Minor in Scientific Computation

This document describes the College of Arts and Sciences Minor in Scientific Computation, established in Spring 1999. This minor is a natural complement to the curriculum for majors in natural sciences, mathematics, economics, and CSOM finance concentrators. A minor in Scientific Computation enriches training in any of these disciplines, adding an applied emphasis on the methodologies which have been developed for empirical research, and stressing the cross-fertilization of research methods across disciplines. The advancement of science in many fields is becoming less discipline-specific, and nowhere is this more apparent than in the common tools used for challenging computational problems. For instance, the solution of ‘hard’ optimization problems or the simulation of large-scale nonlinear models are common to many fields of science and applied mathematics. Significant resources exist among the Boston College faculty for the advancement of applied computational methodologies. An interdisciplinary minor in Scientific Computation provides students with a valuable, intellectually challenging experience and marketable skills applicable in many fields, but would also stimulate interdisciplinary collaboration and exchange among faculty. The program does not have significant overlap with existing offerings and programs in Computer Science, which are not generally oriented toward the scientific applications of computation such as simulation, modelling, and data visualization. Thus, a minor in Scientific Computation would be a useful complement to a major or concentration in Computer Science.

Requirements
The interdisciplinary minor in Scientific Computation consists of six courses and a one-credit senior seminar (lecture series). The six courses include:

- Two courses in mathematics
- One course in programming languages (PH 330)
- One course in numerical methods and scientific programming (PH 430)
- One course from a list of approved options
- One course in advanced scientific computation (PH 530)

Two Courses in Mathematics
The mathematics courses required include MT 202, Multivariable Calculus, and MT 210, Linear Algebra. They could be taken concurrently with the Programming Languages course. These courses are offered each semester.

PH 330: Introduction to Scientific Programming
The course in programming languages is cross-listed under several departments (PH 330, CH 330, MT 330, EC 314). This course is offered in lab format (3+1 cr.) and is cross-listed under several departments (using different course numbers where required). The course focuses on the use of appropriate algorithms and tools—including both C/FORTRAN and MATLAB/Mathematica languages—for the solution of large-scale problems arising in scientific research. Staffing includes faculty from physics, mathematics, economics, finance, and computer science.

One Course from a List of Approved Options
The fifth course in the minor is chosen from a list of approved options. Emphasis is placed on courses available outside the student’s major, including additional courses in mathematics, computer science, econometrics, the natural sciences, and quantitative methods. This course may be taken concurrently with any other required courses.

PH 430: Numerical Methods and Scientific Programming
The course in numerical methods and scientific programming is offered in lab format (3+1 cr.) and is cross-listed under several departments (using different course numbers where required). The course focuses on the use of appropriate algorithms and tools—including both C/FORTRAN and MATLAB/Mathematica languages—for the solution of large-scale problems arising in scientific research. Staffing includes faculty from physics, mathematics, economics, finance, and computer science.

PH 530: Advanced Scientific Computation
The course in advanced scientific computation focuses on multidisciplinary applications, with special emphasis on the potential to apply computational methods developed in one discipline to problems in other disciplines. The course is offered in lab format (3+1 cr.), and would be heavily modular, consisting of three or four modules presented by faculty from different disciplines, including chemistry, physics, mathematics, computer science, economics, and finance. This course serves as the capstone course in the minor.
I would like to bring your attention to a brand new minor in Scientific Computation. Today’s technological society places great value on analytic computational and scientific skills, through which one can gain important insights from connections and analogies between very different fields. For instance, the vibrations of a molecule, the behavior of pulsating stars and the relation between inflation and unemployment are realizations of quite similar mathematical behavior. The study of such phenomena typically requires modeling based on computational techniques. The training needed to understand many interesting real-world problems typically goes beyond the material covered in a single academic discipline.

The Minor in Scientific Computation is an interdisciplinary program drawing on the expertise of faculty from several departments to complement students’ training in the natural, mathematical and social sciences.

Dean Joseph F. Quinn

For more information

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