Necessary Conditions for Constraint-based Register Allocation and Instruction Scheduling

Background

Scientists at SICS and KTH have developed a constraint model for code generation in a compiler back-end. The model captures register allocation as well as instruction scheduling, combining aspects such as multiple register banks (subsuming spilling to memory), coalescing and packing.

The feasibility of the model has been demonstrated in a proof-of-concept implementation that generates code of quality on par with LLVM. A recent paper can be found here.

There are many opportunities for strengthening the constraint model by adding necessary conditions aka. redundant constraints, to reduce the search effort in the code generator.

The project is funded in part by LM Ericsson AB and by the Swedish Research Council. Two PhD students are working full-time in the project.

Objective

The work consists of:

- Familiarization with the code generation project and its constraint model
- Literature study of necessary conditions in other constraint-based code generators
- Definition of the set of necessary conditions to generate
- Implementation of the necessary condition generator. This can be done in an imperative language such as Java, or in a symbol-crunching language such as Prolog, Haskell or Python.
- Evaluating the impact of the necessary conditions
- Documentation of the necessary condition generator including pseudo-code of the key algorithms and an discussion of their complexity
- A written report covering the above

Competence

We are looking for a bright MSc student with the following requirements:

- Taken constraint programming course
- Taken compiler technology course
- Taken programming theory course
- Fluent in selected implementation language
- Fluent in spoken and written English

Applications

Applications should include a brief personal letter, your CV with your education, professional experience and specific skills and recent grades. In your application, make sure to give examples of previous programming or other projects that you consider relevant for the position. Candidates are encouraged to send in their application as soon as possible via e-mail. Suitable applicants will be interviewed as applications are received.

About SICS

The Swedish Institute of Computer Science (SICS) is a non-profit research organization focusing on applied computer science. SICS employs approx. 130 researchers, including 70 PhDs.

Work environment

We offer you a challenging task, a good working environment and a supervision that makes sure that both the project and your academic thesis will be successful.

The work will be supervised in part by Mats Carlsson (SICS, Uppsala) and in part by Roberto Castañeda Lozano (SICS, Kista), and can be carried out at either site. It will be examined by Christian Schulte (KTH, Kista). The credits of UU students will be accredited at UU. Some travel will thus be required.

Contact

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