

COMPUTING EDUCATION IN THE 21ST CENTURY

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ONCE PERCEIVED AS A CAREER CHOICE guaranteeing exceptional job security and very high salaries, computing is a field in transition. While it still offers students a solid future in the workplace, this future looks quite different from the one expected just a few years ago. Students who are now preparing for careers in computing will have to be aware of rapidly changing features of the computing landscape. Examples include the ever-increasing role of information security in all aspects of computing and the impact of offshoring on the number and kinds of jobs available in the U.S. software industry.

However, rapid change has been a constant feature of the computer industry since its very beginnings. The evolution of computers has spanned mainframes, minicomputers, desktops and laptops. Each generation of software (operating systems, databases, and compilers) has rapidly been replaced by the next. New programming languages (Fortran, Cobol, Pascal, C, C++, Java) and design methodologies (structured programming, object-oriented programming, extreme programming) have taken their places in the spotlight.

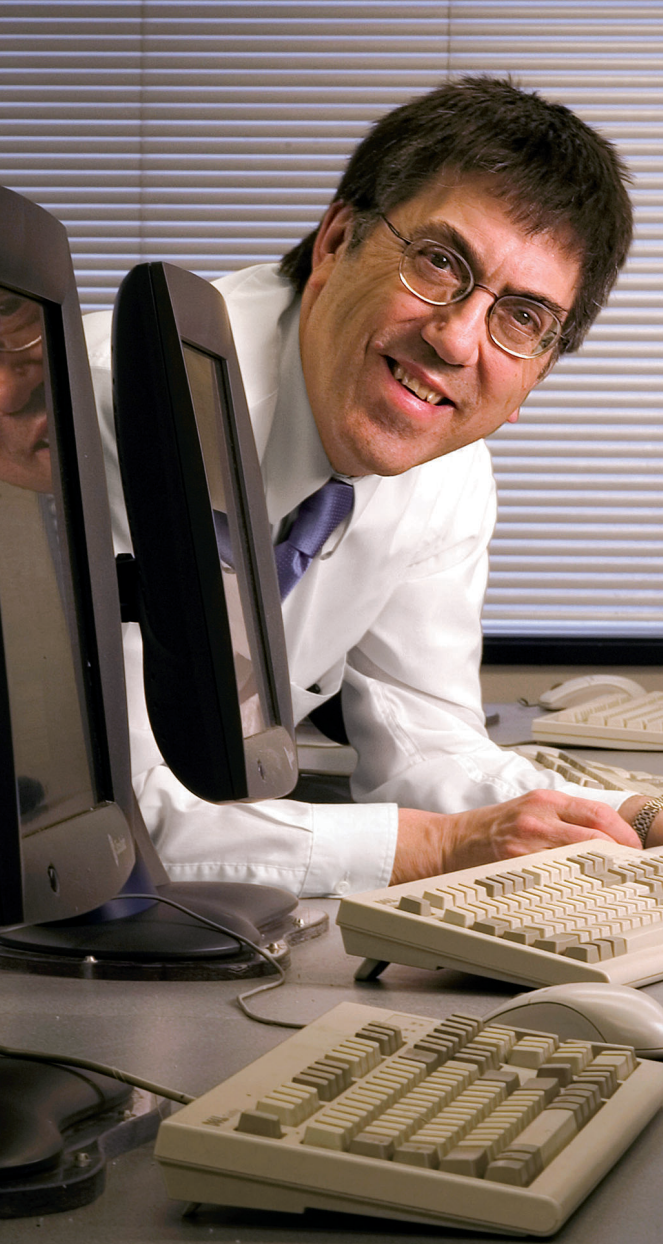
Over the years, computing education has also had to deal with this culture of change. Back in the 1960s, computing curricula developed independently in various engineering, science and business departments. By 1975, the situation had clarified somewhat, and it was usually possible to distinguish undergraduate computing curricula by program name and program location. Computer science (CS) curricula emphasized the design and organization of computer software systems; computer engineering (CoE) curricula emphasized the design of computer hardware; and information systems (IS) curricula emphasized the use of the computer in

the business domain. Programs in all of these areas are accredited by ABET (formerly known as the Accreditation Board for Engineering and Technology). NJIT's CS, IS and CoE programs have all received ABET accreditation.

These computing programs were found in different parts of universities. CoE and IS programs were located almost exclusively in engineering schools and business schools, respectively. CS programs could be located either in engineering schools or schools of arts and sciences. The location was determined primarily by local academic considerations. At NJIT, the Department of Computer and Information Systems (CIS) was established in 1971 within Newark College of Engineering, but eventually came to be housed in the College of Science and Liberal Arts. It offered undergraduate degrees in CS and IS (followed later by graduate degrees).

Several leading universities realized in the 1970s that their rapidly growing computing programs needed to be housed in academic units that would be devoted to computing. The pioneers of this approach were Georgia Tech, Carnegie Mellon and Northeastern University. Computing colleges were subsequently established at Cornell University, Penn State, Indiana University, and the University of California at Irvine. NJIT was part of this movement, creating the College of Computing Sciences from the CIS department in 2001.

Since the classification of computing programs allowed quite a bit of freedom, two programs with the same name at different universities could be quite different in character, even if both were accredited. In particular, many computer science programs became rather theoretical. Such programs tended



MAKING THE BEST CHOICE

The variety of departments, schools, and undergraduate programs dedicated to computing can be very confusing to prospective students. The leading professional societies in computing — the IEEE Computer Society and the Association for Computing Machinery — are currently sponsoring preparation of an overview of computing programs that will serve as a guide for students and parents. The Office of the Dean of the College of Computing Sciences at NJIT will be happy to answer questions about the university's computing programs. Please feel free to call us at 973.596.5304, or visit us on the Web at <http://ccs.njit.edu>.

to be less interesting to students and also to the industries employing the programs' graduates.

The situation has recently been exacerbated by the movement of computing jobs to other countries. Parents and students have become concerned about the viability of computing as a career choice, and at the same time computing enrollments have started to drop. It is important to note that this negative perspective is not shared by the U.S. Department of Commerce, which recently projected that the employment growth for IT professionals in 2002-2012 would be far greater than the growth anticipated for engineers.

In this context, some universities have recently developed new computing programs that respond to the needs of students and industry for a closer link between education and practice. NJIT's information technology (IT) degree program is an excellent example. Students enrolled in the IT program take an eight-course common core emphasizing the computing techniques needed for the Internet age. They also select one of 21 concentrations that cover topics in computer science (software engineering, information security), engineering (bioengineering, telecommunications), science (applied mathematics, applied physics), and visual arts and sciences (multimedia, architecture). Students who complete such programs have hands-on experience in computing but also are familiar with a particular application area. Industry is very interested in students with this combination of skills, and the resulting jobs are less likely to be moved offshore.

The flexibility of NJIT's IT program makes it highly suitable for the rapidly changing computing environment. The program has been enormously popular with NJIT students, and it has become a model for IT programs nationally. We have just started to offer the IT program at off-campus industrial locations, and we hope to do much more along these lines to help IT professionals keep their skills current. Building on the success of the IT program, NJIT's College of Computing Sciences is working hard to develop other computing programs and concentrations that will meet the career needs of undergraduate students and also the retraining needs of working IT professionals. ■