# Teaching Statement

Wenjing Rao

As a PhD student, having gone through over 20 years of learning experience, I have always felt very lucky to have encountered numerous excellent teachers, who have not only opened the gate to the fascinating world of knowledge, but also bestowed on me the capability to think independently and explore new knowledge by myself. Fascinated by the influences imposed by my teachers, I have developed a very high appreciation and respect for the teaching activity and consequently would like to devote myself to it. My initial motivation for participating in teaching was the desire to contribute to the learning process of students as well as the idea that it would be the best way to acknowledge and return the favor I had received from my teachers. Subsequently, through my own teaching-related activities, I found my motivation growing stronger and more concrete as I realized that I found teaching very enjoyable and rewarding. On the other hand, I have also recognized challenging aspects of teaching through some experiences in my own learning process, during which I noticed that the teaching activity was having a negative impact on my enthusiasm towards a certain field of knowledge, rather than stimulating a lasting interest in the field. This part of my experience revealed to me the challenges inherent in a teaching job, leading to a realization that serious efforts are required to effectively carry out teaching responsibilities.

My teaching related experiences started during my years as an undergraduate student, when I took two tutoring jobs: one for a middle school student on the subjects of mathematics and English, the other for a group of five college students on the topic of X86 assembly language. During my subsequent years as a PhD student in the CSE department of the University of California, San Diego (UCSD), I held teaching assistant (TA) positions for a number of CSE courses: *Theory of Computability*, *Digital Systems Lab*, *Introduction to Computer Architecture*, and *Computer Architecture Project*. These positions involved various responsibilities, including holding office hours and discussion sessions, maintaining the course websites, helping the instructor with preparing exam problems, and grading exams and homework assignments. In order to gain more knowledge about teaching, I attended the program *Preparing Professional Faculty (PPF)* held by the Center for Teaching Development of UCSD, which included a seminar series covering topics such as instructional technology, course development, teaching styles and cognitive strategies. In 2006 I took advantage of the opportunity offered by the CSE department to senior PhD students to teach undergraduate courses in a summer session. This provided not only a rewarding experience, but also invaluable teaching practice for me.

The summer teaching was a very demanding task. Not only was it my first time teaching a course, but I was also facing the challenge of compacting the course into the short summer period of five weeks. The subject matter was normally taught over an entire quarter of ten weeks' length. I adopted a number of new techniques that helped me prepare better and also helped my students to learn more effectively. For example, to avoid a lack of interaction that is common with a slide-based lecture style, I used a tablet computer based approach, where I could show my prepared slides while at the same time add lecture notes dynamically during class. This approach not only got students more engaged in class, but also helped them outside of class. That's because in addition to making the slides available online before each lecture so my students could prepare, I updated the online slides with the notes added during class, allowing my students to review them afterwards. The course material of my summer teaching can be found in the following link: http://www.cse.ucsd.edu/classes/su06/cse21/

I view the responsibilities of a teacher as multi-layered. A basic requirement is the ability to explain complex concepts clearly. I developed this capability through my experience as a tutor and as a TA, when I was using easily understandable examples and multiple ways of explaining a problem to my students. Such strategies were also systematically introduced in the PPF sessions that I attended to prepare for my teaching activities. During my summer teaching, I used various methods to effectively enable my students

to grasp the essence of complex concepts. For instance, when introducing the concept of recursion with the classical Hanoi Tower problem, I found that many students felt it challenging to follow the procedure depicted in the textbook. But doing a hands-on experiment with a Hanoi Tower toy in class to illustrate the recursion procedure left my students with a much clearer impression of the concept. Different students have different propensities for acquiring knowledge, and to accommodate that I used various ways including in-class experimenting and graphical illustrations on class notes to cover concepts from different angles.

At a higher level, a teacher is responsible for introducing new knowledge systems, as well as methodologies and techniques for solving a certain category of problem. The tasks at this level require well structured approaches in constructing the new knowledge system, as well as building connections with existing knowledge systems that the students are familiar with. I developed the synopsis and selected appropriate course materials for the course I taught in the summer. I particularly paid attention to the internal connections among different parts of the course materials, such as utilizing the counting part of knowledge for the subsequent discrete probability part and applying algorithm analysis methodologies to the subsequently introduced recursion algorithms.

A teacher is furthermore responsible for stimulating student interest in exploring a field, as a genuine interest is always a person's most powerful drive in learning. In order to stimulate my students' interests, I found it important to build connections to motivate them: connections between existing knowledge systems and a newly introduced one, as well as connections between the abstract knowledge and concrete applications in real life. The former kind of connections helped my students with placing the new knowledge system appropriately within the existing knowledge framework, so that they could start to appreciate the beauty of the theory structures. The latter kind motivated my students through the realization of the importance of abstract knowledge.

To me, university education constitutes the most important stage for students in establishing the learning interests and preparation for their future careers. From this point of view, a well-developed curriculum setup plays a very significant role in providing students with three things: 1) a well constructed knowledge system, 2) breadth and depth in well-developed knowledge, and 3) a view into current research frontiers.

I'm very interested in developing a series of advanced level courses and seminars in the following curriculum directions:

- *Nanoelectronic architecture related topics:* with the goal to help the student establish a fundamental understanding of this exciting new area, which is fast and actively evolving. This series of topics will mainly be based on my research related directions, yet will also be tightly connected to other areas such as material science, electronic devices, nanotechnology, computer engineering and computer architecture. Such a series of highly inter-disciplinary research topics will benefit a wide range of students in various majors and areas by exposing them to a current research frontier of great importance.

- *VLSI CAD, testing and embedded system related topics:* related to directions in my research interests, highly practical and closely connected to the electronic design automation (EDA) industry. Related courses in this area, such as VLSI design, digital system synthesis and optimization, digital testing and testable design, embedded system design, can provide students with valuable knowledge and experience in this important computer engineering branch.

- *Fault tolerance related topics:* with a focus on reliability from a hardware perspective. Such topics can be organized under general fault tolerance and security, crossing the fields of hardware, software, systems and networks, thereby providing students with a comprehensive understanding of the reliability related approaches in the computer science and engineering areas.

In addition to the above described research-related course development, I am also well prepared to teach a number of undergraduate and graduate level courses, including discrete mathematics, digital design (theory and lab project), computer architecture, introduction to VLSI CAD and embedded system design.