementation, and this course's web page for additional resources and tutorials.
- Programming homeworks will not be large, but will require prior preparation.

The Rules of the Game

All home work (and exams, too):

- Individual work.
- Limit discussion of homeworks to *problems*, not *solutions*.
- Cheating, illegal collaboration and plagiarism will be treated with maximum seriousness.

Course Support

Course web pages are split between CS web server, the Blackboard system, and Piazza.

- **Pages on CS Web Server** will have *Course Material:* handouts, homeworks, notes, etc. will be in the CS server (open access).
- **Pages on BlackBoard:**
  - *Homework submission forms:* all homework assignments will be submitted via the Blackboard system.
  - *Grades:* Homework and exam grades will be posted on Blackboard.
- **Piazza:**
  - *Discussion Forum:* for all course discussion

Course Discussion Board

- Use this to discuss any course-related material: lectures, homework problems, exams, etc.
- If you have any questions on the material, first check to see if any one else had the same question as you have, and whether the question has been answered already; otherwise post the question on the board.
- We'll try to answer all questions on the board asap: within 24 hrs for normal days, and much quicker near exam/homework deadlines.

Questions

How to contact course staff:

- Staff contact information is on the web page/Blackboard.
- Post your question on the discussion board.
- Meet me during my office hours (or fix an appointment).
- Send me email. (Post on discussion board unless the question is personal.)