Some project proposals

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Compiling MicroC to x86 code

• Idea: Compile MicroC to x86 code
• Topics:
  – Understand the x86 instruction set
  – Decide on runtime (stack) layout
  – Design new Compile methods for MicroC
  – Generate x86 code as text input to nasm
• Challenges:
  – Use extreme care, or spend May debugging
  – Once it works, make it run as fast as possible
Extend MicroC compiler

• Idea: Learn more about C and compilation by covering more of C
• Topics:
  – C features, such as struct types, switch, break, continue, malloc/free, fct pointers
  – Design compile-time type representation and run-time data representation
  – Modify parser, checker, compiler, (machine)
  – Write example programs and test
• Challenges:
  – Investigate compiler literature and transfer ideas to MicroC compiler

Icon (or SETL?) interpreter

• Idea: Icon interpreter in Java or C#
• Topics
  – The Icon language, with backtracking; e.g. (1 to 3) * (4 to 5) gives 4 5 8 10 12 15
  – Continuations – very cool technique
  – Implement parser, optional
  – Implement interpreter using continuations
  – Write and run Icon examples
  – See Programming Language Concepts section 8.9
• Challenges
  – Understand continuations
  – Consult http://www.cs.arizona.edu/icon/
  – Find or invent clever Icon programs
  – (If in .NET, using tail. prefix on calls)
**Code duplication discovery in Microsoft Dynamics NAV (Navision)**

- **Idea:** Find common patterns in NAV source code
- **Topics:**
  - Understand Michael Schou Christensen’s CodeDup
  - Design C/AL (NAV) grammar from code examples
  - Adaptation to Coco/R and testing on code examples
  - Build on CodeDup
  - Empirical study of large C/AL source base
  - Collaboration with Microsoft Dev Center under NDA
  - Possibly: Propose refactoring – MSc thesis?
- **Challenges:**
  - Understand and reverse engineer C/AL
  - What CodeDup parameters (constants,...) work?

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**Performance engineering**

- **Idea:**
  - Tune software for modern platforms: .NET/JVM and x86-processors
  - Improve *Numeric performance in C, C# and Java*
- **Topics**
  - Consider e.g. matrix computations, or the C5 collection library, and large problem sizes
  - Measure time and space performance
  - Compare platforms (.NET vs JVM, hardware)
  - Rewrite code for better performance
- **Challenges**
  - Find good profiling tools; be systematic
  - Draw general conclusions
Fast serialization using runtime code generation

- Idea: To serialize array of 100,000 structs, use reflection once to generate serialization code, then run that code 100,000 times
- Topics
  - Reflection to discover a type’s components
  - Generating .NET or JVM code at runtime
  - Benchmarking
- Challenges
  - Understand .NET or Java bytecode in detail
  - Debugging the serialization code generator
  - Cover as much of C#/Java as possible