Purdue University Computer Science and Data Science Bridge Class

Ten Years of Success

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- Students arrive at Purdue University's Computer Science and Data Science programs with a wide range of backgrounds

- At one extreme -- lot of programming experience

- At the other extreme -- students who have never done any programming

- In the past these inexperienced students rarely made it through the first year of our program

- Many underestimated their ability to succeed as a CS major and self-selected out of Computer Science after the first or second semester

- We realized such students could be successful given a little boost ("a bridge")

- We have found that students who are comfortable in first CS course and do well in it, usually do well in all their other CS and DS courses and usually get the degree

- On the other hand, those students who are not comfortable and do not do well in their first CS course, frequently have difficulty in other courses and often drop out without earning the degree

- We started the Bridge Program in 2013 to give those students with little or no programming experience the equivalent of a good high school programming course

- The Bridge Program is meant for students with…
- good math scores
- good high school GPAs
- good SAT scores
- but with little or no programming experience

- Many high schools have Computer Science courses taught by teachers with limited experience
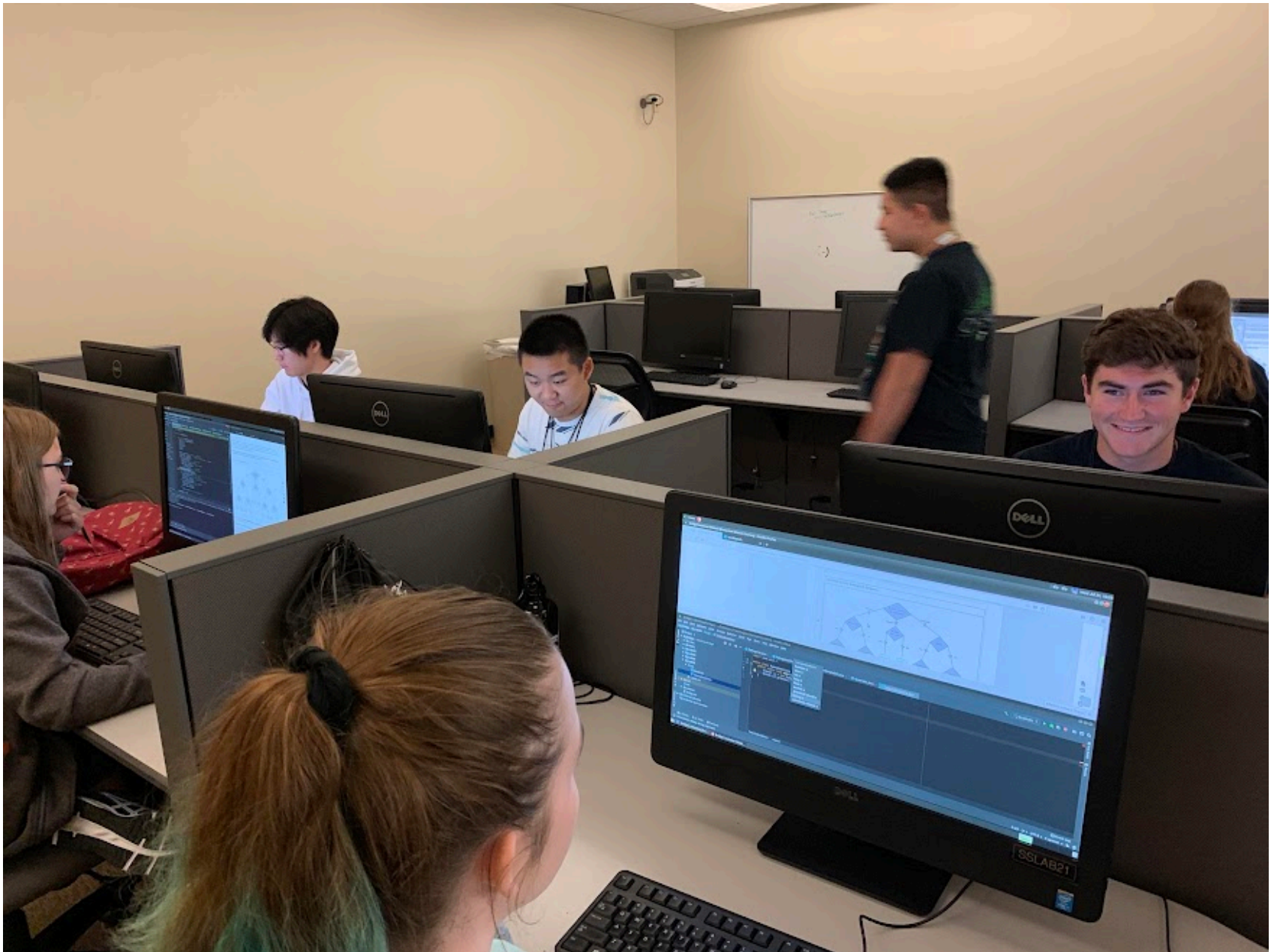
- In addition to the academic benefits, students in the Bridge Class form friendships that carry throughout the academic year … and throughout their time here at Purdue … and it appears … the rest of their lives

- This is an intensive program Monday-Friday for two weeks

- We have classes and labs every morning and afternoon with activities at night

- In Bridge I cover what is typically covered in an AP Java high school programming class

- About a dozen Undergraduate Teaching Assistants, most of whom are former Bridge students
- The student-to-UTA rate is about 4-to-1, ensuring plenty of personal attention

- Bridge Class topics include Computing Basics, Types, Variables, Strings, Selection, Repetition, Arrays, Simple Graphical User Interfaces, Classes, Objects, Methods, and Inheritance
- The students have a "final exam" on the last Friday morning

- When students finish this program, they...
- Are prepared for their first Computer Science course
- Are experienced with classes like they are going to encounter in college and will know how to get every bit of information they can from them
- Are experienced with labs and will know how we conduct them
- Have taken exams like they will have in their first course

- When students finish this program, they...
- Have met and gotten to know several members of their incoming freshman class
- Have met and gotten to know CS students who will serve as teaching assistants and mentors for them
- Are on campus early, exploring the campus and CS building, and knowing their way around (unlike many freshmen who will be lost for the first week or so)
- Are confident that they can succeed

- Bonds formed with students in the same situation could be the most important aspect of the Bridge Program

- Form friendships that will carry throughout the academic year, their time at Purdue, … and likely will last throughout rest of their lives

- Most enjoyed activity is evening with Corporate Partner representatives
- Talk about what they are looking for in internships and full-time employees

- The retention rate after one year for Bridge students has been approximately 80%, even better than the 75% retention rate for non-Bridge students

- Many of these students are not just surviving, but thriving!

- They have been chosen as officers in student organizations, have been recognized for academic honors, have received internships, have received scholarships, and have been chosen as Undergraduate Teaching Assistants (UTAs)
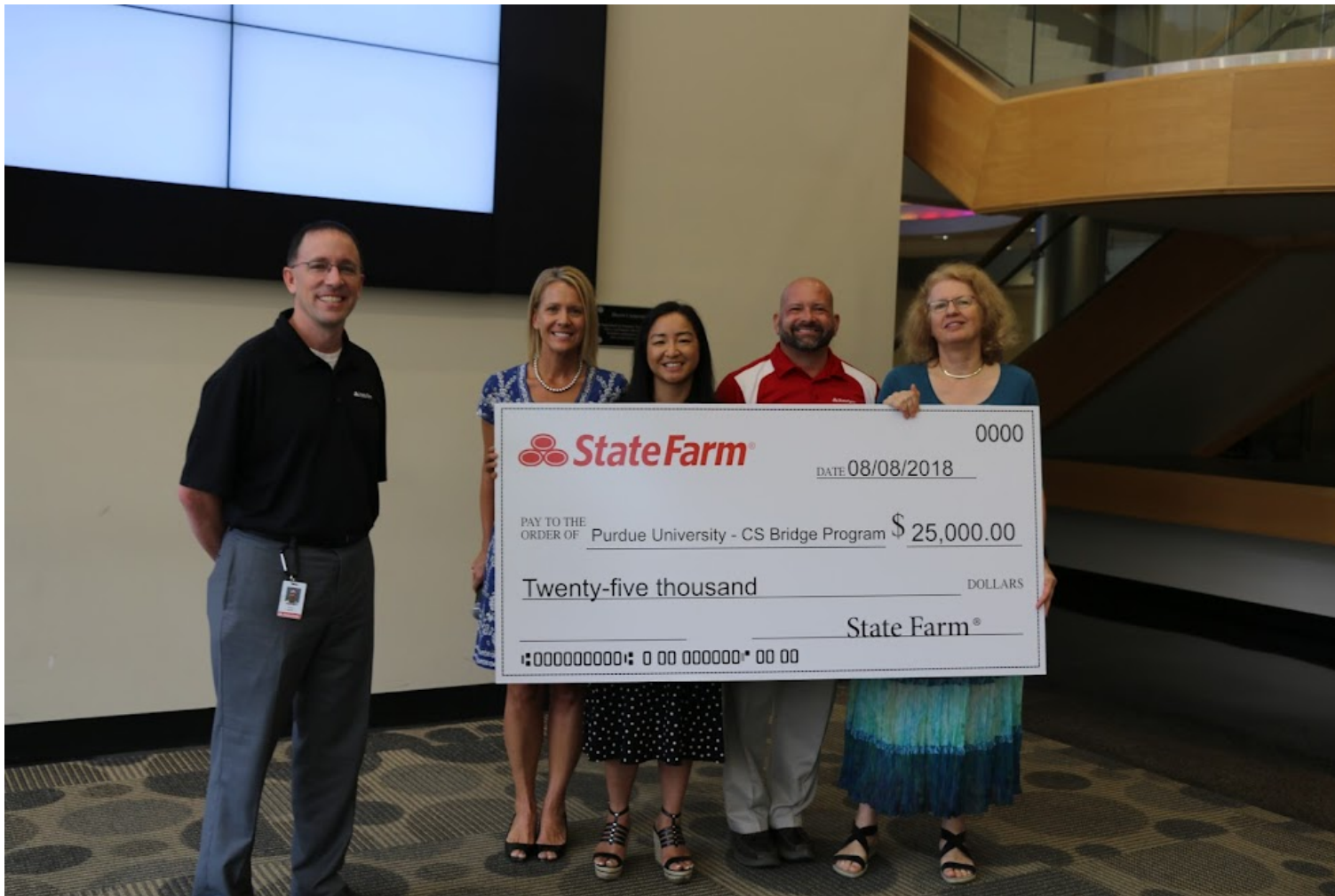
- In the past students with little or no programming experience almost never got our degree

- Over 400 young people have been helped by Bridge

- Instead of numbers, let me give you one example:
- In 2013, Michelle: "Don't know if I'm in right major or even if I should be in Bridge. I don't speak Java."
- Spring 2017, last day of class
- Michelle was her Software Engineering Senior Project Team Leader
- In Final Sprint Review Michelle talked about Sockets, Server Sockets, Server Threads
- Michelle came in uncertain if she was in the right major
- Michelle graduated as a technically-strong, Software Engineering team leader

- We charge $550 for this program (which includes room and meals), but only charge $150 to students with financial need

- The money paid by students covers less than half of the actual cost

- We always welcome Corporate Partner gifts to help fund the Bridge Class!

- **CS 18000-GOLD and CS 18000-BLACK**

- Harvey Mudd College, Claremont, California

- Small college, less than 1000 students

- Gold and Black First Computer Science Courses

- We created Gold and Black sections of CS 18000 in Fall 2016

- We have been doing this for 7 years

- Our primary motivation behind this effort is to increase retention
- We want to keep the inexperienced students in CS 18000 from being intimidated by students with a lot more experience than they have

- CS 18000-GOLD assumes absolutely no programming background
- CS 18000-BLACK assumes that the student is already familiar with programming (Java, in particular)

- The two CS 18000 classes have identical learning objectives
- The difference lies only in the prior knowledge of programming with which students enter the course

- CS 18000-GOLD has its own labs as does CS 18000-BLACK
- Both sections share the same homeworks, lab assignments, projects, and exams
- The motivation for separating students by prior experience is to allow instructors to tailor the level of discussion in lectures and labs so that it is best suited for the students in that lecture or lab

- Topics with which we assume students are already familiar in CS 18000-BLACK:
- Types and Strings
- Selection (if, switch)
- Repetition (while, do while, for)
- Arrays
- Classes, Objects, and Methods

- Students work with their advisor to determine which of CS 18000-GOLD or CS 18000-BLACK is best for them

- Based on their conversation, advisors typically recommend one or the other and students usually choose the one recommended by their advisor

- All evidence is that this effort has been very successful in retaining students