Computation and Deduction

Lecture 17: Proof Search and Sequent Calculus

March 11, 1997

1. Suggested Projects

2. Normal Derivations

3. Canonical Derivations

Suggested Projects I

- A calculus of explicit substitutions [Abadi, Cardelli, Curien, & Levy 91]

- A calculus of objects [Abadi & Cardelli 94]

- Coherence of a language with subtyping and implicit coercions [Breazu-Tannen, Coquand, Gunter, & Scedrov 91]

- A lambda-calculus with intersection types [Coppo, Dezani-Ciancaglini, & Venneri 81] [Reynolds 91]

- A logic for parametricity [Plotkin & Abadi 93]

- A lambda-calculus with names [Odersky 94]

- First-order unification [Snyder & Gallier 88]

- Higher-order logic programming [Miller, Nadathur, Pfenning, & Scedrov 91]

Suggested Projects II

- Program analysis and optimization (each topic below is a possible separate project)

  - Binding-time analysis [Nielson & Nielson 92], [Davies & Pfenning 96] [Davies 96] [Hatcliff 96]

  - Abstract interpretation [Cousot & Cousot 77]

  - Strictness analysis [Hankin & Metayer 94]

- The Categorical Abstract Machine [Cousineau, Curien, & Mauny 87]

- Closure conversion and lambda-lifting [Reynolds 72]

Suggested Projects III

- Extending Mini-ML (each topic below is a possible separate project)

  – with exceptions

  – with references

  – with general datatype definitions

  – overloading and typecase

  [Milner, Tofte, & Harper 90]

- Mini-Forsythe [Reynolds 88]

Suggested Project IV

- Elementary notions of rewrite systems [Bachmair 91]

- Modal logic and Kripke semantics [Basin, Matthews, Vigano 96]

- Polymorphic recursion and semi-unification [Henglein 93, TOPLAS]

- Lazy evaluation [Launchbury 93]

- Pure functional programming and monads

- Evaluation based on evaluation contexts [Felleisen]

Suggested Projects V

- Logical interpretations [Goedel, Friedman]

- Linear logic [Girard 87, Pfenning 96]

- Computational interpretations of classical logic [Ong 96, Ong & Stewart 97]

- Pi-calculus [Milner]

Suggested Projects VI

- Theorem proving

  - via tactics

  - via iterative deepening

  - other methods

  - induction

  - Presburger arithmetic

  - decision procedures for fragments

- Elementary category theory [Rydeheard & Burstall, Gehrke]

- Type-directed compilation [Morrisett 95]

Suggested Projects VII

- Shape types [Fradet & Metayer 97]

- Relational parametricity and units of measure [Kennedy 97]

- Type directed partial evaluation [Danvy 96]

- Typed closure conversion [Minamide, Morrisett, Harper 96]

- Call-by-value lambda-calculus [Plotkin 75, Sabry & Wadler 96]

- Call-by-need lambda-calculus [Ariola et al 95]

- Recursive types [Abadi & Fiore 96]

- "Logical" logic program compilation [Pfenning 97]

- LF in Elf

- Elf in Elf