Senior Project Ideas

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August 20, 2023
Investigate empirically the performance of existing garbage collector (Java’s?) on graph algorithms or string algorithms.

- implement sample graph algorithms (shortest path, etc)
- find large data sets to run experiments on (Stanford Large Network Dataset Collection, etc)

Identify which GC options work in different situations.
Improve static analysis tools (like Ada metrics) by identifying how the programmer might get a better score:

1. break up a large procedure into smaller procedures (refactoring)
2. decrease coupling among modules
Code Visualization

1. code visualizer
2. algorithm visualizer
public class Postfix {
    public static void main(String[] args) {
        Stack<Integer> stack = new Stack<>();
        for (char ch : "123+45*6--.\toCharArray()") {
            if (ch == '+')
                stack.push(stack.pop() + stack.pop());
            else if (ch == '*')
                stack.push(stack.pop() * stack.pop());
            else if (ch == '-')
                stack.push(-stack.pop() + stack.pop());
            else
                stack.push(ch); // 0
        }
        System.out.println(stack.pop());
    }
}
Investigate the development of provably correct software by programming a significant program, e.g., a SAT solver.

- Agda and/or Ada SPARK (imperative languages)
- Coq and/or Idris (functional languages)

Ada SPARK has been used in several high profile safety-critical systems, covering commercial aviation (Rolls-Royce Trent series jet engines, the ARINC ACAMS system, the Lockheed Martin C130J), military aviation (EuroFighter Typhoon, Harrier GR9, AerMacchi M346), air-traffic management (UK NATS iFACTS system), rail (numerous signaling applications), medical (the LifeFlow ventricular assist device), and space applications (the Vermont Technical College CubeSat project).
Formal Examples

Examples

- Agda
- Ada SPARK
- Coq
- Idris
Computer-Aided Programming Feedback

Some team might be interested in computer tools for programming education. Various aspects of evaluating large number of student projects could be addressed.

1. Handling/processing
2. Feedback and development assistance
3. Static analysis for quality and correctness
4. Analysis of dynamic behavior to find the source of bugs