

Strategic Plan

*Department of Computer Science
Fall 2005*

Introduction Computer Science includes the study of all aspects of the design, implementation, and application of computer systems. It concerns general problem solving, emphasizing both the design of efficient solutions and the expansion of the capability of computers to solve even larger and more complex problems. This requires detailed understanding of the nature of algorithms, the software implementation techniques necessary to utilize these algorithms on computers, and a knowledge of how to develop modular software that can be combined to form highly complex software systems.

Computer Science is a rapidly evolving discipline. Therefore, a university education must give students the basic underlying fundamentals to enable them to keep up with the fast pace of both anticipated and unanticipated future developments in the field.

Mission The mission of the Computer Science Department encompasses education, scholarship, and service. We strive to:

- offer high-quality baccalaureate, masters and doctoral level computer science programs;
- provide computer and information technology coursework to the broader UNH community;
- perform scholarly research to advance the state-of-knowledge, the state-of-the-art, and the state-of-practice in computer science and related fields; and
- provide expertise to serve the UNH community, region, state and nation.

Core Values We believe expectations should be set high and clearly articulated for both students and faculty. We believe in a high level of engagement in learning and scholarship for both students and faculty. Students should be active learners; practicing skills is critical. Faculty should be active scholars and should make their scholarship accessible to students through their teaching and by incorporating students in their research. We believe continuous improvement is necessary for the department to be effective in a discipline that is continuously changing. Students, alumni and local industry need to be part of the improvement processes.

Strengths The B.S. program is ABET accredited. Our successful “interim visit” in AY 2004–2005 made us the first program at UNH to obtain full accreditation under the ABET 2000 guidelines, which emphasize educational outcomes, assessment and continuous improvement. The curriculum was recently strengthened to include more emphasis on problem analysis, solution design and oral communication. The program attracts strong students, whose average SAT scores are higher than the CEPS average, which in turn is higher than the UNH average. The program graduates strong students. The top UNH male graduate in 1999, 2003 and 2004 was a Computer Science major. Graduates are very competitive both regionally and nationally for industry jobs. Graduates are very competitive nationally for graduate school, with alumni currently in Ph.D. programs at CalTech, Georgia Tech, Arizona, New Mexico and Utah.

The M.S. program is very strong. Graduates are in very high demand from regional and national industry. Computer Science led all CEPS departments in 2000–2004 in M.S. degree production. (Computer Science was also very near the top in total graduate degrees awarded.)

There are a large number of out-of-classroom learning experiences available to our students, through our active collaborations with the UNH InterOperability Laboratory, the UNH Center for Coastal and Ocean Mapping, the UNH Hubbard Center for Genome Studies, and local and national industry.

Challenges Since the department was founded in 1981, there has been a cyclical undergraduate enrollment trend that tracks the public's perception of the health of high-technology industry. This trend runs counter to enrollments in "traditional" engineering fields such as mechanical, civil and chemical engineering. People seem to move to computer science when there is a high-tech boom and migrate back to traditional engineering when there is a high-tech slowdown.

We are currently in a down period, and have seen our first-year major count, now 25, more than halved since a peak of 67 in 2000. (This closely follows the national data for computer science departments during the same period.) However, the high-tech economy in New Hampshire has rebounded more quickly than the rest of the nation and the job market for our students is strong and getting stronger. We expect our number of majors to recover quickly in the years to come.

The U.S. Department of Labor statistics agree with this assessment. Three of the top-ten predicted fastest growing occupations for the period 2002-2012 are ones for which we train our majors. There is expected to be 45.5% growth in software engineers and 57.0% growth in network systems analysts.

The only other CEPS professions with very high growth are biomedical engineers (26.1% growth) and environmental engineers (38.2% growth). Overall, the expected growth in computer science is 35.8%, in mathematical science 7.4%, in engineering 7.3%, and in physical science 14.4%.

We also experience heavy attrition, roughly 50%, for our majors during their first year. We do not believe this is a matter of ability, rather it is a matter of interest. Unlike other CEPS majors, we find many of our computer science students simply have no idea what their chosen discipline is all about, prior to taking their first course from us. Often they find their capability in *using computers* does not translate to enjoyment in *programming computers*.

We are also experiencing a drop in graduate enrollment. Historically, graduate enrollment has followed a similar, but damped, cycle to undergraduate enrollment. However, our graduate enrollment has relied heavily on international students and we, following a national trend, are seeing fewer applications from international students.

We have had a very difficult time keeping Ph.D. students in school. We have only graduated seven Ph.D. students in the fifteen years of the program's existence. We have lost a high number of students to industry after they decide to stop with a M.S. degree. Part of this is due to the high quality of our M.S. program, which we have been unwilling to compromise on, and which produces graduates who are in very strong demand in industry. And part of this is due to our need to obtain more support for Ph.D. students through grants, collaborations with industry, and collaborations with on-campus laboratories and centers.

Competition for federal computer-science research funding has risen dramatically in the past five years. The proposal success rate in the NSF Directorate for Computer and Information Science and Engineering has fallen from 34% to 16%. This is below the NSF-wide average of 24%. Moreover, the federal government has established a higher priority for funding life science than physical science, mathematical science or computer science.

Goals and Action Items

1. **Diversify undergraduate degree offerings to address the historical cyclical enrollment demand and the emerging trend for integration of computer technology into all business units.**

The approval of the bioinformatics option last year was the first step in this direction.

During spring 2006 we will prepare proposals for a minor in Computer Science, a B.A. degree in Computer Science, and a bachelors degree in Information Technology. These proposals will be developed with the awareness that we will need to deliver these new programs, if approved, with no additional faculty resources.

2. Raise the number of undergraduate applicants, raise the percentage of admitted students who choose to enroll, and lower the attrition rate for first-year students.

- We will continue to improve the department website, with a special emphasis on student profiles. The improvements to date have been made possible by our decision in September 2004 to hire an administrative assistant, Rachel Toussaint, with writing and interviewing skills, and an interest in learning webpage development.
- During this academic year we will work with the NH Science and Engineering Exposition (NHSEE) to create a software-design category for their statewide science fair. This new category was approved at their November 2 meeting and Phil Hatcher was directed to oversee the category along with Norm Messa from the Seacoast School of Technology. In conjunction with NHSEE we will host in January 2006 a workshop for high-school teachers teaching computer science. The goals would be to make better contact with the high-school teachers and to encourage them to have their students participate in the software-design competition.
- Starting this year we will try to forge closer ties with 4–5 local high schools each year. During this year we will work with Dover High School, Seacoast School of Technology, Bishop Guertin High School and Pinkerton Academy. The goals will be to have their students learn more about who we are and what computer science is, to encourage visits by students and teachers to UNH, and to encourage participation in computer science activities, such as the NHSEE software-design competition.
- During this year we will aggressively recruit new undergraduate students by offering up to two years of free graduate tuition to students who complete our undergraduate program with a GPA of 3.4 or higher. The free tuition might be in the form of a tuition scholarship, but more likely would be coupled with either a teaching or research assistantship. This idea has already been vetted by the Admissions Office, who responded very positively, and suggested that the idea be used with students who are offered Presidential Scholarships. This is a very select group and our yield for this group is very low.
- During spring 2006 we will form an ad-hoc committee to investigate different strategies for teaching our first-year courses. In particular we will investigate structuring the courses around applications that will be more interesting to the current generation of students, such as computer graphics and computer games. We will also consider including modules that try to make the students more aware of the long-term benefits of majoring in computer science. In particular we will provide more information about careers in computer science.

3. Establish a Center for Software Systems.

Scott Valcourt, a former managing director of the InterOperability Laboratory, was hired by the department in July 2005 as a research project manager to work on building industry collaborations, particularly ones that employ our students. His first project is funded by the Service Availability Forum and employs three students. He is currently finalizing two additional projects, one with Meetinghouse Data Communications in Portsmouth and one to be funded by the Department of Justice.

In December we will ask Dean Klewicki to approve the creation of the Center for Software Systems, which will be directed by Valcourt. An appropriate website will then be created and we will begin to aggressively market the Center to companies.

We plan to use the Center as a recruiting tool for both undergraduate and graduate students. Our goal is to build on the great success we have had collaborating with the InterOperability Laboratory by providing a similar entity for software-based projects.

We also plan to use the Center to provide other services to industry, such as the offering of training to their employees. This aspect of the Center is discussed below in the context of growing graduate enrollment.

4. Grow graduate enrollment.

- We will improve our department website. In particular, we need to strengthen the description of the ongoing research projects and collaborations. We plan to attack this in 2006 by creating profiles for both individual students and for research groups. Rachel Toussaint will also work with individual faculty members to improve their project webpages.
- In January 2006 Phil Hatcher will contact the undergraduate computer science program directors for the New England state universities (U. Mass Amherst, U. Vermont, U. Maine and URI) to encourage cooperation in the sharing of information about each department's graduate programs. In particular, he will propose yearly e-mail distribution of graduate program information to each school's graduating seniors. In this material we need to emphasize the diversity of opportunities for students in our department, with students currently supported by the InterOperability Laboratory, the Center for Coastal and Ocean Mapping, the Hubbard Center for Genome Studies, and our planned Center for Software Systems.
- This fall all computer science seniors scheduled to graduate in May 2006 and owning appropriately high GPAs were encouraged by the department to apply for early admission to the UNH Graduate School for the spring 2006 semester and this direct encouragement will be continued in future years. The goal is to get our top students thinking about going to graduate school.
- Elizabeth City State University (North Carolina) is a historically black institution that has established close ties with UNH through its Center of Excellence in Remote Sensing Education and Research. Phil Hatcher has been in contact with the director of the center, Dr. Linda Hayden, who is on the mathematics and computer science faculty of ECSU. Hatcher is submitting a proposal to NSF concerning his bioinformatics work with the UNH Center for Structural Biology and, if this is funded, Hayden and Hatcher will submit a supplement request to the NSF Broadening Participation in Computing program to fund ECSU students to collaborate in the project. The long-term goal is to connect ECSU students to the UNH graduate programs.
- We will employ strategic course release to initiate and expand projects that will directly lead to more funded graduate students. For example, in spring 2006 Dan Bergeron has been given a one-course release to focus on grant writing with faculty in the Hubbard Center for Genome Studies.

We would like to begin to move toward a lower teaching load for our faculty, one that is more in line with the College norm. By reallocating our time in this way, we believe we will be able to raise our research profile, while providing more funding for graduate students. We plan to fund the replacement teaching costs, and slowly expand this program to more faculty, largely by leveraging the monies obtained from increased net graduate tuition. We anticipate that the College will implement a program by which departments will obtain some portion of their net graduate tuition.

In addition, we are going to aggressively seek direct industrial funding for faculty course release. This will largely be through our planned Center for Software Systems. For example, Radim Bartos will be given a one-course release in spring 2006, to be funded by a contract with Meetinghouse Data Communications. We also expect that some funds will be available from the difference between what is budgeted in contracts like this and what we need to pay for replacement teaching. We anticipate that the College will let us keep this difference to use for additional course release, or for other activities that will allow us to grow our net graduate tuition.

- We have been working with our industry advisory board on the creation of a graduate certificate program in advanced software engineering. We initiated this conversation at the April 2005 meeting. At the October 2005 meeting Scott Valcourt presented a proposal

for the program to be offered as an outreach activity by the proposed Center for Software Systems. The board reacted very positively to the proposal and we currently plan to pilot the two core courses for the program during AY 2006-2007. We will also request graduate school approval during that year.

5. Increase the number of Computer and Information Technology minors.

The CIT minor was initiated in 2000 and has grown to the point where we expect to graduate 30 minors this academic year. However, we believe the minor can be grown considerably with no additional resources. It is largely a matter of better publicizing the minor.

In fall 2005 we developed both a poster and a brochure for the minor. We are currently distributing these to all departments and programs on campus and are working to identify key academic advisers who will advocate for the minor to their advisees. We strongly believe that complementing most majors on campus with a CIT minor will increase a student's value to potential employers.

6. Ensure that our computer literacy general education offerings are well-positioned for the transition to the Discovery Program.

We believe this goal is critical to the financial health of the College and therefore both Phil Hatcher and Israel Yost, director of our Computer Literacy program, are currently serving as liaisons to the Discovery Program Implementation committee and have both volunteered to serve on appropriate subcommittees.

We believe strongly that our Computer Literacy program should play a central role both in performing the information technology assessment and in providing remediation to those students who need further training. We have many years of experience in this through our offering of CS401.

We also believe that the continuous review process being planned for Discovery courses should include the use of metrics to try to measure student engagement and learning. We believe our General Education courses are notable for the high expectations we set for our students and the high level of engagement we demand from them. We believe all Discovery courses should meet these high standards and we are concerned about the RCM implications when there exist programs that seem, to us, to be more interested in creating "cash cows" than high-quality courses. We will advocate this position both in our interactions with the Discovery Program Implementation committee and through Phil Hatcher's position on UCAPC.

In Spring 2006 we will also work to get our existing General Education courses to be approved for the Discovery Program. In some cases this may require some modifications to the courses. For example, we will explore revamping our CS400 class, Exploring Computer Science, to be a four-credit course that will satisfy both the Quantitative Reasoning and the Technology categories. Satisfying two requirements may make the course attractive, and it may also serve as an effective gateway to the majors and minors we plan to offer.

7. Build stronger relationships with alumni.

This goal will attempt to leverage the 25th anniversary of the creation of the department and the move back to the renovated Kingsbury in 2007. We hope to use both of these items to attract alumni to come back to campus and reconnect with us. We are currently working on building an effective e-mail list for our alumni. In Spring 2006 we will use that to try to identify a core group of alumni to help us organize appropriate events and to, in general, advise us on how to build stronger ties with our alumni. The long-term goals would be to make more effective use of alumni in the assessment of our existing programs and the development of new programs. We would also like to better use alumni in the recruiting of students. And, of course, we would like to be more effective in asking our alumni for financial support.