

CS 242

Programming Languages

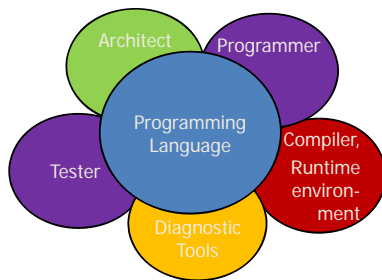
John Mitchell

Course web site: <http://www.stanford.edu/class/cs242/>

Some Course Goals

- Programming Language Concepts
 - A language is a “conceptual universe” (Perlis)
 - Framework for problem-solving
 - Useful concepts and programming methods
 - Understand the languages you use, by comparison
 - Appreciate history, diversity of ideas in programming
 - Be prepared for new programming methods, paradigms, tools
- Critical thought
 - Identify properties of *language*, not syntax or sales pitch
- Language *and* implementation
 - Every convenience has its cost
 - Recognize the cost of presenting an abstract view of machine
 - Understand trade-offs in programming language design

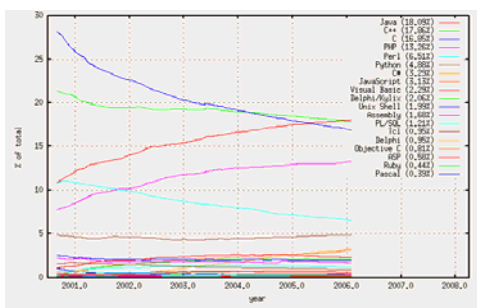
Language goals and trade-offs



Value of Language Concepts

- Parable
 - I started programming in 1970's
 - Dominant language was Fortran; no recursive functions
 - My algorithms and data structure instructor said:
 - Recursion is a good idea even though inefficient
 - You can use idea in Fortran by storing stack in array
 - Today: recursive functions everywhere
- Moral
 - Futuristic ideas may be useful problem-solving methods now, and may be part of languages you use in the future
- Current examples
 - Function passing: pass functions in C by building your own closures, as in STL “function objects”
 - Continuations: used in web languages for workflow processing
 - Concurrency

Languages in common use



Compiled by François Labelle from statistics on open-source projects at SourceForge

What's new in programming languages

- Commercial trend over past 5 years
 - Increasing use of type-safe languages: Java, C#, ...
 - Scripting languages, other languages for web applications
- Teaching trends
 - Java replacing C as most common intro language
 - Less emphasis on how data, control represented in machine
- Research and development trends
 - Modularity
 - Java, C++: standardization of new module features
 - Program analysis
 - Automated error detection, programming env, compilation
 - Isolation and security
 - Sandboxing, language-based security, ...

What's worth studying?

- Dominant languages and paradigms
 - C, C++, Java
 - Imperative and Object-oriented languages
- Important implementation ideas
- Performance challenges
 - Concurrency
- Design tradeoffs
- Concepts that research community is exploring for new programming languages and tools

First half of course

- JavaScript (1 lecture)
 - Current language illustrating features covered in course
 - Lisp, lambda calculus (1.5 lecture)
 - Conventional prog. language concepts (4.5lectures)
 - ML/Algol language summary (1 lecture)
 - Types and type inference (1 lecture)
 - Block structure and memory management (1 lectures)
 - Control constructs (1 lectures)
 - Analysis and comparison (2 lectures)
 - Denotational semantics (briefly)
 - Code analysis methods
 - Scripting and domain-specific languages (???)
- Midterm Exam -----

Second half of course (subject to change!)

- Modularity, data abstraction, objects (1 lecture)
- Object-oriented languages (4 lectures)
 - Smalltalk and Self (1 lectures)
 - C++ (1 lectures)
 - Java (2 lectures)
- Security (1 lecture)
- Concurrent and distributed programming (1 lecture)
- Interoperability (1 lecture)
- Conclusions and review (1 lecture)

----- Final Exam -----

General suggestions

- Read ahead
 - Some details are only in HW and reading
- There is something difficult about this course
 - May be hard to understand homework questions
 - Thought questions: cannot run and debug
 - May sound like there is no right answer, but some answers *are* better than others
 - Many of you may be used to overlooking language problems, so it takes a few weeks to see the issues

Course Logistics

- Homework and Exams
 - HW handed out and due on Wednesdays
 - Midterm Wed Oct 24 7-9PM, Final Mon Dec 10, 12:15 PM
 - Honor Code, Collaboration Policy
- Homework grader?
 - Send email to cs242@cs email addr
- TA's, Office hours, Email policy, ...
- Section
 - Friday afternoons, 2:15 in Gates B03
 - Optional discussion and review; no new material
- Reading material
 - Book available in bookstore
 - Supplementary reading on web

See web site...

Questions?