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Zhao '18 Refines Algorithm as Eckley Scholar

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BLOOMINGTON, Ill.— Wenting Zhao '18 (Guangzhou, China) grasps difficult, complex concepts very quickly.

It's a trait she demonstrated at age five, when she beat her father at 24, an arithmetical card game, just a month after he'd taught her the addition, subtraction, multiplication, and division needed to make four integers equal 24.

Her lively mind surfaced early in her first semester at Illinois Wesleyan, when Associate Professor of Computer Science Mark Liffiton swiftly realized he could give Zhao the briefest explanation to a concept in his introductory computer science course, and she'd understand the notion. Soon Zhao approached him with the desire for more complex and independent work.



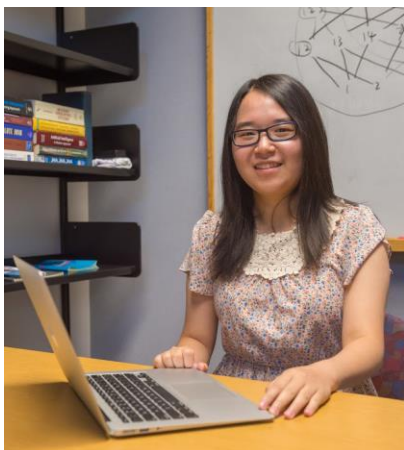
Associate Professor of Computer Science Mark Liffiton supported Wenting Zhao '18 as she sought more complex, independent work.

"I started out by giving her journal articles to read and told her to come to me with questions," Liffiton said. "She picked things up remarkably quickly from a paper written for people with years of experience, not first-year students just starting in computer science. That's extremely rare among students in general, and even more so in first-year students."

Soon Zhao was designing fairly large algorithms and converting them into code. This foundation led to Zhao's successful application for an **Eckley Scholarship**. A **mathematics** and **computer science** double major, Zhao is the first student to receive an Eckley scholarship as a first-year student.

"I was really excited when I learned I'd received it," said Zhao. "It felt good that other people were acknowledging my academic skills."

Zhao's Eckley project involves optimizing and improving an algorithm for analyzing systems of constraints, which impose conditions that variables must satisfy.



Wenting Zhao '18

"A Sudoku puzzle is a type of constraint system, where you have a lot of different ways to fill in the numbers, but you have rules, or constraints, for how you are allowed to do so," Liffiton explained. "I've come up with an algorithm that looks at all the constraints and tries to tell you why it's unsatisfiable. If you had a Sudoku puzzle where the initial numbers were filled in in such a way you could not correctly solve the puzzle, the algorithm would tell you why. The puzzle is still impossible, but the algorithm points out the reason."

Liffiton said the algorithm, named MARCO for the explorer Marco Polo, has been applied to microprocessor design verification. His work was state of the art when it was first published a few years ago. "There's still more we can do to make the algorithms faster or return the results more efficiently, so Wenting is looking at ways to improve it," he explained.

Zhao said her greatest takeaway so far has been learning how to break down a big problem into smaller pieces so it becomes manageable.

"I'm now understanding this is a process," she said. "I think I had romanticized research before, and now I have a better understanding of what it really is."

Liffiton noted one of the Eckley Scholarship's many benefits is the student's early introduction to research. "Wenting is

working on all types of things that will be coming up later in the courses she'll be taking here at Illinois Wesleyan, and she's learning them because they are relevant to the project, not just because they are part of the coursework," said Liffiton. "And students who can apply to graduate school having done a couple of years' worth of research, maybe even having a publication, are in a really good position."

As Zhao prepares to begin her second year of college, she doesn't have a clear picture of her plans after IWU, although she believes a graduate degree figures in the future at some point. "I have been in love with math since I was four or five, so somehow mathematics will be part of my life," she said. "In math and computer science, everything can be explained. I love that."

Established by President Emeritus and Mrs. Robert S. Eckley before President Eckley passed away, the Eckley Scholars & Artists fellowships are awarded to meritorious students to remain on campus over the summer under the supervision of a faculty mentor. The program is designed to develop and deepen a student's creative and research competencies. Eckley Scholars receive a \$4,000 stipend and complimentary on-campus housing.