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A Techie, Absolutely, and More

By STEVE LOHR

Jamika Burge is heading back to Virginia Tech this fall to pursue a Ph.D. in computer science, but her research is spiced with anthropology, sociology, psychology, psycholinguistics - as well as observing cranky couples trade barbs in computer instant messages.

"It's so not programming," Ms. Burge said. "If I had to sit down and code all day, I never would have continued. This is not traditional computer science."

For students like Ms. Burge, expanding their expertise beyond computer programming is crucial to future job security as advances in the Internet and low-cost computers make it easier to shift some technology jobs to nations with well-educated engineers and lower wages, like India and China.

"If you have only technical knowledge, you are vulnerable," said Thomas W. Malone, a professor at the Sloan School of Management at Massachusetts Institute of Technology and the author of "The Future of Work" (Harvard Business School Press, 2004). "But if you can combine business or scientific knowledge with technical savvy, there are a lot of opportunities. And it's a lot harder to move that kind of work offshore."

Ms. Burge's research, for example, is in a hot niche called computer-supported cooperative work, which studies the ways people use technology to communicate and collaborate in work groups and social networks. She spent the summer as a research intern for I.B.M., and her job prospects seem bright.

On campuses today, the newest technologists have to become renaissance geeks. They have to understand computing, but they also typically need deep knowledge of some other field, from biology to business, Wall Street to Hollywood. And they tend to focus less on the tools of technology than on how technology is used in the search for scientific breakthroughs, the development of new products and services, or the way work is done.

Not all of them are even headed for computer careers. Many are going into medicine, law, media and arts as well as other scientific fields.

For people who stay in computing, the job outlook is brightest for those skilled in the application of technology. While jobs in categories like programming have declined since 2000, according to the Labor Department, the need for information technology experts has not.

In fact, jobs that involve tailoring information technology to specific industries or companies, like software engineers who make applications and specialized systems, have grown. Total employment among information technology professionals, the government reports, reached nearly 3.5 million by the end of last year, surpassing the previous high in 2000, when the technology investment boom peaked.

At the same time, the march of computing is rippling across all academic disciplines. Even as computer science students are being encouraged to take more courses outside their major, students in other disciplines are finding more often that they need to use, design and sometimes write computer programs.

Several universities, for example, are developing multidisciplinary courses in "services science." The idea is to combine research in the social sciences, management, engineering and computing to pursue insights, innovations and increased productivity in the huge services sector of the economy, which now employs more than 80 percent of American workers. The University of California, Berkeley will offer a services science graduate course in the coming academic year.

Of course, such multidisciplinary shifts are still predicated on a solid grounding in computing. And there are worries that too few students are getting a technical education. While the need for technical expertise is growing, the number of students choosing computer science as a major is 39 percent lower than in the fall of 2000, the last of the dot-com bubble years, according to the Computing Research Association.

This trend has troubled Bill Gates, the co-founder and chairman of Microsoft, who traveled to several elite universities in a campaign-style tour in the spring of 2004 to stir up enthusiasm for computer science. He plans another campus tour this fall.

"There isn't the buzz and excitement about computer science that there should be," he said. "We're on the threshold of extraordinary advances in computing that will affect not only the sciences but also how we work and our culture. We need to get the brightest people working on those opportunities."

To help reverse three years of steep decline in the major at M.I.T., professors there met with freshmen last fall to extol the virtues of computer science. In one such gathering, John V. Guttag, a professor, brought pizza and soft drinks to a freshman dormitory. Professor Guttag spoke and so did a heart surgeon from Massachusetts General Hospital, who had majored in computer science as an undergraduate at M.I.T.

"The idea was to give them a sense of what you can do with a computer science degree," Mr. Guttag recalled. "It doesn't mean you're going to turn into Dilbert."

Ken Michelson, a computer science major at the University of Washington, is entering medical school at Columbia University in New York this month. Mr. Michelson caught the computing bug early, starting to program simple games and puzzles as a 9-year-old.

His computer science training, Mr. Michelson said, will also be useful in medicine, especially "in the way you learn to attack and break down complex problems."

Edward D. Lazowska, a professor at the University of Washington, points to students like Mr. Michelson as computer science success stories. The

real value of the discipline, Mr. Lazowska said, is less in acquiring a skill with technology tools - the usual definition of computer literacy - than in teaching students to manage complexity; to navigate and assess information; to master modeling and abstraction; and to think analytically in terms of algorithms, or step-by-step procedures.

Educating the engineers who design and build computers and software will remain important, Mr. Lazowska emphasized, "but we need to be educating everyone else, too."

For Kira Lehtomaki, it was the advance of digital technology into animation that pulled her toward computing. Ms. Lehtomaki, a 23-year-old post-graduate researcher at the University of Washington's animation research labs, says she recalls wanting to be an animator after being enthralled by "Sleeping Beauty" as a 3-year-old. Growing up, she drew constantly, and even took a summer job at Disneyland as "cookie artist" - painting designs and Mickey Mouse faces in frosting - because that job allowed her to spend a couple of days observing animators at Disney's studio in Burbank, Calif.

As hand-drawn animation gave way to computer-generated animation, Ms. Lehtomaki took up computer graphics in college. "These two worlds of art and computing are really merging, and, if anything, they will blend even more," she said.

The same is true in other fields. In biology, DNA code can be explored and simulated in computer code. Drug discovery and chemical analysis rely on computer simulations, as do weather prediction and oil exploration. Even the automobile - now largely controlled and monitored by a network of microprocessors and software - has become a computer on wheels.

"Computing has become the third pillar of science, along with theory and experiment," observed Daniel A. Reed, director of the Renaissance Computing Institute, a collaboration of researchers from the University of North Carolina, Duke University and North Carolina State University.

Having an understanding of information technology has become critical in many jobs that do not involve programming. Brian Randles, 27, for example, is a business consultant at I.B.M. based in Dublin, Ohio, working mostly with banks to use technology to fine-tune their marketing and improve their customer service.

As part of I.B.M.'s big services unit, he and other team members work on projects that can last up to a year. It is face-to-face work, constantly dealing with both the business and technical experts at the banks. Someone like Mr. Randles, industry analysts say, can make $90,000 a year or more.

Mr. Randles started playing with a home computer as an 8-year-old, he recalled. He did some programming for a high school science project and took an introductory computer science course at Otterbein College in Westerville, Ohio. He said he enjoyed dabbling with computers, but considered it mostly a hobby. He majored in business.

His perspective changed because of a summer job with a retail consultant that was using product tags equipped with radio frequency identification, or RFID, to track goods and streamline the shipment of supplies. "That's when it started to click for me, seeing how the technology and business blended together and worked," he recalled.

At I.B.M., Mr. Randles has been trained in the basics of banking and insurance as well as in technical fields like databases and data mapping.

The lesson he has learned so far in his few years in the modern work force? "You've got to constantly keep learning," he said. "If I'm with I.B.M. or not, I've got to constantly upgrade my skills. That's what gives you that edge."