Research Assistant position - Adaptable Context-Sensitive Points-To Analysis for Large-Scale Java Codes

Duration: 6 months
Timeframe: To commence between June & November, 2015
Supervisor: Raghavendra K.R.

A 6 month, full-time internship position is available in the Program Analysis group within Oracle Labs, Brisbane, Australia (http://labs.oracle.com/locations/australia).

The position is available for a June/July start, with a duration of 6 months.

These positions are paid at the current industry rate and travel costs associated with overseas applicants will be reimbursed.

Static points-to analysis is fundamental to understand the semantics of a program without running it. Although there exists a cornucopia of approaches for solving points-to analysis for object-oriented programs, little research has been conducted on making points-to analysis scalable for Java programs with millions lines of code.

This project will explore the design space for scalable and precise analysis. In particular, we will study the aspect of adaptive context-sensitive in conjunction with compositional points-to analysis. Adaptive context-sensitivity is a technique to perform procedure cloning only at call-sites which improve the precision of the points-to analysis rather than applying the same context-sensitivity to all call-sites. A compositional points-to analysis permits to compose points-to analysis of packages in a bottom-up fashion.

Oracle Labs is the research arm for Oracle, focusing on applied research that produces new technologies of interest to the company. Oracle Labs Australia, based in Brisbane, focuses on Program Analysis as it applies to a variety of domains, including bug-checking, security analysis, productivity tools, testing and more. The group is best known for its research on static code analysis that led to scalable and precise bug-checking algorithms embedded in the Oracle Parfait tool.

This 6 month internship is suitable for students who are currently enrolled in a Computer Science or related degree (advanced progression only), Masters, or PhD degree. Exceptional students enrolled in other research programs will also be considered. International research candidates are also welcome to apply. These internships provide students with valuable industry experience whilst simultaneously allowing them to work on cutting edge research projects that have real world application.

Selection criteria:

- PhD student, Masters or advanced under graduate student enrolled in Computer Science, Software Engineering or a related area;
- Basic understanding of program semantics (including abstract interpretation);
- Notions of logic programming (preferred Datalog, Prolog, CLP, etc.);
- Demonstrable capacity to work independently and collaboratively;
- Be available for 6 months in the June, 2015 - May, 2016 timeframe.

To apply:
Please submit your resume (including Academic Transcript) in PDF format, along with your publications and relevant experience to Juliette Hatton - juliette.hatton@oracle.com. Juliette will coordinate interviews and answer any general questions that you may have.
Research Assistant position - Generating Traces from Flow-Insensitive Static Program Analyses

Duration: 6 months
Timeframe: To commence between June & November, 2015
Supervisor: Paddy Krishnan

A 6 month, full-time internship position is available in the Program Analysis group within Oracle Labs, Brisbane, Australia (http://labs.oracle.com/locations/australia).

The position is available for a June/July start, with a duration of 6 months.

These positions are paid at the current industry rate and travel costs associated with overseas applicants will be reimbursed.

Static program analyses for large-scale Java code often ignore control-flow of programs to make the analysis scalable, i.e., the analyses consider the data-flow of programs only. When the control-flow of programs is abstracted, the analyses will produce extra information that is infeasible in practice causing false-positives.

This project will explore the theory of converting flow-insensitive analysis information to flow-sensitive analysis information as a postmortem step of the flow-insensitive analysis. The postmortem step will overlay the data-flow information with the control-flow structure using the notions of language intersection of formal languages.

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This 6 month internship is suitable for students who are currently enrolled in a Computer Science or related degree (advanced progression only), Masters, or PhD degree. Exceptional students enrolled in other research programs will also be considered. International research candidates are also welcome to apply. These internships provide students with valuable industry experience whilst simultaneously allowing them to work on cutting edge research projects that have real world application.

Selection criteria:
- PhD student, Masters or advanced under graduate student enrolled in Computer Science, Software Engineering or a related area;
- Basic understanding of program semantics (including abstract interpretation);
- Basic understanding of formal grammars (regular and context-free languages);
- Good skills in C++ programming;
- Exposure to logic or functional programming (preferred Datalog, Prolog, CLP, etc.);
- Demonstrable capacity to work independently and collaboratively.

To apply:
Please submit your resume (including Academic Transcript) in PDF format, along with your publications and relevant experience to Juliette Hatton - juliette.hatton@oracle.com. Juliette will coordinate interviews and answer any general questions that you may have.
Research Assistant position - Partial parsing for security analysis of web applications

Duration: 6 months  
Timeframe: To commence between June & November, 2015  
Supervisor: Francois Gauthier

A 6 month, full-time internship position is available in the Program Analysis group within Oracle Labs, Brisbane, Australia (http://labs.oracle.com/locations/australia).

The position is available for a June/July start, with a duration of 6 months.

These positions are paid at the current industry rate and travel costs associated with overseas applicants will be reimbursed.

The successful candidate will work on the analysis of web-based applications, for the purposes of finding security vulnerabilities related to tainted data. Web-based applications are often written using a combination of different languages, including Java, JSP, JSF and XML. In the context of this project, the candidate will implement partial parsers for these languages, focusing on parts of these languages that are relevant to security.

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This 6 month internship is suitable for students who are currently enrolled in a Masters, or PhD degree. Exceptional students enrolled in other research programs will also be considered. International research candidates are also welcome to apply. These internships provide students with valuable industry experience whilst simultaneously allowing them to work on cutting edge research projects that have real world application.

Selection criteria:
- PhD student or Masters student enrolled in Computer Science, Software Engineering or a related area;
- Solid knowledge of data structures is required;
- Experience with parsers, parser generators, compilers or program analysis is a plus;
- Demonstrable capacity to work independently and collaboratively.

To apply:
Please submit your resume (including Academic Transcript) in PDF format, along with your publications and relevant experience to Juliette Hatton - juliette.hatton@oracle.com. Juliette will coordinate interviews and answer any general questions that you may have.
**Research Assistant position - Evaluation of experimental Datalog compiler for static program analysis**

Duration: 6 months  
Timeframe: To commence between June & November, 2015  
Supervisor: Nathan Keynes

A 6 month, full-time internship position is available in the Program Analysis group within Oracle Labs, Brisbane, Australia (http://labs.oracle.com/locations/australia).

The position is to available for a June/July start, with a duration of 6 months.

These positions are paid at the current industry rate and travel costs associated with overseas applicants will be reimbursed.

The use of Datalog as a specification language for program analysis has been proposed by a number of research groups, however existing implementations have suffered from poor performance and high memory requirements. The Parfait project at Oracle is a bug-checking and security vulnerability detection tool, widely used in-house at Oracle. Parfait is built on top of the LLVM infrastructure, and includes a variety of analyses written in C++. A prototype Datalog compiler has recently been developed, to translate Datalog specifications into C++ analyses compatible with Parfait, and is hoped to provide more acceptable performance.

The aim of this project is to evaluate the Datalog compiler in terms of both performance and ease of specification, by implementing a series of program analyses in Datalog specifications and integrating them into Parfait. The project is also expected to involve proposing and implementing changes to the Datalog compiler and/or infrastructure in order to improve the usability of the tool.

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This 6 month internship is suitable for students who are currently enrolled in a Computer Science or related degree (advanced progression only), Masters, or PhD degree. Exceptional students enrolled in other research programs will also be considered. International research candidates are also welcome to apply. These internships provide students with valuable industry experience whilst simultaneously allowing them to work on cutting edge research projects that have real world application.

**Selection criteria:**

- PhD student, Masters or advanced under graduate student enrolled in Computer Science, Software Engineering or a related area;  
- Knowledge of compilers (undergraduate or higher);  
- Development experience in C++;  
- Demonstrable capacity to work independently and collaboratively.

**To apply:**  
Please submit your resume (including Academic Transcript) in PDF format, along with your publications and relevant experience to Juliette Hatton - juliette.hatton@oracle.com. Juliette will coordinate interviews and answer any general questions that you may have.
Research Assistant position - Explorations for a new information visualisation project

Duration: 6 months  
Timeframe: To commence between June & November, 2015  
Supervisor: Nathan Hawes

A 6 month, full-time internship position is available in the Program Analysis group within Oracle Labs, Brisbane, Australia (http://labs.oracle.com/locations/australia).

The position is available for a June/July start, with a duration of 6 months.

These positions are paid at the current industry rate and travel costs associated with overseas applicants will be reimbursed.

The successful candidate will assist in determining the direction of a possible new information visualisation project. The project will likely focus on a specific field, such as software visualisation, but aims to develop innovations applicable more generally. The position will involve trying out a variety of relevant academic, commercial, and internal visualisation tools and techniques to gauge the current state of the art, and subsequently performing initial experiments in one or two promising research areas. This work will contribute to the core goals and ideas for the new project ahead of its proposal.

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This 6 month internship is suitable for students who are currently enrolled in a Masters, or PhD degree. Exceptional students enrolled in other research programs will also be considered. International research candidates are also welcome to apply. These internships provide students with valuable industry experience whilst simultaneously allowing them to work on cutting edge research projects that have real world application.

Selection criteria:
- PhD student or Masters student enrolled in Computer Science, Software Engineering or a related area;
- Current or previous study/experience in information visualisation or a related area;
- Strong programming ability in C/C++, Java or similar and capable working in a unix-like environment;
- Demonstrable capacity to work independently and collaboratively.

To apply:
Please submit your resume (including Academic Transcript) in PDF format, along with your publications and relevant experience to Juliette Hatton - juliette.hatton@oracle.com. Juliette will coordinate interviews and answer any general questions that you may have.
Research Assistant position - String Manipulation Support for JDK Analysis

Duration: 6 months
Timeframe: To commence between June & November, 2015
Supervisor: Andrew Santosa

A 6 month, full-time internship position is available in the Program Analysis group within Oracle Labs, Brisbane, Australia (http://labs.oracle.com/locations/australia).

The position is available for a June/July start, with a duration of 6 months.

These positions are paid at the current industry rate and travel costs associated with overseas applicants will be reimbursed.

Oracle Labs Australia is currently engaged in the research and development of analysis tools to detect security vulnerabilities in the Java Development Kit (JDK). As JDK often uses strings to identify classes and methods, the symbolic reasoning of strings is thus essential.

The aim of the project is to design and implement a symbolic string reasoning unit for analysis tools, specifically for strings that are used to identify Java software components.

This project includes the following tasks:
1) Identify the domain of the string constraints.
2) Implement an API for symbolic reasoning of string operations.
3) Interfacing with a back end constraint solver.

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Oracle Labs Australia, based in Brisbane, focuses on Program Analysis as it applies to a variety of domains, including bug-checking, security analysis, productivity tools, testing and more. The group is best known for its research on static code analysis that led to scalable and precise bug-checking algorithms embedded in the Oracle Parfait tool.

This 6 month internship is suitable for students who are currently enrolled in a Computer Science or related degree (advanced progression only), Masters, or PhD degree. Exceptional students enrolled in other research programs will also be considered. International research candidates are also welcome to apply.

These internships provide students with valuable industry experience whilst simultaneously allowing them to work on cutting edge research projects that have real world application.

Selection criteria:
- PhD student, Masters or advanced undergraduate student enrolled in Computer Science, Software Engineering or a related area;
- Strong familiarity with the Java programming language.
- Demonstrable capacity to work independently and collaboratively.

To apply:
Please submit your resume (including academic results) in PDF format, along with your publications and relevant experience to Juliette Hatton - juliette.hatton@oracle.com. Juliette will coordinate interviews and answer any general questions that you may have.