

Assorted Announcements

- HKN Survey at end of lecture (worth 5 points).
- Project due next Wednesday. Autograder sometime this weekend.
- **Final:** Tuesday, 12 May at 3PM in F295 Haas.
- Please make sure to get in requests for alternative finals by next Wednesday.

Course Summary

- Programming Languages
- Translation of Programming Languages
- Tools
- Construction of Complex Software

Programming Languages

- Scope of declarations
- Scope vs. extent (lifetime) of variables
- Interactions between language design and runtime structures:
 - Function representation
 - * Effects of recursion, variable-sized data, functional values
 - Inheritance
 - * Single vs. multiple inheritance
 - * Java-style interfaces
- Formal methods for describing languages: type systems
- Specific languages used here: Prolog, Python, C++.

Translation of Programming Languages

- Lexical analysis
 - regular expressions, finite automata
- Context-free syntax
 - BNF
 - Top-down, recursive descent
 - Bottom-up, shift-reduce parsing
 - Terminology: derivation
 - Syntax-driven translation
- Static semantics
 - Symbol tables, relation to environment diagrams
 - Types, type inference

Translation of Programming Languages, contd.

- Code generation, intermediate forms
- Runtime representations for “special effects”
 - Exceptions
 - Procedure calls
 - Object-oriented method dispatch
 - Garbage collection
- Optimization
 - Terminology: basic blocks, control-flow graph
 - “Classical” optimizations
 - Structure of flow analysis

Tools

- Lexer-generation, use of regular expressions and states
- Parser generators, rule-based programming
- Version-control concepts

Construction of Complex Software

- Be familiar with project, including parts you didn't write.
- Concept of a "pass" or "phase".
- Use of object-orientation to partition task
- Importance of intermediate forms; how used to reduce work of porting compilers

Parting Remarks

- It's not just compilers:
 - Ideas in this course are general-purpose tools
 - Think domain-specific languages
- Opportunities for research
 - Parallelism and distributed computation
 - Static program analysis:
 - * Supports compiling for parallelism & distributed computation.
 - * Analyzing programs for security attacks/flaws
 - * Formal analysis for program validation (e.g., avionics)