NSF Northeast Workshop on Integrative Computing Education & Research
November 3-4
Boston MA

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The purpose of this workshop will be to bring together a broad range of stakeholders from the northeast region with strong interests in Computer and Information Science and Engineering (CISE) undergraduate education, to identify and discuss needed transformations in undergraduate computing education in the USA. The output of the workshop will be a report documenting the discussion and overall recommendations that emerge from the workshop. The report will be shared with participants, NSF, and the interested public via the project website and other paper and electronic means. The recommendations will be aimed at long-term, high impact, and potentially high-risk, strategies to catalyze the transformation of university computing education throughout the nation.

The Need for Computing Curriculum Change

The field of computing is constantly changing, as a result of both technological innovations (in computing and in allied disciplines) as well as societal/economic shifts. We see continuous change in the content of the field, and consequent differences in opinion about what constitutes the core of the computing field and how to produce graduates who are intellectually agile in such a dynamically changing discipline. New programs, in areas such as Information Technology, intersect with those in traditional Computer Science, but often extend computing concepts into other (often traditionally non-technologically-oriented) disciplines. Core Computer Science is also increasingly touching other science and engineering disciplines, requiring an integrative, systems approach to educating our students, one that overcomes disciplinary barriers. Computing faces tremendous pipeline and retention issues, as well as severe under-representation issues concerning women and other minorities as enrolled students in computing programs or as practitioners.

Workshop goals

With this constant change as a background, the goal of this workshop is to bring together a broad range of approximately 30 stakeholders in CISE education from the northeast region of the United States to identify and discuss needed transformations in undergraduate computing education in the USA. These stakeholders will include computing faculty, academic administrators, representatives of professional computing
societies and trade organizations, government policy makers and funding organizations, recognized nation leaders and futurists in the field of computing, and representatives of national research and industrial laboratories.

The workshop participants will be charged with developing recommendations aimed at long-term, high impact, and potentially high-risk, strategies to catalyze the transformation of university computing education throughout the nation.

Some of the specific issues to be addressed at the workshop might include (but will not be necessarily limited to):

- **Attracting and retaining students.** What programmatic, curricular, and pedagogical changes can be adopted to attract and retain more students, particularly women and minority students? What existing efforts show promise? Might revised or radically new gateway courses, new approaches to mentoring, team work, and/or an increased focus on the social relevance of information technology help? How can the field better “market” itself, and convey a sense of intellectual excitement, challenge, and opportunity to potential students?

- **A changing and ever-expanding field.** How should we produce graduates who are intellectually agile in a dynamically changing discipline? What are the key principles that should be expected to transcend mere technology changes? The knowledge and skills a U.S. graduate will need in the future in order to secure a good job in the computing field are not diminishing but expanding. Will the norm in the future be an undergraduate degree followed by a Master degree (possibly in one of many disciplines), and if so, what are the curricular ramifications?

- **Scale up, and an integrative view.** Graduates of computing programs often lack a systems approach toward solving problems. What changes can be made in an undergraduate curriculum to produce undergraduate who are adept at dealing with the scale-up challenges associated with complex systems and complex interactions of the type they will encounter as practitioners? Might both the graduates and industry benefit if what a student learns in class is closer to what is needed in industry, such as team work on large and complex projects and heterogeneous system integration and interoperability, in addition to the principles of computing?

- **Relationship to IT programs.** What is the relationship between “core computer science” and various IT programs on a campus? In what ways do they complement or compete with each other? How can each leverage the other’s success? What are the success models to date?

- **Security.** Security has become one of the nation’s most pressing immediate needs. However, most traditional computing programs do not include it or only addresses its principles in a narrow way. On the other hand, security is a multidisciplinary area and involves other fields such as business, laws, and management. An integrative computing program would prepare graduates for security needs in real practical systems for the whole society in U.S., in additional to the basic principles.

- **Global competitiveness.** National IT competitiveness is threatened by globalization, and an increased emphasis on IT and education in other countries. It
is often suggested that the future will hold far fewer jobs in the U.S. for those with computing degrees, that computing research here will suffer along with the computing industry, and that loss of U.S. leadership in computing is at a serious risk. What activities can be undertaken in the various segment of higher education (community colleges, four year colleges, and universities) to produce graduates who enhance the IT competitiveness of our country?

- **NSF activities.** What future programmatic activities might the NSF undertake to catalyze and support the needed changes?

The output of the workshop will be a report documenting the discussion and overall recommendations that emerge from the workshop, as well as a set of recommendations to the NSF for programmatic activities that could help initiate the needed transformations.