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Professor Johnson

CS 6315 Automated Verification

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Project Proposal

For CS 6315 Final Project, I decided to investigate what formal verification methods exist for Haskell (or implement an SAT solver in Haskell). I decided to research Haskell for four main reasons.

First, Haskell is a statically typed and strongly typed functional programming language, which makes it well-suited for formal verification.

Second, many of the programming language research are conducted in Haskell. For instance, Professor Ruzica Piskac at Yale University is researching developing a “Symbolic Execution Engine for Haskell.” Regarding aiming to publish a paper, I know it is usually better to come up with a topic that nobody has done, and, therefore, no such paper exists. Trying to write a topic that other people have already done, as I then need to go through almost all the processes for how things have been done to research for other people and must then also come up with a better idea for the improvement to ensure that I am not plagiarizing, and my paper has uniqueness. A topic in which many other people are also currently working on improvements is usually even more difficult, as I must publish a paper on time; otherwise, it may lose originality or market value of my research if others publish a paper earlier than my schedule. Nonetheless, I would like to adjust the difficulty for my CS 6315 final project and decided instead to survey the current research or implement an SAT solver in Haskell.

Third, I decided not to investigate Rust because someone else in the previous CS 6315 class had conducted a final project on Rust.

Last, this will help me to succeed in PhD admissions in computer science at other U.S. universities after graduating M.Sc. in computer science at Vanderbilt University. My research interests are creating new programming languages and compilers/interpreters for computer graphics and other specific domains, and creating new in-memory multi-modal database management systems (DBMS) based on non-Von Neumann architecture (e.g. neuromorphic, quantum, or in-memory computing) for Hyperscale Generative AI and perhaps other domains. Therefore, I decided to do a project that can most help me to succeed in my PhD admissions at my chosen disciplines.

I plan first to take one or two courses at Udemy to grasp Haskell as soon as possible. Next, I will survey the literature and what tools exist for formal verification in Haskell and investigate what is state-of-the-art, what exists for software verification, etc. Then, I will try tools or frameworks that look promising with Haskell. Following that, I could perhaps do something more in-depth if there is enough time, for instance, trying some new examples or case studies and verifying something with some of the existing approaches I may find, or implement an SAT solver in Haskell.

Note that I decided to do this project alone. Since this is my first semester at Vanderbilt University, I do not know how hard the other students will work for the CS 6315 final project.