The Hard Part of Computer Science? Getting Into Class

Computer science is so sought-after on certain college campuses that students like Aafia Ahmad, a sophomore and computer science major at the University of Texas at Austin, say they have to compete just to get into popular courses. © Joanna Kulesza for The New York Times

Lured by the prospect of high-salary, high-status jobs, college students are rushing in record numbers to study computer science.

Now, if only they could get a seat in class.

On campuses across the country, from major state universities to small private colleges, the surge in student demand for computer science courses is far outstripping the supply of professors, as the tech industry snaps up talent. At some schools, the shortage is creating an undergraduate divide of computing

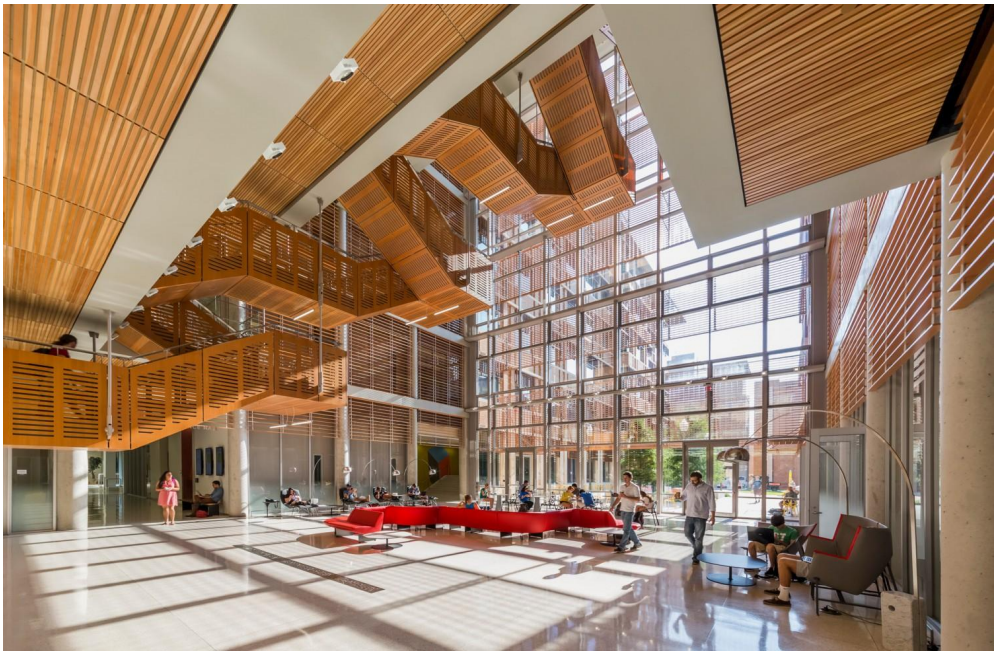
haves and have-nots — potentially narrowing a path for some minority and female students to an industry that has struggled with diversity.

The number of undergraduates majoring in the subject more than doubled from 2013 to 2017, to over 106,000, while tenure-track faculty ranks rose about 17 percent, according to the Computing Research Association, a nonprofit that gathers data from about 200 universities.

Economics and the promise of upward mobility are driving the student stampede. While previous generations of entrepreneurial undergraduates might have aspired to become lawyers or doctors, many students now are leery of investing the time, and incurring six-figure debts, to join those professions.

By contrast, learning computing skills can be a fast path to employment, as fields as varied as agriculture, banking and genomics incorporate more sophisticated computing. While the quality of programs across the country varies widely, some computer science majors make six-figure salaries straight out of school.

At the University of Texas at Austin, which has a top computer science program, more than 3,300 incoming first-year students last fall sought computer science as their first choice of major, more than double the number who did so in 2014.



The Bill and Melinda Gates Computer Science Complex and Dell Hall at the University of Texas at Austin, home to one of the nation's leading computer science programs. A surge in student demand for the courses is outstripping the supply of professors available to teach them. © Joanna Kulesza for The New York Times

"The demand is unbounded," said Don Fussell, chairman of the university's computer science department. The university is looking to hire several tenure-track faculty members in computing this year, he said, but competition for top candidates is fierce. "I know of major departments that interviewed 40 candidates, and I don't think they hired anybody."

Although the problem has been building for years, a recent boom is straining resources at new levels at institutions large and small. The situation has become so acute that Swarthmore College, which was already holding lotteries to select students for computing classes, is now capping the number of courses

that computer science majors may take. The University of Maryland plans this fall to make computing a limited enrollment major, which will make it harder for non-majors to transfer in. At the University of California, San Diego, introductory lecture courses have ballooned to up to 400 students to accommodate both majors and non-majors.

As a result of such changes, students on some campuses said they felt shut out of computer science while others said they faced overcrowded classes with overworked professors.

Aafia Ahmad, a sophomore computer science major at U.T. Austin, had hoped to take an elective course in computer security this semester. But when she tried to sign up during early registration in November, the course was already full. She said that was the case for nearly every computer science elective she wanted. She is now 79th on a waiting list for the security course.

"It's a cutthroat race to register for classes," she said.

Some university leaders said they were concerned that certain measures taken to address surging student demand may disadvantage people who are already unrepresented in computer science — including women, African-Americans, Latinos and low-income, first-generation college students.

Some universities now require incoming students to get accepted into computer science majors before they arrive on campus — and make it nearly impossible for other undergraduates to transfer into the major. That approach can favor incoming students from schools with resources like advanced programming courses. It can also favor male students — because women on average are less likely to have taken a computer science course in high school.

"When you put any kind of barrier in place in terms of access to computer science majors, it tends to reduce the number of women and students of color in the program," said Maria Klawe, presidentof Harvey Mudd College, a private college in Claremont, Calif., that has become a national model for diversity in computer science.

Don Fussell, the chairman of the computer science department at the University of Texas at Austin, said top programs nationwide were competing with tech companies to keep their professors and hire Ph.D.s. © Joanna Kulesza for The New York Times

Other experts warned that some students without computing experience may be rushing into the major because it seems to be trendy and pay well — not because it is the subject that most interests them.

"Maybe they are cutting off other options too early," said Richard Wicentowski, the chairman of Swarthmore's computer science department.

One solution, he suggested: Universities could treat computer science more like math — courses that lay the foundations for other majors like data science and physics. That way, he said, students could learn important computing skills and then apply them to other majors, like literature, while keeping their job prospects open.

On some campuses, students have protested measures like course lotteries and long waiting lists.

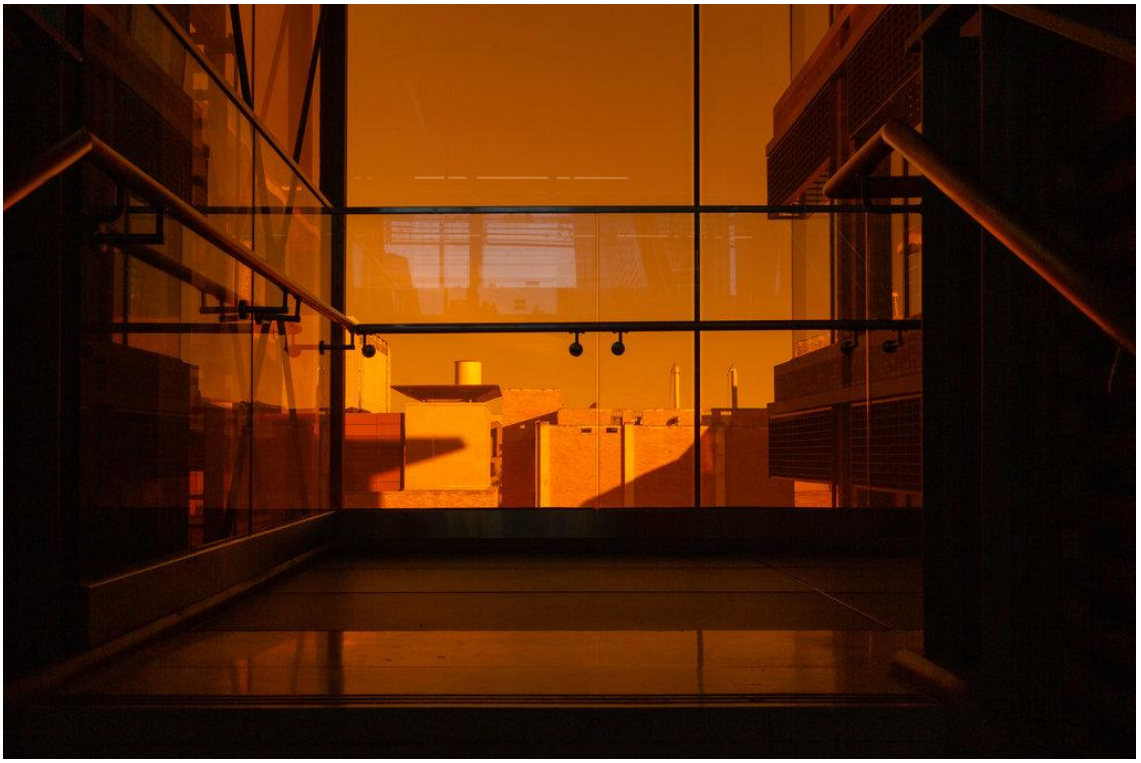
At Haverford College in Pennsylvania, students put up posters in the science building on April Fools' Day, lamenting the dearth of computing teachers. One showed a featureless face with the caption: "This Is Where I'd Put My New Tenure-Track CS Professor … If I Had One." Students later wrote a letter to college officials pushing for more professors.

Haverford has since opened a search for a new computer science professor.

Some schools are trying to create more hospitable conditions. Both Harvey Mudd and the University of Washington in Seattle offer introductory computing courses intended to attract students with or without computing experience.

Likewise, Tracy Camp, head of the computer science department at the Colorado School of Mines — a public university where the number of computer science majors has more than doubled in recent years — said she was determined not to put in deterrents like capping the major. Instead, she said, class sizes had sharply increased.

"I don't want to tell a student already at Mines, 'You can't major in computer science,'" Professor Camp said.



The computer science complex opened in 2013 at U.T. Austin. The number of incoming students seeking to major in the subject more than doubled between 2014 and 2018. © Joanna Kulesza for The New York Times

Still, the pipeline of professors is limited — partly because of economics and partly because university hiring is geared toward long tenure appointments, not the latest trends.

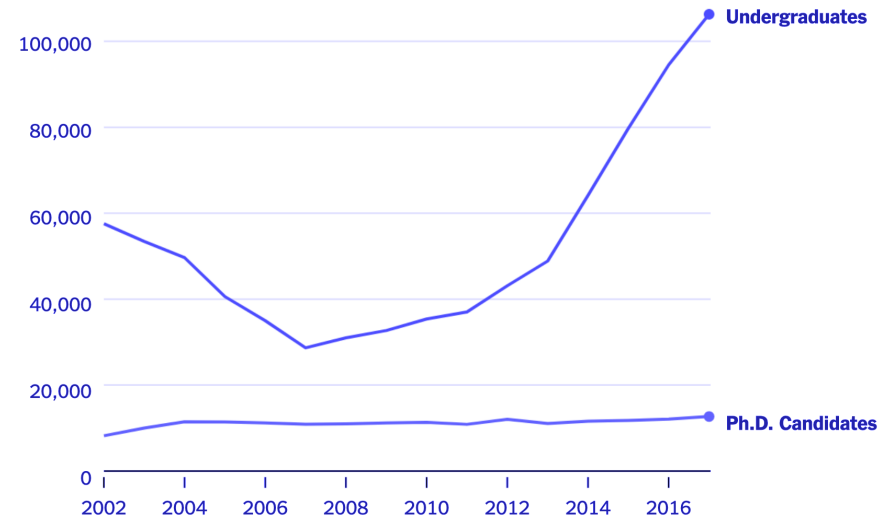
High entry-level salaries are luring undergraduates to pick the private sector over graduate school, limiting the supply of future professors. The number of graduate students enrolled in computer science Ph.D. programs has only inched up in recent years, to nearly 12,700 in 2017 compared with about 11,000 in 2013, according to the Taulbee Survey, an annual report from the Computing Research Association.

In addition, tech giants and other companies have been poaching professors and hiring new Ph.D.s.

"I had a faculty member who came in with an offer from a bank, and they were told that, with their expertise, the starting salary would be $1 million to $4 million," said Greg Morrisett, dean of computing and information science at Cornell University. "There's no way a university, no matter how well off, could compete with that."

The Computer Science Stampede

While the number of undergraduates majoring in computer science at certain American universities more than doubled from 2013 to 2017, the number of Ph.D. candidates — the potential pool of future professors — remained relatively flat.



By The New York Times | Source: Computing Research Association Taulbee Survey

To stem the tide of professors decamping for industry, universities are turning to dual appointments. Last year Amazon hired Siddhartha Srinivasa, a world-renowned robotics expert who is a computer science professor at the University of Washington. He now splits his time between the two.

Ed Lazowska, a computer science professor at the university, said such arrangements gave faculty members access to resources, like giant computing power and tremendous data sets, that could help further their research and benefit their students.

"What better place could there be than Amazon to put your robot to work?" Professor Lazowska said.

Professor Fussell at Texas also said joint appointments could be a partial remedy, adding that he had recently talked with major tech companies about helping universities retain faculty.

"They are well aware that they are eating their seed," Professor Fussell said.

Dr. Klawe at Harvey Mudd is weighing a more academic solution to meeting student demand. She wants to train people with Ph.D.s in subjects like math, physics and biology to teach computer science, potentially increasing the supply of professors.

She is raising money for a pilot program, but she said any solution would take time.

"It's going to get worse before it gets better," Dr. Klawe said.