

## DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

### Section 1 Department/Program/Center Description

#### 1.1.1 Mission, vision, and goals

The Department of Mathematics and Computer Science is staffed by 12 full-time faculty, 1 full-time faculty/technology coordinator, and 1 part-time support staff. We offer four majors and two minors. Since 2001, we have taught, on average, about 1,200 students per year in an average of 65 courses per year, as well as an average of 40 students per year in an average of 2.5 FTS courses per year.

**MISSION STATEMENT:** The Department of Mathematics and Computer Science offers an in-depth education in the concepts, structures, and techniques of the major fields of Mathematics, Statistics, and Computer Science. It is the philosophy of the Department that all students of the mathematical sciences should have an understanding of and an appreciation for both the theoretical and aesthetic aspects of these fields as well as their far-reaching applications. The skills of analytical thinking and logical argument, combined with the ability to communicate effectively, form the core of a solid liberal arts education in the mathematical sciences. The Department fosters these ideals through both its major course offerings and through its general education and service courses. Finally, the Department feels that collegiality and an academically stimulating atmosphere are indispensable to academic growth, and thus actively encourages continuing intellectual activity and communication among its students and faculty.

**VISION STATEMENT:** The Department of Mathematics and Computer Science strives to provide a high quality education in mathematics, statistics, and computer science to prepare students as citizens in the twenty-first century. The Department aims for breadth and depth within each discipline, integration between the three disciplines, and assimilation across client disciplines. The Department strives to develop understanding and appreciation of problem-solving, scientific thinking and reasoning, and research methods in all students. The Department aspires to be a community of teacher-scholars who encourage students to engage in research, application, and other fundamental activities in mathematics, statistics, and computer science.

#### GOALS:

Goal 1: Develop a flexible palette of majors that reflects the twenty-first century view of the mathematical sciences as an integrative theme in a multidisciplinary environment.

Goal 2: Offer a more diverse and academically-stimulating exposure to mathematics, statistics, and computer science at the lower and middle levels.

Goal 3: Expand computer science courses suited to multidisciplinary integration.

Goal 4: Provide opportunities and support for the development of faculty as teacher-scholars.

Goal 5: Strengthen student-faculty research.

Goal 6: Enhance the utilization of technology and classroom space to support pedagogy.

Goal 7: Cultivate alumni for recruiting and mentoring as role models.

Goal 8: Increase school and community based programs and partnerships.

## **1.2 Programs**

The Department offers majors in mathematics and computer science, as well as honors variants of each of these majors. In cooperation with the Department of Elementary and Secondary Education, the Department has also designated a particular track within the mathematics major for use by those students who are preparing to be licensed as secondary school teachers of mathematics. Additionally, the Department offers a minor in each field, which can serve to focus and recognize the efforts of those students seeking a complement for another major.

The Department regularly contributes to the First-Term Seminar program by offering three sections per year, temporarily reduced to two pending permission to fill a vacant position. Eight members of the Department have completed FTS training.

The Department contributes the major portion of courses approved for the Mathematical and Logical Reasoning requirement of the Liberal Arts Perspectives courses for Curriculum I (Distributive Core). These courses are:

- MCS-115: The Nature of Math
- MCS-118/MCS-119: Calculus with Pre-calculus Review 1a and 1b
- MCS-121: Calculus I
- MCS-122: Calculus II
- MCS-140: Elementary Statistics
- MCS-142: Introduction to Statistics
- MCS-170: Nature of Computer Science
- MCS-177: Introduction to Computer Science I

Average enrollments in all sections of these courses over the past five years are 498 students in an average of 21 sections in the Fall and 393 students in an average of 18 sections in the Spring. Since the College's implementation of the Mathematical and Logical Reasoning requirement in 2005, average enrollments are 514 students in an average of 20 sections in the Fall and an average of 415 students in an average of 18 sections in the Spring.

### **1.3 Support relationships**

The Department works closely with the Department of Education in assuring that the mathematics course offerings align with the teacher standards. The Department also regularly converses with the Departments of Physics, Chemistry, Biology, and Economics and Management to maintain appropriate topic coverage for their cognate requirements in mathematics courses.

## **Section 2 Strategic Review**

### **2.1 Strategic issues**

#### **STRENGTHS**

The Department of Mathematics and Computer Science has identified strengths in the areas of people, multi-discipline nature of the Department, curriculum, facilities, and alumni and outreach.

The collegiality of the Department members leads to efficient decision-making by group consensus across our disciplinary boundaries. The multi-disciplinary character of the Department (mathematics, statistics, computer science) provides depth through the richness of faculty interests, leading to flexibility in staffing courses. The people of the Department provide leadership within the Gustavus community by assuming integral and leadership roles in campus committees, serving as chairs of major faculty committees (Faculty Senate, Personnel). The Department also is active and visible in the greater professional community as indicated by their roles in professional organization such as the Mathematics Association of America, Liberal Arts Computer Science, and the American Statistical Association.

The Departmental curriculum is full, deep, and broad. Our introductory courses enrich all students through an exposure to the beauty and rigor of the disciplines mathematics, statistics, and computer science. Mathematics majors receive a solid foundation of mathematical rigor and proof in the middle-level courses, as well as an in-depth study of a mathematical sub-area in their upper-level sequence courses. The mathematics major has great flexibility, preparing students for graduate studies or corporate employment. Secondary education mathematics majors are well-prepared to teach our future leaders.

The Department maintains strong connections with its alumni and potential employers. The MCS Blog keeps potential students, alumni, and friends abreast of the Department's activities and accolades. Current students learn more about the disciplines through presentations by alumni and field trips to potential employers, such as Target Corporation, Federated Insurance, and West, a Thomson Reuters business.

The facilities on the third floor of Olin Hall are pleasant and spacious. Classrooms sport multimedia technology, and wireless keyboards allow student engagement in class. The Department also has a multi-purpose classroom, which is also used by the Art Department.

## WEAKNESSES

The Mathematics and Computer Science Department acknowledge weaknesses in the areas of planning, curriculum, research, interdisciplinary connections, and facilities.

The Department does not have a fixed planning cycle (sans its ten-year external review), so that planning is often reactive, rather than proactive.

Although the Department sees strengths in its curriculum, there are also conspicuous weaknesses. The introductory calculus courses are too narrowly focused to acquaint students with the breadth of mathematical thought. In addition, these courses do not specifically target students who may be potential majors or minors, since we no longer have an “honors” calculus course for advanced first-year students. Potential computer science majors may not take the introductory sequence early enough in their college career. The Department recognizes a deficiency in the sequencing of the middle-level mathematics courses; students may delay taking one or more of these courses, hampering their success in upper-level courses. The Department does not always take full advantage of its collegiality by sharing resources over multi-sectioned courses. Although the mathematics major has flexibility in the coursework, there still is some overlap in the tracks for graduate school and employment, short-changing students in their career path. Currently, the Department is under-staffed in Computer Science, creating a strain in course offerings in that major.

The Department has not taken full advantage of developing interdisciplinary connections both within and outside of the Department. There is no mechanism or process for connecting our three disciplines (mathematics, statistics, and computer science) for majors. Although interdisciplinary applications appear in many courses, this is not done with any regularity or intentionality. Across campus, the Department has not fully explored partnerships and relationships with client and allied disciplines, such as Economics and Biology.

The Department also admits to weaknesses in research. Faculty publication rate is low, and student-faculty research opportunities are not readily available, with the exception of the Honors thesis.

The Department employs students as tutors for the lower-level courses, but does not address students who need remediation. In addition, the Department does not have a formal structure to provide consulting and assistance to constituents on campus. The Department facilities also have some deficiencies. The classroom equipment is not always user-friendly, and there is no formal training or support to best use this equipment in teaching. The classroom equipment is also limited, with no access to newer, pedagogical technology such as smart boards and clickers. The laboratory computers do not have a fixed replacement cycle (partially due to the dysfunctional IIAC process), so the lab equipment is woefully inadequate. The Department technology is not integrated with the students’ technology, resulting in frustration and inefficiency. Although Olin

Hall is one of the newer buildings on campus, it is beginning to show its wear through aging carpets and out-dated, ineffective classroom furniture.

## OPPORTUNITIES

The Department recognizes opportunities in curriculum, interdisciplinary connections, and students.

The Department realizes that the strengths and weaknesses of its curriculum present substantial opportunities for curricular innovation and change. The professional associations have published curricular guidelines, and external funding may be available to support curricular change. In particular, the areas of statistics and actuarial science have substantially grown, both at Gustavus and in the world. The opportunity to develop majors in one or both of these areas would reap substantial rewards for students, the Department, the College, and our nation.

The Department anticipates greater collaboration with client disciplines, such as Economics, Biology, and Education. Opportunities include the creation of interdisciplinary majors or minors, cross-referencing of courses across disciplines, interdisciplinary course development, and interdisciplinary research programs.

The Department sees several opportunities related to students including increasing minority and under-represented students in our majors, programs for recruiting students for graduate schools, increasing our tutoring program beyond the Department, and increasing the number of majors due to the strong job market for those with strong analytical skills.

The Department also foresees opportunities with the new Federal administration, as well as in the areas of accountability and assessment.

## 2.2 Barriers

The Department identifies barriers (threats) in the areas of staffing, students, technology, the economy, and accountability and assessment.

In recent years, the Department has devoted a larger share of its resources to service courses, at the expense of upper-level courses. The increased enrollments of the College (with the exception of 2008-2009) and the addition of a mathematical and logical reasoning general education requirement have resulted in lower-level courses at or near capacity, without any additional staffing to the Department. Also, retirement patterns within the Department have been irregular, uneven, and unpredictable.

The Department has observed a slow, but subtle, shift in the mathematical background and abilities of students. Computer Science students may not be mathematical, and math anxiety appears to be increasing. Remediation requires resources that would otherwise be available to strengthen our existing programs.

Enrollment patterns are a concern. The college-age student population is declining, as well as the first-year student enrollment at Gustavus. The decline of computer science majors, both at Gustavus and (until last year) nationally, and the under-representation of women in computer science affect our enrollments and course offerings.

The Department is constrained by the lack of adequate and current technology. The College's process of obtaining equipment and software does not lend itself to our needs, nor is the funding for these items adequate. Because we do not have a system which funds replacements in a 3-5 year cycle, we continually limp along, barely making due with insufficient equipment. Our competitors have better technology, so it puts our department at a disadvantage for recruiting and retaining high quality students.

The Department is also highly affected by resource allocation at the Folke Bernadotte Memorial Library. Because the Department consists of three related disciplines, each of these disciplines has unique, although overlapping, resource needs. In particular, faculty research relies heavily on access to and the availability of a wide range of scholarly journals. When access to these journals is reduced, the Department members are disadvantaged in their research and in their teaching.

The current state of the national economy affects the College's resource availability and the student body. Students may choose public institutions over private because of cost, and students may not understand the value of a liberal arts education. The present economic conditions also affect potential sources of funding.

### **Section 3 Strategic Initiatives and Recommendations**

Goal 1: Develop a flexible palette of majors that reflects the twenty-first century view of the mathematical sciences as an integrative theme in a multidisciplinary environment.

Strategic Initiative 1.1: Develop a multidisciplinary major in Quantitative Sciences incorporating the three disciplines of mathematics, statistics, and computer science.

Strategic Initiative 1.2: Develop a major and a minor in Statistics, possibly with an interdisciplinary emphasis in a related discipline such as biology, psychology, economics, or political science, following the American Statistical Association recommendations.

Strategic Initiative 1.3: Assess and evaluate the current Mathematics major with regard to the curriculum guidelines issued by the Committee on the Undergraduate Program in Mathematics of the Mathematical Association of America.

Strategic Initiative 1.4: Consult with partner disciplines with an eye towards creating multidisciplinary majors and/or programs.

Tactic 1.4.1: Determine the interest in and the feasibility of a multidisciplinary major in Actuarial Science in partnership with the Department of Economics and Management.

Tactic 1.4.2: Determine the interest in and the feasibility of a multidisciplinary major in Mathematical Economics in partnership with the Department of Economics and Management.

Tactic 1.4.3: Determine the interest in and the feasibility of a multidisciplinary major in Mathematical and Computational Biology in partnership with the Department of Biology.

Tactic 1.4.4: Determine the interest in and the feasibility of a multidisciplinary major in Mathematical and Computational Physics in partnership with the Department of Physics.

Goal 2: Offer a more diverse and academically-stimulating exposure to mathematics, statistics, and computer science at the lower and middle levels.

Strategic Initiative 2.1: Form working groups in specific targeted areas to investigate alternative models for lower and middle level course offerings.

Tactic 2.1.1: Develop an introductory survey of mathematics course for students having a background in calculus.

Tactic 2.1.2: Examine alternative models of the introductory and mid-level computer science courses.

Goal 3: Expand computer science courses suited to multidisciplinary integration.

Strategic Initiative 3.1: Begin discussions with other disciplines to assess their computer science needs for their programs and course offerings.

Strategic Initiative 3.2: Conduct a summer workshop to identify innovative courses that although application-oriented could span multiple partner disciplines.

Goal 4: Provide opportunities and support for the development of faculty as teacher-scholars.

Strategic Initiative 4.1: Create a departmental journal club in which department members read and discuss current literature.

Strategic Initiative 4.2: Initiate a program of faculty development within the Department to provide mentoring to junior faculty and opportunities for faculty collaboration.

Goal 5: Strengthen student-faculty research.

Strategic Initiative 5.1: Establish a summer faculty research program to fund summer collaboration with students.

Strategic Initiative 5.2: Pursue ways to include student research supervision as part of faculty teaching load.

Goal 6: Enhance the utilization of technology and classroom space to support pedagogy.

Strategic Initiative 6.1: Use low-cost, highly portable netbook computers to enable students to conduct otherwise disruptive experiments and explorations with operating systems and networking technology.

Strategic Initiative 6.2: Design classrooms to include interactive technology (such as SmartBoards and clickers) and collaborative furnishings.

Strategic Initiative 6.3: Investigate ways of incorporating student-owned technology into current classrooms.

Strategic Initiative 6.4: Provide support for faculty in the use of technology (hardware and software), possibly through departmental seminars.

Goal 7: Cultivate alumni for recruiting and mentoring as role models.

Strategic Initiative 7.1: Resume the recently-dormant tradition of gathering alumni to discuss careers.

Strategic Initiative 7.2: Develop systems for tracking and maintaining communication with alumni.

Goal 8: Increase school and community based programs and partnerships.

Strategic Initiative 8.1: Survey nearby school districts regarding their needs.

Strategic Initiative 8.2: Develop a working relationship with the South Central Service Cooperative to provide service to local schools.

#### **Section 4      Assessment**

The Department intends to meet before the Fall 2009 semester begins to develop a timeline and benchmarks for implementing its Strategic Plan. Throughout the 2009-2010 academic year, the Department will schedule regular meetings for the express purpose of implementing its Strategic Plan and assessing its progress.