Statement of Teaching Interests

Mahdi Nazm Bojnordi

Throughout my education, I have had many great teachers and mentors who have taught me theoretical concepts and their applications to real life problems. As a result of their commitment to excellence in teaching and research, I have developed the ability to think critically and to carry out research independently. In return, I would like to partially repay the efforts of these great teachers by participating in academic teaching at different levels.

As a teaching assistant, I have graded homeworks, held discussion sessions, and designed new projects and exam materials. As a guest lecturer, I have prepared class notes and slides, delivered lectures, and designed homeworks and projects. I am genuinely excited to commence the next step of my academic career, where I can have a positive impact on my own students.

Past Experience

Since my undergraduate studies, I have had the opportunity to get involved in teaching courses and mentoring students. As my first teaching assistant experience, I volunteered to grade homeworks and hold problem-solving workshops for an undergraduate course on Logic Circuits at Shiraz University. Later at the University of Tehran, I was invited to be a teaching assistant for a graduate course on Advanced VLSI Design, for which I designed a lab manual, managed lab sessions, gave lectures, designed and graded homeworks, and held office hours. Shortly after graduating from the University of Tehran, I started my new role as a guest lecturer to teach undergraduate courses at the Computer Engineering departments of Qazvin Islamic Azad and Shiraz Universities. This was a great opportunity that allowed me to positively impact students’ careers by designing exciting classes and engaging projects.

At the University of Rochester, I have served as a teaching assistant for both undergraduate and graduate courses. In Spring 2011, I was a teaching assistant for the Circuits and Microarchitecture for Engineers course taught to undergraduate students at the ECE department. I and two other teaching assistants held weekly lab hours to instruct students on how to operate the lab facilities, as well as assemble and test various circuits. Parts of the lab hours were dedicated to problem solving and answering the students’ questions. As a teaching assistant, I also graded homeworks, quizzes, and exams. In Fall 2011, I was the teaching assistant for the Advanced Computer Architecture course taught by my advisor, Prof. Engin Ipek. The course included a large project component with various RTL design requirements, ranging from understanding and debugging a five-stage pipeline code to the complete design of an out-of-order, superscalar RISC processor. Since the course was taught to both graduate and undergraduate students of the CS and ECE departments, I had to manage the project instructions and problem descriptions according to each student’s knowledge about computer hardware design. In addition to answering their questions about the concepts taught in class and explaining various design choices for each hardware component, I had to help them understand the differences between RTL coding and software programming. As a result, I redesigned the course projects, gave introductory lectures on Verilog HDL, held regular office hours, and individual problem solving sessions for each group, participated in the design of homeworks and exams, and graded assignments. During my office hours for the Advanced Computer Architecture course, one of the M.S. students who originally planned to earn a Master degree and join the industry was excited by our discussions on the microarchitecture of modern processors, and later decided to follow his research interests in computer systems. At the beginning of the course, he had little knowledge about computer systems. As I noticed his interests in research, I shared with him some of my industrial and academic experiences and persuaded him to pursue the Ph.D. program. He earned an A for the Advanced Computer Architecture course, and later started his Ph.D. program in Electrical and Computer Engineering at the University of Rochester.

In Summer 2011, I had the opportunity to mentor an undergraduate student at the University of Rochester. I helped him implement a configurable memory architecture for GPGPUs that improves the performance of certain graphics functions, such as z-buffering. I first helped him gain basic knowledge about the graphics processors and on-chip memory structures through book chapters and reference papers. We then started our regular meetings and one-on-one discussions to develop new architectural ideas, to solve technical issues, and to understand the related work. I also helped him to efficiently use his preliminary knowledge on C/C++ programming to modify an existing GPGPU simulation tool and implement the proposed memory structure. He successfully finished his undergraduate project and later joined the University of Michigan for graduate studies.

Apart from mentoring students and serving as a teaching assistant, I have had the opportunity to give guest lectures on computer architecture, caches, and memory systems for the Advanced Computer Architecture and Advanced Memory Systems courses taught by Prof. Ipek at the University of Rochester.

Teaching Plans

I believe that a solid understanding of computer system design fundamentals, including architecture, memory system design, and energy efficient computing, is essential to the success of future computer professionals and researchers. As an Assistant Professor, I would like to help build this solid foundation by teaching courses at both the graduate and the undergraduate...
levels.

**Teaching Goals.** In *The Future of Computing Performance*, the National Research Council emphasizes the incorporation of “parallel computational thinking, parallel algorithms, and parallel programming” in the engineering, science, and computer-science curricula [1]. My teaching philosophy for undergraduate courses is aligned with this vision, and aims at introducing students to parallel hardware and software in computer architecture. Moreover, I believe that *learning by doing* is critical to a successful education in computer engineering. I plan to develop courses with a significant project component that require in-class presentations and to encourage questions during the lectures. In addition to explaining the fundamentals to everyone, I will offer optional assignments and encourage the students to further explore the course topics, thereby nurturing the students’ intellectual curiosity. In particular, for the graduate level courses, I would like to incorporate challenging research projects that will introduce students to the research process in computer engineering. The centerpiece of my teaching philosophy for the graduate students will be a new set of courses that introduce the changing scene of computing, which will help foster the ability to apply critical thinking to existing problems, and to find challenging future problems.

**Course Coverage.** I am eager to teach courses in the fields of Computer Science and Engineering, including introductory and advanced Computer Architecture, Parallel Computer Architecture, Memory Systems, Logic Design, Microprocessors, and VLSI. For the undergraduate courses, I would like to emphasize the interaction between the hardware and software layers and help the students understand the design implications of architectural decisions. My understanding of the issues at various levels—from circuits to the hardware/software interface—should enable me to help advance the current undergraduate curriculum and design new graduate courses and seminars. At the graduate level, I would be excited to offer courses on advanced topics in computer architecture, parallel computer architecture, and modern memory systems. Moreover, I am interested in designing a new course covering the heterogeneous nature of future computing systems, including (1) *chip-level heterogeneity*, in which different processing cores and accelerators on a single chip interact, and (2) *network-level heterogeneity*, in which a group of portable devices and servers collaborate on a task. In this new course, I would like to encourage students to rethink the conventional hardware/software computing layers and find novel cross-layer designs satisfying the critical power and performance requirements of heterogeneous systems. Recently developed techniques for processing in memory, as well as the importance of memory based accelerators for future large-scale computers, will be extensively covered in this course.

I am also interested in designing a new course at the graduate level that will cover advanced topics in the reliability of emerging computer systems, including ultra low power processors, unconventional memory architectures, hardware accelerators and their programming models, and emerging hardware/software interfaces. In addition to the basic concepts and classical solutions, the course will cover the newly introduced reliability challenges in emerging computer systems. For example, in a typical Internet of Things (IoT) architecture that comprises *nodes*, *gateways*, and a *cloud*, I would like to discuss the sources of unreliability at all of the circuit, architecture, and software levels. The course will cover mechanisms for modeling failures and vulnerability of such systems, thereby enabling students to understand the existing challenges and develop novel solutions for future computer systems. I will encourage students to form collaborative groups with two or three people each that will 1) read, understand, and prepare in-class presentations about the reliability challenges in current and future computer systems, and 2) choose and perform a course project that involves significant efforts on modeling errors and failures, developing programming models, and designing architectural solutions to satisfy the system goals. Ultimately, a technical report explaining all of the assumptions, observations, and achievements will be written by each group. Based on class performance, I would also like to arrange long or short term collaborations with motivated and interested students.

**References**