COMP 520 - Compilers

Lecture 12 (Tue Feb 23, 2017)

miniJava Contextual Analysis

- Please pick up from back of room
  - short written assignment WA4
    - due Thursday Mar 2 (day after tomorrow)
Topics

• Punish your prof!
  – Great chance to vent your compiler frustrations!

• miniJava Contextual Analysis
  – Summary / review
Celebrate Pi Day: Pi Your Professor!

Wednesday, March 8
12 Noon
Outside of the Brooks Lobby

• $10 donation buys one pie to throw at the professor of your choice
• $15 donation to pi the Chair
• Get an extra pie to throw, if you’re willing to get pi’ed
• Pie available to eat, too

Venmo donations @Kevin-Jeffay any time, or bring cash the day of.

Donations support student clubs and initiatives.

Participating Professors
Stan Ahalt • Mohit Bansal • Tamara Berg • Michael Fern
Jan-Michael Frahm • Kevin Jeffay • Kris Jordan • Fabian Monroe
Don Porter • Jan Prins • Diane Pozefsky • Mike Reiter
Identification

• **IdTables**
  – enter(String s, Decl d)
    • associate s with Decl d
  – Decl retrieve(String s)
    • yields decl or null

• **Specific id tables**
  – is s a class name?
  – is s a member of class X?

• **Scoped id table**
  – what declaration is associated with s in the current scope?
  – is s already declared in the current scope?
  – is s already declared in a scope at level > k?
  – enter a new <name,Decl> at the current level
  – enter or exit a scope
Identification

• How to perform identification
  – Declarations need to be entered
    • ClassDecl, MemberDecl, LocalDecl
  – Identifiers need to be retrieved
    • add a Declaration attribute to the Identifier class
    • work out a correct order to visit different parts of the AST to ensure all applicable declarations will have been seen before visiting an Identifier
    • link each identifier in the AST to its declaration using the appropriate idTable(s)
  – What constructs need identification?
    • Basically all
      – Declarations
      – Statements, Expressions, References, TypeDenoters
        » anything that could contain an Identifier
Identification

• Special challenges
  – Access and Visibility restrictions of MemberDecls
    • Non-static members are not always accessible
    • private members are not always accessible
    • need a “context” for a reference to make a judgment

  – References
    • example
      – x.y.z

    • what needs to be checked at each node of the Reference ast?
Identification

• Special challenges
  – Scope of variable in a VarDecl
    • e.g.

    \[
    \text{int } x = 3 + x;
    \]

    • is erroneous!

• predefined classes
  • System, etc.
Type Checking

• Relatively simple
  – Create a typeDenoter attribute in every Expression node (or possibly in every node)

• The type rules for predefined functions are relatively simple
  
  
  
  +, -, *, etc : Int x Int → Int
  
  == : α x α → Boolean
  
  index : Array(α) x Int → α
  
  assign : α x α → Stmt

• A single upwards pass suffices for miniJava type checking

• Study the type related classes in the AST
  – TypeDenoter, TypeKind, BaseType, ArrayType, Classtype
  – create an equality function between arbitrary instances of TypeDenoter

• provided identification has completed successfully!
  – e.g. A x = new A();
Type Checking

• Additional types
  – Error type
    • Error type is equal to any type
    • limits propagation of errors
    • gives most useful continuation of type checking after an error
  – Unsupported type
    • Unsupported type is not equal to any type
    • therefore a value of type unsupported is not type correct in any operation
    • predefined name String can have unsupported type
Midterm exam scope

• Textbook chapters 1-5
  – Chapter 4 scanning and parsing
    • Scanning
    • EBNF context-free grammars
    • Grammar manipulation
    • LL(1) property
  – Chapter 5 contextual analysis
    • Identification
    • Type checking

• Project checkpoints PA1 and PA2
  – know your compiler
  – should know what you are doing in PA3
Midterm

- Thursday March 9, 2017 start 3:30 – exams collected at 4:45
  - in-class exam – 75 mins
  - Arrive early – you will be split over two classrooms so you can spread out

- Open book / notes
  - Limited to materials distributed in this offering of COMP 520
  - You may use a computer to read materials
    - No search!
    - No communication!
  - You must complete the pledge