

ext. 34453  
September 25, 2022

To Whom It May Concern,

Zhenyan is an *outstanding* student with an overall average of 90% and a Computer Science average of 91% in the Honours Computer Science program at the University of Waterloo. Three standout grades are 91% in the Operating Systems, 97% in the Principles of Programming Languages, and 94% in Compiler Construction, where all of these courses contain difficult system-software material. I taught Zhenyan in CS343, Concurrent and Parallel Programming, where he achieved a grade of 87%, which is a high mark. Finally, Zhenyan has also excelled in mathematics courses showing the ability to assimilate both theoretical and practical material. It is rare for a student to have strong abilities in both theoretical and system-software material, allowing them to understand and handle all aspects of a research area in Computer Science.

I supervised Zhenyan for 4-months working as an Undergraduate Research Assistant (URA) on the **CV** programming-language research-project; therefore I am able to make an informed assessment. Zhenyan's work involved extending the **CV** concurrent runtime with a pthreads emulation to circumvent pthread-library calls from blocking kernel threads used to execute user-level threads. The project was complex and Zhenyan had to assimilate a large runtime code-base (20,000 lines of code). Zhenyan's work was excellent and he achieved all the goals assigned to him. He has also done a URA project with Dr. Martin Karsten, adding user-level threading into C++. Finally, Zhenyan has completed two interesting work-terms performing advance software development at each company.

Zhenyan's academic and research interests extend to two core areas of computer science: programming languages and their runtime systems, areas where he can demonstrate both his mathematics and computer-science skills. Over the last 5–10 years, there has been a renaissance in new programming language development, e.g., Golang, Rust, Kotlin, Scala, all with advanced type systems and highly concurrent runtimes. Working in programming languages requires understanding the software stack from the hardware up to advanced runtime interactions with the operating-system kernel and I/O libraries. This level of complexity matches with Zhenyan's desire to improving compiler optimization and solving OS-related issues like deadlock algorithms, culminating with developing a new programming language, which is an ambitious goal. There are currently many open research and engineering problems in the design of new algorithms and software to advance the area of programming languages, and Zhenyan is keen to work in multiple areas in this field. Solving these kinds of problems with optimal solutions requires expertise in several areas of Computer Science, and complex engineering of these ideas to build and test possible solutions. It is rare to find a student with interests in complex algorithm design and software systems to tackle these real-world problems. Finally, his English oral and written skills are very good.

Zhenyan's strong academic background and ability to do well in systems related work augurs well for success in his chosen research areas. He is an industrious and dedicated student, capable of strong independent work, and therefore, I strongly recommend him for graduate studies.

Yours truly,



Dr. Peter A. Buhr  
Associate Professor  
pabuhr@uwaterloo.ca

