Training for techies: Career preparation in information technology

Preparing for careers in information technology is a function of multiple subroutines. Which algorithm will you choose?

by Roger Moncarz

Maria and Spencer are both in their early 20's. Maria recently completed her bachelor's degree in English; Spencer dropped out of college after a few semesters. If asked to speculate on Maria's and Spencer's occupations, perhaps you would guess writer and waiter.

But it might surprise you to learn that Maria is a computer systems analyst and Spencer is a computer programmer. Maria, while majoring in English, took several computer-related courses and gained experience working in a computer lab. Spencer, although not formally enrolled in a degree program, took courses at a community college and earned certification in a programming language. Both benefited from the flexible training requirements for individuals hoping to work in information technology, often identified as IT.

The Bureau of Labor Statistics (BLS) projects that 8 of the 10 fastest growing occupations between 2000 and 2010 will be computer related. For this reason, future jobseekers need to know about the variety of ways to prepare for a career in information technology. Following a discussion of how these workers are defined, this article focuses on the available training, which ranges from certificates to advanced degrees.

What is an information technology worker?

The information technology workforce is defined differently by trade organizations and Government sources.

The Information Technology Association of America defines an information technology worker by using the eight career clusters developed by the National Workforce Center for Emerging Technologies. Those career clusters include programming and software engineering, technical support, enterprise systems, database development and administration, Web development and administration, network design and administration, digital media, and technical writing. According to its latest study, "Bouncing Back: Jobs, Skills, and the Continuing Demand for IT Workers," the Association notes that 92 percent of all information technology workers are in non-information-technology companies—80 percent of them in small companies outside the information technology industry.

The U.S. Department of Commerce identifies the information technology workforce more broadly. In its report on information technology, "Digital Economy 2002," the Department defines workers in information technology occupations as those who design, manufacture, operate, maintain, and repair information technology products and provide related services across all industries.

For purposes of this article, information technology workers are considered to be those employed in 12 computer-related Standard Occupational Classification System (SOC) occupations. These occupations are:
◆ Computer and information systems managers
◆ Computer programmers
◆ Computer and information scientists
◆ Computer systems analysts

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- Computer hardware engineers
- Computer software engineers, applications
- Computer software engineers, systems software
- Computer support specialists
- Database administrators
- Network and computer systems administrators
- Network systems and data communications analysts
- All other computer specialists, a residual category of workers.

Using this definition, BLS data show that there were about 3.3 million information technology workers employed in the United States in 2000. However, that number excludes marketing and sales workers employed by information technology companies.

What type of training do I need?

As Maria's and Spencer's backgrounds suggest, there is considerable interest in the topic of education and training required for information technology workers. This interest stems from the U.S. economy's demand for such workers and a presumption that the current educational system is not producing enough of them for the workforce. Rita Caldwell, director of the National Science Foundation, notes that there are many pathways for becoming an information technology worker. Training ranges from a few months for certification to 6 years for a doctoral degree.

BLS data show that in 2001, most information technology workers—almost 70 percent—had a bachelor's or higher degree, although the number who had some college but no degree is rapidly increasing and accounted for almost 16 percent of these workers. (See chart 1.) In fact, anecdotal information

Most IT workers receive instruction through certification and degree programs.

suggests that many people attend community colleges not to earn degrees but to take computer-related courses in hopes of getting a job or as a way to retrain and update their skills. And
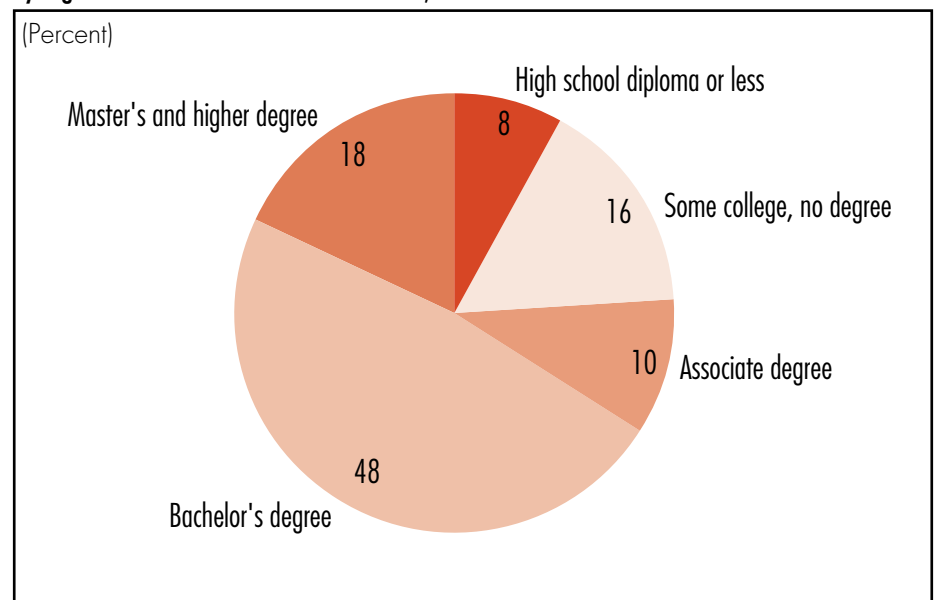
according to the National Science Foundation, two-thirds of workers who had a bachelor's degree and worked in a computer-related occupation in 1999 had majored in subjects other than computer and information sciences. (See chart 2.)

Clearly, earning a postsecondary degree in a computer-related field is not the only way to prepare for a job in information technology. But learning the technical skills necessary to work in these occupations remains paramount. Specialized certification and degree programs—associate, bachelor's, and graduate-level ones—are the primary ways workers train for information technology occupations.
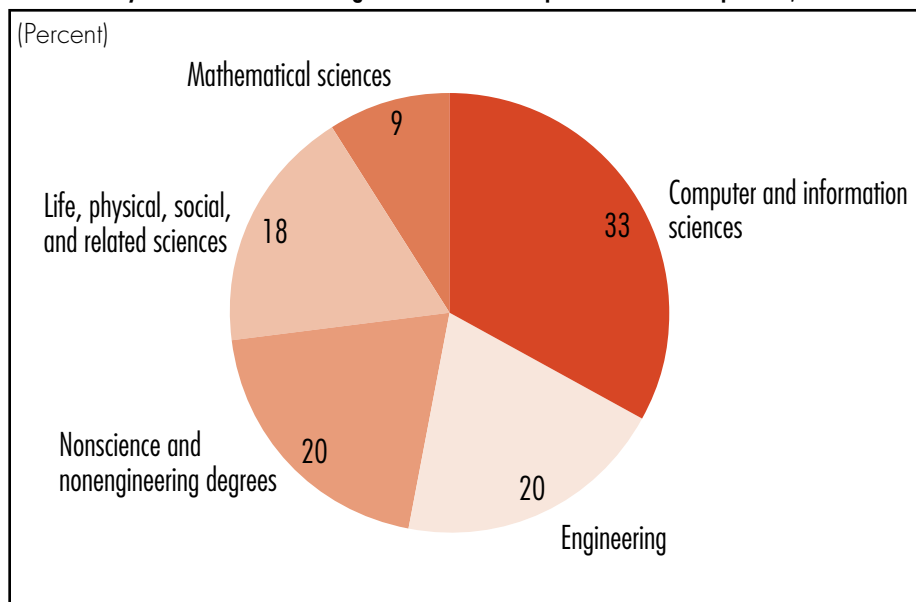
Certification

Technical or professional certification demonstrates that an individual has achieved a level of competency in a

Chart 1

Distribution of workers in computer-related occupations by highest level of educational attainment, 2001

(Percent)

High school diploma or less — 8

Some college, no degree — 16

Associate degree — 10

Bachelor's degree — 48

Master's and higher degree — 18

Chart 2

Field of study distribution for all degree holders in computer-related occupations, 1999

(Percent)

Source: National Science Foundation. 1999 SESTAT Integrated Data System. The SESTAT Web site is **sestat.nsf.gov**.

particular field. There are various certifications available for information technology workers. Spencer, for example, earned certification that qualified him for a computer programming job. Product vendors and industry organizations offer different types of certification, providing a training niche that is expected to continue.

Growth of certification. According to the Information Technology Association of America's study on the information technology workforce, the significance of certification has grown in each of its job categories in the last year. Kenneth Bartlett, project director for the National Research Center for Career and Technical Education, says that as of August, there were almost 100 vendors and organizations offering more than 670 separate certifications in information technology.

And these certifications are growing more popular. Data from the U.S.

Department of Education's National Center for Education Statistics show that the number of awards of less than 1 year granted in computer and information sciences grew almost 400 percent between 1990 and 2000.

When international trends are considered, the impact of certification is even more dramatic. In his 2000 report, "The Certification System in Information Technology," author Clifford Adelman describes a "parallel universe" outside conventional educational routes for potential information technology workers to develop skills. The report notes that, by early 2000, about 1.6 million people worldwide had earned roughly 2.4 million information technology certifications.

Vendor and organization certification. Product vendors and software firms—including Microsoft, Cisco, and Oracle—offer certification and may require individuals who work with their

products to be certified. And industry organizations, such as the Institute for the Certification of Computing Professionals, offer voluntary certification. The Institute's certification is available to those who have a college degree, at least 2 years of experience, and have passed a series of examinations.

Vendor certification evolved from the difficulty employers had finding skilled workers to fill the rising number of high-tech jobs created by the Internet boom in the mid- to late 1990's. Because certification is faster, cheaper, and more focused than traditional educational tracks, vendor certification soon emerged as a solution to the problem of worker shortages.

As of May, Microsoft Corporation had issued more than 1.2 million certifications to individuals classified as Microsoft Certified Professionals. One example of the rapid growth in vendor certification is the increase in the number of Microsoft Certified Systems Engineer awards over the last few years: 35,000 in fall 1997; 280,000 by June 2000; and almost 463,000 by July 2002.

Future of certification. Certification has become an increasingly important standard in the information technology industry in the last decade. However, it also has become more controversial. Although it enables workers to demonstrate a specific set of skills, some employers say that certification is not a viable substitute for practical experience. Others prefer that workers have formal education and practical experience, predicting that certifications will diminish in importance. But as the following example illustrates, certification should continue to play a role in training information technology workers.

The growing importance of network security in information technology has

led to an increased demand for computer security professionals. Someone who wants to work in information security can get one of a variety of certifications instead of a 2- or 4-year degree. Employers interested in securing their organizations' computer networks seek individuals with expertise in information security—which, presumably, a specialized certification demonstrates.

In an era in which new technology may become obsolete in a few years, acquiring skills quickly is important to both employers and workers.
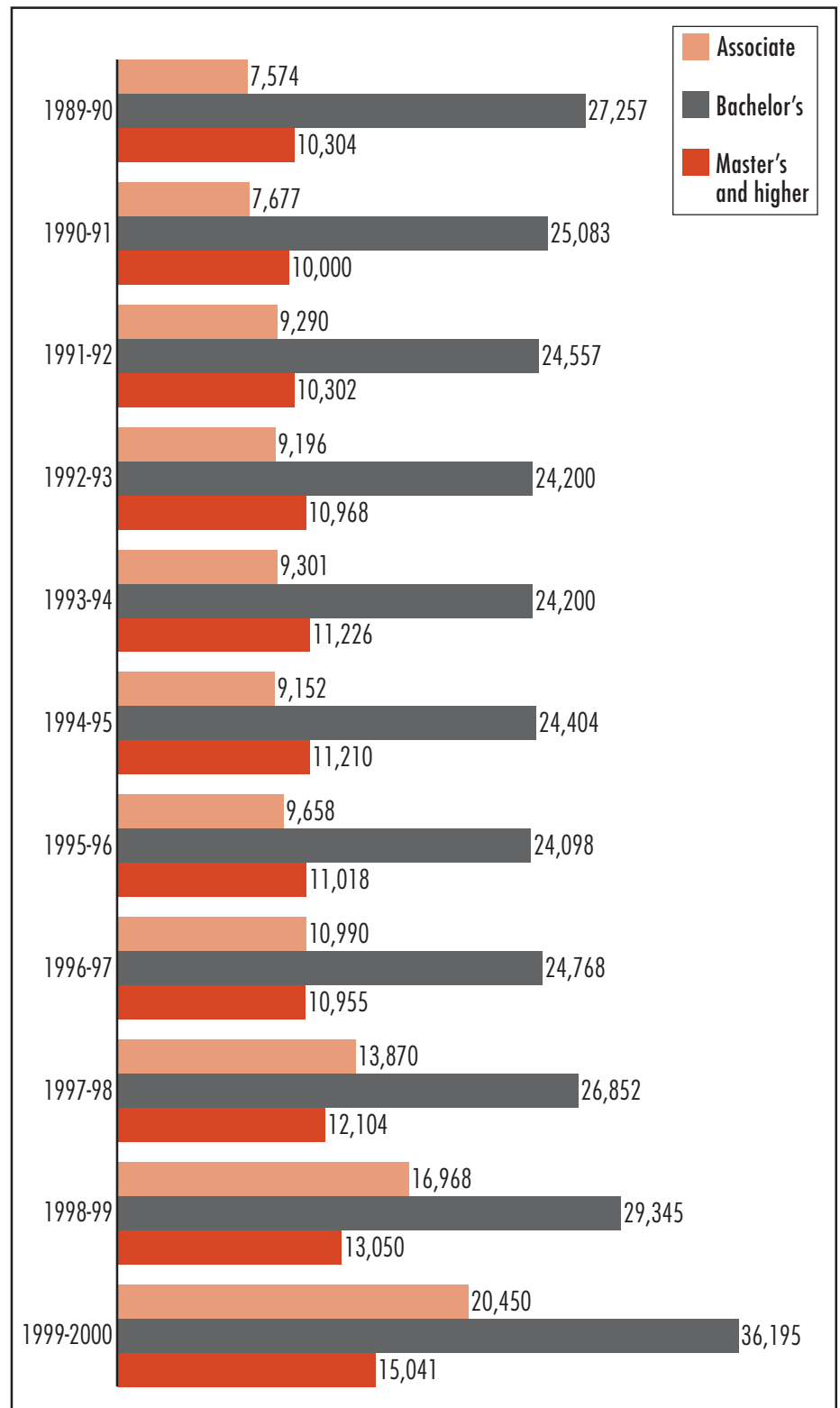
Degrees

Many employers of information technology workers require applicants to have a degree, which they perceive as proof of a worker's ability to think logically. And there are plenty of options for students interested in earning a degree in information technology. According to the National Center for Education Statistics, computer and information sciences include computer programming, data processing, information science and systems, computer systems analysis, and computer science.

But as mentioned previously, most information technology workers who have a degree do not have one in a computer field. Some, like Maria, studied subjects completely unrelated to information technology and gained computer knowledge through other coursework and related experience. Associate, bachelor's, and graduate degree programs have different focuses in training workers for information technology jobs.

Associate degrees. The associate degree is an increasingly attractive option for information technology workers. Most community colleges and many independent technical institutes and proprietary schools offer an associate

Degrees awarded in computer and information sciences, 1989-90 to 1999-2000

Source: U.S. Department of Education, National Center for Education Statistics

degree in computer science or related information technology fields. Because many of these programs are designed to meet the needs of local businesses, they are more occupation-specific than are those of a 4-year degree. Some jobs may be better suited to the level of training these programs offer. Many students who earn an associate degree seek employment as computer support specialists or as computer programmers.

There has been a steady rise in the number of associate degrees granted in the computer and information sciences over the last decade, from fewer than 8,000 in 1990 to more than 20,000 in 2000. (See chart 3.) Furthermore, the number of associate degrees conferred in the business information and data processing services doubled from about 7,000 in 1991 to nearly 14,000 in 2000.

Bachelor's degrees. As previously indicated, most information technology workers have at least a bachelor's degree. In his report for the National Research Center for Career and Technical Education, "The Perceived Influence of Industry-Sponsored Credentials," Kenneth Bartlett points out that employers still prefer a 4-year college degree as preparation for information technology jobs. And in a tight job market, preference for a bachelor's degree rises as employers attempt to differentiate among potential jobseekers. But the degree concentration and relevant experience required may vary by occupation.

For computer software engineers, most employers prefer that applicants have at least a bachelor's degree and broad knowledge and experience with computer systems and technologies. The usual degree concentrations for applications software engineers are computer science and software engineering; for systems software engineers, usual concentrations are computer science and

computer information systems.

There is no universally accepted way to prepare for a job as a systems analyst or database administrator, network administrator, or network systems and data communications analyst. However, most employers place a premium on some formal college education; a bachelor's degree is a prerequisite for many jobs. Some workers in these occupations have a degree in either computer science, mathematics, or information systems.

The number of bachelor's degrees awarded in computer science rose between 1990 and 2000. However, an increasing number of people in the information technology workforce had a non-computer-related degree. Chart 4 shows that for bachelor's degree holders in computer-related occupations in 1999, more than half the workers had studied something other than the computer and information sciences. Large numbers of workers did have degrees in related fields, such as engineering and math. According to the National Center for Education Statistics, for example, the

Acquiring IT skills quickly is important to employers and workers.

number of bachelor's degrees conferred in management information systems rose dramatically: from 4,700 in 1991 to almost 15,000 in 2000.
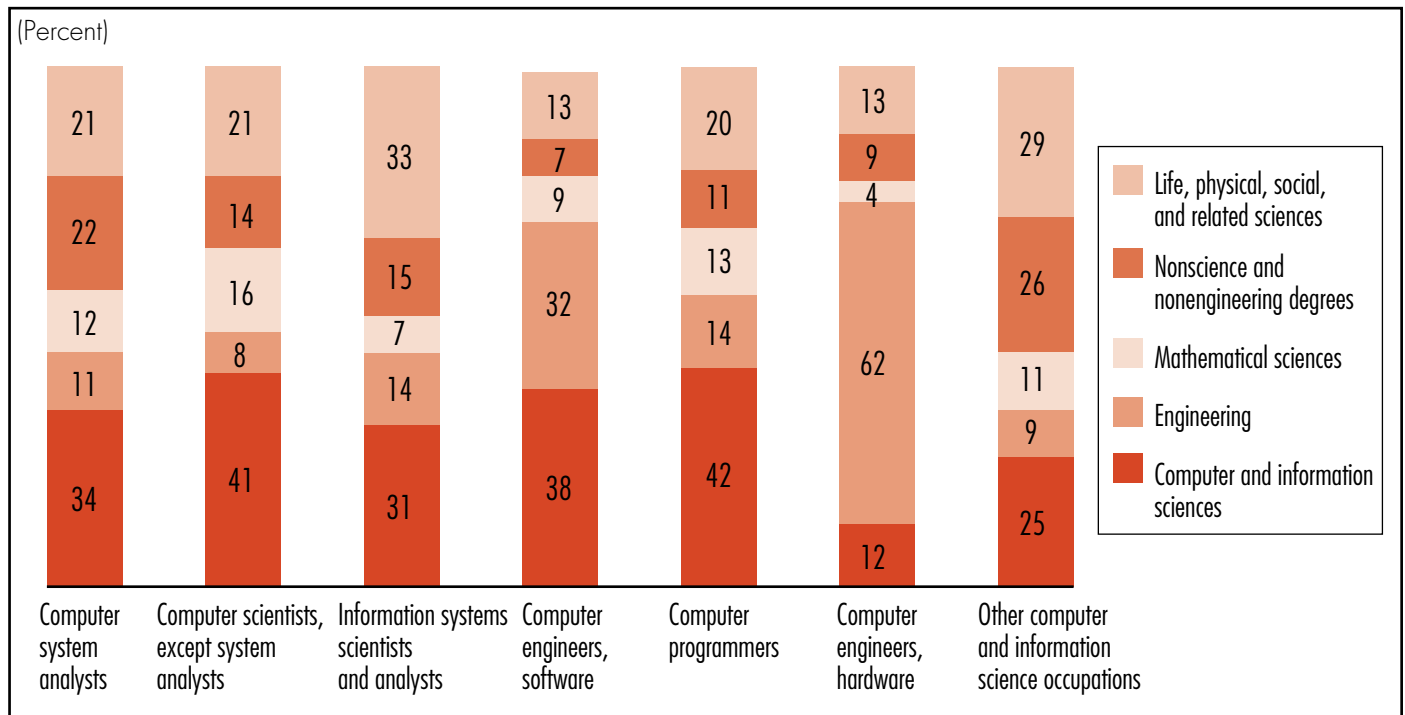
The lack of emphasis on computer-related bachelor's degrees in information technology occupations points up an important trend for prospective information technology workers. Employers still demand technical skills, but "soft" skills—including the ability to communicate effectively, both orally and in writing—also are important for these jobseekers to have. Knowing how to write a computer program or administer a database is critical, but ability to interact with other computer specialists, clients, customers, and users continues to gain importance.

The need for multidimensional workers in information technology means that employers prefer workers who have business skills and acumen, along with relevant and up-to-date technical expertise. Thus, it is not surprising that increasing numbers of information technology workers do not have computer-related degrees. National Science Foundation data illustrate this point: in 1995, roughly 18 percent of computer scientists either had a nonscience or nonengineering degree or had a degree in the life, physical, social, and related sciences. But by 1999, the number of computer scientists with a degree in those concentrations had nearly doubled, growing to 35 percent.

Graduate degrees. Graduate degrees are preferred for some of the more complex jobs in software engineering and database administration. According to the National Center for Education Statistics, the number of master's degrees conferred in computer and information sciences rose sharply between 1990 and 2000, while the number of doctoral degrees in computer science grew slightly.

Chart 4
Distribution of bachelor's degree holders in computer-related occupations by field of study, 1999

(Percent)

21	21		13	20	13	29
		33	7		9	
22	14		9	11	4	26
	16	15		13		
12	8	7	32	14	62	11
11		14				9
34	41	31	38	42		25
					12	

Legend:
- Life, physical, social, and related sciences
- Nonscience and nonengineering degrees
- Mathematical sciences
- Engineering
- Computer and information sciences

Categories (x-axis):
Computer system analysts | Computer scientists, except system analysts | Information systems scientists and analysts | Computer engineers, software | Computer programmers | Computer engineers, hardware | Other computer and information science occupations

Source: National Science Foundation. 1999 SESTAT Integrated Data System. The SESTAT Web site is **sestat.nsf.gov**.

Many computer and information systems mangers have a master's degree in business administration (MBA) with technology as a core component. This so-called techno-MBA degree differs from a traditional MBA because of its heavy emphasis on information technology in addition to the standard business curriculum. And because computer and information systems managers make not only technology decisions but also business decisions for their organizations, techno-MBA programs are becoming increasingly popular.

Information technology workers interested in becoming a computer or information scientist usually need a doctoral degree in computer science or computer engineering because of the highly innovative and technical nature of the work. Some computer and information systems managers may have a doctoral degree in a computer-related field, demonstrating thorough technical knowledge.

Employers seek IT workers who can interact with others.

Flexible pathways

The discussion about career preparation for information technology occupations reveals that there is no universal education and training requirement for jobseekers in information technology. A computer-related degree may be the easiest and most direct route to take, but it is by no means the only one. There is a variety of ways in which workers can demonstrate the computer knowledge and skills necessary to get a job in one of several computer-related occupations. Practical experience, although difficult to measure and quantify, is important and allows jobseekers flexibility—especially for those who do not have a computer-related degree.

Information technology workers must continually acquire new skills to remain in this dynamic field. To this end, the role of community colleges in educating

and retraining information technology workers should continue to grow in the coming years. A May 2000 Urban Institute report, "The Role of Community Colleges in Expanding the Supply of Information Technology Workers," says that these schools conduct a large amount of information technology training and contribute to retraining both veteran workers and those from other fields.

Technology changes at such a rapid pace that retraining and updating information technology skills is essential, even for workers already in their jobs. The emphasis on nondegree programs, such as employer training and self-study, also will rise in importance. And just as colleges and universities are increasingly using distance education as an efficient and cost-saving measure, organizations are using it to train and retrain their employees in information technology.

There are several ways that individuals may prepare to become an information technology worker. At first glance, the tracks that Maria and Spencer took to get jobs in their respective computer-related occupations might seem unorthodox. Yet with rapidly changing technology and increasingly flexible training requirements, the routes they took should remain commonplace.

For more information

Consult the 2002-03 *Occupational Outlook Handbook* to learn more about specific information technology occupations. Along with training requirements, the *Handbook* provides details about the nature of the work, working conditions, earnings, employment, and job outlook for the following information technology occupations: Computer and information systems managers; computer hardware engineers; computer programmers; computer

software engineers; computer support specialists and systems administrators; and systems analysts, computer scientists, and database administrators.

The following organizations also provide information for computer-related careers:
Association for Computing Machinery (ACM)
1515 Broadway
New York, NY 10036-5701
1 (800) 342-6626
(212) 869-7440
www.acm.org

IEEE Computer Society
Headquarters Office
1730 Massachusetts Ave., NW.
Washington, DC 20036-1992
1 (800) 678-4333
(202) 371-0101
www.computer.org

National Workforce Center for Emerging Technologies
3000 Landerholm Circle SE.
Bellevue, WA 98007
(425) 564-4215
www.nwcet.org

Information about the designation of Certified Computing Professional is available from:
Institute for Certification of Computer Professionals (ICCP)
2200 E. Devon Ave., Suite 247
Des Plaines, IL 60018
1 (800) U-GET-CCP (843-8227)
www.iccp.org

Information about training leading to a CompTIA certification is available from:
Computing Technology Industry Association (CompTIA)
1815 S. Myers Rd., Suite 300
Oakbrook Terrace, IL 60181-5228
(630) 268-1818
www.comptia.org

Those interested in earning an IT degree have many options.

For information about training for Microsoft certification, contact:
Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399
1 (800) 636-7544
www.microsoft.com/train_cert

Information about training for Oracle certification is available from:
Oracle Corporation
500 Oracle Parkway
Redwood Shores, CA 94065
1 (800) 529-0165
education.oracle.com

For information about training for Cisco certification, contact:
Cisco Systems, Inc.
170 W. Tasman Dr.
San Jose, CA 95134
1 (800) 829-6387
www.cisco.com/warp/public/10/ wwtraining

Information about training for Novell certification is available from:
Novell, Inc.
2211 N. First St.
San Jose, CA 95131
1 (800) 233-3382
education.novell.com