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I. ABOUT THE PROGRAM REVIEW

A. *Requirements for the Self Evaluation*

The intent of the departmental and program major review is to allow the academic departments or program committees responsible for the departmental or program majors of the University to clarify (in such a way as to be understood by other faculty and the Academic Affairs Council) the purpose, the curricular requirements, the effectiveness, and the institutional resources that support the major, as well as contributions to the General Education Requirements of the University¹.

Current policy, not yet reflected in the *Faculty Handbook*, requires submission of the Program Evaluation to the Assessment Committee, including a specific format of our assessment grid.

For additional detail on requirements, see Appendix IV.

B. *Terms*²

The phrase “mathematical and computational sciences” refers to a collection of related disciplines, including, but not limited to, pure and applied mathematics, mathematics education, computer science, computational mathematics, operations research, and statistics.

"Partner disciplines" are those with majors required to take at least one specific course within the Department.

"Alternate required" refers to a group of courses, one of which is required. "Alternate 1" and "Alternate 2" are used to indicate separate groups of courses, one of which is required from each group.

C. *National Standards*

Two main documents have been used both to guide change and evaluate our program: *CUPM Curriculum Guide 2004: Undergraduate Programs and Courses in the Mathematical Sciences*, which was used in draft form beginning in F01, and *Computing Curricula 2001 Computer Science*. The latter was used extensively to guide the changes in the Computer Science Curriculum. The former was used primarily at the time of this major review to evaluate what had been done. .

The CUPM Guide contains a list of recommendations, most of which apply to all of the mathematical sciences. They are listed below, since they articulate the main goals of the Department well, and provide the rationale for much of this document.

CUPM Recommendation 1: Mathematical sciences departments should •Understand the strengths, weaknesses, career plans, fields of study, and aspirations of the students enrolled in mathematics courses; •Determine the extent to which the goals of courses and programs offered are aligned with the needs of students as well as the extent to which these goals are achieved;

¹ 2004-05 *Faculty Handbook*

² Some terms adapted from *CUPM Curriculum Guide 2004*.

- Continually strengthen courses and programs to better align with student needs, and assess the effectiveness of such efforts.

CUPM Recommendation 2: Every course should incorporate activities that will help all students progress in developing analytical, critical reasoning, problem-solving, and communication skills and acquiring mathematical habits of mind. More specifically, these activities should be designed to advance and measure students' progress in learning to

- State problems carefully, modify problems when necessary to make them tractable, articulate assumptions, appreciate the value of precise definition, reason logically to conclusions, and interpret results intelligently;
- Approach problem solving with a willingness to try multiple approaches, persist in the face of difficulties, assess the correctness of solutions, explore examples, pose questions, and devise and test conjectures;
- Read mathematics with understanding and communicate mathematical ideas with clarity and coherence through writing and speaking.

CUPM Recommendation 3: Every course should strive to

- Present key ideas and concepts from a variety of perspectives;
- Employ a broad range of examples and applications to motivate and illustrate the material;
- Promote awareness of connections to other subjects (both in and out of the mathematical sciences) and strengthen each student's ability to apply the course material to these subjects;
- Introduce contemporary topics from the mathematical sciences and their applications, and enhance student perceptions of the vitality and importance of mathematics in the modern world.

CUPM Recommendation 4: Mathematical sciences departments should encourage and support faculty collaboration with colleagues from other departments to modify and develop mathematics courses, create joint or cooperative majors, devise undergraduate research projects, and possibly team-teach courses or units within courses.

CUPM Recommendation 5: At every level of the curriculum, some courses should incorporate activities that will help all students progress in learning to use technology

- Appropriately and effectively as a tool for solving problems;
- As an aid to understanding mathematical ideas.

CUPM Recommendation 6: Mathematical sciences departments and institutional administrators should encourage, support and reward faculty efforts to improve the efficacy of teaching and strengthen curricula.

D. Overview of the Document

This document intends to explain, provide evidence, and evaluate current practice and to reflect on how we have changed and how we might continue to improve. In this document as in our teaching, we provide multiple representations of information (description, tables, graphs) to increase clarity.

Following a section describing recent assessment efforts, facts regarding the current program are discussed: how the Mathematics and Computer Science courses count for various degrees, pre-requisite structures, frequency of offerings, enrollment data, and a description of enrollment management. Next, program enhancements are described, supported with data: supplemental courses, student organizations, invited speakers, student research and conference activities, tutoring, and contests. Advising and mentoring are followed by curriculum changes

from the 1993-94 program. Description and data for alternative credits (primarily advanced placement and transfers) are followed by detailed student information including student success data and profiles of degree recipients. In addition, we discuss several assessment tools that do not depend upon course grades. A thorough analysis of staffing is dealt with, followed by a discussion of other resources – facilities, technology and equipment, library, and budget. Finally, we provide a self evaluation of the program, a comparison to national standards, and an indication of possible improvements. Additional detail on selected items are included in the Appendices. Also in the Appendices are a description of data requests and manipulation.

E. Review Committee and Support Crew

Table: Members other than Department Faculty

<i>Member</i>	<i>Role</i>	<i>Info</i>
Jim Hunt	Provost	
Hilari Tiedeman Morgan Sweatt	student member	
Don Parks	University faculty member from outside of the department	Associate Professor of Business in the Department of Economics and Business holder of the John Shearn Chair in Business Administration SU 1994
Henry Walker	Outside consultant	Grinnell College, Grinnell, Iowa Samuel R. and Marie-Louise Rosenthal Professor of Natural Science and Mathematics Department of Mathematics and Computer Science

The following have provided help in the Review Process.

Table: Others Contributing to the Review Process

<i>Person</i>	<i>Role</i>	<i>Info</i>
Amy Anderson	evaluated library holdings	Library
Dave Stones	helped with and approved data requests	Registrar
Paige Bonner	helped with understanding and checking variations in data, especially AP and transfers; provided old catalogs	Registrar's Office
Debbie Sanderfer	helped with understanding and checking variations in data, especially AP and transfers	Registrar's Office
Jennifer O'Daniel	helped with formulating data requests, checking discrepancies	Academic Computing
Laura Gerlinger Gatlin	gathered all the data and submitted files to Shelton; worked extensively	Academic Computing
Arden Baxter	document polishing, coordinated reviewer visit	Faculty Secretary
Dianne Sprock	provided information	Program Assistant, Provost Office
Stephanie Fabritius	provided information and guidance	Associate Provost
Julie Cowley	provided general information on program review	Associate Vice President for Academic Administration, Provost Office

In the following Table, each tenure track member of the Department is briefly described.

Table: Department Faculty Members

<i>Member</i>	<i>Role</i>	<i>SU Info</i>	<i>Education</i>
John Chapman	Mathematics auxiliary member MAA Prep Assessment team	Professor holder of the Jesse H. and Mary Gibbs Jones Professorship in Mathematics Paideia Professor SU 1966 former Dept chair prior to 99	PhD University of Texas at Austin MS University of North Texas BS Baylor University
Gary Richter	Mathematics	Associate Professor SU 1977 former Dept chair 00-02	PhD University of Texas at Austin MS University of Houston BA University of Texas at Austin
Rick Denman	Mathematics and Computer Science member MAA Prep Assessment team	Associate Professor SU 1981	MA, PhD University of Texas at Austin BA, MS Texas Tech University
Therese Shelton	Mathematics member MAA Prep Assessment team primary writer and editor of review	Department Chair 2002-present Associate Professor SU 1987	MS, PhD Clemson University BS Texas A&M
Walt Potter	Mathematics and Computer Science auxiliary member MAA Prep Assessment team	Professor holder of the Lord Chair in Computer Science SU 1988	MA, PhD University of Wisconsin at Madison BA University of Washington
Kendall Richards	Mathematics	Professor SU 1991 former Dept chair 99-00	PhD Texas Tech University BS, MA Eastern New Mexico University
Barbara Owens	Computer Science auxiliary member MAA Prep Assessment team	Associate Professor SU 1999	PhD New York University MA University of Texas at Austin BA Ohio Wesleyan University
Suzanne Buchele	Computer Science	Assistant Professor SU 1998 Paideia Professor	MA, MS, PhD University of Texas at Austin BA Connecticut College
Cami Sawyer	Mathematics	Assistant Professor SU 2000	MA, PhD University of North Texas BA Southwestern University

F. Evolution of our Assessment Efforts

The Department's last major program review was submitted in March 1994. An update was submitted in January 2001. The standards for assessment have changed dramatically in recent years,

Southwestern University revised formal assessment methods after a Southern Association Accreditation of Colleges and Schools (SACS) visit. SACS made recommendations to the

Institution, whose response was due September 1, 2002. SU administration required a specific format annually.

The following description provides an overview of recent “phases” of assessment efforts. Some are sequential; others overlap in time. Clearly, our department has made concerted efforts in this area.

Phase I: Mission statement, goals, learning outcomes

- June 2002 Some university department chairs met with Dr. Linda Salane, Vice President for Strategic Planning and Assessment at Columbia College. Dr. Salane had been invited by Southwestern. Shelton, upcoming department chair in Math and Computer Science, attended. Departments were expected to formulate a set of up to 6 learning outcomes and, for each outcome, several measurements.
- August 2002 As part of our Fall Faculty Conference, our Department hammered out the two-column grid of outcomes and measurements, knowing more was to come later. We worked mainly on the majors, using two national guides: a draft version of *CUPM Curriculum Guide 2004: Undergraduate Programs and Courses in the Mathematical Sciences* and *Computing Curricula 2001 Computer Science*. We submitted the resulting grid to the Provost.

Phase II: Assessment mechanisms

- Fall 2002, Spring 2003
 - Not having received any feedback on previous work, the Department was charged with expanding the previous grid into a new five-column grid format, adding assessment mechanisms, assessment results, and department improvements to the previous version. Beginning with the first two columns in place, we focused on the third column, leaving places for the others. Department members shared ideas, debated, and created a new draft that had vaguely stated mechanisms, still mainly for the majors. We revised some of the wording from the previous version after debating what we had meant. We also submitted a tentative timeline for assessment activities, as required.
 - The Institution had administered a survey to all its faculty assessing General Education, so Shelton mimicked this and created a survey of the Natural Science Division faculty, asking for their general assessment of students' math and computer science mastery. This possible assessment method was included in our March draft of the revised grid that was sent to the Provost, and he liked it. However, after deliberation and attempts to modify it, this possible assessment method was abandoned and removed from the June report. Faculty could not agree on what was being assessed or how the results would be used.
 - The Department agreed to use the results of the Departmental Online Alumni Survey found at <http://csmath.southwestern.edu/alumn-form.html>. We were glad that one of our faculty members had set this up a few years before. We were also aware of the bias inherent in such a voluntary survey. The survey was based on a draft of the national *CUPM Guide*.
 - The Department decided, after much debate and review of materials, to include the occasional use of the MFAT, a standardized test for senior undergraduates from ETS. This was administered to the Math and Computer Science capstone students, who were encouraged to perform well since an adjusted score counted as part of their course grade.

- June 2003 Shelton submitted a draft of the assessment grid with the first three columns filled in, including target percentages. The department had debated these percentages and finally decided that we would establish minimum percentages necessary to meet expectation. Understanding the variations inherent with such a small number of majors.

Phase III: Assessment results and department improvements

- Summer 2003 Shelton analyzed data from our Departmental Online Alumni Survey. From this analysis and the MFAT results, Shelton filled in parts of the last two columns in a five-column grid, which the department checked. This new draft of the assessment grid was submitted to the Provost.

Phase IV: Department Discussions

- Fall 2003 and beyond
 - Shelton had difficulty assigning transfer credit because of the variation in our own classes, and she wondered what core topics should be. Shelton had fielded a few complaints from students, faculty within the department, and other faculty on campus about what was or was not taught in a variety of classes. The department had been aware of variations, especially in the courses taught by adjuncts, and there would now be 15-20% of our classes taught by adjuncts because of additional faculty releases. Shelton felt she lacked sufficient guidance for our adjuncts about what text to use or what topics to cover. While none of this was new, Shelton appealed to the department for help, believing that tackling these issues would aid us in our ongoing assessment and upcoming ten-year departmental review. Departmental discussion was quite revealing and informative.
 - We decided to formulate a list of topics that must be covered in certain classes, providing a benchmark by which to measure ourselves. This process also should aid us in better articulating our goals and learning outcomes. Now we have drafts of topic lists for three of the nine targeted courses.

Phase V: National and internal feedback on assessment

- January 2004
 - At the Joint National Meetings, Shelton participated in the MAA minicourse "Assessment at the Departmental Level," which required reading assessment articles. (She had prepared by reading the suggested articles.) It became evident that our one goal seemed more like a mission statement, our learning outcomes were really goals, and we had no learning outcomes.
 - At the end of the month, Shelton met with a representative of the Institution's Assessment Committee and received similar feedback. The Committee recommended changing the percentages, perhaps to indicate levels (at least 90% good, at least 5% excellent, etc.) to be levels we would like to achieve rather than minimal levels.

Phase VI : National guidelines for assessment

- Two documents have been used both to guide curriculum changes and to evaluate our program: *CUPM Curriculum Guide 2004: Undergraduate Programs and Courses in the Mathematical Sciences*, which was used in draft form beginning in F01, and

Computing Curricula 2001 Computer Science. In addition, faculty have read current literature and participated in national workshops, panels, and focus groups on curriculum and on assessment.

- In February 2004, the Department submitted an application to be included in "Assessing the Undergraduate Program in Mathematics", a three-year series of workshops through the Mathematical Association of America (MAA). The project is funded from MAA PREP, The Professional Enhancement Program and MAA SAUM, Supporting Assessment in Undergraduate Mathematics Project, with multiple National Science Foundation Grants. Additional funding was required from the institution and was provided by the Office of the Provost and by the Department.
 - ❖ Shelton attended the first Workshop in March 2004. She wrote the preparatory document, essentially Phases I-V above, prior to attendance. During the workshop, she wrote a tentative plan for assessment during the upcoming year. After the workshop, Shelton informed the Department of the workshop findings, shared the tentative plan, and received feedback.
 - ❖ Shelton submitted the required progress report to the Workshop Committee in December 2004. Shelton and Denman attended the second Workshop in January 2005. They received additional ideas and suggestions, such as good ways to maintain and use portfolios for individual students and for individual courses.
 - ❖ Shelton was accepted to serve on a national panel on assessment at the Joint National Mathematics Meetings in January 2005, largely because of the good progress the Department had made in assessment. They hosted a departmental discussion upon return.
 - ❖ The third PREP Workshop will be in January 2006.

Phase VII : Major program review Fall 2004-Fall 2005.

- Shelton organized the data and prepared a draft of the current document, the major program review.
- Shelton met with Associate Provost Fabritius early in F04. Fabritius approved of the plans to use the *CUPM Guide* document, sample survey questions.
- The Department met multiple times in Fall 2004 and Spring 2005 to discuss assessment and the program review. During finals week in December 2004, the Department held an extensive assessment meeting, discussing recommendations and suggested survey questions from the *CUPM Guide*. Many of the results are included in the following subsections.
- Shelton met with Fabritius again early in S05. Fabritius approved of the draft but emphasized the need to include "the grid" and think of how to revise it to continue improvements.
- The outside reviewer is scheduled to visit in March 2005.
- The Department's response to the reviewer's report is due Fall 2005.

II. OUR COURSES - Requirements, Recommendation, Electives Across SU

This section reflects the current curriculum based on the *2004-05 Course Catalog*. Changes in and evaluation of the curriculum are discussed elsewhere. For convenience, the current course descriptions are also included in Appendix II. For the ease of data presentation, the cross listed courses within the program are only listed within Computer Science: Introduction to Numerical Analysis and Discrete Mathematics. We have been moving toward a course numbering system that corresponds to course level. (There are some exceptions.)

A. Guiding Principles

The Department has the same primary objective for all of its constituents. "Mathematics and Computer Science courses help students develop concise and logical patterns of thinking and encourage independent and creative work. The Department seeks to develop in students an understanding of mathematical models and a facility with problem-solving techniques³."

The Department has sought a balance in the curriculum, appropriate to our resources and the size and character of the institution, that serves our three majors and two minors, five other academic programs within our Division, programs outside of our Division, and the General Education Mathematics requirement for the academic programs with no specific requirement.

The Department regularly engages in curriculum review and revision, especially for our majors. The Computer Science curriculum has undergone the greatest revision, which is appropriate considering the dynamic nature of the discipline and the additional faculty resources in that area.

We do not offer "tracks" in our curriculum, and the Provost supports this decision. For instance, anyone who takes Calculus I enrolls in the same course; we do not have a separate Business Calculus, nor do we offer multiple flavors of Statistics. This eliminates the problem with students having to retake a course if they change majors and makes the best use of our faculty resources.

B. Requirements for Majors and Minors in the Department⁴

The Department offers the following three majors leading to either the Bachelor of Science or the Bachelor of Arts degree: Mathematics, Computer Science, and Computational Mathematics. The Department offers a minor in Mathematics and in Computer Science. The Department supports a teaching field in Mathematics, an elementary academic specialization in Mathematics, and a teaching field in Computer Science.

The **major in Mathematics** requires 34 semester hours in Mathematics and must include 52-154 Calculus I, 52-253 Calculus II, 52-353 Calculus III, 52-673 Linear Algebra, 52-683 Algebraic Structures I, 52-753 Elementary Differential Equations, 52-853 Introductory Analysis, 52-893 Senior Seminar in Mathematical Modeling, and three additional mathematics courses at the 300-level or above, including at least one from 52-693 Algebraic Structures II, 52-763 Intermediate Differential Equations, 52-863 Complex Analysis, 52-883 Topology. The major in Mathematics also requires at least one computer science course at the 100-level or above,

³ 2004-05 *Catalog*, p95. Also our Mission Statement in the Assessment Grid.

⁴ The first three paragraphs are direct quotes from the *Catalog*. The next two are paraphrased from the *Catalog*. The remainder is a description of current practice.

preferably to be completed no later than the sophomore year. The **minor in Mathematics** must include 52-154 Calculus I, 52-253 Calculus II, 52-353 Calculus III, 52-673 Linear Algebra, and two Mathematics courses at the 200-level or above.

The **major in Computer Science** requires 33 semester hours in Computer Science and must include 54-183 Computer Science I, 54-283 Computer Science II, 54-383 Discrete Mathematics, 54-393 Computer Organization, 54-453 Algorithms, 54-473 Programming Languages, 54-643 Computer Systems, 54-893 Senior Seminar in Software Engineering, and four additional Computer Science courses at the 300-level or above. The major in Computer Science also requires 52-154 Calculus I, 52-253 Calculus II, and 52-673 Linear Algebra. The **minor in Computer Science** requires 18 semester hours in Computer Science, of which 12 must be at the 200 level or above.

The **Computational Mathematics major** is designed to provide students with a foundational mastery of the interdependent disciplines of Mathematics and Computer Science. The curriculum is a blend of core courses intended to provide a broad knowledge base while maintaining depth in both subject areas. The major in Computational Mathematics requires 48 semester hours and must include 54-183 Computer Science I, 54-283 Computer Science II, 54-383 Discrete Mathematics, 54-393 Computer Organization, 54-453 Algorithms, 54-473 Programming Languages, 54-643 Computer Systems, 52-154 Calculus I, 52-253 Calculus II, 52-353 Calculus III, 52-523 Introduction to Numerical Analysis, 52-673 Linear Algebra, 52-753 Elementary Differential Equations; the capstone (either 52-893 Senior Seminar in Mathematical Modeling or 54-893 Senior Seminar in Software Engineering); at least one course from 52-683 Algebraic Structures I, or 52-853 Introductory Analysis.

Note: A minimum grade of C- must be earned in any course if it is to count as a prerequisite for a subsequent Mathematics or Computer Science course.

All majors in the department are required to successfully complete the designated senior seminar in their respective majors or to carry out a Department-approved senior project to satisfy the capstone-experience requirement. See Appendix IV for the Catalog description of Southwestern's Capstone requirement.

All students in recent Capstone courses in our Department complete a research project.

In Computer Science, students work in groups to design a software product for a client. For instance, in S02, Buchele guided three students in creating a "course delivery system" for ACS to create and deliver consortium inter-institutional collaborative courses (ICC's), such as the spring Archaeology Practicum. The students went on to complete the software during the first ACS Software Engineering Internship, discussed more fully elsewhere.

In S03, Owens coached the students to develop a computerized alcohol education game customized for the SU community and available from any campus computer. The game covers a broad cross-section of information about alcohol -- physiological effects, social norms, laws & penalties, expectancies & myths, moderation strategies, and risks like alcohol poisoning, sexual assault, unprotected sex, drunk driving, academic consequences, etc.

In Mathematics, students work on a mathematical model, sometimes an implementation of an existing model but often of their own creation. For instance, students fitted tide data using Fourier analysis, modeled collisions with three billiard balls, statistically analyzed manatee injuries or deaths against human interactions, considered the aging of Europe, and more. Students are required to choose their own topic, and the faculty member serves as a research advisor. Some have presented their project at a conference. Richards taught this course once; otherwise Shelton has taught the modeling capstone.

Table: Courses Contributing to Departmental Majors and Minors

No specific course is required for the Computer Science Minor.

The Computational Math Major requires three other upper level Computer Science courses, and the Math minor requires two other courses. Students not prepared for Calculus should take Elementary Function Theory, but that situation is rare.

COURSE (unless otherwise specified, courses are 3 credit hours)	Math Major	CS Major	Computational Math Major	Math Minor
Calculus I (4 hr)	required	required	required	required
Calculus II	required	required	required	required
Calculus III	required		required	required
Linear Algebra	required	required		required
Algebraic Structures I	required		alternate 2 required	elective
Introductory Analysis	required		alternate 2 required	elective
Elementary Differential Equations	required		required	elective
Algebraic Structures II	alternate 1 required			elective
Complex Analysis	alternate 1 required			elective
Intermediate Differential Equations	alternate 1 required			elective
Probability	elective		elective	elective
Geometry	elective		elective	elective
Topology	alternate 1 required		elective	elective
Senior Seminar in Mathematical Modeling	required		alternate 1 required	
Discrete Mathematics	elective	required	required	elective
Introduction to Numerical Analysis	elective	elective	required	elective
Introduction to Programming	alternate 2 required			
Computer Science I	alternate 2 required	required	required	
Computer Science II		required	required	
Seminar in Elementary Software Engineering (1 hr)		elective	elective	
Computer Organization		required	required	
Algorithms		required	required	
Programming Languages		required	required	
Database Management		elective	elective	
Functional Programming		elective	elective	
Computer Graphics		elective	elective	
Artificial Intelligence		elective	elective	
Computer Architecture		elective	elective	
Computer Systems		required	required	
Theory of Computation		elective	elective	
Senior Seminar in Software Engineering		required	alternate 1 required	

C. Partner Disciplines in the Natural Science Division⁵

Students receiving a Bachelor of Science degree must take Calculus I. Students who are unprepared for Calculus I should first take Elementary Function Theory. They must also choose from Calculus II, Introduction to Statistics, Introduction to Programming, or Computer Science I. In addition, the student must take an approved science elective which should be outside of their Major department. In our department, these are Calculus III, Elementary Differential Equations, Linear Algebra, Computer Science I, and Computer Science II.

The Bachelor of Arts degree in Biology requires either Introduction to Statistics or Calculus I.

Physics requires Calculus I, which is a pre-requisite for Fundamentals of Physics I; Calculus II, which is a pre-requisite for any "Level II" Physics course; Calculus III, which is a pre-requisite for any "Level III" Physics course; and Elementary Differential Equations, which is a co-requisite or pre-requisite for Classical Mechanics I. Linear Algebra is a pre-requisite for Elementary Differential Equations. Thus, the Physics Major who takes one more math course has a Minor in Mathematics.

The Bachelor of Arts degree in Physical Science is also known as the Dual Degree (informally known as the 3-2 Engineering Degree); the requirements are almost identical to those of Physics. This degree requires Calculus I, which is a pre-requisite for Fundamentals of Physics I; Calculus II, which is a pre-requisite for any "Level II" Physics course; Calculus III, which is a pre-requisite for any "Level III" Physics course; Linear Algebra; and Elementary Differential Equations, which is a co-requisite or pre-requisite for Classical Mechanics I. Linear Algebra is a pre-requisite for Elementary Differential Equations. In addition, either Introduction to Programming or Computer Science I is required. Thus, the Physics Major who takes one more math course has a Minor in Mathematics.

All majors and minors in Chemistry or Biochemistry must take Calculus I and II, which are a pre-requisites for Physical Chemistry I. Calculus III is recommended for Physical Chemistry I and is required for the American Chemical Society certified degree. Elementary Differential Equations is recommended for Physical Chemistry I and is required for Advanced Physical Chemistry; both Physical Chemistry I and Advanced Physical Chemistry are required for the American Chemical Society certified degree.

⁵ paraphrased from the 2004-05 *Catalog*.

Table: Courses contributing to Majors and Minors elsewhere in the Natural Science Division

The BS degree requires an "approved science elective", which need not be math; possibilities are indicated below as "elective." Physics requires three other advanced math courses.

	BS degree	Physics	Physical Science (3-2 Engineering Dual Degree; BA)	Chemistry and Biochemistry	Biology - BA
Introduction to Statistics	alternate 1 required				alternate required
Elementary Function Theory	refresher for Calculus I				
Calculus I	required	required and pre-req	required and pre-req	required and pre-req	alternate required
Calculus II	alternate 1 required	required and pre-req	required and pre-req	required and pre-req for one track	
Calculus III	elective	required and pre-req	req and co- or pre-req	required and pre-req for one track	
Linear Algebra	elective	required as pre-req for Elem. DE	required	required as pre-req for Elem. DE	
Elementary Differential Equations		required; also co- or pre-req	required; also co- or pre-req	alternate recommended pre-req for a required course for some tracks; required pre-req for ACS certified degree	
Probability	elective				
Introduction to Programming	alternate 2 required		alternate required		
Computer Science I	alternate 2 required, and approved elective		alternate required		
Computer Science II	elective				

D. Education of Prospective Teachers⁶

A **teaching field in Mathematics** requires 24 semester hours, at least 12 of which must be advanced. The 24 hours must include 52-113 Introduction to Statistics, 52-154 Calculus I, 52-253 Calculus II, 52-403 Geometry, 52-673 Linear Algebra, and 52-683 Algebraic Structures I. The additional six hours would generally be selected from 52-173 Mathematical Modeling, 52-353 Calculus III, 52-573 Probability, 52-693 Algebraic Structures II, or 52-843 Seminar in Special Topics.

An **elementary academic specialization in Mathematics** requires 18 semester hours with at least nine advanced. Required courses are 52-103 Mathematical Concepts, 52-113 Introduction

⁶ The first three parts below are taken directly from the 2004-05 *Catalog*; most of the rest is paraphrased from the *Catalog*. Some clarifying details have been added.

to Statistics, 52-154 Calculus I, and 52-673 Linear Algebra with two courses from 52-123 Elementary Function Theory, 52-173 Mathematical Modeling, 52-253 Calculus II, 52-403 Geometry, and 52-683 Algebraic Structures I recommended as the additional six semester hours.

A **teaching field in Computer Science** requires 24 semester hours, at least 12 of which must be advanced. The 24 hours must include must include 54-143 Introduction to Programming, 54-183 Computer Science I, 54-283 Computer Science I, 54-393 Computer Organization, 54-453 Algorithms and 54-473 Programming Languages.

There is also an Elementary Academic Specialization in a combination of math and science.

The course Teaching Mathematics and Science in Elementary School II has a pre-requisite of a math or science elective beyond the General Education requirement.

The "teaching field" is primarily for those who will teach high school. An "elementary academic specialization" is primarily for those who will teach grades 4-8 and wish to specialize.

Table: Courses contributing to Education in Mathematics

Some electives would also require some Computer Science Courses.

COURSE	Teaching Field in Math (24 hrs with 12 advanced)	Elementary Academic Specialization in Math (18 hrs with 9 advanced)
Mathematical Concepts	elective	required
Introduction to Statistics	required	required
Elementary Function Theory	elective	alternate required
Mathematical Modeling	recommended	alternate required
Calculus I	required	required
Calculus II	required	required as pre-req for Linear Algebra
Calculus III	recommended	elective
Linear Algebra	required	required
Algebraic Structures I	required	alternate required
Algebraic Structures II	recommended	elective
Probability	recommended	elective
Geometry	required	alternate required
Special Topics Math	recommended	elective
Introductory Analysis	elective	elective
Elementary Differential Equations	elective	elective
Algebraic Structures II	elective	elective
Complex Analysis	elective	elective
Intermediate Differential Equations	elective	elective
Topology	elective	elective
Discrete Mathematics	elective	elective
Introduction to Numerical Analysis	elective	elective
Senior Seminar in Mathematical Modeling	elective	elective

Table: Courses contributing to Education in Computer Science

Of the 24 hours required, 12 must be advanced. Several of the electives would require multiple Mathematics courses.

COURSE	Teaching Field in Computer Science
Introduction to Programming	required
Computer Science I	required
Computer Science II	required
Computer Organization	required
Algorithms	required
Programming Languages	required
Database Management	elective
Functional Programming	elective
Computer Graphics	elective
Artificial Intelligence	elective
Computer Architecture	elective
Computer Systems	elective
Theory of Computation	elective
Discrete Mathematics	elective
Introduction to Numerical Analysis	elective
Senior Seminar in Software Engineering	elective

E. Specific Course Requirements in Other Areas⁷

Introduction to Statistics is required for degrees in Environmental Studies, Psychology, Business, Economics, Accounting, Sociology, Animal Behavior, and Feminist Studies. Introduction to Statistics is a pre-requisite for Research Methods and Psychological Testing in Psychology; Finance in Business; and Research Methods in Economics, Sociology, and Feminist Studies. Although not listed in the Catalog for Political Science, Introduction to Statistics is highly recommended verbally to students⁸.

Calculus I is required for Business, Economics, and Accounting majors. Calculus I is recommended for Animal Behavior⁹. Those not ready for Calculus I should take Elementary Function Theory.

When Mathematical Modeling had decent enrollments, it served the Environmental Studies Program as an elective.

⁷ Most of the following is paraphrased from the *Catalog*.

⁸ From F04 discussion by chairs.

⁹ In S05, proposals for catalog changes for Psychology and Animal Behavior include the addition of a BS degree, which would require Calculus I.

F. General Education¹⁰

Currently, the Department is solely responsible for courses which satisfy the General Education requirement in Mathematics. Every student must take a Mathematics or Computer Science course here, have a transfer course approved, or receive AP credit. Prior to Fall 2002, students could receive an exemption through sufficiently high scores on the SAT or ACT. At the time it was estimated that 30 students a year were exempt.

In support of a liberal arts setting, we regularly offer thirteen to fifteen sections of four courses appropriate for any student with an adequate high school background: Mathematical Concepts, Introduction to Statistics, and Elementary Function Theory, and Introduction to Programming. Well-prepared students sometimes take Calculus I, Calculus II, or Computer Science I as their only course; we offer twelve of sections of these courses each year. Under prepared students who need Elementary Function Theory are expected to take a remedial course elsewhere.

Programs which have no specific Mathematics or Computer Science requirement are: American Studies, Art, Classics, Communication Studies, English, History, International Studies, Kinesiology, Modern Languages and Literatures, Music, Religion and Philosophy, and Theater.

Extra efforts have been made recently to inform advisors of students' options and guidelines for choices. For instance, the chair has sent memos by email to advisors, and recently two of our faculty spoke at a campus advising workshop.

Students who need algebra, trig, logs, and exponentials should take Elementary Function Theory. Anyone is allowed to take this course. Students who do not need this course or data analysis should consider the more generic Mathematical Concepts. Introduction to Programming has recently been revised to be more appealing to a general audience. Advising is discussed in greater detail elsewhere.

¹⁰ The first two sentences are paraphrased from the *Catalog*. The rest is a description of current practice.

G. Program Support, by Course

Table: Mathematics Support of SU Programs, by Course

All courses except Calculus I are 3 credit hours. All courses support the General Education requirement, but the ones listed below are the primary ones used. No distinction is made here between required, recommended, or elective.

COURSE	PROGRAMS SUPPORTED
Mathematical Concepts	General Education, Education (K-12)
Introduction to Statistics	General Education, Education, Biology, all BS degrees, Environmental Studies, Psychology, Sociology, Animal Behavior, Political Science, Feminist Studies, Business, Economics, Accounting.
Mathematical Modeling	General Education, Education
Elementary Function Theory	General Education, Education, refresher for those taking Calculus I
Calculus I (4 hr)	Mathematics, Computer Science, Computational Mathematics, Biology, Chemistry and Biochemistry, Physics, 3-2 Engineering, all BS degrees, Education, Business, Economics, Accounting, Animal Behavior
Calculus II	Mathematics, Computer Science, Computational Mathematics, Chemistry and Biochemistry, Physics, 3-2 Engineering, all BS degrees, Education
Calculus III	Mathematics, Computational Mathematics, Chemistry and Biochemistry, Physics, 3-2 Engineering, all BS degrees, Education
Linear Algebra	Mathematics, Computer Science, Computational Mathematics, Chemistry and Biochemistry, Physics, 3-2 Engineering, all BS degrees, Education
Algebraic Structures I	Mathematics, Computational Mathematics, Education
Introductory Analysis	Mathematics, Computational Mathematics, Education
Elementary Differential Equations	Mathematics, Computational Mathematics, Chemistry and Biochemistry, Physics, 3-2 Engineering, Education
Algebraic Structures II	Mathematics, Education
Complex Analysis	Mathematics, Education
Intermediate Differential Equations	Mathematics, Physics, 3-2 Engineering, Education
Probability	Mathematics, Computational Mathematics, all BS degrees, Education
Geometry	Mathematics, Computational Mathematics, Education
Topology	Mathematics, Computational Mathematics, Education
Senior Seminar in Mathematical Modeling	Mathematics, Computational Mathematics, Education

Table: Computer Science Support of SU Programs, by Course

All but 2 courses are 3 credit hours. All courses support the General Education requirement, but the ones listed below are the primary ones used. No distinction is made here between required, recommended, or elective.

COURSE	PROGRAMS SUPPORTED
Introduction to Programming	Computer Science, Computational Mathematics, Mathematics, General Education, 3-2 Engineering, all BS degrees, Education (K-12)
Computer Science I	Computer Science, Computational Mathematics, Mathematics, 3-2 Engineering, all BS degrees, Education
Computer Science II	Computer Science, Computational Mathematics, all BS degrees, Education
Seminar in Elementary Software Engineering (1 hr)	Computer Science, Computational Mathematics
Rapid Application Development (1 hr)	Computer Science, Computational Mathematics
Computer Organization	Computer Science, Computational Mathematics
Algorithms	Computer Science, Computational Mathematics, Education
Programming Languages	Computer Science, Computational Mathematics, Education
Database Management	Computer Science, Computational Mathematics, Education
Functional Programming	Computer Science, Computational Mathematics, Education
Computer Graphics	Computer Science, Computational Mathematics, Education
Artificial Intelligence	Computer Science, Computational Mathematics, Education
Computer Architecture	Computer Science, Computational Mathematics, Education
Computer Systems	Computer Science, Computational Mathematics, Education
Theory of Computation	Computer Science, Computational Mathematics, Education
Discrete Mathematics	Computer Science, Computational Mathematics, Mathematics, Education
Introduction to Numerical Analysis	Computer Science, Computational Mathematics, Mathematics, Education
Senior Seminar in Software Engineering	Computer Science, Computational Mathematics, Education

III. OUR COURSES - Descriptions and Structure

See the Appendices for current course descriptions.

A. Courses with no pre-requisites

The following courses have no pre-requisites other than a good high school background: Mathematical Concepts, Introduction to Statistics, Elementary Function Theory, Calculus I, Mathematical Modeling, Geometry, Introduction to Programming.

B. Pre-requisites

Figure: Mathematics Pre-requisite Structure

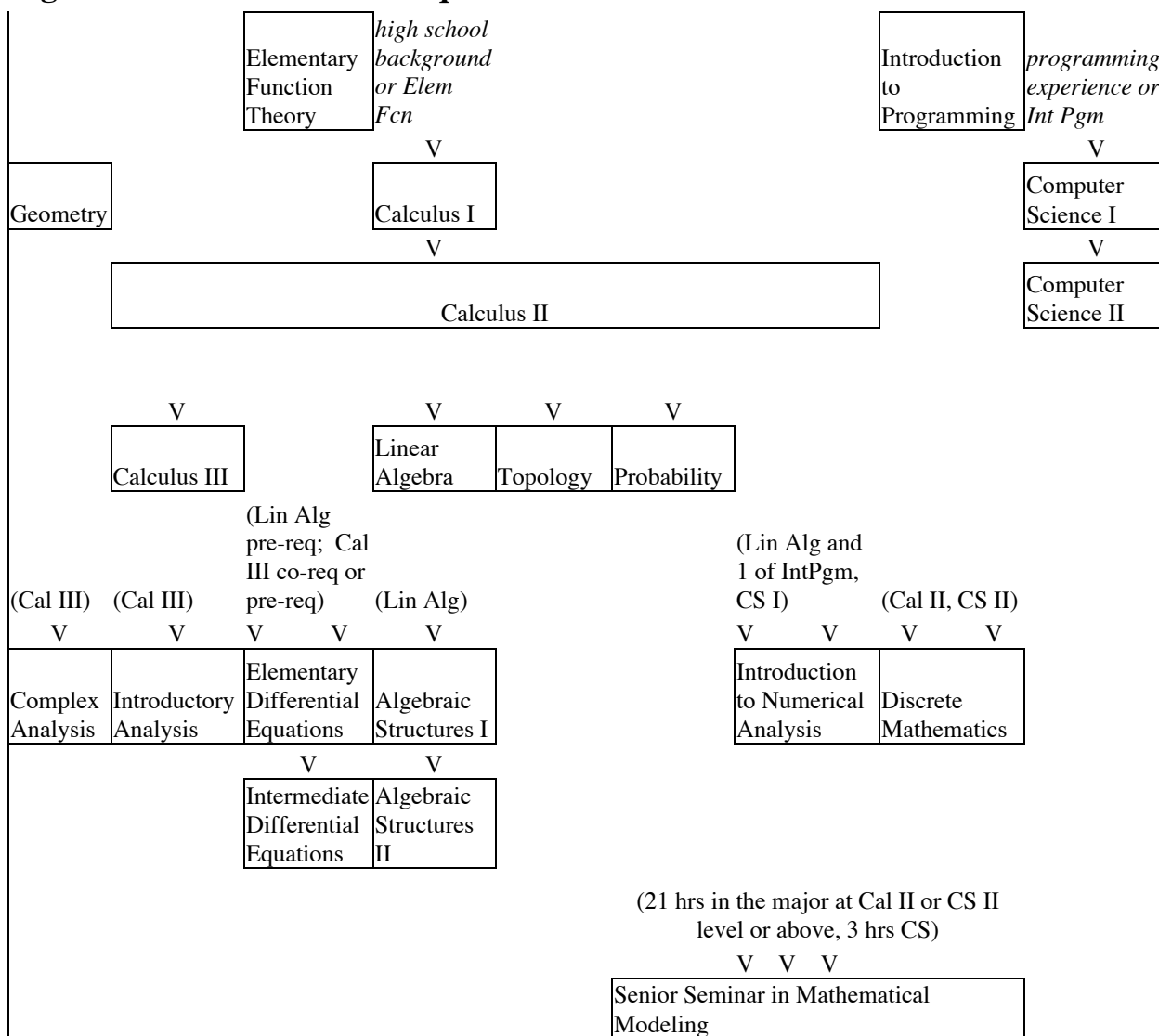
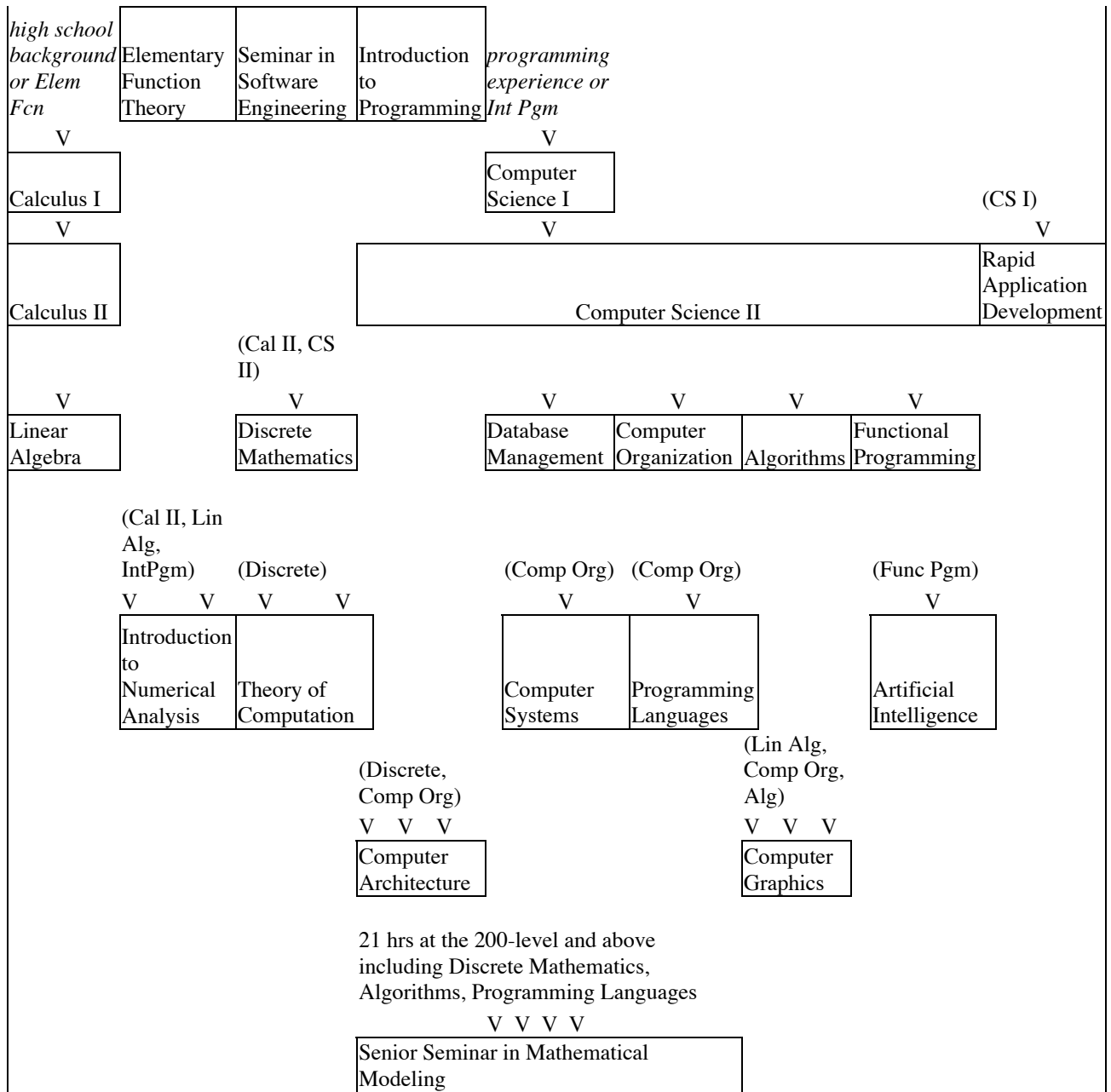


Figure: Computer Science Pre-requisite Structure



C. Frequency of Offering

Currently, we have nine full time tenured or tenure track faculty. We have been guaranteed three sections a year to be taught by adjunct faculty on a regular basis, without regard to sabbaticals or other course adjustments. Since 2001-02, our Department Chair receives one release per year, absorbed by the Department. That allows us to offer $9*6+3-1=56$ sections a year. Our staffing is somewhat complicated by Calculus I which counts as 1.5 sections in our load, so that 6 Calculus I sections per year count as 9 "weighted sections" in teaching load. In later sections of the document, we provide ample evidence of the rarity of being fully staffed.

As seen in the table below, some courses are offered every semester, some once a year, and some once every two years. This allows us, with our full current faculty resources, (meaning no sabbatical or other release) to offer a full spectrum of courses within a major's term here as well as to support the many programs that rely upon us.

Note that the current plan does not include the mid-level 52/54-303 Selected Topics courses or various one-hour courses, even though one of the one-hour courses has been taught every Fall for several years.

Table: Course Offerings by Semester and Year

The following indicates weighted offerings in which Calculus I counts as 1.5 courses. Adjustments in offerings are made to respond to enrollment needs and staffing resources.¹¹

FALL	even	odd	SPRING	odd	even
	weighted sections			weighted sections	
<i>Mathematics Courses: Fall</i>			<i>Mathematics Courses: Spring</i>		
Mathematical Concepts	1	1	Mathematical Concepts	1	1
Elementary Function Theory	1	1	Elementary Function Theory	0-1	0-1
Introduction to Statistics	3	3	Introduction to Statistics	5	5
			Mathematical Modeling (E)	0	0-1
Calculus I (4 * 1.5)	6	6	Calculus I (2 * 1.5)	3	3
Calculus II	2	2	Calculus II	2	2
Calculus III	1	1	Calculus III	1	1
Linear Algebra	1	1	Linear Algebra	1	1
Elementary Differential Equations	1	1	Introductory Analysis	1	1
Algebraic Structures I	1	1	Geometry	1	1
Senior Seminar in Math Mod.	1	1	Algebraic Structures II (O)	1	0
Topology (O)	0	1	Intermediate Differential Equations (E)	0	1
Complex Analysis (E)	1	0	Probability (O)	1	0
TOTAL Math	19	19	TOTAL Math	17-18	16-18
			(843) Seminar or (303) Selected Topics, M or CS	0-2	0-2
<i>Computer Science Courses: Fall</i>			<i>Computer Science Courses: Spring</i>		
Introduction to Programming	1-2	1-2	Introduction to Programming	1	1
Computer Science I	1	1	Computer Science I	1	1
Computer Science II	1	1	Computer Science II	1	1
Computer Organization	1	1	Algorithms	1	1
Discrete Mathematics	1	1	Computer Systems	1	1
Programming Languages	1	1	Computer Graphics	1	1
Database Management (O)	0	1	Functional Programming	1	1
Numerical Analysis (O)	0	1	Senior Seminar in Software Engineering	1	1
Artificial Intelligence (E)	1	0			
Theory of Computation (E)	1	0			
Computer Architecture (E)	0-1	0-1			
TOTAL Computer Science	8-10	8-10	TOTAL Computer Science	8	8
TOTAL Math and CS	27-29	27-29	TOTAL Math and CS	25-28	24-28

¹¹ Corrections were made after the outside evaluator's visit.

IV. ENROLLMENTS

A numerical and graphical report of information from the University's database is followed by a discussion of management. Twelfth day enrollments are used to allow predictions for spaces needed in the near future. Courses were sometimes merged or reclassified for the best alignment with the current course offerings.

Courses such as 843 Seminars in Special Topics or 303 Selected Topics are included in the Table below. Courses taught as faculty overloads - Independent Study, Honors, and 1- or 2-hour courses - are included in the next section, except for those which became regular courses.

The slight decline in Mathematics enrollments resulted in part from the large entering class of F98 as well as increases in Advanced Placement credits. Fluctuations in Computer Science enrollments tend to mirror national Computer Science enrollment trends.

A. Regular Course Enrollments F98-S04

Table: Mathematics Enrollments, 2-yr Totals

	98-00	00-02	02-04
Mathematical Concepts	102	102	79
Introduction to Statistics	423	429	422
Elementary Function Theory	109	79	72
Calculus I	313	297	252
Calculus II	117	144	116
Calculus III	54	53	62
Geometry	17	22	23
Probability	12	19	24
Linear Algebra	77	68	83
Algebraic Structures I	27	27	18
Algebraic Structures II	5	7	8
Elementary Differential Equations	38	34	32
Intermediate Differential Equations	15	8	13
Introductory Analysis	19	17	22
Complex Analysis	5	13	5
Topology	7	6	5
Math Capstone	14	19	14
Other Math (Seminars, etc.)	14	16	13
TOTAL MATH	1368	1360	1263

Table: Computer Science Enrollments, 2-yr Totals

	98-00	00-02	02-04
Int Computing/Int Programming	182	118	76
Computer Science I	67	69	32
Computer Science II	33	56	34
Discrete Mathematics	21	34	21
Computer Organization	17	31	36
Algorithms	24	32	27
Programming Languages	15	20	17
Database Management	8	14	27
Introduction to Numerical Analysis	4	10	11
Functional Programming	20	23	18
Computer Graphics	5	9	8
Artificial Intelligence	0	20	0
Computer Architecture	8	0	7
Computer Systems/Operating Systems	0	11	8
Theory of Computation/Automata Theory	0	4	5
Other CS (Seminars, etc.)	13	10	8
TOTAL CS	417	461	335

Figures, Part 1: Enrollments, by Year

Note: the legends are in the same order horizontally as the graph columns.

Note that the scale on this graph is different from all the others.

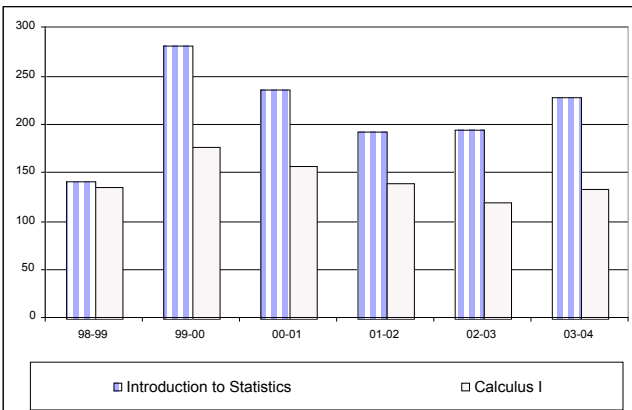
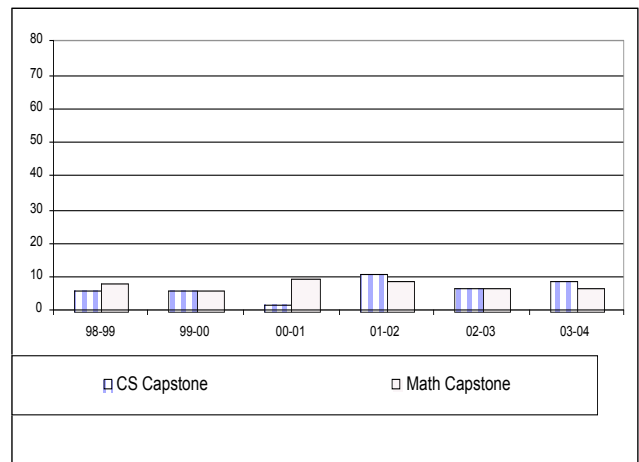


Fig.



Figures, Part 2: Enrollments, by Year

Note: the legends are in the same order horizontally as the graph columns.



Figures, Part 3: Enrollments, by Year

Note: the legends are in the same order horizontally as the graph columns.

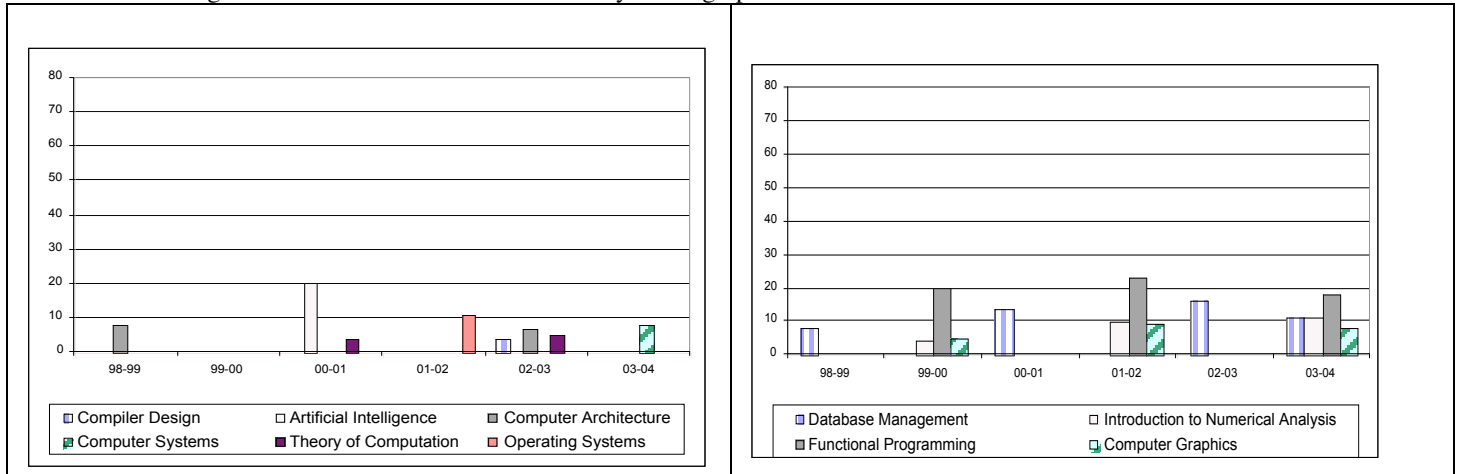


Table: Number of Sections, by Category

	98-99	99-00	00-01	01-02	02-03	03-04
Non-major Math	11	14	12	11	11	12
Calculus I, II	10	10	11	10	10	10
Other Regular Math	12	11	12	11	12	11
Int Pgm, Int Computing	4	4	3	3	3	2
Computer Science I, II	3	4	4	4	4	4
Other Regular CS	8	8	8	9	9	10
Other (Seminars, etc.)	4	1	0	4	0	2
Total Sections	52	52	50	52	49	51

Table: Average Section Size, by Category

	98-99	99-00	00-01	01-02	02-03	03-04
Non-major Math	21.4	28.5	29.2	23.6	23.9	25.8
Calculus I, II	19.4	23.6	20.8	21.2	17.9	18.9
Other Regular Math	10.6	14.8	13.6	11.8	12.7	14.3
Int Pgm, Int Computing	21.0	24.5	20.7	18.7	12.7	19.0
Computer Science I, II	14.7	14.0	17.5	13.8	10.0	6.5
Other Regular CS	7.5	9.3	12.0	13.9	9.9	10.7
Other (Seminars, etc.)	5.8	4.0		5.5		10.5

B. Enrollment Analysis and Management

Obviously, Introduction to Statistics has consistently had the largest total enrollments, followed by Calculus I. Introduction to Statistics has consistently had the highest average section size as well. As expected, the highest level courses have the lowest enrollments.

The Department is careful to use its faculty resources wisely. Our goal is to provide appropriate opportunities for all Southwestern students and to provide a rigorous program for our majors without spreading our faculty resources or clientele too thin. Sometimes we offer small enrollment courses because it is in the best interest of our students, particularly our majors. The decision to keep or cancel a course has been discussed openly in the Department. We regularly discuss possible changes to our curriculum and course offerings to meet our goals.

Consider Mathematical Modeling, for instance. After there was a Senior Seminar version beginning in F98, we repeatedly considered whether a second course should be offered. It was thought that there was a niche for a mid-level course with a Calculus II pre-requisite, especially since enrollments as a Special Topics class had been good. The course supported the Environmental Studies program, served as an elective for Mathematics majors, and counted for Mathematics minors. National standards for K-12 education call for modeling. Enrollments were low, so the course was revised to have a Calculus I pre-requisite and then further revised to have no pre-requisite. In S00 only three students enrolled, so the course was cancelled, and two took Modeling Independent Studies. The course was taught in S02 with just three students. It was cancelled in S04. Hence, it will not be offered unless demand is higher and the department has the resources. It is apparent from conversations that many advisors and students do not realize the content or value of this course.

We have made other adjustments, such as reducing the number of Introduction to Programming sections from 3/year to 2; increasing the number of Introduction to Statistics sections from 6/year to 8; offering Linear Algebra both semesters instead of only Fall, and offering Elementary Functions Theory only in the Fall. These adjustments are expected to continue for the next year or two. Temporarily for 04-05, we will offer only one Computer Science II section because of recent low enrollments and low enrollments in the preceding course.

Usually, departmental conversations suffice to manage our enrollments. We consider our majors and how many may move on to various courses. The Department is aware of past average enrollments and uses this model to predict future enrollments. Use of past Fall averages cannot account for surprises in the number of matriculants, as we had in F98. Enrollment and entering class size data are provided in the next subsection.

In addition, a simple model was formulated for spot checking number of Spring seats in these introductory courses. A variation was also used which did not consider Calculus II or Computer Science II, for a more conservative estimate. This was not based on needing data from Academic Computing but used periodic recordings of information readily available (see <http://www.southwestern.edu/academic/registrar/CSchedLaunchPage2.htm>).

Consider the example of estimating seats for S05. An estimate of first years enrolled in these courses in F04 is given by the difference between the enrollments during the first week of F04 and pre-registration totals from May 2004. Subtracting this value from the number of first year matriculants (provided to all faculty at the Fall Faculty Conference) yields an approximation of the first years who are not currently enrolled in an introductory math or computer science course. Comparing the first week enrollments to the twelfth day enrollments allows for drops, which may be added. The result is an estimate of the number of seats needed for first years; it does not take AP or transfer credits into account. The Department chair sought the opinion of the Registrar, who approved the model.

These methods seem sufficient to manage our course offerings and staff allocations. For instance, during pre-registration for S05, with a large F04 entering class, we were able to

accommodate most students, which was not the case for all departments, although several of our sections closed as they always do (especially Introduction to Statistics). This was partly accomplished through planning as described and partly through additional advising of General Education options during pre-registration, which clarified students' options.

The Table below provides some aggregate data on enrollment in subsequent courses. For some courses, information from Fall to Spring only is provided. The large number of first years enrolled in Calculus I and Computer Science I makes other comparisons meaningless. For instance, F03 enrollments for Calculus II were 132% of the previous spring enrollments for Calculus I; obviously, this does not yield any information about the number of students from one course who go on to take another. There have been an increasing number of first year students in Calculus II and Calculus III, and we have not adjusted for those. The Table below gives an estimate of subsequent course taking.

Table: Comparison on Enrollments in Subsequent Semester for Intro Courses in the Majors

For example, enrollment in Computer Science I for Sp01 was 47% of the F00 enrollment for Intro to Programming.

	01/SP	01/FA	02/SP	02/FA	03/SP	03/FA	04/SP	04/FA
Int Pgm to CS I	47%		40%		35%		61%	
CS I to CS II	95%	70%	69%	79%	91%	100%	71%	
Cal I to II	42%		37%		35%		22%	
Cal II to III	56%	29%	35%	47%	44%	61%	36%	83%

C. Low Level Courses F93-S04

The great numbers of students and programs served by low level courses warrants greater detail. Considering data back to the last review, we clearly demonstrate the response of the Department to changing needs.

Table: Enrollments in Low Level Courses and Matriculants

"Nonmajor" includes Math Concepts, Stat., & Elem. Fen.

	93-94	94-95	95-96	96-97	97-98	98-99	99-00	00-01	01-02	02-03	03-04
Int Comp	42	38	49	38	40	42	40	na			
Int Pgm	na	35	26	40	40	42	58	62	56	38	38
CS I	25	13	8	20	19	32	35	39	30	19	13
CS II	14	10	4	5	17	12	21	31	25	21	13
Math Concepts	47	60	60	56	37	35	67	65	37	21	58
Stat	162	171	162	174	173	141	282	237	192	194	228
Elem Fen	93	95	92	42	68	59	50	48	31	48	24
Cal I	180	168	160	134	125	135	178	157	140	119	133
Cal II	72	69	67	62	59	59	58	72	72	60	56
nonmajor subtotal	302	326	314	272	278	235	399	350	260	263	310
matriculants ¹	351	326	328	309	333	378	354	354	326	342	343

¹ Class Profile, First-Year Student Application Flow 1982-04. Provided to faculty at the Fall Faculty Conference.

Figure: Enrollments in Low Level Courses

Note: the legend is in the same order vertically as the stacked columns.

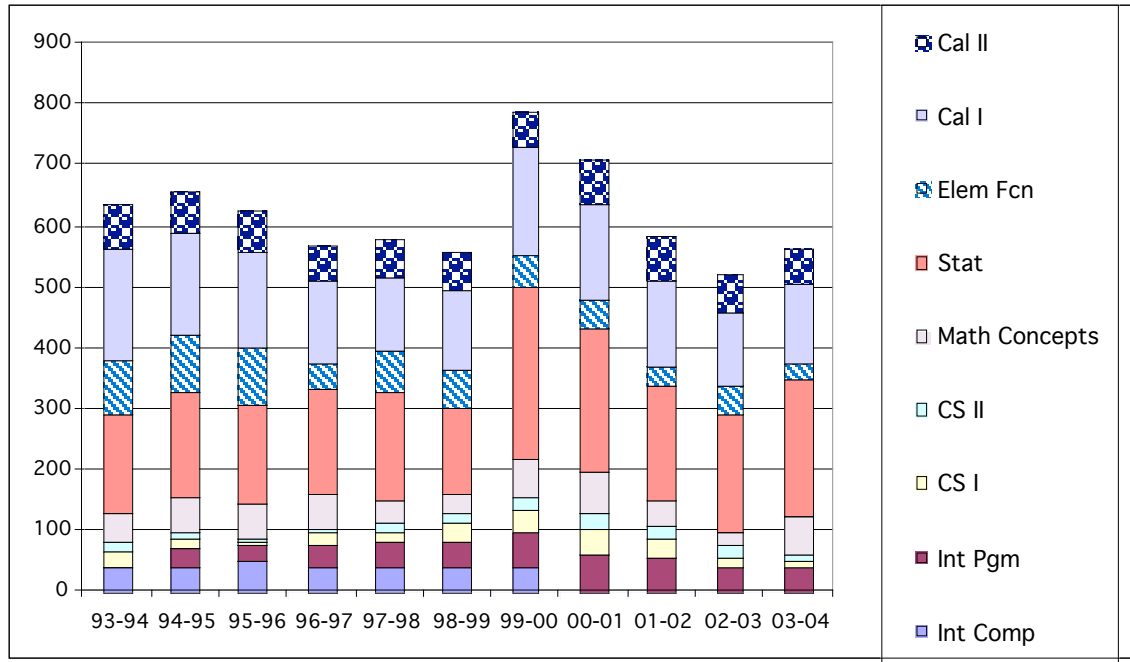


Table: Number of Low Level Sections, by Year

“Nonmajor” includes Math Concepts, Stat., & Elem. Fcn.

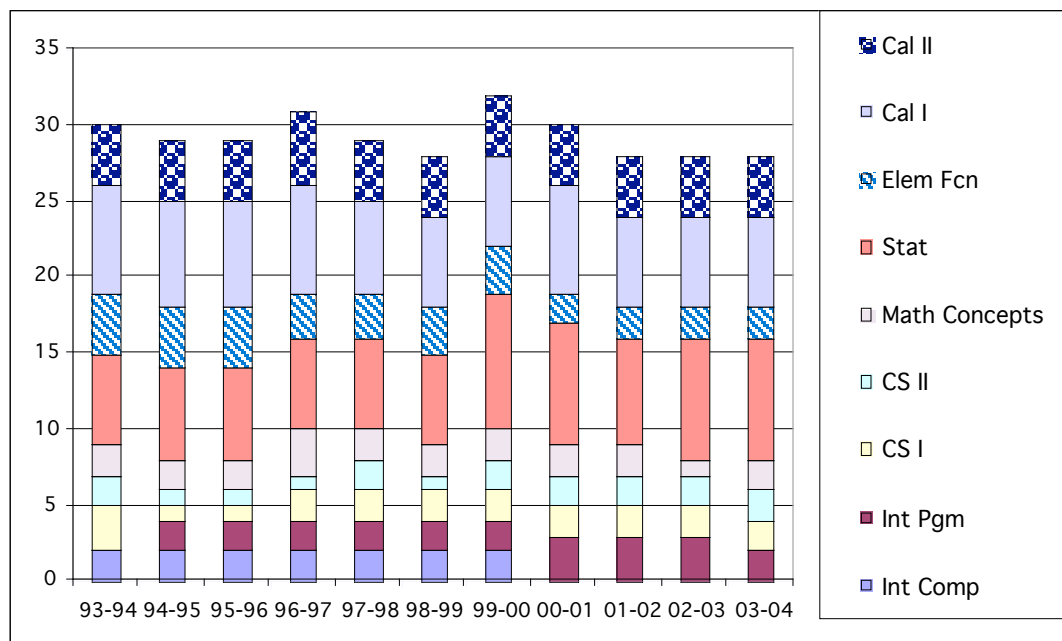
	93-94	94-95	95-96	96-97	97-98	98-99	99-00	00-01	01-02	02-03	03-04
Int Comp	2	2	2	2	2	2	2	na			
Int Pgm	na	2	2	2	2	2	2	3	3	3	2
CS I	3	1	1	2	2	2	2	2	2	2	2
CS II	2	1	1	1	2	1	2	2	2	2	2
Math Concepts	2	2	2	3	2	2	2	2	2	1	2
Stat	6	6	6	6	6	6	9	8	7	8	8
Elem Fcn	4	4	4	3	3	3	3	2	2	2	2
Cal I	7	7	7	7	6	6	6	7	6	6	6
Cal II	4	4	4	5	4	4	4	4	4	4	4
subtotals											
CS up to CS II	7	6	6	7	8	7	8	7	7	7	6
nonmajor math	12	12	12	12	11	11	14	12	11	11	12
Cal I, II	11	11	11	12	10	10	10	11	10	10	10
matriculants	351	326	328	309	333	378	354	354	326	342	343

The boost in nonmajor sections for 99-00 was to accommodate the overflow from the extra large F98 entering class; the F99 entering class was the second largest in Southwestern's history at that time. Prior to 93-94, in reverse chronological order, matriculants numbered 318, 324, 311, and 316; the F93 figure of 351 was quite large.

The following Figure provides a graphical representation of the section data reported above.

Figure: Sections of Low Level Courses

Note: the legend is in the same order vertically as the stacked columns.

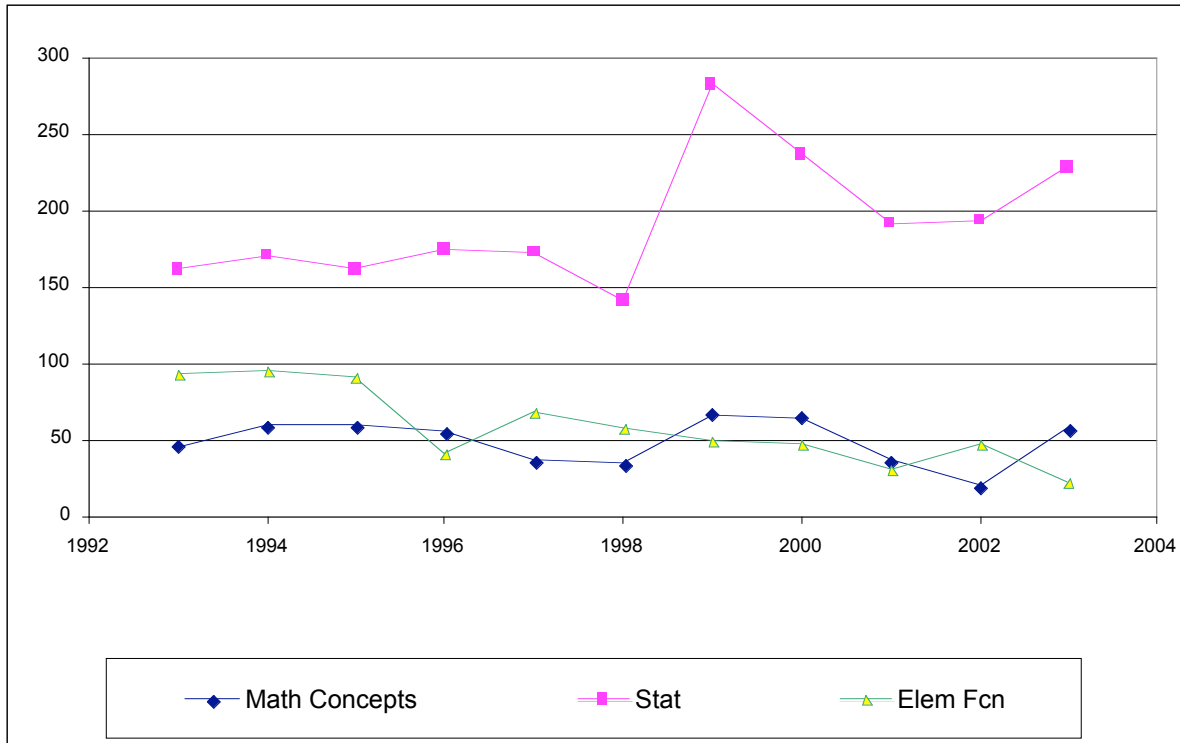


The following Figure focuses on enrollments in the courses which cannot count toward a degree in our Department. Enrollments have fluctuated greatly. A quick then-and-now comparison may be made with the two-year averages for 93-95 and for 02-04. Mathematical Concepts enrollments have dropped by 26%, Statistics enrollments have increased by 27%, and Elementary Functions enrollments have dropped by 62%. These comparisons are within the courses themselves; Statistics compared to Statistics, etc. When compared to percentages of the non-major courses, Statistics has risen from 53% to 74%, Math Concepts has dropped from 17% to 14%, and Elementary Functions has dropped from 30% to 13%. Note that a change in course numbering in 99-00 reduced Intro Stat & Math to lower level courses. Students could no longer take these and also satisfy requirements for upper level credit hours.

The increase in Statistics enrollments stems from our ability to offer more than six sections per year, which did not satisfy demand. We offered six sections prior to 99-00, when we were able to offer nine. Since then we have offered seven or eight. Note that we moved from seven to eight faculty in 96-97, and to nine in 00-01, which gave us the ability to satisfy demand. Having an additional tenure track faculty, especially a statistician, would allow us to offer more probability and statistics in a wider variety of flavors than we can now, as well as to reduce section size.

Figure: Enrollments in NonMajor Courses

Sections of Stat were added in 99.



V. SUPPLEMENTAL COURSES

With sufficient faculty resources, we can augment our usual offerings as other programs do. The breadth of topics and number of students involved provide evidence of the flexibility in our program. Usually such a course counts as an elective for our majors. The opportunities exist for nonmajors as well. Some of these experiences have resulted in student presentations, which are discussed in another section.

Almost all of our faculty have led supplemental courses recently. Recently, the Seminars in Special Topics and courses in Selected Topics are taught in the regular faculty load. Independent Studies, Honors projects, and the one-hour courses are taught as an overload for the faculty. Only in F04 have we been able to compensate two faculty for some of their accumulated Independent Study credits at a reduced level to that provided for in the *Faculty Handbook*. See the Section on Staffing for further discussion. More of these opportunities might be offered with additional tenure track faculty. These courses, though supplemental, are vital to our program.

A. Special Topics and Selected Topics Courses

There are two types of special courses. As seen in the Table below, these courses have been offered in multiple areas recently. They are only offered when staffing allows, and pressures apparently will not allow them to be offered for the next several years.

Occasionally we are able to offer a 52/54-843 Seminar in Special Topics, which counts in a regular teaching load for faculty. The 843 courses have a prerequisite of 9 hours at the 200 level or above and consent of instructor. (Note that prior to the 1996-97 *Catalog*, 52-843 was The Senior Seminar in Analysis. Beginning in the 1997-98 *Catalog*, the 52-843 number was recycled as Seminar in Special Topics. This data analysis begins after the transition, so these truly are Seminars in Special Topics.)

A course with a similar name is 52/54-303 Selected Topics, which has only consent of instructor as the pre-requisite. Our policy is to apply the 52/54-303 Selected Topics particularly to experimental courses or initial offerings of courses. These have only recently counted in a faculty member's regular teaching load.

Table: Special Courses, F98-S04

98-99	99-00	00-01	01-02	02-03	03-04
8 students Combinatorics CSC 303 & MAT 843	4 students in Knot Theory, MAT52-843		13 students in Computational Number Theory CSC & MAT 843		13 students History of Math MAT 843
7 students History of Math MAT 843			6 students in Extreme Programming CSC 843		
8 students Computer Architecture CSC 303 (regular course 99-00)			3 students Cwatsets MAT 843		8 students Computer Systems CSC 303 (regular course 04-05)

B. Independent Studies

Frequently, a student engages in an Independent Study in a special area, usually one-on-one with a faculty member. Independent Studies have been summarily approved by the Chair, but as we try to regularize compensation, we may move to some procedure of review. The Department recognizes the policy in the *Catalog* that students should have demonstrated an ability to work independently and that Independent Studies may not repeat regular courses. Most Independent Studies receive 3-hours of credit.

The Independent Studies have been offered in many topics, including the following: Coding and Information Theory, Distributive Computing, Probability and Computer Models, Computer Systems Security, Primes and Computing, Mathematical Statistics, Automating Programs, Advanced Computer Graphics, Hypergeometric Mean Value, Superellipses and Superellipsoids, and more.

Occasionally when a course has had very low enrollment, the course is canceled, and the faculty member has catered the content to students of sufficient motivation. For instance, when only three students signed up for the lower level Mathematical Modeling, two students engaged in individually catered Independent Studies and presented their results at a regional meeting; these students were not majors in our Department. In two instances, the work of the faculty and student(s) has paved the way for new regular courses in Computer Science.

Table: Students in Independent Study, F98-S04

	98-99	99-00	00-01	01-02	02-03	03-04
3 hr	5	7	1	10	5	3
2 hr	1	2				
1 hr		2	1	3	2	

For F04, three students studying to be high school teachers worked with a faculty member on Making Connections from the college to the high school curriculum; two took the course for capstone credit.

C. Honors

Exceptional students may engage with a faculty member on an Honors project, which are "invitation only" experiences for exceptional students summarily approved by the Chair. The faculty engaged in an Honors projects hold the students to a very high standard. Several attempted Honors projects have either been scaled back to an Independent Study or cancelled altogether. Only the successful ones are indicated in the Table above. Here is a sample of completed projects. For Summer and Fall 2002, Buchele directed Karlie Verkest in *Aging of Surfaces by Texture Map Manipulation*. In F00, Lindsay Cowart worked under Potter. In 1997, a student worked under Potter on *Design of the Acetylcholinesterase Enzyme Using Brownian Dynamics Simulation* in Computer Science and Chemistry. Kelson Gist is working toward an Honors project under Buchele for 2004-05.

D. Other

To augment the curriculum and draw more students into the Computer Science major, we created a 1 credit hour course in Elementary Software Engineering, taught as an overload.

Enrollments were seven for F01, then one for S02. It remains an option when warranted by student interest, subject to faculty availability.

To prepare students for the annual regional Programming Contest, a 1 credit hour course was created that does not count toward the major. This course meets for three hours a week for most of the semester and has been very successful in preparing students. Successful participation in the Contest is discussed later. For F02, 14 students enrolled; for F03, there were 12. More students enroll than will actually participate in the contest.

VI. UNDERGRADUATE RESEARCH

Undergraduate research involves student centered work on material that is new to the student and guided by faculty. There are multiple opportunities for our students at Southwestern, some available for all students with appropriate background and some for exceptional students. All students in recent Capstone courses in our Department complete a research project; see Section I for details. Independent studies, Special Topics, Selected Topics (mid level), and Honors Theses are also available and discussed elsewhere.

A. Funded Projects

Southwestern has sometimes been able to support special student ability and interest with internally funded collaboration with students: Mundy Fellowship, Jones Fellowship, and Fleming Science Initiative which later became the Fleming Collaborative Research and Creative Works Funding. Mundy Fellowships provide modest funding typically for two semesters and the summer between, if applicable. Jones Fellowships are for smaller projects. Fleming provided better funding for extended summer research until recent budget cuts. The recent call for proposals is welcome.

Table: Recent Funded Undergraduate Research with Faculty

Time	Type	Description	Students	Faculty Advisors
Sum 1998	Fleming SI	<i>Mathematical Biology</i>	Nora Horick Laura Goad Jennifer Wightman	Brooks
1999	Fleming		2	Potter
Sum 2000	Fleming SI		2	Potter
Sum 1999, F99, S00	Mundy	<i>Interactive Models in Probability</i>	Laura Goad	Shelton
Sum 2000	Fleming SI	<i>Probability Models</i>	Kelly Van Camp Kevin Hiam	Shelton
Sum 2000	Fleming SI	<i>Binary Space Partitioning Trees and Constructive Solid Geometry Trees</i>	Angela Roles	Buchele
Sum 2002	Fleming CRCA	<i>Error Correcting Codes</i>	Amanda Milby Daniel Morris A. James Sloan Conrad Miller Ryan Smith Brittany Kornmann Casey Douglas	Shelton and Sawyer
Sum 2003, F03, S04	Jones	<i>Understanding Conceptual Barriers to Learning Mathematics</i>	Whitney McCall	Sawyer

The summer 00 Fleming CRA resulted in a joint paper by Buchele & Roles, "Binary Space Partition Tree and Constructive Solid Geometry Tree Representations for Objects Bounded by Curved Surfaces." The paper was presented by Buchele at the Thirteenth Canadian Conference on Computational Geometry and published in the proceedings. In addition, several students have received special funding from the internal King Creativity Award, established by Computer Science alum Joey King ('93) to support "innovative and visionary projects". In 2002-03, Mary Pamela Hightower worked on her French Honors Thesis with connections to Mathematics: *Mathematics and Language Play: Raymond Queneau and the Oulipo*. Potter and Shelton served on the Honors Committee along with the French faculty; see <<http://www.southwestern.edu/~shelton/Students/Hightower/index.html>>. For 2001-02, Jason Jones worked on *Finding All Solvable Groups of Size Less than 2002* and Charles Lindsey worked on *Automating the Verification of Programs*.

Leigh Lambert and Sarah Peterson worked with Owens under an external grant through the CRA-W during Spring 2002: *The Effects of Color and Age on Web-based Task Performance*. CRA-W is a committee of the Computing Research Association on the Status of Women in Computing Research. The work resulted in two conference presentations.

B. Internships and Work Experience

1. Internships other than ACS

We do not include a course number for an Academic Internship in our section of the catalog. The Department has had multiple conversations, but we have not sufficiently determined what constitutes an Academic Internship. 1) Two faculty expressed willingness to work in a student for S05, but the student did not follow through. 2) On few other attempts such an opportunity would involve intense work between a faculty member, the employer, and the student to ensure a true academic component.

A few students have participated in a non-academic Internship. The list may not be exhaustive; since the internships are not for credit, students may not inform us of their work, and we have not kept records.

Two alumni who graduated in the late 1990s indicated the value of their internship experiences on the Departmental Online Alumni Survey, at IBM and at Hayes Software Systems. Other students commented on how valuable such an experience would have been; these comments are included elsewhere.

In addition, Jon McClure interned in Gaming at Lionhead Studios in London, England for Summer 2002. Misti White expects to intern with an actuarial firm in Austin, TX for Spring 2005 while she completes her major here. We expressed willingness to investigate the possibility of this being an Academic Internship, but she has not initiated conversations, in spite of encouragement from two of our faculty and from Career Services.

2. ACS Internships

The most fruitful internships have been through the Associated Colleges of the South (ACS). The following ad from <http://www.colleges.org/techcenter/se/> describes the upcoming edition.

The Associated Colleges of the South Technology Program is in search of Computer Science majors or individuals with a passion for computers and software development. Through development of a real software project, interns will develop real-world skills and create a network of friends while working with a professional software developer. The internship will be from May 30 to July 29, 2005 (tentative schedule).

Summer interns learn extreme programming (XP), one of the latest approaches to software engineering. Programmers work in pairs and rotate tasks so that all team members will have the opportunity to work on each aspect of their project. This approach facilitates rapid development by having customers on site for consultation, releasing versions of the software quickly, e.g., every two weeks, and developing the design with an initial overall architecture and daily "stand-up" meetings.

This fabulous opportunity for students and faculty was organized by one of our faculty and grew out of a capstone experience. The following description is from <http://cds.colleges.org/dev/docs/credits.php> with a few clarifying additions.

Spring 2002 [*SU CS Capstone, precursor to ACS internship*]

Dr. Suzanne Buchele, Computer Science assistant professor at Southwestern University, taught a Software Engineering course during the Spring of 2002 in which students were assigned to construct a software product proposed by SU faculty and staff members. The Course Delivery System (CDS) was one of those products, proposed by Suzanne Bonefas at the ACS Technology Center. Leigh Lambert, Robert Reid, and Angela Roles were the first students to begin production on the CDS. Once a week, they met with Suzanne Bonefas, the Director of ACS Technology Programs, to discuss the components of the CDS. They also wrote up documents that explain in great detail the system requirements, the design specifications, and the verification and validation procedures for the CDS. Along with these documents, they began coding using a freeware program called WebThread, copyrighted by Emaze Software Corp. and Daniel Macks in 1996-1998, as a basis for the early version of the CDS.

Summer/Fall 2002 [*First ACS Internship*]

During the summer of 2002, Leigh Lambert and Angela Roles continued their work on the project, along with newbies Jason Jones, Robbie Sternenberg, and Zach Toups. Joey Nasser joined the team in September, 2002, after Lambert and Roles left ACS to begin their graduate school careers. A month into the programming, the team switched from using the WebThread freeware to the Threadland freeware, copyright 2001, by Maciej Ceglowski, which had a more professional and streamlined interface than WebThread.

Spring 2003 [*Second ACS Internship*]

Karlie Verkest joined the CDS team in 2003 as work on version 2 of the software began. Version 2 replaced the Threadland core with a home-grown application framework for PHP, and added support for a modular design and a plug-in architecture.

In 2003, Buchele and other faculty worked with students Natalie Berry and Christina Garcia from Southwestern and eight other students. In 2004, interns created a web-based client for the Fedora Open-Source Digital Repository Management System. Southwestern faculty Buchele and other faculty led Southwestern students Shane Baumgartner and Kelson Gist as well as eight other students. See <http://www.colleges.org/techcenter/se/2004/index.html> .

3. ITS Work Experience

Several of our students gain very valuable work experience through ITS, some after they graduate. Some of our students have presented a research project under ITS supervision at our undergraduate symposium. There have been several instances where ITS trains a student, and the student is subsequently hired by the ACS Technology Center. Raising pay for technical student workers could improve this situation.

VII. PROGRAM ENHANCEMENTS

A. Student Organizations

The student chapters of the Mathematical Association of America and the Associated Computing Machinery are active. The MAA Student Chapter was established at Southwestern University in 1991, preceded by a campus math club that was in existence for about 17 years. The club meets about once monthly for speakers, planning, or social gatherings. The purpose of ACM is to increase knowledge and interest in the science and applications of computing.

Chapters of the honorary societies of Pi Mu Epsilon (math) and Upsilon Pi Epsilon (computer science) were inaugurated in 2002-03 and 2001-02, respectively. PME began with 19 students. More were added each year; last year 12 students were added. UPE began with 5 students. More were added each year; last year 5 were added.

The MAA, in addition to hosting regular meetings, helps as graders in the Math Counts high school competition. On the social side, the MAA held a picnic for students interested in mathematics and for the faculty of the department. The MAA contacted alumni and surveyed them about their careers in 2000-2001, and they are working on an annual newsletter to foster further communications with alumni.

The ACM, in addition to having regular meetings, has had a table at the SU Student Organizations Fair for several years (since 2000-01). A student or staff member has spoken to the club at several meetings, such as the Linux workshop given by ITS staff Todd Watson in 1999-00, and talks by students Jon McClure on his experiences at Lionhead Studios in England and EJ Nonmacher's "PC Under the Hood" in 2002-03. For 2002-03 and 2003-04, the ACM hosted a "Women in CS" movie night. In 2002-03, the ACM and the Department of Art co-sponsored a Computer Animation Festival. In 2002-03, the ACM hosted a robotics demonstration at Mall Ball.

Members of both organizations have attended regional lectures (listed later). In the 2001-02 academic year, the organizations had a joint "progressive dinner", in which participants travel from home to home for different courses of the meal. Other co-sponsored social events include a white-elephant party.

In addition, SU teams have participated in the ACM Programming Contest for several years; more detail is given elsewhere.

B. Speakers, at SU and elsewhere

Our students have been quite active at conferences recently, both in just attending and in making presentations. Those who attend gain valuable experience and often are encouraged to engage in a project leading to a presentation. Recently, the Mathematics and Computer Science student organizations sponsored attendance at various nearby talks. In 2000-01, five students attended a talk by John McCarthy at UT-Austin; McCarthy invented the LISP programming language, the main language for artificial intelligence programming for many years. The next year, a faculty member took students to hear the legendary Edsger Dijkstra. Others attended the Artificial Intelligence Colloquium, the Brother Lucian Blersch Symposium on Advances in Science Through Mathematics Colloquium, or a talk by Tony Hoare, all in Austin in 2001. Multiple students have attended the Texas MAA Section Meetings, such as Mesquite in 2002 and Huntsville in 2003. Several attended SIGGRAPH in San Antonio (2002). One student attended the Nebraska Conference for Undergraduate Women in Mathematics in Lincoln (2003) in addition to the two who presented.

Many of the speakers, both local and external, have been arranged through the aforementioned student organizations. In 2000-01, Dr. Barbara Owens organized talks for the Fleming Lecture Series at Southwestern on "Computer Ethics". Students in multiple classes are encouraged or required to attend. Recent activity is listed below.

Speakers in 2000-2001

Dr. Michael Monticino, SIAM visiting lecturer from the University of North Texas, "Search Theory"

Jennifer Slimowitz, visiting lecturer from Rice University, "What is a symplectic matrix and why can't it squeeze?"

Maria Kruger, Southwestern University Internship Coordinator

Conrad Miller, an undergraduate student, on his external summer research experience

Dr. Bill O'Brien, Southwestern, Physics

Dr. Cameron Sawyer, Southwestern University, Mathematics, "Research Experiences for Undergraduates"

Dr. Therese Shelton, Southwestern University, Mathematics, "Information on Actuarial Science" Fleming Lecture Series 2000-2001, organized by Dr. Barbara Owens:

- o Don Gotterbarn, East Tennessee State University, "Ethical Implications of Smart Cards"
- o Deborah Johnson, The Georgia Institute of Technology, "Virtual Violations"
- o Langdon Winner, Rensselaer Polytechnic Institute, "The Automated Professor (An Ethical Satire on Distance Learning).

Speakers in 2001-2002

Dr. James Comer, National UPE Representative

Dr. Shirlene Pearson, Director of the Center for Statistical Consulting and Research, Southern Methodist University, "Statistical Science: Mathematics with a Logical Twist"

Dr. Yale N. Pratt, ACM Distinguished Lecturer, Professor of Electrical and Computer Engineering, University of Texas Austin, "Faster Microprocessors and Ramblings After All These Years"

Georgetown High School Honors Presentations: 1) Bobby Potter "Random Number Generators"; 2) Michael Quinn "Escher Art and Mathematics" 3) Michael Rothenberg "Problem Solving"

Speakers in 2002-2003

Bits and Bites: eight student presentations (more detail is given elsewhere)

Dr. Donald Sutherland, National PME Representative, "Undergraduate Research"

Dr. Jim Daniel, Director of Actuarial Studies, University of Texas Austin, presented "Actuaries and Actuarial Mathematics---What Are They?"

Math Futures: a panel of SU math alumni who discussed their careers (Mary Earles '53, Mike Gagliardo '98, Sarah Geenburg '01, Charles Lindsay '02, Jeanne Clifford Weiss '83, Jed Wilshire '02) and Career Services discussed aspects of graduate school and career searches specific to mathematics.

Dr. Gary Richter. Southwestern University, Mathematics, "How [NOT] to Prove the Chain Rule: Three Methods"

Dr. Doug Burger, University of Texas at Austin, "Technology Trends for Future High-Performance Computing Systems"

Speakers in 2003-2004

Dr. J Strother Moore, University of Texas at Austin, "How Mathematical Logical and Artificial Intelligence Combine to Help Us Build Better Computers"

Dr. Michael Starbird, University of Texas at Austin Distinguished Teaching Professor, "Circles, Pyramids, Spheres, and Archimedes"

Speakers in 2004-2005

Cathy Seeley, President of the National Council of Teachers of Mathematics. The talk was scheduled in the largest teaching auditorium to accommodate the large number of off-campus constituents.

Dr. Anand Pardhanani, Visiting Assistant Professor of Mathematics at Southwestern University, "Is There a Closet Researcher in YOU?"

Doug Burger, University of Texas at Austin, "The Inflection Point has Arrived: Major Shifts in the Semiconductor Industry"

Lisa Kaczmarcyk, University of Texas at Austin, PhD candidate in Computer Science and applicant for the Visiting Assistant Professor in Computer Science for 2005-06, "The Acquisition of Intellectual Expertise: A Computational and Human Studies Theory" - upcoming

Qasim Iqbal, currently working in industry, applicant for the Visiting Assistant Professor in Computer Science for 2005-06- upcoming

C. Student Presentations, Locally and at Conferences

The Department has increased its expectation of student oral presentation, both in number and quality. In several classes, students make short presentations. In particular, every Capstone student in recent years has made an oral presentation of their project in class; the presentations are open to other attendees. The Department would do well to advertise these better.

The Mathematics and Computer Science student organizations have hosted several "Bits and Bites" sessions. Other students in multiple classes have been encouraged to come. At the F02 presentation, approximately 50 other students attended, some because they had to write a summary for a class grade. Seven students presented their departmental summer research

projects (discussed in greater detail later), and one (Jon McClure) presented his Internship in Gaming at Lionhead Studios in London.

Students who have done special work have presented orally or with a poster at Southwestern's Undergraduate Research and Creative Works Symposium (URCWS), which began in 2000. Four of our students participated in 2001, one in 2002, and two in 2004.

The Table below provides documentation of the many students who have made conference presentations. The Table may not be exhaustive; the Department would do well to improve its documentation.

Table, part 1: Student Presentations at External Conferences

Time	Place	Conference	Student Presentations	Source, Advisor	Funding
S04	Austin, TX	Undergrad Poster Session, CCSC-SC (national)	Jacob Schrum - "Genetic Algorithms with Lego Robots" Reviewed for Entry. Won first place.	Ind Study, Owens	Dept
S03	Huntsville, TX	TX MAA (regional)	Brittany Kornmann "All These Numbers are Driving Me Crazy"	Summer Research, Shelton and Sawyer	Fleming
			Casey Douglas "Another Delightful Hypergeometric Function Discussion" Judged Outstanding Session Presenter	Ind Study, Richards	Dept
S03	Reno, NV	Undergrad Poster Session, SIGCSE-ACM (national)	Ryan Smith - "Functional Ham" Reviewed for Entry.	Summer Research, Shelton and Sawyer	Fleming
S03	Lincoln, NE	Nebraska Conference for Undergraduate Women in Mathematics (regional)	Katie Silverthorne and Alison Trumble - "Tides"	Capstone, Shelton	McMichael Enrichment Fund
			Amanda Milby "Driving Mis-Coding".	Summer Research, Shelton and Sawyer	Fleming
F03	Vancouver, BC	Grace Murray Hopper Conference	Leigh Lambert, "The Effects of Color and Age on Web-based Task Performance"; Lambert presented work she and Sarah Peterson had done.	Ind Study, Owens	external: CRA-W
Sum 02	Burlington, VT	MathFest (national)	1) Casey Douglas "A Hamming Code by Any Other Name" 2) Conrad Miller "Implementation of Error Correcting Codes" 3) James Sloan "Check, Please!" 4) Amanda Milby "Driving Mis-Coding" 5) Daniel Morris "Modeling Genetic Error Correction on the Molecular Level"	Summer Research, Shelton and Sawyer	Fleming; external: PME, MAA

Table, part 2: Student Presentations at External Conferences

Time	Place	Conference	Student Presentations	Source, Advisor	Funding
S02	Mesquite, TX	TX MAA (regional)	Conrad Miller "Simulating Divergent Evolution Resulting from Environmental Gradation"	external summer research	Dept
			Charles Lindsey "Automation of Program Verification"	King Creativity project and Independent Study, Potter	King Creativity Fund
			Jed Wilshire "CWATSet Operations"	Special Topics course, Sawyer	Dept
S02	Seguin, TX	CCSC (national)	Leigh Lambert, Sarah Peterson: "A Preliminary Study of the Effects of Color and Age on Web-based Task Performance"	Ind Study, Owens	external: CRA-W
S00	Austin, TX	TX MAA (regional)	Laura Goad - "Activities for Learning Probability"	Mundy, Shelton	Mundy
			Amy McNeer - "Models in Biology",	Ind Study, Shelton	
			Meagan Bourg "Models in Chemistry	Ind Study, Shelton	
			Sarah Geenberg - "Is Light a Predator?",	psychology project with Purdy, consultants Richards and Shelton	
S00		CCSC (national)	Angela Roles – "CSG to BSP Conversion of Objects Bounded by Curved Surfaces" Reviewed for Entry Best Paper Award	Ind Study, Buchele	Dept
S99	San Marcos, TX	TX MAA (regional)	Laura Goad - "Interactive Probability	Ind Study, Shelton	Dept
			Jennifer Wightman "Applications of Chaos and Fractal Theory"	Richards	
S98	Dallas, TX	TX MAA (regional)	Shannon Franks - "Modeling the Edwards Aquifer."	Capstone, Shelton	Dept
S97	Seguin, TX	TX MAA (regional)	Nora Horick - "Projective Geometry: Mathematical Perspective in Painting"	Special Topics Course, Chapman	Dept

Table, part 3: Student Presentations at External Conferences

Time	Place	Conference	Student Presentations	Source, Advisor	Funding
S96	Lubbock, TX	TX MAA (regional)	Jonathan Summers - "Cryptography on the World Wide Web"		Dept
S95	Waco, TX	TX MAA (regional)	Lassa Savola - "Modeling Contest Solution."	COMAP Modeling Contest by self, paper coaching by Shelton	
S94	College Station, TX	TX MAA (regional)	Michelle Bryant, David Gritzmacher, Holly Tiemann - "Mathematical Modeling of an Environmental Issue."	Capstone, Shelton	Dept

D. Tutoring

The Southwestern University Mathematics Department has provided a student tutoring program for over forty years and was the first department to provide this type service. Some of our best junior and senior level mathematics or computer science majors are selected to act as tutors for students in our beginning mathematics and computer science courses. Tutoring sessions for the past few years have been in the Whitmore Mathematics Lounge from 6:00 to 9:00 PM. Currently there are five tutors with at least two tutors available each evening. The tutors are paid by the University at the minimum salary rate.

There is a strong belief among both faculty and students that the program is very beneficial. In recent years several other departments have started similar programs based on our model. Surveys indicate that from two to fifteen students with a median of six students utilize the tutors on a nightly basis. Anecdotal data indicate that students find the tutoring quite helpful.

The student tutors benefit academically as well as financially from the program. For example, their knowledge of first year calculus tends to be significantly enhanced. Graduate students report that their tutoring experience provides a positive background for later work as a teaching assistant. Those who enter the teaching profession find the tutoring experience useful for student teaching and for additional background in classroom teaching.

E. Contests

1. On-Campus Problem-Solving Contest

For several years, Dr. Cami Sawyer has organized a problem-solving contest on campus for students.

2. COMAP Modeling Contest

Southwestern students have participated in the COMAP Mathematical Contest in Modeling¹ each year since 1994 until 2003. The Consortium for Mathematics and its

¹ <http://www.comap.com/undergraduate/contests/mcm/>

Applications MCM is a contest where teams of undergraduates use mathematical modeling to present their solutions to real world problems. Students participate with no special preparation, except in 2002. All teams of one to three students have been recognized as at least "Successful Participant". One of the two 2002 teams and the team for 2003 received "Honorable Mention". One student signed up to participate in 2004, but did not follow through. None signed up for 2005. Recent drop-off coincides with additional other responsibilities of the sponsoring faculty.

3. ACM Programming Contest

Some of our faculty in Computer Science (Buchele, Owens, Denman) have worked to prepare students for the South Central Region ACM Programming Contest; we participated in 1990, 1992, 1999, 2000, and every year since 2002. In 1999, two faculty took a team of three students and an alternate to Rogers State University in Claremore, OK. In 2000, two faculty and two teams (six students and an alternate) traveled to LSU in Baton Rouge, LA, which has hosted the contest since then. In 2001, the faculty sponsor took one team of three students.

Since Fall 2002, the course CSC54-291 Problem Solving for Rapid Application Development prepares the teams. In 2002, Denman took two teams, one of which scored 19th out of 79 teams overall and 3rd among teams from schools with no graduate programs. In 2003, one team placed 48th overall and 8th among strictly undergraduate institutions; the other scored 24th overall and 3rd undergraduate. In 2004, the team advanced to 12th out of 77 and 2nd undergraduate, the highest ranking yet.

Greater detail about recent participation may be found in the Appendix.

VIII. ADVISING and STUDENT RECOGNITION

A. Work with Prospective Students

The Department is quite active in participating with Admissions and SHARP¹ events, including allowing prospective students to sit in on our classes, attending "Student Life" Panel Discussions, participating in luncheons for prospectives, and holding open office hours for individual visits.

Our student clubs interact with local high schools, such as grading for the Math Counts competition. Sometimes our faculty have participated at the high schools, such as evaluating Georgetown Honors presentations. Several of us have mentored high school teachers, which makes a connection to students.

B. Initial Course Advising and Placement

The Department is adequate in this area. Given additional time and faculty resources, the Department might be able to improve its placement and advising.

For students interested in Mathematics or Computer Science, the Department relies largely on student self-evaluation regarding which course they should take first. We field many questions by phone and advise students individually as needed regarding which course to take.

During Orientation week, the Department discusses the matter generally in the "Academic Interest" sessions. In these two sessions, first year students and transfer students voluntarily come to departments in which they are interested. We have incrementally formalized information in recent years, providing students with handouts of the course pre-req structure. We address quick individual questions at these sessions and also invite one-on-one discussion.

In addition, we have provided faculty advisors with guidelines regarding which Math and Computer Science courses students should take, particularly for non-majors. Messages have been broadcast via email for several years, announcements were made at Fall Faculty Conferences, and occasionally a paper memo was circulated, as in F96. In F04, two of us attended an advising workshop for faculty to provide information. We also examine our courses and adjust content and pedagogy to better match student needs.

In the late 1990s, we used a standardized diagnostic test for Calculus Readiness. We required all those enrolled in Calculus I to take the test, reported individual scores, and suggested that those below a certain score drop Calculus and begin in Elementary Function Theory. Results were not conclusive, so the practice was not continued. Now, one of the faculty uses a voluntary on-line Calculus Readiness exam for student information; the exam is available to all students.

Because of low enrollments and faculty resources, we eliminated Elementary Function Theory in Spring 2005 after advertising the change well in advance. This deprives students of a fallback should they begin Calculus I in the Spring and not be ready.

We have an increased number of students who took Calculus in high school but did not place out of Calculus I. Some begin in Calculus II; some of these discover they need to switch to Calculus I. Some take Calculus I; some do well and are satisfied, others are bored through a

¹ Students Helping the Admission Recruiting Program

good deal of the course, others have an attitude of "I know this already." The Department has no firm solutions but has been discussing these issues.

C. Recruitment, Academic Advising, Mentoring and Nurturing

We make a "soft sell" of our program; we treat all our students equally, regardless of their major. We all affirm students' success, ensuring that good work is recognized and students are encouraged. There are several instances of a non-major completing an Independent Study with one of our faculty. We usually provide advice about subsequent courses in our classes, especially before pre-registration. We work to ensure that our curriculum is challenging and exciting, including by offering courses in special topics when resources allow. Our faculty have a strong office presence and are very accessible.

Our club activities and guest speakers stimulate interest in the program. For instance, in S03, students demonstrated their work with Lego Mindstorm robots. Also, after a guest lecture dealing with uses of probability, enrollment in this non-required course was very high. All of our faculty serve as academic advisors after their first year, as is Southwestern's policy.

We also advise students who are not our official advisees, especially minors. Those with a minor typically have an official advisor outside of our Department but still seek advice from us, so this is an uncounted significant increase in our true advising load. As discussed later, between F95 and S04 there were 123 graduates with a major or major/minor combination in our Department and another 90 with only a minor. This could have accounted for a 73% increase in official advising load in this time period.

Several of us mentor individuals extensively. We help students make good academic decisions, including when to drop a course or even a major. We work with students with disabilities, test anxiety, and personal problems. A number of us have guided students to seek Counseling Services or Academic Services, including making phone calls with them to set up appointments or physically walking them to the appropriate office. Several of us actively help the student who is not performing well academically to separate their academic performance from their sense of self worth. These involvements are time consuming but worthwhile.

D. Advising External Undergraduate Research, Graduate School, and Careers

Information regarding research experiences for undergraduates at other institutions, graduate schools, and careers in mathematics is available on large bulletin boards down our hall, in a special box in the Whitmore Lab and Lounge, and on a website. In addition, the student clubs address these issues. We actively communicate through two list-serves (su-maa and su-acm), to which anyone may subscribe.

Although CS information is adequate, there is much more organized information available for students in mathematics than in computer science. This could be improved with more faculty resources. The faculty in Computer Science have been very busy with curriculum reform.

We have many individual conversations with students about what courses will prepare them for Graduate School or a career.

All of our faculty are asked to write letters of recommendation for students for a variety of opportunities: scholarships, fellowships, the second institution of a 3-2 Engineering program, summer research, graduate school, and jobs. Alumni who have been gone for years also make requests.

E. Student Awards

The Department has three awards with which to recognize student achievement: the Atkin Memorial Scholarship for an outstanding junior in Mathematics or Computer Science, the Ralph Whitmore Award in Mathematics, and the Grogan Lord Award in Computer Science. The Atkin Scholarship comes with a \$1,000 award. Students on financial aid see no net gain since this amount is absorbed into their overall package. Students are recognized at the University Honors Convocation each spring. Usually each student receives a book as well.

IX. CURRICULUM CHANGES SINCE LAST REVIEW

The increase in faculty resources prior Fall 2000 allowed many program improvements, particularly in the breadth of Computer Science courses offered and the number of sections of Introductory Statistics. Both majors have been considerably strengthened, and a new paired major, Computational Mathematics, has been added. Further improvements could be made with another tenure track position.

Periodically, we check the content of our some of our courses through informal discussions within the department and with those we serve. Breadth and depth of coverage, pedagogy, and inclusion of technology vary with the instructor. The Department has begun work in several courses to develop "Essential Topics Lists" which should help consistency in those courses which we have identified as needing it.

A. Changes in the Degree Requirements

The Mathematics major and minor have more structure to ensure that our graduates are well prepared either for advanced study or employment. The first Tables comparing the Computer Science major and minor are deceptive; the later discussion and Tables show the great changes in the curriculum.

Table: Mathematics Major Catalog Comparison²

	93-94	04-05
Hours	30 hours, and 18 of the 30 must be above intro (effectively 30 hours, 24 of which is at the 200 level or above)	34 hours of Math and 3 of CS (effectively 37 hours, 27 of which is at the 200 level or above)
Required Courses	Calculus I (3 hr) Calculus II (200 level; "upper level") Calculus III Linear Algebra Algebraic Structures I 3 other courses Senior Seminar in Analysis For graduate school Analysis II and Complex Analysis are recommended.	Calculus I (4 hr) Calculus II (100 level; "lower level") Calculus III Linear Algebra Algebraic Structures I Elementary Differential Equations Introductory Analysis 1 of Algebraic Structures II Intermediate Differential Equations Complex Analysis Topology 2 at the 300 level or above Senior Seminar in Mathematical Modeling Also either Introduction to Programming or Computer Science I

² Corrections were made after the outside evaluator's visit.

Table: Computer Science Major Catalog Comparison

	93-94	04-05
Hours	30 hours of CS and 9 hours of Math, with 18 of the 30 must be above intro (effectively 39 hours, 27 of which is at the 200 level or above)	33 hours of CS and 10 hours of Math (effectively 43 hours, 36 of which is at the 200 level or above)
Required Courses	<p>Programming Concepts I Programming Concepts II Computer Architecture Programming Languages Discrete Mathematics Analysis of Algorithms</p> <p>3 others at 300 level or above</p> <p>Senior Seminar in Compiler Design</p> <p>Also implicit pre-reqs Calculus I Calculus II Linear Algebra</p>	<p>(the following are updated versions of the 93-94 counterparts)</p> <p>Computer Science I Computer Science II Computer Organization Programming Languages Discrete Mathematics Algorithms</p> <p>3 others at 300 level or above</p> <p>Senior Seminar in Software Engineering</p> <p>Also Calculus I Calculus II Linear Algebra (explicit in general description)</p>

Table: Mathematics Minor Catalog Comparison

	93-94	04-05
Hours	18 hours, 12 of which is above intro	effectively 19 hours, 15 of which is above intro
Required Courses	no specific requirements	Calculus I Calculus II Linear Algebra 2 at the 300 level or above

Table: Computer Science Minor Catalog Comparison

	93-94	04-05
Hours	18 hours, 12 of which is above intro	18 hours, 12 of which is above intro (but hard to get 6 at the 100 level)
Required Courses	no specific requirements	no specific requirements

B. Changes in Mathematics Courses

Courses have been updated and offerings change to respond to changes in national curriculum guidelines and in demand. The first Table below summarizes some of the changes. By offering Linear Algebra each semester, for instance, students have greater flexibility and may not need to try to take three math courses in one semester of their sophomore year.

In many of the mathematics courses, technology has been integrated. This depends greatly upon the person teaching.

The Department realized that a capstone in Analysis served those going on to graduate school best but that a different capstone might serve them as well and would serve the rest of the graduates better. A Modeling capstone was first taught in F99, although several students had done extra work in the Modeling course to receive capstone credit. See the second Table below for an overview. Mathematical Modeling was introduced as a mid-level course in S94. It has been changed repeatedly to meet the needs of the students.

The Department has tried to meet national recommendations to provide a low-level modeling course for non-majors and for those intending to teach pre-college. These attempts have been unsuccessful because of lack of student interest. Prior to the S04 offering, the Department emailed all chairs of departments and academic programs, explaining the modeling course and suggesting it might better meet the needs of their students. Only two chairs replied. It is uncertain whether the course will be offered again even though state guidelines indicate that pre-service teachers should have a modeling course.

In F04, two students took an Independent Study as their Capstone, which focused on making connections for secondary education. Taught as an overload for the faculty member, it is unclear whether this powerful opportunity will be offered in the near future because of resource limitations. Enrollments in the Modeling course have been six to ten, so splitting off two or three students to another course has a significant impact.

Table: Math Catalog and Offerings Comparison

Course	93-94	04-05
Mathematical Concepts (for nonmajors)	52-203, upper level	52-103, lower level as of 03-04
Introductory Statistics (for nonmajors)	<ul style="list-style-type: none"> 52-213, upper level mostly taken by upper class students because demand greatly exceeded supply 	<ul style="list-style-type: none"> 52-113, lower level as of 03-04 mostly taken by 1st & 2nd year students; demand mostly satisfied
Elementary Function Theory (for nonmajors)	two sections per year	one section per year as of 04-05
Calculus and Linear Algebra for the Social Sciences	for non-majors	eliminated from Catalog in 97-98
other lower level courses for the nonmajor		added 52-001,002,003, and 004 Selected Topics to aid with transfers as of 03-04
		added Mathematical Modeling; may be eliminated for lack on enrollment
Calculus I	3 hours credit	<ul style="list-style-type: none"> changed as of 97-98 4 hours credit, meets 5 hours a week laboratory component
Calculus II	52-163, lower level	52-253, upper level as of 97-98
Linear Algebra	two sections in the Fall	one section each semester as of 01-02
Calculus III	52-823	52-353 as of 97-98
Probability	Calculus I pre-req	Calculus II pre-req as of 01-02
Elementary Differential Equations	Calculus II pre-req	<ul style="list-style-type: none"> replaced by Linear Algebra pre-req (which requires Calculus II) as of 99-00 additional Calculus III co-req or pre-req as of 04-05
Senior Seminar	Analysis with Calculus III pre-req	Mathematical Modeling with pre-req of 7 courses past Calculus I and 1 CS course, as of 97-98 in Catalog but 98-99 in practice
other		<ul style="list-style-type: none"> eliminated Seminar in Analysis eliminated Analysis II as of 97-98 added Seminar in Special Topics as of 99-00 cross-listed Intro to Numerical Analysis (was only CS) as of 04-05 cross-listed Discrete Mathematics (was only CS) as of 04-05 added 4th hr option Ind Study added 4th hr option Selected Topics (mid level) require C- or better in any course counting as a pre-req as of 00-01

Table: Timeline of Modeling and Analysis Changes

In Fall 04, two students took an alternative capstone to prepare them for teaching high school math.

	Catalog	Modeling				Analysis
		no pre-req	Cal I pre-req	Cal II pre-req	Capstone	
93-94				303 with 10 students (13 total)	3 from 303	843 Capstone
94-95						843 Capstone
95-96				303 with 9 students		843 Capstone
96-97						843 Capstone
97-98	new course 893 Senior Seminar in Mathematical Modeling; 843 Analysis changed to "Seminar in Advanced Topics"			373 with 7 students (8 total)	1 from 303	843 listed as "Advanced Topics" but taught as Capstone
98-99					893 Capstone	
99-00				373 cancelled with 3 students; 2 took as 953 Independent Study	893 Capstone	
00-01					893 Capstone	
01-02			373 taught with 3 students		893 Capstone	
02-03	173 Catalog change				893 Capstone	
03-04		173 cancelled after pre-registration			893 Capstone	
04-05					893 Capstone	

C. Changes in Computer Science Courses

The lower level courses have gone through several changes. Introduction to Computing had some programming content in Pascal and also included word processing and spreadsheets. The beginning computer science course was Programming Concepts I. Intro to Computing became more and more elementary, and Programming Concepts I increased in difficulty, broadening the gap between them. Introduction to Programming was introduced to bridge the gap. The portion of Intro to Computing dealing with use of a programming language was eliminated. Sometimes, when Intro to Computing was taught, it still held programming concepts

in the context of spreadsheets (accumulating sums, sequential or nested selection); other times it was taught merely as a course in software applications. Introduction to Computing was eliminated from the curriculum. Programming Concepts I and II were revised into Computer Science I and II. Introduction to Programming is currently being redesigned again to appeal to a broader audience.

Two one-hour courses have been added and are offered according to student demand: Seminar in Elementary Software Engineering and Rapid Application Development. See Section XIII for a discussion of faculty compensation for these overloads.

A number of courses have been added and a few deleted. See the Tables below, the first of which provides a "then-and-now" snapshot of the Catalogs; the second provides evidence of systematic program change. Catalog descriptions have been adjusted also. The addition of a math tenure track position in 96-97 impacted the Computer Science curriculum by allowing our two math/CS faculty to focus more on Computer Science. The greatest changes were implemented in 99-00, which is when we added a second faculty member devoted to Computer Science.

The upper level courses have also gone through several changes, due both to faculty changes and in response to the *Computing Curricula 2001 Computer Science* or CC 2001 (ACM/IEEE suggested computing curriculum). Two courses changed names and have had their content significantly updated: Computer Organization (previously Computer Architecture) and Theory of Computation (previously Automata Theory). Formal Derivations of Programs was removed from the curriculum. In response to CC 2001, the Operating Systems course was morphed into a combination of operating systems and computer networks, now called Computer Systems. Two regularly offered upper level electives, Functional Programming and Computer Graphics were added to the curriculum. Computer Architecture, also an upper level elective course, is on the books, but we do not currently have enough students or faculty resources to warrant the offering of the course. A Seminar in Special Topics is also on the books, although current low enrollment of students, faculty sabbaticals, and faculty release time will not allow the course to be offered on a regular basis.

Table: Computer Science Catalog Comparison

Course	93-94	04-05
generally first year courses	<ul style="list-style-type: none"> • Introduction to Computing 54-043 • Programming Concepts I 54-183 • Programming Concepts II 54-373 	<ul style="list-style-type: none"> • Introduction to Programming 54-143 • Computer Science I 54-183 • Computer Science II 54-283
other lower level courses		<ul style="list-style-type: none"> • added Seminar in Elementary Software Engineering (1 hr) • added Rapid Application Development for contest preparation (1 hr, doesn't count toward major or minor) • added 52-001,002,003, and 004 Selected Topics to aid with transfers
54-393	"Computer Architecture"	"Computer Organization" (name change)
added new course Computer Architecture		<ul style="list-style-type: none"> • 54-643 • pre-reqs of Discrete Mathematics (so also Calculus I and II in math and Computer Science II) • upper level elective • unable to offer
Programming Languages	pre-req 54-393 Computer Architecture	pre-req 54-393 Computer Organization
Introduction to Numerical Analysis	<ul style="list-style-type: none"> • 54-523 • pre-req of Calculus II, Linear Algebra, and Programming Concepts II (so also Programming Concepts I and Calculus I) 	<ul style="list-style-type: none"> • 52 and 54-523 • pre-req still has Calculus II and Linear Algebra but is lowered to Computer Science I (so also Calculus I)
Artificial Intelligence	pre-req of Programming Concepts II (so also Programming Concepts I)	pre-req of Computer Science II and Functional Programming (so also Computer Science I)
Discrete Mathematics	<ul style="list-style-type: none"> • 54-583 • pre-reqs of Calculus II, Linear Algebra, and Programming Concepts II (so also Programming Concepts I and Calculus I) 	<ul style="list-style-type: none"> • 52 and 54-383 • pre-reqs still has Calculus II and Computer Science II (so also Computer Science I and Calculus I) but not Linear Algebra
Algorithms	54-693 "Analysis of Algorithms"	54-453 "Algorithms"
54-683	"Automata Theory"	"Theory of Computation"
course replacement	Operating Systems 54-723 with pre-req of 54-393 Computer Architecture	Computer Systems 54-643 with pre-req of 54-393 Computer Organization.
other		<ul style="list-style-type: none"> • eliminated Formal Derivation of Programs • added Seminar in Special Topics • added Functional Programming • added Computer Organization • added Computer Graphics • added 4th hr option Ind Study • added 4th hr option Selected Topics

Table: Timeline of Computer Science Curricular Changes

	offerings of courses as special that became permanent	Major Catalog Change	Minor Catalog Change
94-95		added 143 Introduction to Programming	changed 393 from "Computer Architecture" to "Computer Organization" simplified name of 693 to "Algorithms"
96-97	303 Software Engineering		
98-99	303 Computer Architecture		
99-00		added 633 Computer Architecture	changed Discrete Math from 583 to 483
		added 533 Computer Graphics	changed Algorithms from 693 to 453
		added 893 Seminar in Software Engineering	changed "Programming Concepts" I and II to "Computer Science" I and II
		changed Capstone from Compiler Design to Seminar in Software Engineering cross-listed Numerical Analysis with Math	changed Compiler Design from 563 to 653
00-01		added requirement of C- or better in any pre-req	
01-02		deleted 043 Introduction to Computing (last offered S00)	changed 683 from "Automata Theory" to "Theory of Computation"
		added 191 Seminar in Software Engineering	
		deleted 493 Formal Derivation of Programs	
		added 843 Seminar in Special Topics	
02-03	301 Rapid Application Development		
	953 Computer Graphics		
	953 Computer Systems and Networking		
03-04	301 Rapid Application Development		allowed for X=4 in 30X Selected Topics
	303 Computer Systems		allowed for X=4 in 95X Independent Study
			added 00X Selected Topics, X=1,2,3,4 (mostly transfers)
04-05		added 291 Rapid Application Development (had been taught as 301)	changed Discrete Math from 483 to 383
		cross-listed Discrete Math with Math	changed "723 Operating Systems" to "643 Computer Systems"
			eliminated Compiler Design

X. ALTERNATIVE CREDITS - Descriptions and Numbers F98-F04

The Department recognizes selective credit from sources other than its own courses when appropriate. The Department has adjusted its recognition to keep up with changes in our curriculum and in the AP exams. More detail follows. The data included 663 records, representing 489 different students. There was no transfer data for F04 since there was no "transcripted term" at the time.

It is interesting that 10 students were recognized for multiple credits, totaling 14. All recognitions are included in this data; no student received duplicate credit toward their degree plan. One student transferred the same course twice. Another took both Calculus AP exams and so received double recognition for Calculus I. All the other duplicates took the AP exam after transferring the course.

Table: Distribution of Credits per Student

# courses AP or transfer	1	2	3	4	5	6	7
# students	367	89	21	9	1	0	2

Table: AP and Transfers, by Course

No transfer data for F04.

course	AP	Transfer	total	repeats, same student
Introduction to Computing		5	14	19
Introduction to Programming		4	7	11
Computer Science I		8	4	12
Computer Science II		2		2
CS, other upper level			2	2
Math, lowest level general			5	5
Mathematical Concepts			2	2
Introduction to Statistics		60	38	94
Elementary Function Theory			77	75
Calculus I, 3-hr			4	4
Calculus I, 4-hr		269	73	340
Calculus II		52	37	86
Math, selected topics, mid-level, 2hr			1	1
Math, selected topics, mid-level			2	2
Calculus III			3	3
Linear Algebra			2	2
Elementary Differential Equations			1	1
Introductory Analysis			2	2
Totals		400	276	663

Figure: AP and Transfers, Summary by Course

No transfer data for F04.

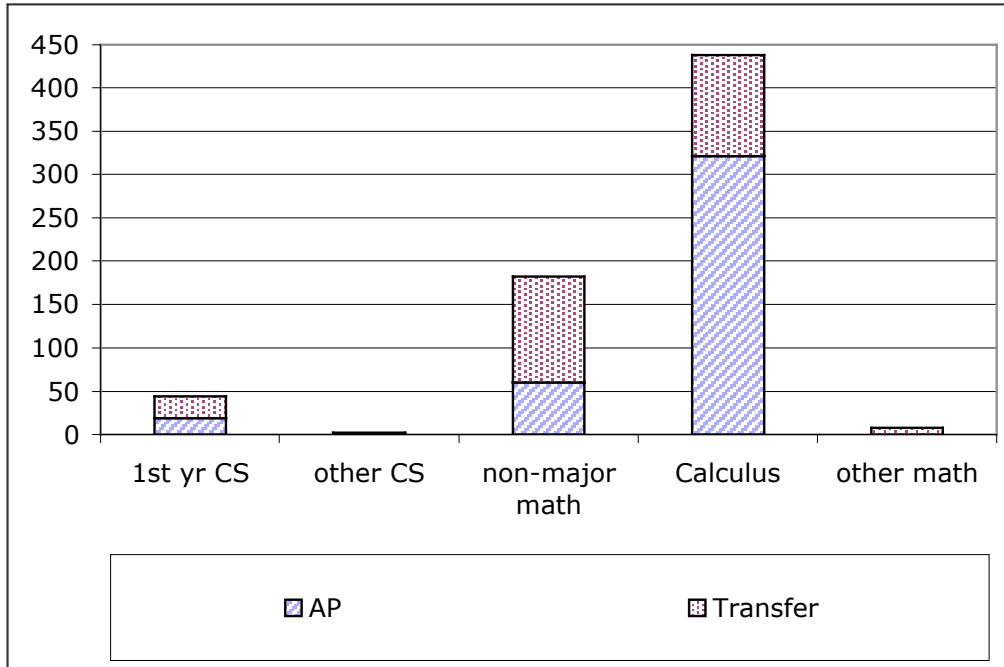


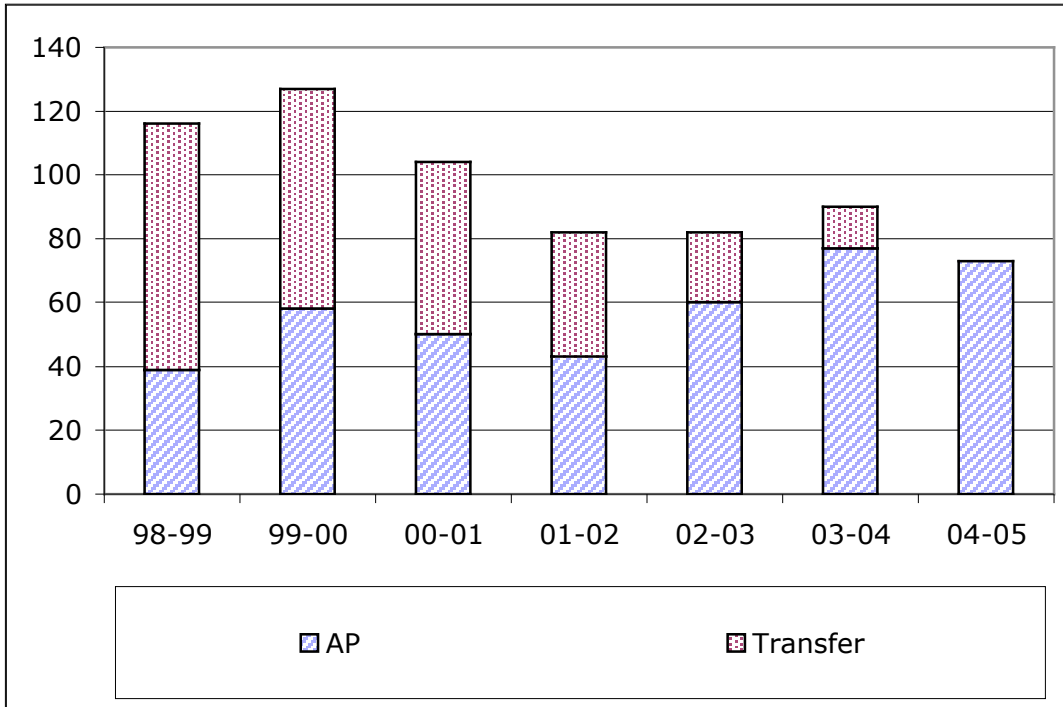
Table: AP and Transfers, by Semester

No transfer data for F04.

	98-99	99-00	00-01	01-02	02-03	03-04	04-05
AP	39	58	50	43	60	77	73
Transfer	77	69	54	39	22	12	0
	116	127	104	82	82	89	73

Figure: AP and Transfers, by Semester

No transfer data for F04.



As seen in the following table, the vast majority of students request credit during their first year. Sometimes data is not fully processed until the following semester, hence the use of the following semester for classification.

Table: Cumulative AP and Transfers, by Classification, F98-F04

Classification is given as of the 12th day of the following semester. No transfer data for F04.

blank	FR	SO	JR	SR
179	356	115	8	5

Other information: 16 students in this dataset went on to take an Education course that indicated they were training to teach at the pre-college level.

Table: AP and Transfers, by Ethnicity

Hispanic-Latin American	46
American Indian/Alaskan	7
Black/Non-Hispanic	15
Asian/Pacific Island	33
White/Non-Hispanic	557
other/not reported	5

A. Advanced Placement

The Department currently grants course credit for a 4 or 5 on an Advanced Placement exam. The Calculus AB exam yields credit for Calculus I; the BC exam yields credit for both Calculus I and II: The Computer Science A exam yields credit for Computer Science I; the B exam yields credit for both Computer Science I and II.

One faculty in Mathematics and one in Computer Science have graded for the AP exam, and several faculty have some familiarity with the rigor and content of the AP programs. We have updated our credit standards as the exams and our courses have changed. An increasing number of students are receiving AP credit, especially in Calculus I.

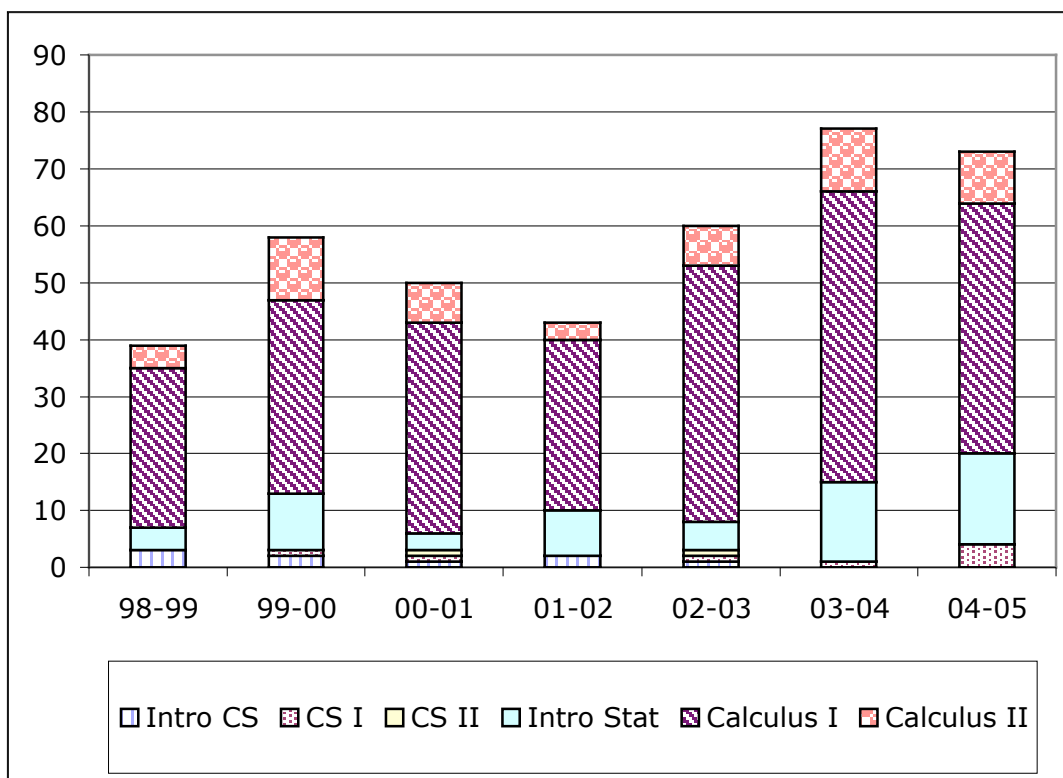
In the following report, data is merged for several courses. For instance, "Introductory Computer Science" includes Introduction to Computing and Introduction to Programming. No distinction is made between the two course numbers for Introduction to Statistics. Calculus I received four credit hours for the timeframe considered.

There was no data in the database for Springs of 1999, 2001-2004. Recall that some students were recognized for both AP and Transfer credit, as discussed at the beginning of this section. Students did not receive duplicate credit. All entries are reported here.

Table: AP Credits by Semester and Course

YEAR	98-99	99-00	00-01	01-02	02-03	03-04	04-05
Introductory Computer Science classes	3	2	1	2	1		
Computer Science I		1	1		1	1	4
Computer Science II			1		1		
Introductory Statistics	4	10	3	8	5	14	16
Calculus I	28	34	37	30	45	51	44
Calculus II	4	11	7	3	7	11	9
TOTALS	39	58	50	43	60	77	73

Figure: AP Credits by Semester and Course



B. Transfer Credits

The Department grants credits for courses taken elsewhere based on equivalent course content. We have worked with the Registrar's Office in recent years to automate many of the requests for transfer credit. Guidelines are posted at <http://www.southwestern.edu/~shelton/Dept/transfer.html>.

Course descriptions are examined carefully. Often, additional information is requested and thoroughly reviewed. Whenever possible, the chair decides credit. In cases where the chair lacks expertise or is uncertain, some or all members of the department are consulted. Occasionally, a student reveals that a course was taken on-line. If this is known beforehand, no credit is granted. In some cases, students who have been granted credit have been found to have poor skills.

Almost any introductory statistics will transfer. Calculus I content varies a great deal and is much harder to transfer; credit is given only for a comparable course that receives at least four hours credit elsewhere. Business Calculus or other Calculus receives "Selected Topics, lower level" credit for three hours. Students who have taken both a College Algebra course and a course with logarithms, exponential functions, and trigonometric functions may receive credit for

Elementary Function Theory. We consider College Algebra by itself to be remedial and grant no credit for it.

Formerly, the Registrar's Office granted elective credit hours when the hours taken elsewhere were greater than the credit given here. For instance, if a Calculus I received 5 hours credit elsewhere, the student can only receive 4 hours for our Calculus I, so the student also received 1 hour general (not math) elective credit. This practice will not continue, effective possibly Spring 2005 but no later than Fall 2005.

Some transfer credits are taken during a semester abroad or other program external to Southwestern (like the Washington semester).

The Department believes it does a good job of accommodating students while maintaining quality. We do not maintain records on the number of requests for transfer that are made, which are considerable. The actual number of transfer credits given, however, has decreased.

Note that a change in course numbering in 99-00 reduced Intro Stats and Math Concepts to lower level courses.

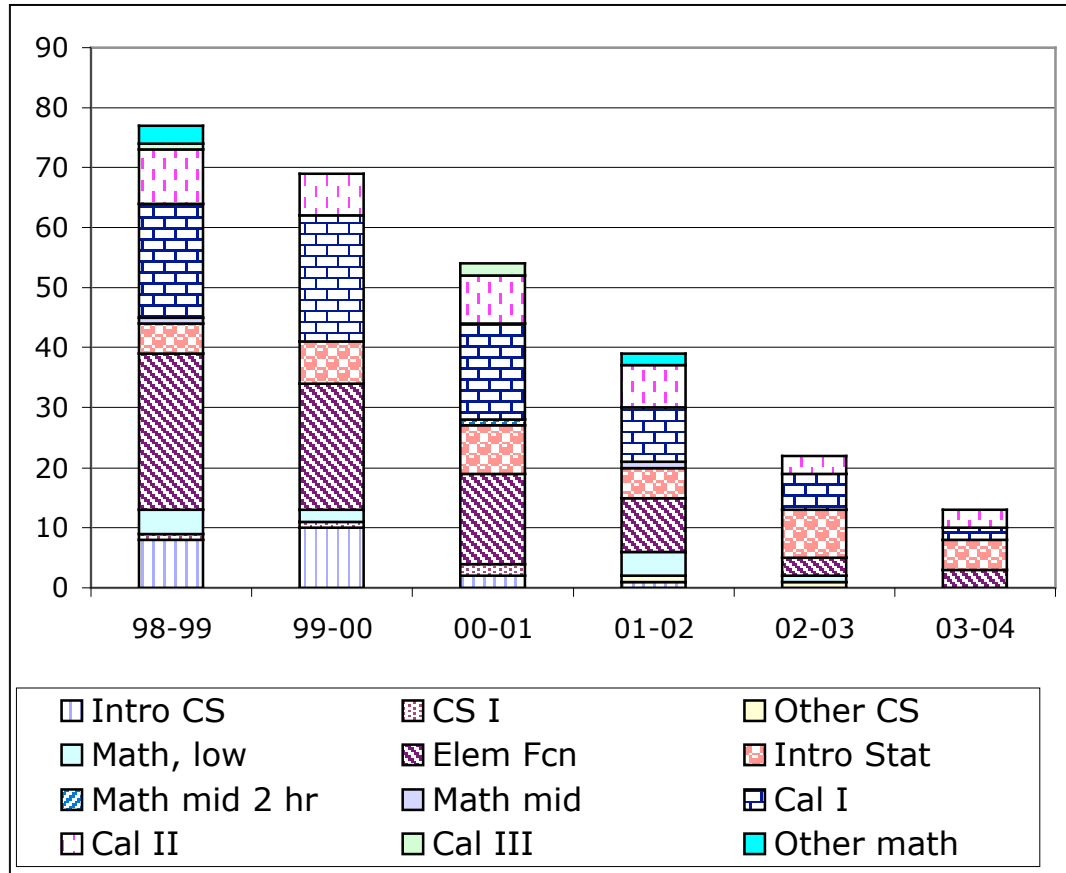
There was no data in the database for Fall 2004.

Table: Transfer Credits by Semester and Course Category

No transfer data for F04.

	98-99	99-00	00-01	01-02	02-03	03-04
Intro CS	8	10	2	1		
CS I	1	1	2			
Other CS				1	1	
Math, general low level	4	2		4	1	
Elem Fcn	26	21	15	9	3	3
Intro Stat	5	7	8	5	8	5
Math general mid level, 2 hr			1			
Math general mid level	1			1		
Cal I	19	21	16	9	6	2
Cal II	9	7	8	7	3	3
Cal III	1		2			
Other math	3			2		
TOTALS	77	69	54	39	22	13

Figure: Transfer Credits by Semester and Course Category



B. Other Credit

The Department recognizes the University policy for "advanced standing" credit. We have prepared a few exams for individual students. In general, however, the student is best served by taking the appropriate course.

X. DETAILED LOOK AT ENROLLMENTS - F00-F04

Data was examined for the previous eight semesters for all students who ever enrolled in a Mathematics or Computer Science course here at Southwestern, including First Year Seminars but excluding special courses such as Independent Studies. In all, 3,886 records were examined, 31 of which constituted section changes. The F04 semester was in progress at the time the data was collected and is included to determine subsequent course taking: do students who take one course go on to take another. In some cases courses were merged, as in the other sections, to account for changes in the curriculum. Efforts were made to account for the changes in course numbering and naming. Other reasons for detailed consideration are as follows: to understand the strengths and weaknesses of our students; to track success and retention; to track those intending to teach pre-college; to see if people seem to have conflicts between being in our program and study-abroad or athletics. Several of these reasons were suggested by the *CUPM Guide*.

A. Knowing Our Students

Our Department knows from experience that the greatest proportion of our students take a single course. Subsequent course-taking is, for the most part, limited to majors and minors within the Natural Sciences. The Department often has conversations about the make-up of certain sections to aid in course management. For instance, we know that in general 30% to 60% of those who complete Introduction to Programming may go on to take Computer Science I. Roughly half of the Fall Calculus I students go on to take Calculus II in the Spring. Very few of the Department's majors take Introduction to Statistics, Elementary Functions, or Mathematical Concepts. These trends were affirmed by an examination of the data.

Many of us survey our students in some way to know their areas of interests. Although this often reveals which students are majors within the Department, all of our faculty treat the students the same, regardless of major. We encourage strong students to take other courses within the Department but do not press the issue. We know from experience that a variety of students take Introduction to Statistics: Business, Economics, Accounting, Psychology, Biology, and Sociology accounting for the majority. We are seeing a rise in the number of Political Science students in Statistics. These trends were affirmed by an examination of the data.

B. Student Success

Students who are still in a class by the twelfth day of the semester may withdraw from the class by the Monday of the sixth week without record on their transcript; however, these students remain in the database. Students may withdraw with a "W" by the Monday of the twelfth week. If they enrolled as pass-fail, they will receive a P for at least a C- or a D or F. Otherwise students will receive a letter grade. Detail regarding pluses and minuses was ignored in this analysis.

The first Table below give summary information by course. Note that Computer Science II and Calculus II have the highest withdrawal rates. Successful completion for non-major courses is comparable, and in some cases better, than rates for upper-level courses, but that is greatly affected by the total enrollment. For instance, enrollments in CS II for three years

totalled 90, so that 22% represents 20 students who withdrew before the first day to drop. In Calculus II, there were 260 students over the same period, so that 19% who withdrew early accounted for 50 students. In Statistics, 15% of 851 students was 128.

Table: Completion and Grade Info, by Course Category

	withdrew early	W	A,B,C,P	D	F
Math Concepts	7%	3%	77%	8%	5%
Intro Statistics	15%	4%	72%	6%	2%
Elementary Function Theory	15%	7%	56%	15%	7%
Calculus I	17%	7%	68%	5%	3%
Calculus II	19%	7%	67%	5%	2%
Calculus III	9%	4%	84%	3%	
Other Regular Math	10%	4%	80%	3%	10%
Intro Programming	13%	4%	77%	3%	3%
CS I	9%	3%	84%	4%	
CS II	22%	4%	65%	8%	1%
Other Regular CS	8%	5%	82%	3%	8%

The following Table indicates that recently upwards of 50% of our students complete a class with an A or B. Grade trends have remained relatively stable across time.

Table: Completion and Grade Info, by Semester

										Overall
A	28%	28%	29%	30%	26%	28%	25%	32%		28%
B	30%	26%	29%	25%	29%	29%	31%	27%		28%
C	20%	16%	14%	19%	16%	14%	18%	16%		17%
P	0%	2%	1%	1%	1%	2%	0%	1%		1%
D	4%	6%	6%	7%	5%	4%	5%	3%		5%
F	2%	3%	3%	2%	2%	3%	4%	3%		3%
W	4%	6%	5%	4%	4%	7%	4%	6%		5%
withdraw early	13%	13%	13%	12%	17%	14%	13%	12%		13%
	00/FA	01/SP	01/FA	02/SP	02/FA	03/SP	03/FA	04/SP		
										Totals
A	148	122	128	124	109	102	122	121		976
B	161	116	131	102	120	105	150	104		989
C	104	70	63	76	66	50	85	61		575
P	1	9	5	6	3	8	2	5		39
D	22	26	28	28	22	14	26	12		178
F	8	11	13	10	9	12	17	11		91
W	22	26	24	15	17	24	18	21		167
withdraw early	67	58	56	49	70	50	60	46		456
Totals	533	438	448	410	416	365	480	381		3471

C. Athletics

Our program seems fully capable of supporting student participation in athletics. There were 810 records for students enrolled in regular (not special) Mathematics or Computer Science courses who were also athletes the semester they took the course, 6 of which were merely section changes, leaving 804. Of those, 100 were in progress at the time of data collection. The remaining 704 records were for 389 separate students.

Athletes from a wide variety of sports succeed in our courses at all levels. Clearly the majority take non-major Mathematics courses. Since these are most often taught by adjuncts, the Department should make an extra effort to educate adjuncts about working with athletes. This poses some problems since athletes are apt to arrange makeups because of their travel schedule.

Table: Sports of Course Takers

Example: There were 37 instances of a female athlete taking a M/CS course in the timeframe. A student is counted as many times as s/he participated.

	Women's	Men's
Volley Ball	37	
Baseball		110
Golf	19	25
Track	5	10
Tennis	17	37
Cross Country	20	43
Swimming	57	46
Soccer	70	98
Basketball	36	79
Athletic Training	10	4
Men's and Women's Auxiliary	18	

Table: Athletes' Course Info, by Category

A student is counted as many times as s/he participated.

Category	#
intro CS	48
CS I or II	44
other CS	47
non-major math	299
Cal I or II	226
other math	126
FYS (by M/CS faculty)	14

The data was examined for a relationship between sport and grade; none was found.

Table: Athletes' Course Completion and Grade Info

Each letter grade includes all levels (plus, minus, plain). "P" means C- or better but taken "P/D/F". A student is counted as many times as s/he participated.

A	B	C	P	D	F	W	withdrew early
166	227	137	7	45	13	24	85
537 better than D				582 passing	122 other		

Table: Athletes' Course Info, by Semester

	00/FA	01/SP	01/FA	02/SP	02/FA	03/SP	03/FA	04/SP	04/FA
intro CS	11	4	11	1	5	3	5	3	5
CS I or II	5	6	8	9	6	3	4	2	2
other CS	4	4	2	8	6	3	9	6	5
non-major math	55	36	28	37	26	29	28	28	32
Cal I or II	32	23	28	17	27	9	38	15	37
other math	18	9	14	10	14	10	15	17	19
FYS	0	0	4	0	89	0	5	0	0

Table: Athletes' Course Completion and Grade Info, by Semester

	00/FA	01/SP	01/FA	02/SP	02/FA	03/SP	03/FA	04/SP
A	30	18	24	16	19	13	26	20
B	43	26	31	29	28	15	34	21
C	28	18	17	12	21	9	23	9
P		1	1	2		2		1
D	4	6	7	8	6	4	7	3
F	2	1	1	1	1	3	2	2
W	4	5	3	3	2	2	3	2
withdrew early	14	7	11	10	12	9	9	13

D. Other Information

150 different students who took a Mathematics or Computer Science course participated in Study Abroad sometime in their time at SU. An examination of the course offerings and pre-requisite structure revealed that Mathematics majors have a very difficult time studying abroad in the Fall of their junior year unless comparable courses are found elsewhere. This information has been delivered to Sue Mennicke who organizes the Study Abroad program. The Department has worked to support Study Abroad for a number of majors.

As is evident from the Table below, the vast majority of our students are in their first two years of study, especially in their first year. Students are to satisfy their math general

education requirement within their first year, and for the most part this occurs. This is another indicator that few of our students go on to become majors. "SU" indicates an alum; "VI" indicates "Visiting", such as an exchange student.

Table: Distribution by Classification

blank	FR	SO	JR	SR	SU	VI
9	1889	877	565	538	2	3

Table: Distribution of Courses with First Years

	FR	SO	JR	SR	other
Int Programming	127	43	23	22	2
Computer Science I	69	21	13	11	1
Computer Science II	29	37	19	7	
Discrete Math	1	3	6	8	
Computer Organization	8	30	21	14	
Algorithms	5	17	24	12	1
Programming Languages	2	6	18	20	
Computer Graphics	1	13	16	11	
Artificial Intelligence	3	7	7	17	
Math Concepts	137	31	21	24	
Int Statistics	580	233	71	54	5
Elem Fcns	135	19	3	4	
Calculus I	469	107	44	24	3
Calculus II	175	77	27	10	1
Calculus III	44	57	21	12	
Geometry	3	9	16	17	
Probability	3	8	14	18	
Linear Algebra	32	88	30	14	1
Int Analysis	2	10	13	14	

As the Table above indicates, a surprising number of first year students take Calculus III. This is consistent with the increased levels of AP Calculus credit.

A significant number of students take low level courses in their Senior year; many of them have not had Mathematics since high school and must virtually begin anew.

XI. DEGREE RECIPIENTS F95-S04

A. Overview

Information was combined from several sources: data, alumni survey, faculty knowledge.

The data was organized by Southwestern's Academic Computing and analyzed by the Chair of the Department: for all students who graduated with a major or minor in math or CS (math major, computer science major, computational mathematics major, math minor, computer science minor) from Spring 2004 back through Fall 1995, student ID number, semester of graduation, BA or BS, list of majors and minors, area of interest indicated at the time of application, gender, race. The purpose was to determine career plans, fields of study, and aspirations of our graduates. Such tracking is suggested in the *CUPM Curriculum Guidelines 2004*. (See, for instance, Sample Questions 3 and 4 of the CUPM Appendix 6.)

Note that some students receive multiple majors and/or minors. We did not request an indication of a third major, but we know that two graduates in this time frame completed three majors. One graduate also completed a second undergraduate degree here at Southwestern.

Many of us keep in touch informally with graduates, including through email and at Homecoming. For several years, the department has hosted an online alumni data gathering survey. When given permission, results are posted on a website. For this self study, information was collected from individual faculty members and merged with the information from the Departmental Online Alumni Survey. Results are shown in the Figure below.

From the Department webpage, clicking on "Alumni Info" takes one to <http://csmath.southwestern.edu/alumn-info.html>, where there is a request to take the alumni survey at <http://csmath.southwestern.edu/alumn-form.html>.

Table : Department Majors and Minors

Individual degrees are counted rather than degree recipients; students are counted in each applicable context.

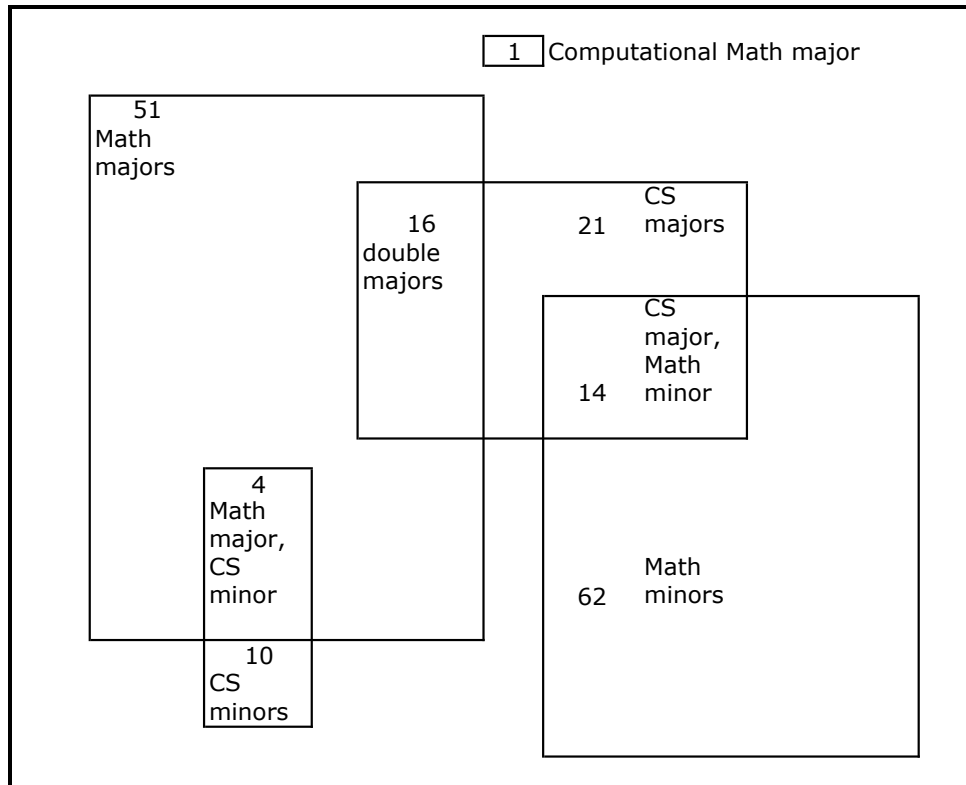
Dept Majors		of our 123 major degrees
Computational Math	1	1%
Mathematics	71	58%
Computer Science	51	41%
Dept Minors		or our 90 minor degrees
Mathematics	76	84%
Computer Science	14	16%

Table: Departmental Degree Combinations

Students are counted once in each category.

Computational Math Major	1	1%
Double Major in Math & CS	16	9%
Math major, CS minor	4	2%
Math major, no department minor	51	28%
CS major, math minor	14	8%
CS major, no department minor	21	12%
Math minor	62	35%
CS minor	10	6%
	179	

Figure: Venn Diagram of Degree Combinations



B. Trends in Academic Interest

When students apply to Southwestern, they are asked to indicate their areas of academic interests. Data suggests there is little correlation between academic program interest upon application to the University and actual degree for Math and Computer Science recipients. Of

the 147 graduates who received a major or minor in Mathematics between F95 and S04, 63 or 43% indicated an interest in math on their application; these values ignore Computer Science. Of the 66 graduates who received a major or minor in Computer Science between F95 and S04, 31 or 47% indicated an interest in math on their application; these values ignore Mathematics. The following Table gives further evidence that application information bears little resemblance to final outcomes.

Table: Academic Interests of Department Degree Recipients

Of the 179 graduates who received at least one major and/or minor in our Department between Fall 1995 and Spring 2004, 18 had indicated an interest in both Mathematics and Computer Science on their application, etc.

no entry made of Academic Interest	23	12.8%
Mathematics & Computer Science	18	10.1%
Mathematics but not Computer Science	48	26.8%
Computer Science but not Mathematics	26	14.5%
Interest other than Mathematics or Computer Science	64	35.8%
	179	

C. Other Majors, Minors

Of those graduates who received at least one major in our Department between Fall 1995 and Spring 2004, 17 had no room for a second major, (although two received a third). Of the 90 who received a single major in our Department, 31 received a second major in a different department and 33 received a minor in a different department. Of the 72 who received only a minor in our Department, there were 76 majors (some double) and 16 minors outside the Department. All these are broadly spread across other disciplines, as seen in the following Table. We take this as evidence that our program supports the liberal arts and is flexible.

Table: Other Majors and Minors for our Degree Recipients

Division/School	Degree	Other Majors for our Majors	Other Minors for our Majors	Other Majors for Our Minors	Other Minors for our Minors
Social Sciences	Accounting	3		4	
	Anthropology		1	1	
	Business	1	2	7	
	Economics	2	3	7	3
	Kinesiology	2	1	3	
	Political Science			4	
	Psychology	2		5	1
	Sociology		1		
Natural Sciences	Biology	3	1	10	2
	Chemistry	1	1	19	1
	Physics	5	1	7	2
Humanities	German			1	
	History			2	1
	Spanish	1		2	3
	French	1	1		1
	Philosophy		1		1
Fine Arts	Architecture		3		
	Communication	1	1	1	
	Music	3	4	1	
	Theater	2	1	1	
Interdisciplinary	Feminist Studies			1	
	Environmental Studies		1		1

D. Facts About our Majors

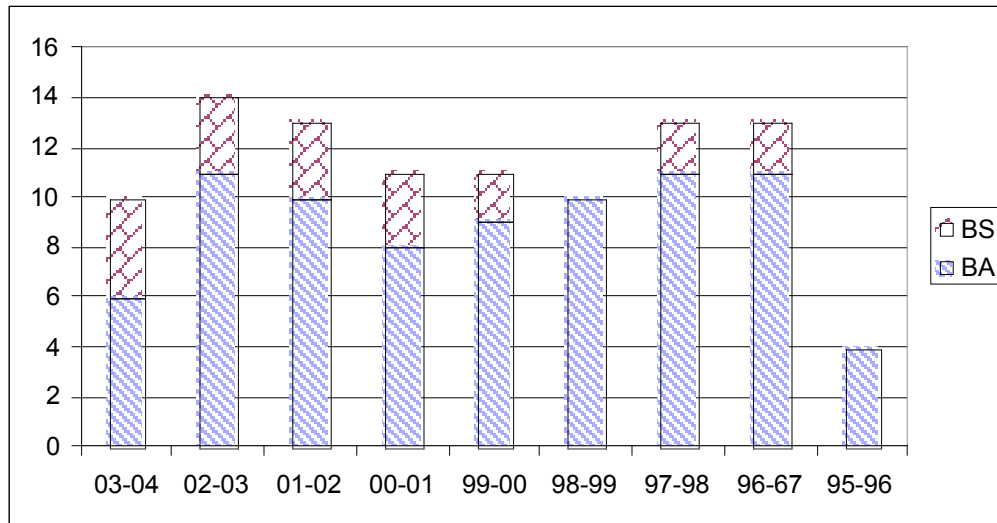
The following consider those who graduated with a major in Computational Mathematics, Mathematics, or Computer Science. No distinction is made for double majors or major/minor combinations. Those with only a minor in the Department have not been included.

Table: BA vs BS, Gender, Ethnicity

Degree Date	number	BA degree	Female	Asian/Pacific Island	Hispanic-Latin American
95-96	8	7	2	1	0
96-67	13	11	5	1	0
97-98	13	11	4	1	1
98-99	10	10	7	0	0
99-00	11	9	6	0	0
00-01	11	8	4	0	0
01-02	13	10	7	0	0
02-03	14	11	4	2	0
03-04	10	6	4	0	1

Clearly almost all of our graduates receive a Bachelor of Arts degree. One person received a BA and returned for a BS; that person was only counted as a BA.

Figure: BA vs BS



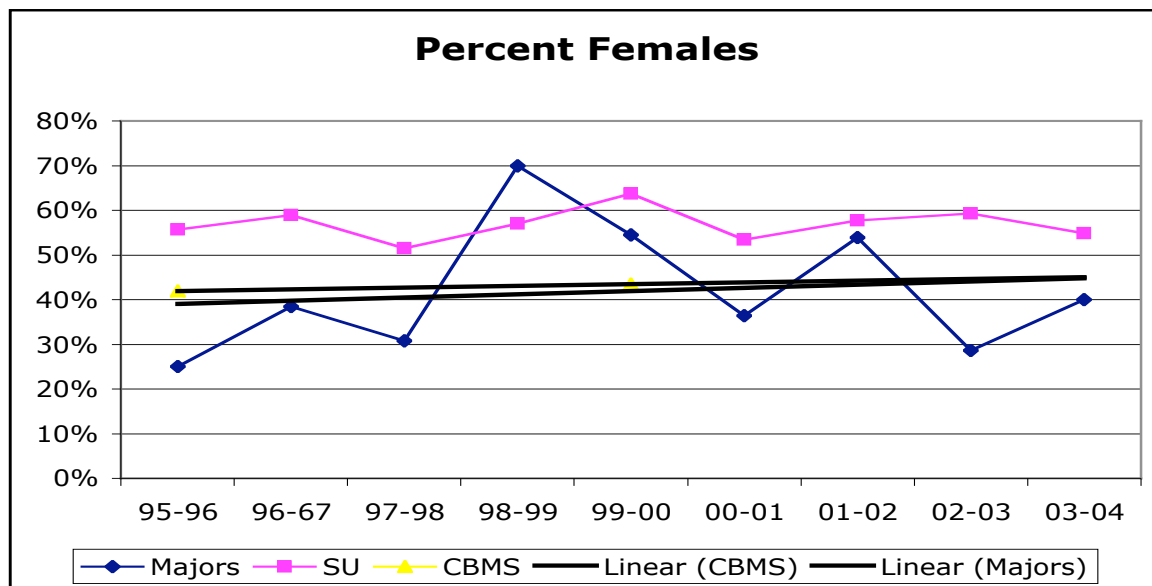
Consider Figure: Gender Comparison, by Year. "Majors" tracks graduates who received one or more majors within the Department. A linear trendline was added to this data.

To compare with the entirety of Southwestern, matriculant data from four years prior to the graduation date was used. For instance, Department graduates from 1995-96 were compared to the matriculants from Fall 1992. The "Class Profile" information provided at the Fall Faculty Conference was used.

Two national data points were taken from the CBMS 2000 Survey, Table SE.4, p 14: Number of bachelors degrees in Mathematics and Statistics Departments at four-year colleges and universities for 1979-80, 1984-85, 1994-95, and 1999-2000. The 1994-95 value was used for comparison to our 95-96; the 1999-2000 value was compared to our 99-00 value. A trendline was added. The CBMS values are higher than those provided by Science and Engineering Indicators, Figure 2-12 of c02.pdf, the latter being closer to 35%.

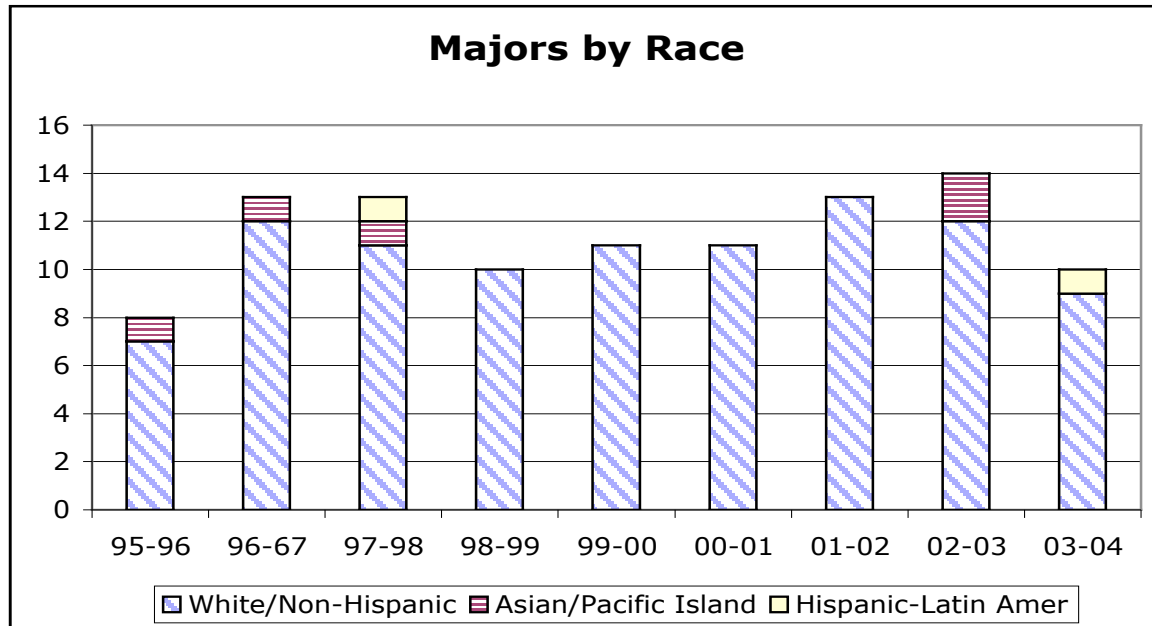
As expected with small numbers, gender varies more within our graduates than in the corresponding cohort of matriculants. Note that the trendlines for our majors is almost identical to the two-point national trend. Overall, there is a reasonable gender distribution among our majors.

Figure: Gender Comparison, by Year



The vast majority of our graduates are White/Non-Hispanic. Nationally, for all science and engineering bachelor degrees, Asian/Pacific Island account for about 8% and Hispanic account for approximately 6%; see Table 2-13 from Science and Engineering Indicators. When we have minority graduates in the Department, they account for 8-13%. Percentages vary dramatically because of the small numbers of people.

Figure: Ethnicity, by Year



E. Post-Graduate Tracking of Majors

For several years, the department has hosted an online alumni data gathering survey. From the Department webpage, clicking on "Alumni Info" takes one to <http://csmath.southwestern.edu/alumn-info.html>, where alumni are requested to take a survey at <http://csmath.southwestern.edu/alumn-form.html>. When given permission, results are posted on a website.

In addition, many of us keep in touch informally with individual graduates.

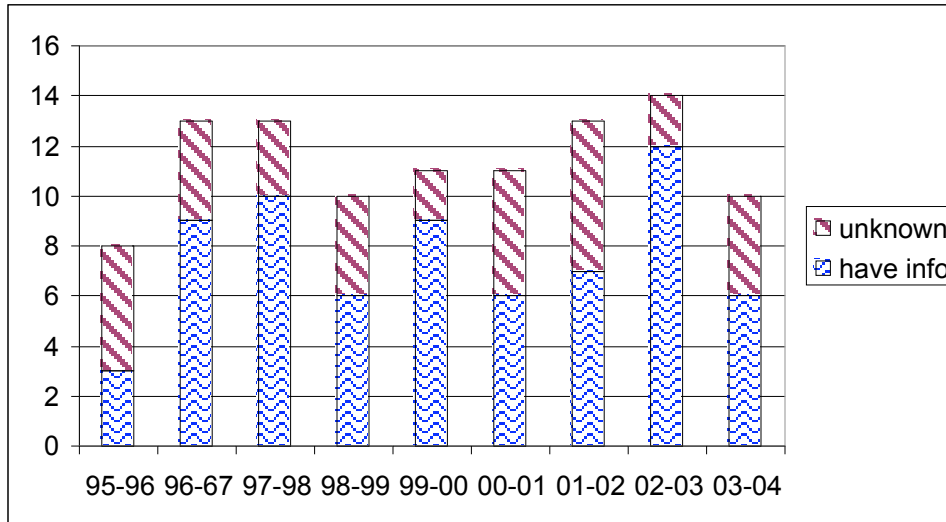
For this self study, information was collected from individual faculty members and merged with the online survey information, whether posted or not, to provide the data below. In general, the Department does a good job of tracking majors. Many have pursued post-graduate studies. Many are employed.

Table : Post-Graduate Information on Majors, Numbers

Degree Date	number graduates	after graduation		
		have information	advanced studies	employed
95-96	8	3	0	3
96-67	13	9	1	8
97-98	13	10	3	8
98-99	10	6	2	5
99-00	11	9	3	9
00-01	11	6	3	4
01-02	13	7	4	6
02-03	14	12	6	9
03-04	10	6	3	1

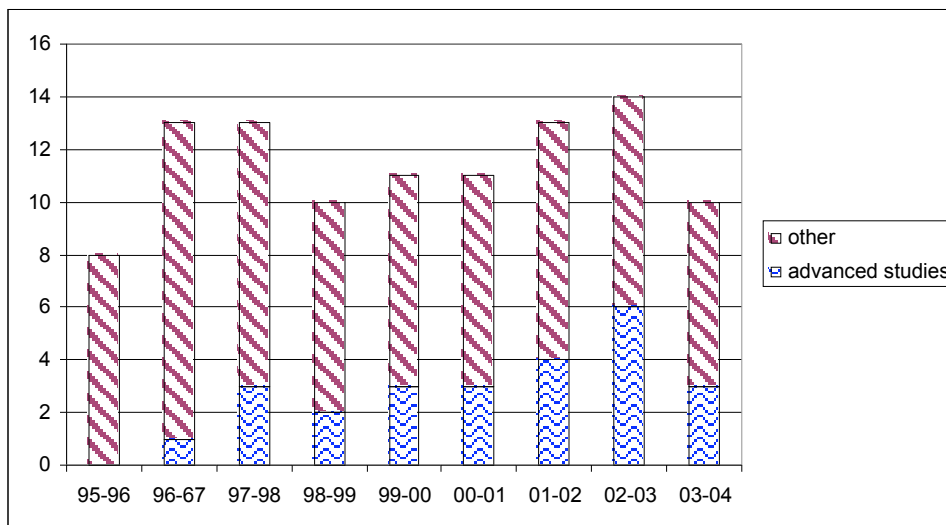
The following Figure shows the number of graduates with a major in the Department in recent years, broken down according to whether we have any information about them or not.

Figure : Graduates Tracked, by Year



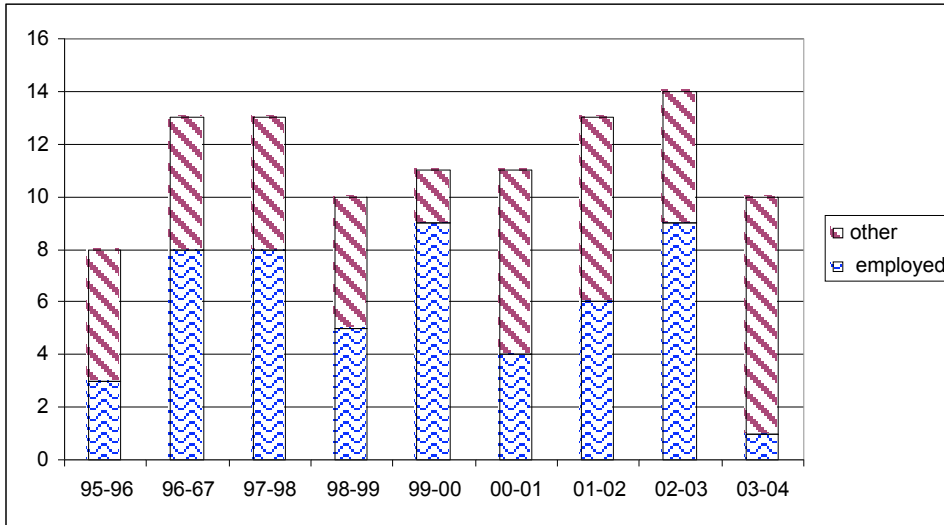
The following Figure shows the number of graduates with a major in the Department in recent years, broken down according to whether they have ever engaged in or are seeking entrance into a post-graduate program. This includes graduate studies in any area, including Mathematics and Computer Science, as well as CPA or other professional degree. Some of these alumni are now employed.

Figure : Post-Graduate Majors in Advanced Studies, by Year



The following Figure shows the number of graduates with a major in the Department in recent years, broken down according to whether they were last known to be employed.

Figure : Employed Post-Graduate Majors, by Year



XII. PROGRAM ASSESSMENTS other than grades

A. Alumni Input

Responses to the Departmental Online Alumni Survey were collected in the Summer of 2003; respondents from that data for recent graduates are provided. See <http://csmath.southwestern.edu/alumn-form.html> and the Appendices for the survey. The Department is aware of the inherent bias in such a voluntary sample instrument.

Figure : Alumni Rating of Program Preparation for Employment



Figure : Alumni Rating of Program Preparation for Graduate School

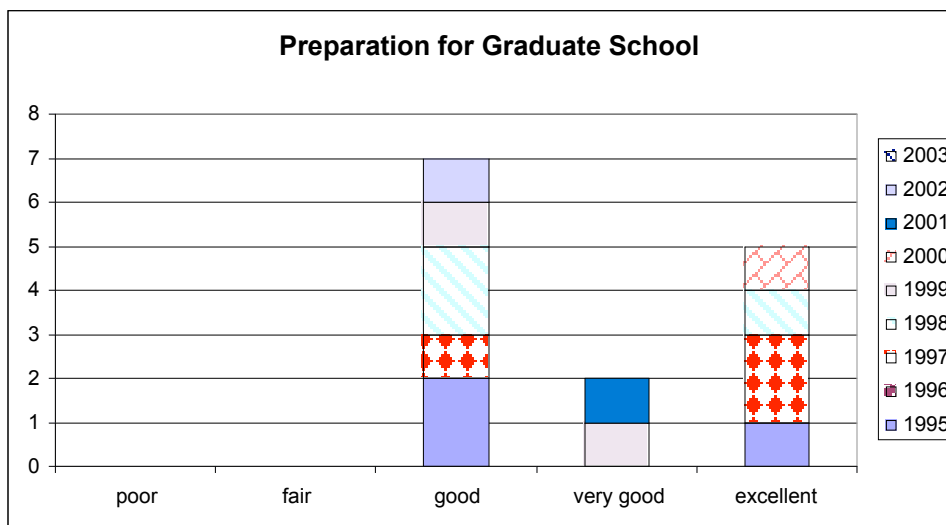


Figure : Alumni Rating of Satisfaction with Program Preparation



Data indicate a high success rate for our students based on good preparation.

Freestyle comments from the online departmental alumni survey indicated the worth of addressing job and graduate school opportunities. Tables below provide responses from the Departmental Online Alumni about a students' most valuable experiences at Southwestern University and suggestions for the Departmental program. Note also the comments indicating the worth of Probability and Statistics both from those who took one of these courses and those who took neither. Several alums pointed to developing good problem solving skills here.

Table: Alumni's Most Valuable Experiences, Part 1

Year of Graduation	MOST VALUABLE EXPERIENCES AT SU:
1995	Calculus I-III Diff. EQ I-II
	Independent study, Take-home exams Courses that offered: 1. Opportunity to appreciate complexity regardless of the specific content. 2. Development of strong conceptual/abstract reasoning skills.
	The mathematical modeling course was by far the most helpful for my career. Having to write about and present our work is invaluable experience. It was also one of the few courses that I took which required computer work. I am also very grateful for the interaction with professors and their concern for our education.
	the courses I found the most valuable were any of the ones taught by Dr. Kendall Richards. What a great American!
	To tell you the truth I've enjoyed learning how valuable our calculator is to us. I teach Algebra II, PreCal, Physics, and Calculus and it never seems to amaze me how much better we are for knowing how to do something with pencil and paper. Then again when you run into the more difficult problems it's reassuring to know how to work the calculator properly.
	I acquired great problem solving skills while at Southwestern that have been a great help to me.
1996	Statistics (even though it doesn't qualify for the math major)
1997	Programming Concepts I and II and Analysis of Algorithms.
	For what I am doing, I don't think any one specific class helped me more than another. But, I do know that, in general, the problem-solving skills that you "hone" as a math major help A LOT in the "real world." I don't mind digging into problems, and I am able to work out solutions, and I think that being a math major helped better shape that ability.
	Learning to logically and systematically solve problems.
	The most valuable skill I learned in the Math and CS department was the ability to think abstractly in order to model a problem either mathematically or programmatically.
	Since I am a high school math teacher, I use the information that I gained from Calculus I, Calculus II, Statistics, and Probability more than any of the more upper level classes.
	The overall thought processes and analytical skills that were developed in my coursework at SU are what is most valuable to me now. I am not in a field in which I use my advanced math skills very frequently, but I regularly benefit from the ability to logically think through complex problems.
	I suppose it would have to be those horrible Algebraic Structures classes. I just think back to how lost I was in those classes and imagine that's how some of my students feel about basic math. Though the only real part of those classes I liked was going to lunch with the class and Dr. Potter. I suppose it's the relationships the professors have with the students at Southwestern that makes it the great place that it is.
1998	Independent study - Cryptography with Dr. Potter was the most valuable as a learning experience.
	Programming Concepts 1 and 2 Operating Systems
	I wish I would have majored in Computer Science rather than Math since software is where my career has lead me. Having the Math major did help me get jobs - people are usually impressed by it, especially in the computer industry. Also, having a Math degree helped my analytical skills which is important in programming.
	Statistics-I wish I would have taken more in depth classes in this area
	The most relevant courses that I took at SU were those in Differential Equations, Calculus, Linear Algebra and the introductory Computer Science courses that I took. In retrospect, I wish that I would have taken more programming classes. Overall, I think that I was better prepared for the theoretical rigors of Applied Math than most of my fellow students.

Table: Alumni's Most Valuable Experiences, Part 2

Year of Graduation	MOST VALUABLE EXPERIENCES AT SU:
1999	The most beneficial experience I had was an internship with IBM the summer after my junior year. Most valuable CS class I took was Computer Architecture.
	Probability (very relevant to my current course of study) Real Analysis (an excellent introduction to proof)
	I liked them all-- they provided a challenge and taught me to think through those challenges. I especially enjoyed algebraic structures, real analysis, complex analysis and combinatorics.
	all
2000	The Algebra and Real Analysis courses were very helpful in learning the language and logic structure of mathematics.
	Introductory to Analysis- the one that has been most hit upon in Grad School
	Personally, I valued the small class atmosphere and the close relations between faculty and students. Now that I am at a larger university, I realize what a great experience I had at SU.
2001	Software Engineering Programming Languages
2001	Calculus III, Real and Complex Analysis
2002	Team software development projects were valuable.
	Technically, the most valuable courses have been Operating Systems and the Database class. The Software Engineering capstone was valuable as well, but would have been more so if it had been structured differently. In terms of graduate school, the most valuable course *subject matters* were Algorithms and Programming Languages. In mathematics, the Mathematical Modeling Capstone was very helpful, as were the Differential Equations and Algebraic Structures courses.
	Comp. Org., Intro. to Analysis, R.E.U. and Senior Research Project under Potter, Automata Theory, Computational Number Theory, Graphics, and other stuff I'm probably forgetting
2003	Senior Capstone: Software Engineering
	So far, the only benefit applicable is the ability to think clearly. As I am just working a summer job for the Girl Scouts, I haven't yet had an avenue in which to apply technical knowledge from school.
??	Although I enjoyed most of my classes, the most valuable experience for my career was my internship at Hayes Software Systems. I think every student should attempt to gain "real world" experience, because it truly adds to your skills and therefore marketability.
	Software Engineering

Table: Alumni Suggestions, Part 1

Year of Graduation	SUGGESTIONS:
1995	Add more scientific math classes such as advanced calculus. That would have helped with Physics and later engineering courses. It would have been nice to have more of those classes so that I would have been able to opt out of some of the algebraic structures and analysis courses.
	1. Stronger links with grad schools & industry through speakers & visits 2. Require a small portion the program to develop skills in languages that are used in industry. This helps in executing theoretical frameworks developed at SU. Having worked and competed with other CS grads, I felt a little disadvantaged on the execution front. 3. Make Operating Systems part of the CS requirement (I missed the course!).
	Any work or research related internships would have been very helpful prior to starting work and graduate school.
1996	More programming. Code code code.
	It would be helpful to have an analytics class on value-at-risk and more complex statistics. I know that there is an intro class for stats that only qualifies for a business degree, but alot of companies are using VaR and other analytics for risk management purposes.
1997	Cooperation with the education department for a math instructional class.
	As a secondary education person, I really feel that I could have benefitted from some sort of math education class for middle/high school. I was encouraged by the education dept. to take Geometry as one of my math classes, but it really did nothing for me as a teacher. There are a lot of ideas that I have seen elementary people have from some of their classes that we missed out on being secondary. I think the math department could improve on that (if they haven't already).
1998	I'd like to see some non-programming courses offered. CS does not need to focus solely on programmers; there are plenty of other fields that the CS department should offer training in (LAN admin, Web design, etc)
	I would recommend a class on networks (both LAN and WAN).
	None for the math dept. I didn't take any CS courses at SU.
	In retrospect, I would have loved to have a class that showcased some of the common subjects of study in graduate school.
	The only suggestion I would have is for the department to give students more information about what they can do with their BA in math. When I went to job fairs, the only jobs I found for math majors(with BAs) was teaching.
	The curriculum at Southwestern seems ideally suited for those entering either Pure Mathematics or C.S. However, for those who would like to branch the two (Engineering, Applied Math) there is a little to be desired. For these disciplines, courses in Numerical Linear Algebra, Computational Differential Equations, Partial Differential Equations, Optimization and Numerical Programming (in Fortran, C++, Matlab) could be added. I realize though, that these are the kind of courses taught to junior and senior engineering students and at the beginning of graduate school. Due to the size of Southwestern, they would be difficult to implement (maybe 1 or 2 people would take them), so it's probably unrealistic.

Table: Alumni Suggestions, Part 2

Year of Graduation	SUGGESTIONS:
1999	require or strongly suggest internships
	More rigorous linear algebra course
	offer a math department statistics class offer topology more often I liked that SU Math was very theoretical vs. applied, but I think there should be a couple more applied math classes since we have grads who go on to study applied math.
	Offer more classes that aren't so theoretical. Although it is important to have these, more employers today are looking for graduates with experience. I would also recommend setting up an internship program for the students.
	Allow more opportunities for students interested in graduate school to get a taste of some higher level mathematics.
2000	Statistics Course for Majors
2001	I like that you have now created a computational math field
2002	Personally, I found myself very platform and IDE dependent when learning to program. For example, to write a java program, the necessary steps in my mind were: 1) open kawa (later jbuilder) on a windows machine 2) write program (in IDE) 3) compile (in IDE) 4) run (in IDE) For a while, I would have been lost without the familiar IDE, and hopeless on a mac or linux machine. I think the meanings of compiling, running, making, and classpath (to name a few) can be obscured by this IDE dependence. It's important to understand these concepts outside the context of an IDE. It would be nice to see the department make more use of linux as a teaching platform. Words like chmod and grep should have special meaning to us grads!
	The Algorithms course, when I took it, placed too much emphasis on searches, not enough on the theory of data structures (red-black trees, minimum spanning trees, and specific graph algorithms) and not enough on detailed study of algorithm complexity associated with such data structures. I feel that to be well-prepared academically for graduate school in computer science, it is absolutely necessary that these topics be covered well, and that at least in my class, they were lacking. The Software Engineering Capstone was fine subject-matter-wise, but in terms of workload served only to frustrate students. I feel like I would have gotten more out of it if students had been required, for instance, to write sample pieces of the required documents as opposed to all parts of the 50-200 page documents required. I also feel like there should at least be better written resources available on certain programming languages (especially web-based ones, as knowledge of these seems to be a deficiency in the department)
2003	Since this is a liberal arts institution, it would probably be best to show more of how modern computer science has developed and make it clear how diverse the field is from an early stage. Senior Capstone seems to have too much information squeezed into one semester and it would probably be best for it to be more than one.
	Corral as many students into the programs as you can, so that the department will be justified in offering a wider variety of courses and offering them more frequently. A specific course that I would like to have taken would be a course on the history of mathematics and/or computer science.
??	My main suggestion would be to work with career services to develop more career options for graduating students. Since SU is so small, it is difficult to get companies to come to us, but there are many other solutions. I think the department could work on establishing resources for students, not only for their job search, but their search for internships as well.

B. Standardized Exam

For 2002-03, capstone students were required to take the appropriate "Major Fields Test" for a grade. Individual data is not given here to preserve anonymity in the small groups of students. The exam will be administered again this year; scores will be available later. Some students were double majors and took both exams.

For both exams, it was interesting that several of our tutors performed very well, either meaning that we choose very good students to be tutors, or tutoring helps hone their skills, or both. Also of interest was the high correlation between the grades these students received in courses in the Department and their MFT scores; students we consider poorer performed the worst on the exam, and those we consider the best performed best on the exam. This seems to lend credence to our usual evaluation techniques.

In Mathematics, the mean score of the 7 students in Fall 2002 was 164.9 (out of 200), which was at the 85th percentile for the 218 institutions which administered the exam, according to "Major Field Test in Mathematics II, Institutional Mean Score Distribution; Seniors Only; 1999-2002 Data". The mean score for all institutions was 151.9. Our students' scores ranged from 136 to 183, which corresponds to 15th percentile up to almost 95th, according to "Major Field Test in Mathematics II, Individual Students Total Score Distribution; Seniors Only; 1999-2002 Data". We did have some exceptionally good students; three performed at the 90th percentile or above.

The exam was administered in Mathematics F04. The Math exam was changed, so there is no comparative data at this time.

Table: National Comparison by Category, Math

Comparison from "Major Field Test in Mathematics II, Institutional Assessment Indicator Mean Score Distributions; Seniors Only; 1999-2002 Data"

Assessment Indicator	SU Mean Percent Correct	National Mean	Percentile
Calculus	52.4	33.8	95
Algebra	48.6	44.4	65
Routine	53.9	45.1	75
Nonroutine	32.1	25.4	90
Applied	57.3	38.8	95

In Computer Science, the mean score of the 7 students in Spring 2003 was 167.7 (out of 200), which was at the 95th percentile for the 133 institutions which administered the exam, according to "Major Field Test in Computer Science, Institutional Mean Score Distribution; Seniors Only; 2002-2003 Data". The mean score for all institutions was 148.8. Our students' scores ranged from 157 to 185, which corresponds to 65th percentile up to 95th, according to "Major Field Test in Computer Science, Individual Students Total Score Distribution; Seniors Only; 2002-2003 Data". Again, we had some exceptionally good students.

The in Computer Science will be administered S05 to Capstone students.

Table: National Comparison by Category, Computer Science

Comparison from "Major Field Test in Mathematics II, Institutional Assessment Indicator Mean Score Distributions; Seniors Only; 1999-2002 Data"

Assessment Indicator	SU Mean Percent Correct	National Mean	Percentile
Programming Fundamentals	75.1	51.2	95
Computer Org/Arch/Operating Systems	34.7	32.3	almost 60
Algorithms/Theory/Comp Math	75.4	43.2	95

C. Senior Survey

In 2003-04, capstone students were asked to complete a survey found in the Appendix. Math capstone participants in F04 were also given the survey; two students were in the alternative Independent Study for pre-service teachers. The survey will be administered to the CS capstone students at the end of S05. On all scales, 5 is excellent, 4 is very good, 3 is good, 2 is fair, and 1 is poor.

For F03, 4 students successfully completed the Math Capstone; 2 of these turned in their survey. All 9 of the Computer Science Capstone students turned in their surveys. For F04, all 10 students turned in the survey.

7 respondents indicated they had engaged in a major collaborative project with faculty here at SU: 3 ACS Internships, 2 Independent Study, 1 REU. The average rating for the experience was 4.4. One student in the alternative capstone did not count the experience as an Independent Study and hence did not give a rating.

Notice that most students responded in both foundation areas although the question used the wording "your field". This is partly because of having several double majors or major/minor combinations, but also probably because our Computer Science curriculum is so mathematical and our Math curriculum requires some CS.

One student gave very positive comments rather than a numerical rating, so the comments were interpreted as a 4.

Several students gave more detailed responses, such as a rating for each core content area, so the average of the details was included as the student's rating for that category.

Table: Capstone Student Self-Assessment

In the score, 5 is excellent and 1 is poor.

Facility with...	# responded	avg score
problem-solving skills	19	4.43
mastery of the core content in required areas for your field(s):		
Mathematics -- calculus, differential equations, algebra, analysis	21	3.76
Computer Science -- computer programming, algorithmic development, computer organization, programming language paradigms, discrete mathematics, software engineering	18	3.44
appropriate technology for your field(s)	21	3.87

Free-form comments included the following, some of which are paraphrased.

Table: Capstone Student Comments

It would be helpful to have a course over basic mathematical language, symbols, and technology. The History of Mathematics course was great! It should be offered more often.
This semester helped with problem-solving skills.
The Department could be more lenient for scheduling like for study abroad.
The alternative capstone was great.
I came to the REU with little experience and learned so much.
Computer Science classes helped with problem-solving skills.
I enjoyed the closeness to the professors; they were glad I asked questions.
Some professors have a difficult time explaining material. Overall I am pleased; professors were willing to help.
Add a networking course.
Make capstone year-long.
A collaborative program group or other long term programming course would be very helpful.
All profs in this department are willing to help students outside of class; this makes for a much better learning environment.
Wish we could have IT pros teach portions of class.
Still lacking hardware, operating systems, etc.

XIII. ISSUES in STAFFING

A. Tenure Track Staffing - Numbers

We made good staffing gains since the last major departmental review, as seen in the Table below. We progressed from seven full time faculty, one of which was female, to nine, four of which are female.

Table: Tenure Track Staffing Trends

	Math *	CS only	Math and CS	TOTAL
93-94	4	1	2	7
94-95	4	1	2	
95-96	4	1	2	
96-97	5	1	2	8
97-98	5	1	2	
98-99	5	1	2	
99-00	4	2	2	
00-01	5	2	2	9
01-02	5	2	2	
02-03	5	2	2	
03-04	5	2	2	
04-05	5	2	2	

* Some of the Math faculty taught the Introduction to Computing course prior to Fall 2000.

Our growth stopped in Fall 2000, however, and our repeated requests for an additional faculty position have not been approved. In particular, the Department's 2000 Update to the Departmental Review stated, "An effort to strengthen the Probability and Statistics component of our curriculum may necessitate adding a faculty position in Statistics". The 2000-01 Departmental Annual Report pointed to "a lack of resources in the area of instruction in Probability and Statistics," outlined the need for three additional courses, and reiterated the need for a faculty position in Statistics, which has been included in the Departmental Annual Report each year. Fourteen more faculty positions have recently been added to Southwestern recently. Some of these positions were funded through the Paideia program, through which two of our faculty reduce their teaching load by one third for three years and one sixth for a fourth. Even so, we were not awarded a position. According to the Provost in Spring 2004, there was no hope of an additional position in the near future, despite the loss of our regular part time faculty member and the large number of recent additional staffing needs. In Nov 2004, Southwestern announced to its faculty the receipt of land from a math alumnus' estate, the sale of which is to fund positions in Mathematics and in Physics as well as the Atkins Memorial Scholarship in Mathematics. The University is debating holding the land for future sale at a possibly larger price versus selling soon and avoiding the liability of fifty year old earthen dams. Students, both majors and nonmajors, would be better served with another full time faculty member.

B. Supplemental Staffing

Our full time faculty resources are required for the higher level Mathematics and Computer Science courses, so when we need part-time faculty, they often teach the lowest level courses, especially in Mathematics. Whenever possible, full time faculty will teach Calculus I and above in Mathematics and Programming Concepts I and above in Computer Science. We have repeatedly hired an adjunct to teach an upper level Computer Science course to accommodate a Computer Science release or to take advantage of expertise. For instance, Database Management is usually taught by an adjunct. Many times we have been able to hire an adjunct over a year or over several years to increase stability and teaching quality.

For a number of years prior to Fall 2002, we had a single person, a valued member of the department, who taught the extra three sections regularly needed by our department. He also served as a staff member of the University. Prior to his staff appointment, he taught up to six courses a year for us. Even after his staff appointment, we had consistent, reliable staffing for a number of lower level classes. In addition, he was an academic advisor and was available five days a week for questions from students in his classes. He participated in some department meetings and was a resource on survey design and other assessment activities. When he left, we had to cancel a course in the Fall. His departure left a hole in our staffing.

As is evident in the next Table, we have consistently needed adjuncts, and we have had greater turnover in part time faculty recently. The number of different adjuncts has increased, as has the number of adjuncts who have never taught here before.

Table: Trends in Part Time Faculty

Sections are unweighted. Includes projections

Year	98-99	99-01	00-01	01-02	02-03	03-04	04-05	05-06
sections taught by part time faculty	11	10	4	9	8	8	8	15
different instructors	5	4	3	4	3	4	2	3
new instructors	2			3	1	2	1	2
sections taught by new faculty	4			4	1	2	1	8

Having even three adjunct positions a year filled by various people has not been nor will ever be equivalent to having regular part time faculty, or better yet, another full time position. The extra work of interviewing and hiring adjuncts is substantial, let alone monitoring/mentoring them. Students in our lowest level classes are often the ones who need the most help, yet these sections are the most easily staffed by adjuncts whose on-campus presence is limited. In addition, our adjunct faculty cannot inform students of usual procedures at Southwestern, such as advising and pre-registration, Homecoming or Brown Symposium, upholding our Honor System, etc. Our faculty have been more active in monitoring and mentoring adjuncts recently, but the students are not as well served as they would be if they were taught by regular faculty. It seems clear that an additional tenure track position would be of great advantage.

We were awarded a Visiting Position in Mathematics for 2004-05 and for 2005-06, but at a 21-hour load, 3 hours over our full load. For 05-06, we cut five sections to bring the number of sections taught by part timers down to 15.

The Figure below gives a visual comparison of the number of students taught by either part time or tenure/tenure track faculty by semester. Data in the following Tables show multiple comparisons between part time and full time teaching by year. Weighted sections are included

for the few times that a part time person has taught Calculus I; unweighted section information varies by a few percent from weighted information. The lower level courses, often taught by adjuncts, tend to be larger.

Figure: PT/FT -- Total Students, by Semester

12th day enrollments.

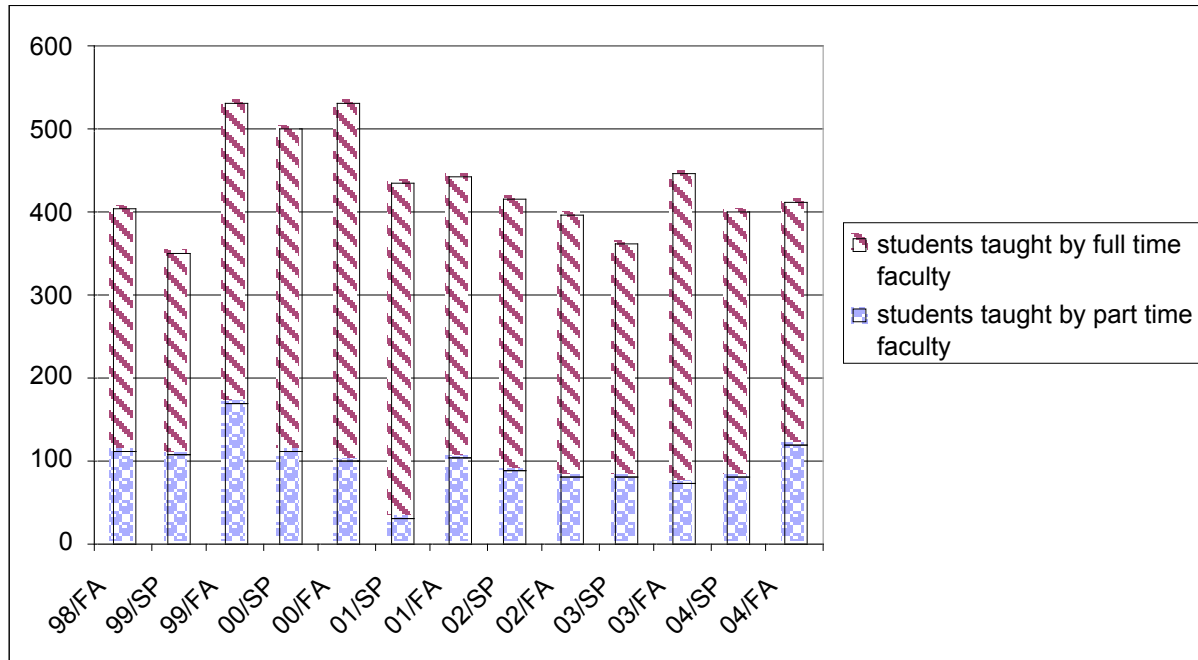


Table: PT/FT -- Total Students, by Year

12th day enrollments.

Year	98-99	99-01	00-01	01-02	02-03	03-04
students taught by part time faculty	221	284	134	197	166	158
students taught by full time faculty	538	752	837	667	598	692
total students	759	1036	971	864	764	850
percent of students taught by full time faculty	71%	73%	86%	77%	78%	81%

In the following Tables, it should be noted that we dramatically cut sections this year and again for next year to reduce the impact of part time teaching.

Table: PT/FT -- Number of Sections, by Year

Weighted sections. Averages are actual, not aggregate. Includes projection.

Year	98-99	99-01	00-01	01-02	02-03	03-04	04-05	05-06
sections taught by part time faculty	11.5	11	4	9	9	8	8	15
sections taught by full time faculty	41.5	46	50.5	47	44	46	41	33
total sections	53	57	54.5	56	53	54	49	48
percent of weighted sections taught by full time faculty	78%	81%	93%	84%	83%	85%	84%	69%
average section size for part time faculty	21.3	28.4	33.5	21.9	18.4	19.8		
average section size for full time faculty	14.8	22.0	25.8	16.7	14.3	15.9		

Table: PT/FT -- Number of Sections, by Two-Year Period

Weighted sections. Includes projection. Cut sections 04-05 to reduce impact.

2-yr period	98-00	00-02	02-04	04-06
sections taught by part time faculty	22.5	13	17	23
sections taught by full time faculty	87.5	96.5	89	74
total sections	110	109.5	106	97
percent of weighted sections taught by full time faculty	80%	88%	84%	76%

C. Future Staffing Needs

The following provides a multi-year projection of planned sabbaticals and need for additional faculty.

For F05-S06, we are already guaranteed seven courses to be taught by adjuncts, without regard to sabbaticals: three regular part time positions and four Paideia. We have been approved for another year of the current Visiting Position in Mathematics to cover these. In addition, we will have full-year sabbatical releases for two faculty, and a half-load release for a junior faculty. This adds up to thirteen more sections to be covered (one faculty is also in the Paideia program, so two of the sections have already been accounted for.) A fourth faculty member is eligible for sabbatical but will defer. We will cut five sections to partially cover the releases. We have been approved for a second Visiting Position, in Computer Science. We have a limited pool of applicants and have been challenged to create a schedule flexible enough to accommodate either math or computer science adjuncts.

In F06-S07, we are already guaranteed five or six courses to be taught by adjuncts, without regard to sabbaticals: three regular part time positions, two Paideia, and one First Year Seminar. One faculty member may take a year-long sabbatical, and another may take a half-year

sabbatical. This adds five to eleven more sections to be covered. We will need to cut sections to partially cover the releases. Two sections can be the Mathematics and Computer Science Seminars in Special Topics. Two visiting positions would be needed.

Participation in First Year Seminar, Paideia Program, London program, etc. is not considered for the following.

For F07-S08, we will have anywhere from three to seven courses to be taught by adjuncts. This includes a half-year sabbatical for one faculty member. Two of the four extra sections could continue to be absorbed by not offering the Mathematics and Computer Science Seminars in Special Topics, a detriment to the program.

In F08-S09, three faculty will be eligible for sabbatical in addition to our usual three adjunct positions.

This is a minimal projection and assumes no retirements and assumes tenure for our tenure track faculty. This does not account for increases in incoming first year classes or increased retention.

XIV. A Balancing Act

A. Supporting University Programs

Since the last major Departmental Review, several of us have participated in First Year Seminar. Under the former FYS system of a common course, Shelton taught in F94 and F97. Under the current FYS system of individual courses, Owens taught Falls 2001, 2002, and 2003. An adjunct was needed each time. Denman also taught an FYS in F03 as an overload, requiring no staffing replacement.

One faculty has participated in the London Semester program.

Since Fall 2003, two of our faculty have engaged in the Paideia Program, which reduces each of their departmental teaching loads by one course per semester for three years and one course per year for the fourth and final year of appointment; they may apply for reappointment. Thus, we have four extra courses a year taught by adjuncts for three years and two for the last year.

B. Supporting Faculty Development

One semester-long sabbatical is three courses/year release, to be absorbed by the department as much as possible according to the *Faculty Handbook*. Considering that on average a department of nine full time people will have one sabbatical per year and sometimes two or even three, absorption seems unreasonable. We have repeatedly reduced our courses offerings to partially cover a release. Sometimes this is reasonable because of low enrollments. Sometimes we do not offer a Seminar in Special Topics for our majors.

One faculty was awarded a Brown Faculty Fellowship, which is essentially a partial junior sabbatical. Another has been awarded a Brown Faculty Fellowship for next year, when two others will also be on full-year sabbaticals.

Another faculty member, whose professional development has been outstanding, is in the third year of service on a major University committee. Newer members of this committee will receive an extra sabbatical. The Department awarded two course releases to this faculty member.

C. Other Faculty Releases

Three faculty needed personal releases for medical reasons or maternity leave since the last review.

Our faculty have taught a number of Independent Study courses as overloads, for which the *Faculty Handbook* allows compensation in the way of periodic course release, a policy which had not been put into practice in our Department or elsewhere on campus. In 1999, we revisited this issue but were not able to implement it until 2004-2005. One release for each of two faculty helped to compensate a backlog of Independent Study overloads at a level below the policy in the *Faculty Handbook*. Other faculty in our Department await compensation.

Our Department made a release for the chair a priority in 01-02. The Provost supported this as long as the Department absorbs the release.

An extra course release was granted to support the chair during our major departmental review, necessary because of the size and dual nature of the department. We had to negotiate for this release and ensure the Department would absorb it.

D. Overview of Releases

The aforementioned releases are necessary to the continued support of our faculty and institutional programs. The table below tallies total releases and predicts future ones. It seems clear that an additional tenure track position would be of great advantage. The usual department chair release, effected 01-02, is not included.

Projections are minimal and does not consider participation in First Year Seminar, Paideia Program, London Semester or other programs, nor retirements, increased retention, or increased size of first year classes. The continued need for three adjunct-taught sections is in addition to the releases below.

Table: Full Time Faculty Releases

less recent	94-95	95-96	96-97	97-98	98-99	99-00
	7	3	3		4	3
most recent	00-01	01-02	02-03	03-04	04-05	
	1	8	10	7	13	
future, probable	05-06	06-07	07-08	08-09		
	20	5 to 11	3 to 7	3		

E. Selected Detail of the Balancing Act

For 2002-03, we had eight part time positions: three regular, three sabbatical releases, and two Brown Research releases. We canceled a course for the Fall and did not offer either the Mathematics or Computer Science Seminar in Special Topics. Two adjuncts each taught two courses in the Fall. Two of them returned in Spring 2003 to teach a total of three sections, and a third adjunct taught a fourth section.

For 2003-04, we had three regular part time positions, one First Year Seminar, three sabbatical releases, and four Paideia reductions. We canceled one section each semester,

justified by low enrollments. We were lucky to rehire two adjuncts for a section each semester. Two new adjuncts each taught a section each semester.

For 2004-05, we had three regular part time positions, one First Year Seminar, and four Paideia reductions; a Visiting Mathematician taught seven sections, and only one other adjunct was needed.

In 2004-05 we have the rare event of having no one on sabbatical. Low enrollments allowed us to cancel two sections in the Fall and one in the Spring. We used these opportunities to support our faculty: two Independent Study compensations, an extra chair release during the Departmental review, and two other compensations. We also did not offer either a Mathematics or Computer Science Seminar in Special Topics in 2004-05.

We continue to struggle with the balancing act of managing our resources: giving credit (or not) for work done in the way of releases, offering (or not) sections, supporting applications for professional work or involvement in essential University programs that would involve further releases (such as a Brown Fellowship, First Year Seminar, or Paideia), hiring and working with adjuncts, and satisfying (or not) needed improvements in curriculum. The newly proposed "junior seminar" would potentially take more of our faculty from teaching within the Department.

XV. More than Just Bodies

Merely speaking of numbers of faculty in our Department would be a travesty. One of the greatest strengths of our Department is the high quality of teaching, service, and professional development of our full time faculty, all of which impact our academic program, programs in other departments, and the entire Southwestern program. Having two faculty who can teach both Mathematics and Computer Science affords us flexibility in staffing, including shifting responsibilities in the event of sabbaticals or in response to availability of part time faculty. The next three subsections provide only an outline and sampling of evidence of quality. A brief description of the role of Department Chair concludes this section.

A. Teaching Excellence

All full time faculty members in our Department are committed to excellence in teaching, as is required by the *Faculty Handbook*. We have a wide variety of backgrounds, experience, interests, and pedagogical styles; this diversity is cemented by a collegial atmosphere. Richter uses a modified Moore method in some of his classes, a discovery-based pedagogy. Sawyer, Richards, and Shelton use a great deal of technology in multiple mathematics classes, helping students' visualization of concepts. Chapman is known for using humor in his classes, and meets individually with each student after the first exam for multiple classes. Potter and Denman teach a wide variety of classes -- theoretical mathematics and computer science. Potter and Buchele have led the most students in Independent Studies and Honors projects. Owens and Denman have recently taught First Year Seminars. Chapman and Buchele are Inaugural Paideia professors.

We participate in workshops and lectures on pedagogy, curriculum, technology in mathematics, disabilities, academic advising, mentoring and nurturing students, undergraduate research, and more. Potter and Sawyer attended the ACS Teaching Workshop (at Rollins). Those in Computer Science work very hard to stay abreast of changes in this dynamic field, as have the Mathematics faculty who use technology. All work hard to serve our students. Our CS

faculty meet fairly regularly as a "sub department" to compare notes on teaching styles, topics, etc. Several of us participated in a recent reading group about Asperger's Syndrome. Many of us have fairly frequent contact with counselors from the Office of Academic Services regarding students with special needs; we are very open to altering our classroom environment. Our male faculty have always been sensitive to women's issues in Mathematics and Computer Science, and our female faculty have participated in national forums on gender. None of us teaches statically; we make curricular and pedagogical changes frequently. Syllabi are available upon request.

Two of our faculty were recognized with teaching awards recently. Buchele was awarded the Board of Higher Education of the United Methodist Church (BHEM) Exemplary Teaching Award in 2003. Richards was awarded the Southwestern Teaching Award in 2001 and BHEM Exemplary Teaching Award in 1996. Others in our Department have been nominated for such awards.

B. University Service

Our faculty are heavily involved in campus commitments outside of teaching. We have served on committees and councils dealing with Southwestern's faculty and the University: Faculty Affairs Council, Faculty Handbook Advisory Committee, Faculty Status Committee, multiple committees for our accrediting body SACS, Campus Campaign for the 2010 Strategic Plan, Strategic Plan Committee, Cullen Faculty Development Committee, search committees for multiple faculty and the Provost, Sexual Harassment Advisory Committee, Library Committee, Faculty Evaluation Taskforce, Benefits Committee, Faculty Grievance Committee, Faculty Sabbatical Advisory Committee, Natural Science Division (NSD) Faculty Advisory Career Team, Faculty Secretary, NSD Secretary, NSD Chair, Honorary Degree Committee, and Abercrombie Travel Committee, and Staff Affairs Council.

More importantly, our Department has served on bodies which directly deal with students: the Student Success Taskforce, Student Affairs Council, University Committee on Discipline, specially called Discipline Hearing, Academic Affairs Council, Brown Scholar Selection Committee, Academic Integrity Committee, Student Judiciary Study Group, Pre-Med Advisory Committee, Instructional Technology Committee, Athletic Committee, Portfolio Committee, American Studies Committee, Admissions Committee, Student Leadership Selection Committee, and FYS Committee.

In addition, Department faculty have served as advisors to SU Chapters of Association of Computing Machinery, Upsilon Pi Epsilon, Mathematical Association of America, Pi Mu Epsilon, Alpha Chi, Phi Beta Kappa, Goldwater Scholarship as well as the SU Anime Club and the McMichael Student Enrichment Experience Fund Committee. We have also organized or helped to organize Alumni Panels, Homecoming Receptions, an Animation Festival and off-campus speakers, including a Fleming Lecture Series. In addition, our faculty show their support of students by attending social events, student performances and presentations, athletic events, and prospective student activities.

C. Professional Development

The professional activity of our faculty helps our classroom teaching, ability to offer special opportunities for students, and ensures a good curriculum, the latter being the backbone of our academic program. To various extents, our faculty serve on national panels, speak at conferences at all levels including internationally, and publish papers in peer-reviewed journals.

We have been awarded Sam Taylor Fellowships, Brown Scholar Fellowships, as well as multiple Cullen Faculty Development Grants. Vitas are available upon request.

D. Balance Between the Three Areas

Southwestern has been engaged in conversations regarding what counts in which category (e.g. First Year Seminar is a teaching activity) as well as what is sufficient or necessary for tenure and promotion. Several years ago the University adopted the two terms "activity" and "achievement" as levels of professional development; achievement is required for tenure or promotion. We worked in F02 to produce departmental lists which would supplement those in the *Faculty Handbook* regarding the difference, yet these have not been "validated" by the administration. Only recently have the lists been returned to each department for possible revision and for re-submission. It is currently suggested that the lists be removed from the *Faculty Handbook* and the distinction be "external peer review."

Consider the following excerpts from the S04 Department Annual Report:

Some faculty in our Department have done exceptional work for our student clubs, are engaged in other exceptional University service, and would like to work on course revision. One concern that our department shares with the Provost is that this level of service may inhibit progress toward tenure or promotion. Assessment tasks, especially in these initial efforts, and course revisions or preparations take time and effort that could be spent on other activities which are more clearly accepted as professional. Further discussions are needed to clarify credit for such essential work.

...

It is increasingly difficult to complete our duties within the nine months specified in the *Faculty Handbook* or even within an average forty-hour week. Summer activities have included assessment, committee meetings, transfer requests, budget work, as well as expected work on usual course revisions and preparations. Our department members are conscientious and have done this work, in spite of the lack of compensation. To meet the newer and rising University expectations of professional growth, faculty members must work on research during the summer, so this time must be protected. Moreover, in order to keep talented people, we must reward their efforts. We would like to explore possibilities for compensation to support these essential activities and ways to maintain a reasonable workload.

Faculty in the tenure track have been advised to cut back on service which would detract from their ability to reach achievement professionally. Apparently, the extra work we do for students or assessment is "just part of our job." Continued conversations across campus to clarify expectations are crucial. See the "Evaluation" section for two CUPM survey questions regarding extra work.

E. Departmental Leadership

The Chair is largely a position of service and voice, and the entire Department contributes to the management process to various extents. For instance, the upgrade of the

Whitmore Lab was accomplished with repeated meetings between multiple members of the Department and of ITS. A course release per year for the Chair was implemented in 01-02; a small stipend was also added recently. Officially, the Chair is the Budget Officer for the Department, submits course schedule requests and changes, approves transfer request with input from faculty where needed, writes the annual departmental report and faculty evaluation, writes letters of support for sabbatical and other requests, meets with the Faculty Status Committee, reads course evaluations for adjunct and tenure track faculty, manages adjuncts, submits the annual assessment grid, and more.

Some of these involve many details; consider for instance hiring an adjunct: maintain pool of applicants; interview several and hire; inform those not hired that the position is filled; fill out beginning paperwork; order texts; pass along course information; arrange for phone, ID, and email; visit a class if possible; read course evaluations; submit exiting or continuing paperwork; write an evaluation especially if s/he continues; cancel phone and email upon departure.

Some departmental duties, such as making library requests and handling student awards are often shared within the Department. Chapman still manages tutors.

Chapman served as the Department Chair for many years and still manages the tutors. Beginning in July of 2000, others began rotating into Chair: Richards for 99-00; Richter for 00-02; and Shelton 02-present. Each chair has had their own style, including whether or not to hold regular meetings. Shelton sought and received additional training to be Department Chair, including a national workshop between the first and second years. Current plans are for Shelton to serve for at least the next few years, especially to see Sawyer through the tenure track. In general, those in our department are much more interested in teaching and professional development than in being Department Chair, and all are grateful to the one serving. Work as Department Chair is time consuming and sometimes stressful, but the cooperation of the entire department eases the burden. Even so, it is difficult to be a good Chair, teach one's classes well, and maintain the level of professional growth that should be modeled.

XVII. FACILITIES and TECHNOLOGICAL RESOURCES

A: General Campus Resources

Our department makes heavy use of classrooms with good chalkboard space, technological classrooms with document camera and instructor computer, mobile laptop barges, and computer labs. Often we need multiple rooms for a single course as we use a combination of lecture and discovery learning. Generally, we have good facilities, but the increased demand across campus for multi-media rooms has diminished our chances of getting the best classrooms. We often share facilities with faculty within our department and across departments. We must be ever vigilant about stating the extent of our needs, and we encounter increasing competition with other departments such as History. Good technological resources, both physical and Information Technology staff, are critical to the success of our academic program.

Every faculty office and campus residence has an individual, high-speed connection to the Internet and a personal E-mail address. Most first-year students have an internet-ready computer; this is now estimated to be 95%¹, up from 80-90% in S01². Computers are also available in on-campus computer labs featuring G4 PowerMacs, Dell Pentium III workstations and quality high-speed laser printers. All systems are connected to the Internet and feature a comprehensive suite of software products including Mathematica.

The FW Olin building was dedicated in 1996, and we use many classrooms there, which is where the bulk of the hi-tech rooms have been. In S01 there were ten technology equipped classrooms, two of which had workstations for up to 25 students³. Additional classrooms have been equipped, including nine over Summer 2004. There are now forty-eight "smart" classrooms; plans include equipping each classroom over the next two summers⁴. Most of these classrooms have both PowerMacs and PC's at the instructor's podium, as well as an electronic projector. Each system is connected to the campus network servers and to the Internet. Only some classes have a document camera, though, needed especially for classes which utilize graphing calculators. There are some mobile laptop barges for use within the buildings in which they reside, and not all classrooms are capable of supporting a barge. Currently there is no formal coordination between requesting a classroom and a barge. The new file server "Helios" has been helpful, especially with managing student files or the instructor's ability to bring up files in the classroom.

There is a large PC Lab in Mood-Bridwell Hall, which also houses our faculty offices. It is primarily for open use rather than classroom use. Many of us teach in the newer Olin Building, in which there is a Mac Lab and a PC Lab, primarily for classroom use. In addition, students have access to a 24-hour lab adjacent to the Library, the SLC Lab. The Department is very fortunate to have a small dedicated Lab, discussed in the next section.

¹ *Southwestern@Georgetown*, Vol 16, #1, p37.

² Pi Mu Epsilon Petition

³ Pi Mu Epsilon Petition

⁴ *Southwestern@Georgetown*, Vol 16, #1, p55.

B: Whitmore Lounge and Lab

The Whitmore Math and Computer Science Lounge and Lab is named after a long time former faculty member, Ralph Whitmore, who began our computer science program and after whom the campus server was named for many years.

The space, located in Mood-Bridwell 133, has multiple purposes, primarily the following:

- (1) a gathering space for computer science and math students, especially for the four clubs (MAA, ACM, UPE, and PME);
- (2) location of the Math and Computer Science tutoring M-TH 6-9 pm for any Southwestern University student enrolled in a lower level Math or Computer Science class;
- (3) a lab of department computers that support the academic program;
- (4) meeting space for small groups of students and faculty

The space has three areas: the main meeting area with a chalkboard wall, a chalkboard room with some kitchen facilities, and a small computer lab. The computer in the main area has a larger monitor since it is used for high level graphics. There are books and a collection of information on undergraduate research programs and graduate schools in the main room. Tutoring occurs primarily in the chalkboard room where there are more text books. Math and CS students meet in small groups in all of the rooms, either for homework or study groups, or with a faculty member for a seminar or Independent Study.

In the Lab there are two machines for general math/computer science use and a campus printer. ITS replaced the eight-year old printer in Spring 2004. Three more computers in the lab are connected to a large computer server to provide a training ground for computer science experimentation; one of these is specially equipped to handle computer graphics. Wireless capability was added in Summer 2003.

In recent years, our program was severely impacted by the understaffing of Information Technology Services and the archaic and decrepit equipment in the Whitmore Lab, which all parties acknowledged to be "orphaned." It should be noted that the Department made multiple requests for several years and tried regular channels, since the Department has no line item for purchase of computer equipment. By the time we replaced the equipment, it was in such dreadful shape that we would have had to omit topics from several of our courses. Students were asked to provide concrete information in Fall 2002 regarding problems with the machines; this evidence was presented to ITS. Furthermore, ITS was so understaffed, they could not help to the degree they and we knew the Lab needed. The Department worked with ITS and the Provost to provide "emergency" technical support for Fall 2003 and to replace equipment over three budget years, mostly with Department funds but also supplemented by ITS and the Provost. ITS was able to install the new equipment, including a new server. As of Fall 2004, the Whitmore Lab was well equipped, requiring little maintenance.

The Whitmore Lab and Lounge is a highly effective space. Dr. Kendall Richards attended the NSF supported and AMS sponsored Workshop on Mentoring and Nurturing Students in Dec 2004, and he reported that such a space was strongly recommended and recognized for its importance.

C. Software

ITS purchased SIMUL8, a simulation package, for the Department several years ago. The Department purchased "Geometer's Sketchpad" in 2003-04 for use particularly in Mathematical Concepts and the Alternative Capstone for K-12 Teachers for Fall 2004. The Department purchased a 5-station site license for "f(Z)" in 2004-05 for use particularly in

Complex Analysis. Software that came with the Lego Mindstorms, mentioned below, is installed on several machines on campus.

The Department has assumed the cost for the license of RedHat Linux as of Fall 2004.

ITS purchases the license for Mathematica, an expensive but very powerful computer algebra system. Many of the machines on campus can access Mathematica via a key system which documents the number of users at any time. ITS purchased additional keys recently to accommodate our heavy use.

D: Experimental Cluster

One of our faculty members, Dr. Walt Potter, spearheaded the use of older machines to form a cluster. He collaborated with a number of students on this project. New Physicist Dr. Steve Alexander joined in, and the cluster machines were moved to the Physics Department in Summer 2003.

E. Small Equipment

1. Calculators and Handheld Technology

The Department currently owns 12 TI-83 Plus Silver Edition calculators, 4 TI-89s (with Computer Algebra capability), and 1 TI Voyage 200 (with Computer Algebra capability and QWERTY input). These are primarily for use by regular and adjunct faculty and for use as semester-long loaners for students. Students fill out a calculator contract and agree to replace the equipment if it is damaged; otherwise the loan is free. To date, every loaner calculator has been returned in good shape. Any student may borrow one, regardless of "need", subject to availability. We have been unable to fill only a few requests. The majority of TI-83s are checked out by students in Introduction to Statistics. For Fall 2004, the TI-89s were used for the alternative capstone. These hand-held technological tools were purchased between May and November 2003, over two budget years.

Other loaner calculators have been available to our students since the Calculus reform in 1997. Faculty invested a great deal of energy on writing materials and programs for the calculators that were current then, the TI-85, which was soon replaced by the TI-86. Repeated changes in handheld technology have discouraged some faculty from reliance on them. The TI-83 family will soon be replaced by the TI-84 family of calculators. The Department advised the bookstore of the upcoming change. It is unlikely that we will purchase new calculators this year.

The Department determined that requiring a particular calculator would be a financial burden on the students on top of the costly texts. Some faculty work hard to accommodate variations in calculators and allow them on exams; other faculty are convinced that calculators should not be allowed on tests.

The Department also has several CBR "Rangers" and a variety of sensors to be used in conjunction with the calculators for data collection. These were heavily used at one time.

2. Camera

The Department purchased a digital camera several years ago. It has been very helpful in documenting student efforts (contests, presentations, etc.) and advertising these and other Department happenings via the Department website.

3. Robots

The Department purchased twelve Lego Mindstorm Robotics kits in the 2002-03 and 2003-04 budget years, partially aided by the NSD budget. We also have one sensor. These have been used in an Independent Study and will be incorporated into the Artificial Intelligence course.

F. ACS Technology Center

Southwestern University is a member of the Associated Colleges of the South, a consortium of sixteen private liberal arts colleges and universities. The following is paraphrased from ACS websites such as <http://www.colleges.org/techcenter/mission.html>.

The ACS Technology Center at Southwestern University was established as a facility for ACS faculty, staff, and student development in the use of technology, and serves both as a training center and as a clearinghouse for information about the use of technology in higher education. Located on the 2nd floor of the Smith Library Center at Southwestern, the Technology Center consists of a classroom and multimedia lab, which are available to faculty and staff when unused by ACS. The center also serves as a focal point for collaborative teaching and research initiatives, collaborative programs in Classics and Music and a summer Software Engineering Program <<http://www.colleges.org/techcenter.se>> for students, in which they create software for the consortium.

XVIII. LIBRARY RESOURCES

A. Department Comments

1. Acquisitions, Periodic Checks

Responsibility for Library Acquisitions has sometimes been taken on by the Chair and at other times has been shared within the Department. Most recently, our Library contact regularly sends the Chair a stack of cards with information about suggested titles, and the stack is distributed among the Faculty, who signify that they want a book by initialing the card. The Library also accepts faculty initiated requests.

The Department reviewed its holdings for the 1993-94 Major Program Review, the January 2001 Five Year Update, and the April 2001 Petition to join Pi Mu Epsilon, the math honorary society for students. The latter, for instance, reported acquiring 210 books, manuals, and videos in the mathematical sciences in the previous year. Budget cuts in 2002-03 required us to review and reduce. The following gives insight to Southwestern's acquisition policy⁵:

⁵ From April 25, 2003 email from Dana Hendrix to Shelton.

From the "Collection Priorities" section of the Collection Development Policy
"Materials needed to support the current study and teaching programs of the university are of primary importance....Materials that aid in the preparation of lectures and other teaching activities are of high priority....

"Secondary in priority are materials supporting the information needs of the university community that are not directly related to the curriculum. The library can afford to purchase only very limited materials to support faculty in their research....Extensive interlibrary borrowing, document delivery services, and TexShare privileges are the primary route the library provides for faculty and others whose information needs include more specialized materials than this library can provide consistently for all members of the campus community."

From the "Periodicals" section of the Collection Development Policy:

"Periodicals....that support the academic program of the university, as well as some general interest magazines appropriate for the student population, are purchased....Selection is based on appropriateness for undergraduate use, cost, availability, language, intellectual value, academic need, availability of indexing, and format.

"New subscriptions are acquired very selectively, as each title represents an increasing cost over a number of years. New titles are only considered after current funds are determined to be sufficient to meet increases in existing subscription costs. Short runs and advanced research materials are avoided due to their limited use to undergraduates."

2. Budget Cuts, Math Membership

In Spring 2003, several members of the Department met to determine which journals would be eliminated to meet the budget cuts. During the collegial meeting, the Department's priority was to serve the needs of general students in our classes, then possible undergraduate research interests. The greatest cuts were made to items which were deemed to serve faculty more than students. The Department took on an additional budgetary item of over \$800 per year, an institutional membership in the American Mathematical Society, to reduce library costs by about \$2,000. Some journals were switched from print to online access, especially for Computer Science which is more quickly out of date. The wisdom of this decision remains to be seen since online access is not guaranteed to be archived.

3. Looked into CS Membership

In Spring 2003, the Department began to investigate the worth of a parallel membership in Computer Science through the Association of Computing Machinery (ACM). Dr. Henry Walker of Grinnell had sent information to the ACM Special Interest Group in Computer Science Education (SIGCSE) regarding alternatives. We relayed this to our Librarian who reported that the suggestions were innovative and worth investigating but that the Library would not save money. The Library was willing to investigate further if the Department really felt the need to access a full Digital Library; the question of archiving arose again.

B. Librarian's Report

Most of the following was submitted by Amy Anderson, Head of Periodical Services and the Librarian assigned to the Natural Science Division. The report, submitted on December 6, 2004, was slightly edited and formatted for consistency with the rest of this document. The Tables were modified to clearly demonstrate change since 1994. Where annotated, additional detail was added.

1. Overview

The reasons for undertaking this analysis are to assess and strengthen the library's holdings in mathematics and computer science and to gather information that can guide faculty and librarian collection development practices in the future. The long-term goal is to better serve the information needs in these subject areas of students at Southwestern University.

This evaluation reviews the current collection development practices and budget; compares current holdings to those in a standard list; and collects data on holdings, subject distribution, and usage.

2. Collection Development, Budgets

Both the math and computer science bibliographer and departmental faculty order materials for the collection. Primary sources for these items include publishers' catalogs and Choice cards circulated within the two departments. The bibliographer infrequently selects outstanding undergraduate titles from issues of SIAM Review, American Mathematical Monthly, Computerworld, and Computer, as well as Library Journal, Booklist, and other library review sources.

Book Budget

For many years prior to 1998, the budget for purchasing math and computer science books, videos, and CDs remained steady at \$10,000.00. For fiscal year 1998/1999, the annual budget increased to \$11,500.00; and increased again in 2001/2002 to \$12,700.00. In 2003, the entire book budget was cut by 10%, which reduced the available funds to \$11,450.00; but the funding was restored to \$12,700.00 for fiscal 2004/2005.

Journal Budget

The 2003/2004 journal budget for math and computer science was cut by 25%. This is the first time since 1985 that this budget has been reduced, and further reduction is not expected. The cuts last year included 10 print journal titles and 4 microfilm subscriptions. Substantial savings were also realized on the subscription to MathSciNet because the Math and Computer Science Department became an institutional member of the American Mathematical Society; and the Library joined the Texas State Consortium to receive a reduced fee on this database. A small amount of money was also saved from the bindery budget. At the request of the department, three titles were added last year: Crossroads (ACM), IEEE Potentials, and Primus.

3. Collection Evaluations

The SLC math and computer science collection was evaluated with the use of the Mathematics Association of America's 1992 Library Recommendations for Undergraduate Mathematics. This

bibliography was also used during the 1994 departmental evaluation, but there does not seem to be a newer list of recommended titles. In May 1992, the library had 39% of the 1,487 book titles listed as "essential," "highly recommended" or "recommended." By November 2004, the library owned 1,124 of these titles, and this percentage had increased to 75.6%.

In 1992, the MAA recommended 60 journals for undergraduate students in the mathematical sciences. The library carries current subscriptions to 33 of these titles, and 5 additional titles are available full text online through JSTOR. Of the remaining 22 titles, 5 are no longer published, 1 was cancelled in 2000 and another in 2003. See the following Tables.

Table: Library Journals

9 ACM Journals ⁶ :		
Computing Reviews	IBM Systems Journal	Journal of the ACM
Computing Surveys	Transactions on Database Systems	Transactions on Graphics
Crossroads	Transactions on Mathematical Software	Transactions on Programming Languages and Systems
Journal of the American Statistical Association		
Mathematical Gazette		
Mathematical Intelligencer		
Mathematical Spectrum		
Mathematical Structures in Computer Science		
Mathematics and Computer Education		
Mathematics Magazine		
Network Magazine		
Notices of the American Mathematical Society		
Online Pacific Journal of Mathematics		
PC Magazine		
(Pi)ME Journal		
Proceedings: Mathematical, Physical, and Engineering Sci.		
Proceedings of the American Mathematical Society		
Proceedings of the London Mathematical Society		
Science of Computer Programming		
Siam Journal on Applied Mathematics		
Siam Review		
Statistical Science		
Stats(ASA)		
UMAP Journal		
UMAP Modules Tools for Teaching		
GENERAL INTEREST TITLES		
Infoworld		
New Scientist		
Science		

⁶ Detail added to Dec 04 report from Jun 04 email from Anderson to Shelton.

Table, part 1: Comparison of Journal Holdings to 1992 MAA Recommendations

TITLE	Subscribe	JSTOR	Free online	Cancelled	No longer published	do not subscribe
AMATYC Review						X
American Journal of Mathematics	X					
American Mathematical Monthly	X					
American Statistician		X				
AMSTAT News						X
Archive for History of Exact Sciences						X
Arithmetic Teacher	X					
Bulletin of the American Mathematical Society	X					
Bulletin of the London Mathematical Society						X
Byte			X			
Chance	X					
College Mathematics Journal	X					
Collegiate Microcomputer					1993	
COMAP Consortium	X					
Communications of the ACM				2000		
Computer Science Education	X					
Computing Reviews	X					
Computing Surveys of the ACM	X					
Crux Mathematicorum						X
Current Mathematical Publications						X
Educational Studies in Mathematics	X					
Elemente der Mathematik						X
Fibonacci Quarterly	X					
Historia Mathematica	X					
Interfaces (TIME)						X
International Journal of Mathematical Education in Science and Technology						X
Journal for Research in Mathematics Education				2003		
Journal of Applied Probability						X
Journal of Number Theory	X					
Journal of Recreational Mathematics	X					
Journal of Technology in Mathematics					X	
Journal of the American Mathematical Society		X				
Journal of the American Statistical Association	X					
Journal of Undergraduate Mathematics					1994	
L'Enseignement Mathematique						X
Mathematical Gazette	X					
Mathematical Intelligencer	X					
Mathematical Spectrum	X					

Table, part 2: Comparison of Journal Holdings to 1992 MAA Recommendations

TITLE	Subscribe	JSTOR	Free online	Cancelled	No longer published	do not subscribe
Mathematics Magazine	X					
Mathematics of Computation		X				
Mathematics Teacher	X					
Notices of the American Mathematical Society	X					
Operations Research		X				
OR/MS Today						X
Pi Mu Epsilon Journal	X					
Primus	X					
Proceedings of the American Mathematical Society	X					
Quantum					2001	
School Science and Mathematics						X
SIAM Journal of Applied Mathematics	X					
SIAM News						X
SIAM Review	X					
Statistical Science	X					
Stats (ASA)	X					
Sugaku Espositions						X
Transactions of the American Mathematical Society		X				
UMAP Journal	X					
Undergraduate Mathematics Education (UME) Trends					1995	

4. Collection Size

Books

As of November 1, 2004, the Smith Library Complex (SLC) owned 4,003 volumes in the math sections of the Dewey Decimal Classification Sections (510, 510.1, 511-516, 519), and 1,587 items in the computer science sections of Dewey (various parts from 003 through 006). Together, the math and computer science collections total 5,590 volumes, making them 2.4 percent of the SLC main collection. This is an increase from 1994, when the math and computer science books totaled 2,248, or just 1.4 percent of the collection.

Journals

As of November 1, 2004, SLC subscribed to 60 math/computer science periodical titles in the Math /Computer Science section; and several titles of more general interest such as Science, Infoworld, and New Scientist. This is a decrease of 11 titles from 1994.

5. Subject distribution of the collection

The statistics available from the Dynix online system show that the majority of the library's computer science books are in Programming, Artificial intelligence, Data in computer systems, Data processing, and Systems programming and programs. Since the most heavily used subject areas are Systems programming and programs; Computer graphics; Data security; and Computer programming, programs, data; some changes will be made in SLC purchasing patterns. See attached table for more information.

In mathematics, the library has the most books on Calculus/Analysis, and Probabilities and applied mathematics. Usage is highest however in Philosophy and theory, and Topology. Once again, adjustments to purchasing patterns will be made. The following Table provides further information.

6. Use patterns of the collection

As of November 2004, the entire main collection's average number of uses per volume is 2.559. This calculation includes the total number of circulations carried out since the online system was brought up in 1989. The average of 2.582 circulations for computer science books is very similar to that of the collection as a whole. The average usage for mathematics titles is much lower at 1.406. In computer science, the most heavily used section is Systems Programming and Programs with average use of 3.737, and the least used is Special computer methods, with average use of .583. The most heavily used part of the math collection is Philosophy and theory, with average uses per volume of 3.765, and the least used section is Mathematics, with uses averaging 1.072. The following Tables provides specific information.

Table: Main Collection Book Holdings and Cumulative Usage Statistics, 1994 and 2004

Dewey Classification	Subject Heading	Volumes			Usage Rate		
		1994	2004	Change	1994	2004	Change
000-999	Entire Main Collection	157,430	231,858	47%	0.8	2.6	220%

Table: Mathematics Book Holdings and Cumulative Usage Statistics, 1994 and 2004

Dewey Classification	Subject Heading	Volumes			Usage Rate		
		1994	2004	Change	1994	2004	Change
510	Mathematics	108	614	469%	0.36	1.07	198%
510.1	Philosophy and theory	42	68	62%	0.97	3.77	288%
511	General principles	138	412	199%	0.43	1.57	265%
512	Algebra and number theory	230	689	200%	0.42	1.29	206%
513	Arithmetic	47	127	170%	0.39	1.33	241%
514	Topology	40	115	188%	0.44	2.76	527%
515	Calculus/Analysis	256	920	259%	0.34	1.50	341%
516	Geometry	92	309	236%	0.35	1.32	276%
519	Probabilities and applied mathematics	315	749	138%	0.55	1.55	182%
	Overall	1,268	4,003	216%	0.43	1.41	227%

Table: Computer Science Book Holdings and Cumulative Usage Statistics, 1994 and 2004

Dewey Classification	Subject Heading	Volumes			Usage Rate		
		1994	2004	Change	1994	2004	Change
003	Systems	31	101	226%	0.67	2.55	280%
004	Data processing	53	129	143%	0.53	2.18	311%
004.1	General works on specific types of computers	31	63	103%	0.68	1.78	161%
004.2	Systems analysis/design, computer architecture, performance evaluation	6	21	250%	0.42	1.71	308%
004.3	Processing modes	7	38	443%	0.23	0.82	255%
004.5	Storage	0	1		0.00	1.00	
004.6	Interfacing and communications	24	78	225%	0.77	2.24	191%
004.7	Peripherals	1	3	200%	0.50	0.67	33%
005	Computer programming, programs, data	28	22	-21%	0.93	3.32	257%
005.1	Programming	348	467	34%	1.01	2.95	192%
005.2	Programming for specific types of computers	51	68	33%	1.10	2.69	145%
005.3	Programs	12	16	33%	1.00	1.81	81%
005.4	Systems programming and programs	104	114	10%	1.89	3.74	98%
005.6	Microprogramming and microprograms	1	3	200%	0.33	0.67	102%
005.7	Data in computer systems	73	162	122%	0.91	3.42	276%
005.8	Data security	4	28	600%	0.57	3.36	489%
006	Special computer methods	3	12	300%	0.50	0.58	17%
006.3	Artificial intelligence	135	188	39%	0.87	2.06	137%
006.4	Computer pattern recognition	3	13	333%	0.33	1.69	413%
006.5	Computer sound synthesis	0	1		0.00	1.00	
006.6	Computer graphics	36	59	64%	1.16	3.37	191%
	Overall	951	1587	67%	0.93	2.58	178%

7. Indexes

The library maintains a standing order for CRC Standard Mathematical Tables in print. Online sources include Academic Search Premier, Applied Science and Technology Abstracts, Computer Source Consumer Edition, General Science Abstracts, JSTOR, ScienceDirect, and MathSciNet. The Applied Science and Technology Index, Computer Literature Index, and General Science Index have been retained in print format as guides to the older literature.

8. Special Collections

Since the last departmental review in 1994, no significant items concerning either mathematics or computer science have been added to the library's Special Collections. The same small collection of 20 or so mathematics books given by Claude C. Cody, Margaret Root Brown, Mrs. Claude Pollard and others is still available.

XIX. BUDGET

A. Library Budget

The Department has had no control over the allocations to support the Library, which was discussed in the preceding section.

B. General Department Budget

The Departmental budget allocations have decreased in recent years. As with other departments on campus recently, no departmental input has been requested until Spring 2005.

Use has fluctuated. As seen in a table below, it is clear that a greater portion of the budget has been used recently in addition to funds from other University sources. Prior to 2002-03, our department used regular channels for equipment requests, with no response. Thus, even when no line item was allocated, department funds were used to upgrade essential equipment. See a discussion of the Technology for more detail. Since the Whitmore Lab is in excellent shape now, these expenses will greatly diminish for 2005-06 and 2006-07, after which time we anticipate incurring expenses similar to those of 2002-2005. It is unclear at this time where the financial responsibility of the equipment maintenance and replacement lies.

The Department has recently incurred expenses for Assessment activities, although no line item is allocated. These expenses are expected to continue.

The Department recently added an institutional membership in the MAA to save the library budget \$2,000. Due to a mix-up in the paperwork, the membership for 2002-03 was not paid until 2003-04. The Department will continue to consider a similar membership in the ACM.

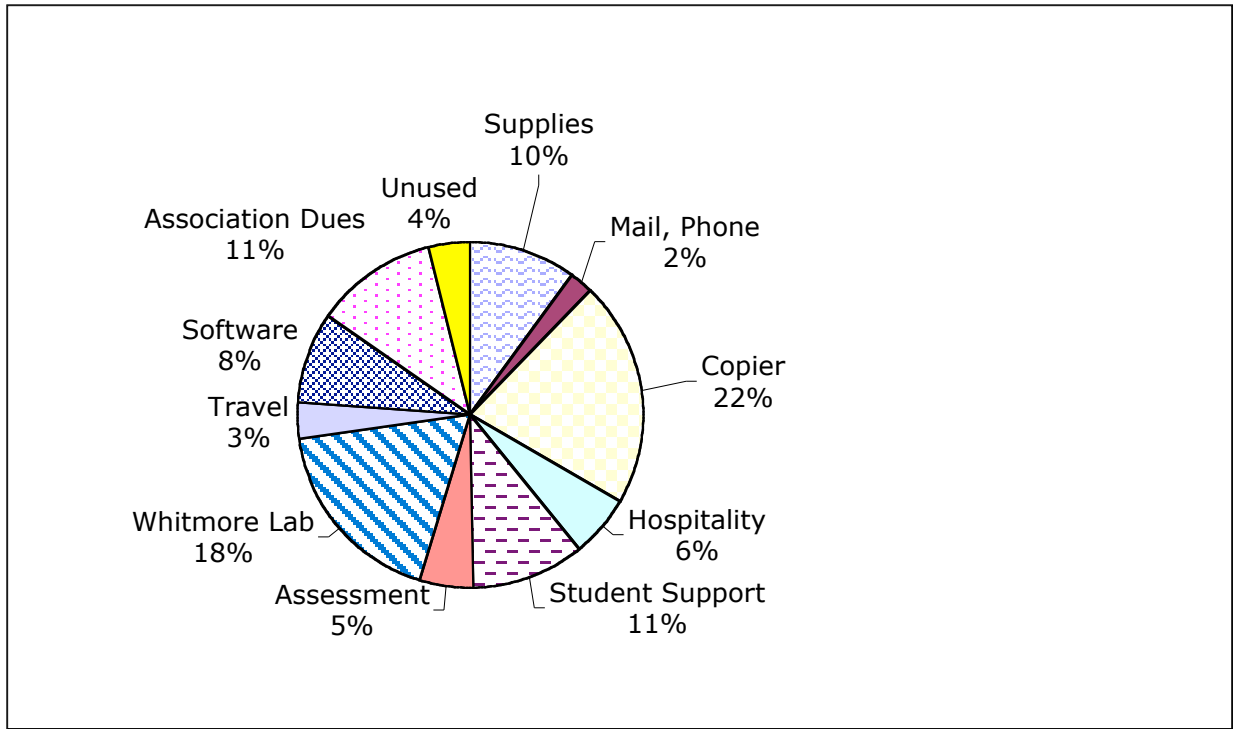
The Department has purchased some supplies in bulk to save money in the last several years.

Table: Recent and Projected Expenditures

Values have been adjusted from official budget reports to increase accuracy of category designation. Categories may have been used differently for 2000-2002 than for 2002-2005.

	2004-05 projected	2003-04 actual	2002-03 actual	2001-02 actual	2000-01 actual
Supplies (includes calculators)	2000	1442	3423	1977	2708
Mail, Phone	400	312	302	273	494
Copier	3100	3080	3007	2584	3279
Hospitality	1200	861	1272	967	1076
Student Support	1600	1527	1623	1208	804
Assessment	1000	709	177	0	0
Whitmore Lab	2500	2640	3403	0	0
Required Travel	820	475	322	699	1680
Software (includes robots)	600	1226	1006	192	107
Association Dues	900	1652	0	0	0
Other	0	0	75	114	200
<i>Unused</i>	<i>384</i>	<i>580</i>	<i>656</i>	<i>7487</i>	<i>5153</i>
Total Allocated	14504	14504	15266	15500	15500
Supplemental	3150	1746	849	0	0
Total Used	17230	15670	15459	8013	10347
Detail of Supplemental Funds					
Provost	1500	750	177	0	0
Information Technology Services	1500	0	0	0	0
Natural Science Division	0	996	672	0	0
Faculty Abercrombie Funds	130				

Figure: 2003-04 Budget Use



Some categories from the official budget reports have been merged. No supplemental funding is shown.

C. Tutoring Budget

The Department has had little control over the allocations to support tutoring. Allocations are shown in the following Table. The Department discussed issues of budget and management of tutors in Fall 2002 when other student workers were pooled from within departments and were overseen by a faculty secretary. The Office of the Provost granted our request that the budget for tutors not be pooled with the others, most of whom performed clerical tasks.

Table: Tutoring Allocation

	2004-05 projected	2003-04 actual	2002-03 actual	2001-02 actual	2000-01 actual
Tutoring Allocation	4000	3500	3500	4025	4000

XX. EVALUATION

A. General Comments

The Department has repeatedly revised the curriculum, learning environment, and offerings to serve our students and to meet national standards.

As we said earlier, two main documents have been used both to guide change and evaluate our program: *CUPM Curriculum Guide 2004: Undergraduate Programs and Courses in the Mathematical Sciences*, which was used in draft form beginning in F01, and *Computing Curricula 2001 Computer Science*. The latter was used extensively to guide the changes in the Computer Science Curriculum. The former was used primarily at the time of this major review to evaluate what had been done. The *CUPM Guide* was used by one faculty member to better serve pre-service teachers and to design the Departmental Online Alumni Survey. The *CUPM Guide* also aided the structure of our assessment grid. In addition, we used a survey of statistics in liberal arts for comparison.

The *CUPM Guide* contains several portions specific to the education of majors in the Mathematical Sciences, which include Computer Science, though not as a separate discipline. A number of the recommendations were flexible enough to apply to both Mathematics and to Computer Science, but in some places, the recommendations and sample survey questions from the *CUPM Guide* were augmented to apply to Computer Science. This is appropriate since the *CUPM Guide* states explicitly that it is meant as a guide, particularly the sample survey questions, rather than a mandate.

Some *CUPM Guide* survey questions were answerable with statements about the structure of our program, especially as described in the *Catalog*. Other questions drove the data requests, manipulation, and reporting. Some questions were answered in the Dec 04 Departmental Assessment Meeting.

Although there is some overlap in the categories below, we evaluate the introductory courses and General Education with special emphasis on Calculus I and Statistics. Then we evaluate service to the major, Education (K-12), and other partner disciplines. Evaluative comments are also made regarding faculty and other resources.

B. Introductory Courses -- Serving General Education, our Majors, and Partner Disciplines.

1. Placement and Advising

[CUPM Question #17] Do we make effective use of advising, placement tests, and/or consultations with colleagues in other disciplines to ensure that students take appropriate introductory courses?

The description of efforts in this area found in other sections of this document provide evidence that we provide good advising students and coordinating with faculty in other areas.

We do not have a formal placement mechanism. For a few years in the late 1990s, we administered a diagnostic exam in Calculus I and advised students who appeared to need a different course. According to the *CUPM Guide*, “[A placement test] may provide useful information on mathematical preparation, but it gives little or no information about the test

takers' actual mathematical needs or academic interests.¹⁴ Conversation seems the most effective method.

Students' lack of basic mathematical preparation has been a problem in the low level courses, especially those for the nonmajor. It is a concern of ours and of the Registrar. Some students still have problems with order of mathematical operations, evaluating a formula, plotting a line, etc. Several of us at various times have slowed down our courses to try to allow students to catch up, and this has contributed to the lack of consistency in breadth of coverage, especially in Elementary Function Theory and Introduction to Statistics. In the last several years, however, the chair has given clear guidance that content cannot be sacrificed. Some students are so poorly prepared even for Elementary Function Theory that they are advised to take a remedial course at a community college.

2. General Comments on Introductory Courses

Recall that some of our introductory courses will not count toward a Departmental major: Introduction to Statistics, Elementary Function Theory, and Mathematical Concepts. Others serve both majors and nonmajors: Introduction to Programming, Programming Concepts I, Calculus I, and Geometry in particular. Calculus I and Introduction to Statistics serve many other majors.

The following CUPM Question epitomizes the main ideas behind Southwestern's Mathematics General Education Requirement.

[CUPM Question #16, revised]. Do we offer at least one introductory course that satisfies Recommendation A.1? [Additional numbering has been added to the CUPM wording to facilitate reference.]

Students meeting general education or introductory requirements in the mathematical [and computational] sciences should be enrolled in courses designed to

[A.1.i.]. • *Engage students in a meaningful and positive intellectual experience;*

[A.1.ii.]. • *Increase quantitative or logical reasoning abilities needed for informed citizenship and in the workplace;*

[A.1.iii.]. • *Strengthen mathematical and computational abilities that will be useful to students in other disciplines;*

[A.1.iv.]. • *Improve every student's ability to communicate orally and in writing;*

[A.1.v.]. • *Encourage qualified students to take at least one additional course in the mathematical sciences.*

At the Departmental Assessment Meeting, we affirmed that our offerings meet the criteria for the most part. Finalizing the "essential topics lists" should provide a greater structure for improved evaluation. We do a good job of assessing and improving students' written communication skills, but oral skills are not as consistently expected or assessed. Mathematical Concepts has sometimes included small oral presentations.

The Department has had periodic discussions, especially recently, regarding the University's math requirement and will continue to do so. The Academic Affairs Council and our Department will continue to investigate "Quantitative Literacy" or "Quantitative Analysis", terms which are more common terms in the national conversation, and will determine if a proposal for change should be presented to the faculty. Participation in the national Assessment Workshops has supplied the Department with more materials to consider.

¹ CUPM Guide, p12.

[CUPM Question #2, portion] Do we know the intended majors of the students enrolled in our introductory courses?

The following detail augments the discussions in other sections of this document. All the tenure track or tenured faculty are familiar with the Catalog requirements, that is which of our courses serve our own and other majors. Many of us survey also our students. The data reveal that a student's declaration of Academic Interest is inconclusive regarding our own majors. Students' intended majors are very dynamic.

3. Calculus I: for Math, Business, Physics and more

One of our large enrollment courses, Calculus I serves a wide variety of students. We have adjusted topics in Calculus I, such as the treatment of limits and continuity, to make the course more broadly applicable, knowing that departmental majors will see this material in another course. We deem this to be a good fit. (Cornell University is currently in the process of revamping their curriculum using this same idea².) Furthermore, in Fall 1997, we changed our Calculus I from being a traditional three-hour course to meeting five hours a week for four hours credit. The extra time allowed for a laboratory component and increased technology in keeping with the changing national standards for Calculus I.

For several years after the new Calculus was instituted, there was a great deal of coordination between those teaching Calculus I, allowing for great consistency. In recent years, there has been very little coordination in Calculus I, allowing for great inconsistency. The Department will continue conversations about balancing uniformity with instructor autonomy.

The Registrar's Office has suggested the Department consider adding minicourses just in the trigonometry portions of Calculus so that students who transfer in with an outside Business Calculus course can make up the difference. Department discussions have affirmed that we lack the staffing for this option, but even if we had the staff we are not convinced that such a course would be beneficial to the students. Students in Business, Accounting, and Economics now receive a more rigorous Calculus I here than their curriculum demands; we eliminated the course "Calculus and Linear Algebra for the Social Sciences" from the Catalog in 1997. Having a single Calculus eliminates the problem students would have by changing majors and retaking a different Calculus.

In the last several years, great efforts have been made to ensure that transfer credit is only given for a Calculus I which has all the elements of ours.

4. Statistics for NonMajors and Probability

We offer a single statistics course, Introduction to Statistics, and this only serves majors outside of our department. Thus, our majors and minors will either take this course as a general elective credit or will have a hole in their education.

Due to limited resources, Probability is offered only once every four years. It is very likely that a Mathematics Major graduate with no probability or statistics.

We have repeatedly requested additional faculty resources to remedy these situations.

[CUPM Question #18] Do we offer a statistics course with an emphasis on data

² Presentation by Dr. Freeman, "Using the CUPM Guide to Improve the Major" at the Joint National Meetings, Jan 2005 and conversation with Shelton.

analysis and without a calculus prerequisite?

The only statistics course we offer has no prerequisite.

Introduction to Statistics serves the most constituents by far, accounting for almost 15% of our offerings by number of sections and over 30% of our department's enrollment. Moreover, these sections typically are full, accounting for a heavier teaching load for those who teach these sections and less individualized attention for the students in these sections. Since the last Major Departmental Review, we have improved this course in several respects. Firstly, we have increased the number of sections, and we are now able to respond to demand, with the acceptable exception that some students who would like to take Statistics as their General Education requirement end up taking another course. Enrollments used to regularly exceed 35, even reaching 45, but since we offered more sections, we have been able to keep class size down. In 2003-2004, we were able to have sections below 30 students, but in Fall 2005 we had to increase class size again to accommodate the extra large incoming class. Until recently, first year students rarely could take Statistics, but now they constitute the vast majority. This allows students to take Statistics in a timely fashion, to satisfy the pre-requisite structure in other departments.

There has often been great variation in the teaching of Introduction to Statistics, although this has intentionally been greatly reduced in the last three years. In 04-05 all eight sections will be taught from the same text with only minor variations in coverage.

The Department is aware that some faculty in other departments feel that their students are not well prepared for their courses which require Statistics. As yet, none of these faculty has examined exactly what is taught in this course to determine what is lacking, if anything. Nor have they provided any concrete feedback. Some faculty from other departments accept that the course is intended as an elementary introduction for all students, regardless of major, and is meant to be built upon as needed. The Department will continue conversations with other departments. Conversations with Dr. Kain and Dr. Hilliard indicate they are satisfied with the foundation in Statistics which this course is intended to provide.

Several of us do not cover ANOVA, which is listed in the Catalog and which is used in sociology but not in psychology; the text for 2004-05 only covers the topic in an appendix of the CD-ROM.

In Fall 2004, Psychology approached the Department with the suggestion that their new faculty member should teach a new Statistics course housed within our Department. The Department believes that conversations should begin with coverage of material. We provided the new psychologist with information regarding what we cover in the course and are awaiting feedback.

5. Liberal Arts Colleges Survey on Statistics

Our Department participated in a survey on statistics at liberal arts colleges in the Fall of 2003. Participants included Perdue, Grinnell, Furman, and others. The resulting report was made available in December of 2004 and included comparisons with a survey performed in 1993.

Southwestern is similar to 64 of the 126 of respondents or 51% in that we have no one with either a Master's or PhD in statistics who teaches in that field. In 1993, however, there were 60/108 or 56% of the institutions in this category. The percentage of institutions that offer only a

non-Calculus statistics has remained the same: 59%. We would like to move to the 24% that offer both Calculus based and nonCalculus based courses; Over a quarter of respondents offer courses beyond the basics (nonCalculus statistics, Calculus statistics, a probability/statistics sequence.) In the Survey, the likelihood of additional offerings increased with the number of PhD Statisticians. In the non-Calculus statistics, 69% require student projects; our course may or may not require projects, and they are often fairly small.

Twenty-nine institutions had tried to hire a statistician in the past three years; 11 were successful in one year, 4 in subsequent years, 5 were still trying to hire, 2 were unsuccessful, and 7 "resorted" to hiring a mathematician (some of whom had special statistical training or experience).

Southwestern University claims to aspire to be an inspiration to other liberal arts institutions; for instance, we seek "to move from national standing to national leadership as a liberal arts and sciences college".³ Teaching Statistics and related courses is one area in which we are in the lower segment.

6. Technology

Southwestern has a "Computer Skills" General Education requirement:

Persons who are to function effectively in today's society must have some knowledge of computers and how they can be used to organize, analyze, and communicate information. Courses within majors may accomplish this through assignments which require the use of word processing, web-based resources for research, spreadsheets, e-mail, or other kinds of discipline-related software.⁴

Our majors must use technology since all must take either Introduction to Programming or Computer Science I. In many of our courses, students are exposed to the use of technology, including mathematical software such as MATLAB and Mathematica, computer programming environments, and graphing calculators. Our Department makes heavy use of the high-tech classrooms.

Opinions vary within the Department about the combination of technology or hand calculations, especially for the lower level mathematics courses for nonmajors. In addition, some students have shown resistance to using technology, both in major and non-major courses. There is little formal assessment of students' ability in this area, apparently across all departments.

Graphing calculators were incorporated into Calculus I in F97 when we changed our Calculus I course. In the last several years, however, the use of the graphing calculator in this and subsequent courses has varied greatly by instructor.

Calculator use has varied partly because a new model of calculator may require materials to be rewritten. In addition, requiring each student to have the same graphing calculator would be an additional \$130, and a new model might be out the following year. Not requiring a single calculator means dealing with multiple models, with different menus, key structure, and key stroke sequence for the same operations. In the TI family, for instance, we began with the TI-85, which was discontinued and replaced by the very different TI-86. The 85 had very poor capabilities in Statistics and no table features. Occasionally we still see a student with an 85.

³ 2004-05 Catalog, p7

⁴ 2004-05 Catalog, p21

Then came the TI-83 with its submodels TI-83 Plus and TI-83 Plus Silver Edition. The TI-92 has been replaced by the Voyage 2000; these and the TI-89 have computer algebra capabilities that the others lack. Beginning in F04, there is a TI-84 Plus and TI-84 Plus Silver Edition. On rare occasions, a student will have a Casio and HP graphing calculators.

Moreover, there is continuing discussion regarding the basic level of calculations which students should be capable of without the use of a calculator, which relates to student backgrounds previously discussed.

C. Serving Our Majors and Minors

Given our current staffing resources and pool of majors and minors, we have done an excellent job in serving our majors and minors, providing a strong regular curriculum and flexibility for individual needs.

[CUPM Question #1] Do we have data on subsequent course taking in mathematics by students enrolled in our introductory courses? (For example, do we know how many of our Pre-calculus students successfully complete Calculus I? How many of our Calculus I students successfully complete a second course in the department?)

Data was gathered to answer this question, although we already had a good idea. See the sections on our Degree Recipients as well as on Enrollment Management. Few students from Elementary Function Theory complete Calculus I. About half of the Calculus I students complete a second course, which is roughly the same for Computer Science I.

[CUPM Question #3] Do we know how many of our majors enter the job market directly after graduation, and what kinds of jobs they take?

We keep up informally with some alumni and have information from others via the Departmental Online Alumni Survey. See Section XI for a profile of our degree recipients.

[CUPM Question #4] In the past five years, have we asked our majors who graduated recently what they think of the quality of their undergraduate preparation in mathematics?

We asked alumni to complete the Departmental Online Alumni Survey, the results of which are tallied in the section on Assessments Other Than Grades.

[CUPM Question #19] Do we offer a discrete mathematics course without a calculus prerequisite that meets the needs of computer science majors?

The Discrete Mathematics course we offer has a calculus pre-requisite, and it is appropriate for majors in either Mathematics or Computer Science or Computational Mathematics.

[CUPM Question #30] Do we assure that every major studies a single area in depth [as specified in Recommendation C.4]? *All majors should be required to •Study a single area in depth, drawing on ideas and tools from previous coursework and making connections, by completing two related courses or a year-long sequence at the upper level.* What are the ways a student can satisfy this requirement?

As stated in the description of Catalog requirements, in Mathematics each major must choose a second course in one of three areas: Algebraic Structures II or Intermediate Differential Equations completes a year-long sequence at the upper level, and draws upon previous coursework. The latter also makes connections between Calculus I-III and Linear Algebra. The third option is to take either Complex Analysis or Topology, both of which extend Introductory Analysis and provide depth of study. In addition, the Senior Seminar in Mathematical Modeling relies heavily upon previous coursework.

This question does not really relate to Computer Science. However, we are following the current national curriculum guidelines. The Senior Seminar in Software Engineering definitely builds on previous coursework and makes connections, in particular between Computer Science II and Algorithms.

[CUPM Question #32]. Is our major flexible and adapted to connections to other disciplines? How do we know?

There is abundant evidence that our major is flexible and adaptable, including the data on other minors for our majors and second majors.

The structure of program requirements allows flexibility and supports both employment and graduate studies. The offering of courses (number of sections and semester/year of offering) provides sufficient flexibility to support our program and related majors/minors, such as the Dual Degree Program.

Furthermore, students are able to participate in athletics or study abroad, though in Mathematics it is difficult to study abroad in the Fall of the junior year and still graduate in four years.

Some courses make specific connections with other disciplines, in particular Differential Equations and Calculus III (the Dual Degree Program, Physics, and Physical Chemistry). The capstones in both Mathematics and Computer Science allow for interdisciplinary work. In addition, from experience we know that many who take Computer Graphics also take Computer Imaging in the Art Department.

[CUPM Question #31 revised] Does every major complete a senior year project that leads them to a written and oral report, as specified in Recommendation C.4? What are the ways a student can satisfy this requirement?

The capstones, as discussed elsewhere, each satisfy this Recommendation. Computer Science students are required to develop a semester-long software project that is client based. Mathematics students are required to develop or implement a mathematical model. In each situation, both oral and written products are required.

[CUPM Question #10] Have we had a conversation with another department about creation of a joint major?

We have added the Computational Mathematics major within our Department. There is no apparent demand otherwise.

[CUPM Question #20] Do we incorporate geometric thinking and visualization in two and three dimensions — including vectors in our first-year courses? In our second-year courses?

This question is only applicable to Mathematics. Geometric thinking in two dimensions is a key part of Calculus I; focus on visualization is dependent upon the instructor. We cover volumes of solids of revolution in Calculus II in the first year. Typically students take Linear Algebra and Calculus III in their second year; vectors are included in both. Geometric thinking and visualization in two and three (and higher) dimensions are an integral part of Calculus III.

[CUPM Question #21] Have we examined the prerequisites for our intermediate and advanced courses with an eye to making them more accessible to students majoring in other disciplines or not yet decided on majors?

Geometry has no pre-requisite and draws students toward intermediate mathematical skills. Geometry is an elective for some of our majors and is required for certain tracks of pre-service teachers, some of whom may decide to major in Mathematics.

The Department has tried to implement a modeling course with one or no pre-requisite but have not had enough interest from students, even though it would be an excellent course for pre-service teachers.

We have considered decreasing the pre-requisites for Discrete Mathematics to help the math majors.

To strengthen our program, we have increased the pre-requisites for Probability and Differential Equations. Other pre-requisites have stayed the same.

[CUPM Question #25]. Can we see progress in our majors' abilities to reason, solve problems and think abstractly as they move through our program? How do we gauge their progress?

We definitely gauge student progress through traditional techniques of exams and class discussions. The structure of the curriculum is designed to guide the students to progress. In particular, the capstone courses requires students to tackle open-ended and applied problems.

[CUPM Question #26 revised]. Do we provide opportunities for our majors to communicate effectively and rigorously in their field?

Students present written documentation in problem solutions, answers to short questions on graded items, proofs, and computer programs and their documentation. Prose papers are included by some professors in some classes: Calculus I (Sawyer, Chapman, Richards, Shelton); Linear Algebra (Chapman); Introduction to Analysis (Richards). Computer Organization (Buchele), and both the Mathematics and Computer Science capstones (Shelton, Richards, Owens, Buchele). All of these courses are required for a Department major .

Prose papers were required in the Seminar in Selected Topics, History of Mathematics (Chapman). Prose papers have also been required in courses for the nonmajor: Mathematical Concepts (McCarthy, Denman, Pardhanani), Statistics (Chapman, Shelton).

Oral presentations are required in both the Mathematics and Computer Science capstones. Small oral presentations have also been required in Calculus I (Chapman, Sawyer), Linear Algebra (Chapman), Numerical Analysis (Potter), Introduction to Programmin g(Owens), Programming Languages (Owens), and Geometry (Denman, Richter, Chapman

In several courses, students have sometimes been required to read a journal article and indicate their understanding either through oral presentation or prose paper.

Our program does a much better job with written presentation skills than with oral,

though it would be extremely rare if a student never presented orally until the Capstone. We are not systematic in requirements or assessment of progress within a term or across courses, however. This is an area the Department would like to improve upon. We will soon consider ways to accomplish this; (perhaps with student portfolios with work across classes or with multiple faculty members reviewing the capstone oral presentation.) In addition, the Department will look into mathematical typesetting software, either an improved version of Latex or some alternative, and will consider adding an elective course in technical writing.

Note, however, the number of students who have given oral presentations at various conferences, whether local to Southwestern, regional, and national, This is good evidence of opportunities for development in oral communication.

[CUPM Question #27 revised]. Do our majors have experience with current technological tools? Which courses provide these experiences?

A discussion of technology in Calculus I is provided elsewhere.

Graphing calculators have been used sometimes in Calculus II, Calculus III, and the courses in Mathematical Modeling. Graphing calculators were used in the F04 alternative capstone for pre-service teachers. Students in Elementary Differential Equations and Intermediate Differential Equations are allowed to use graphing calculators in the course and on exams (but not any computer algebra capabilities).

The computer algebra system Mathematica has been used to varying degrees in Calculus I (Richards, Sawyer), Calculus II (Sawyer, Richards, Shelton), Calculus III (Richards, Shelton), Numerical Analysis (Potter), Elementary Differential Equations and Intermediate Differential Equations (Richards, Shelton), and Linear Algebra (Sawyer, Chapman, Potter). MatLab has been used in Linear Algebra (Chapman).

Geometer's Sketchpad was used in Mathematical Concepts (Denman) and in the alternative capstone for pre-service teachers (Sawyer).

Of course, technology is heavily used in Computer Science courses. Students see both Windows and Unix-based operating systems, IDE (Integrated Development Environment), and multiple languages including Java.

[CUPM Question #28, portion]. Does every major complete a set of courses that encompasses the breadth specified in Recommendation C.3? *All majors should have significant experience working with ideas representing the breadth of the mathematical sciences. In particular, students should see a number of contrasting but complementary points of view: continuous and discrete, algebraic and geometric, deterministic and stochastic, theoretical and applied.*

These categories apply to Mathematics and Computational Mathematics. Following the response for these is a parallel for Computer Science. We satisfy this recommendation well, both with required courses and electives.

Continuous: Calculus I, II, III; Elementary Differential Equations; Intermediate Differential Equations; Intro to Analysis; Senior Seminar in Mathematical Modeling

Discrete: Algebraic Structures I and II; Discrete Mathematics; some in Probability; some in Elementary Differential Equations (Euler's method for 1st order DEs) or Calculus (Newton's method and Riemann sums); some in Numerical Analysis; Senior Seminar in Mathematical Modeling.

Algebraic: Linear algebra, Algebraic Structures I, II

Geometric: some in Calculus I, II, III; Geometry.

Deterministic: most of our courses provide this view.

Stochastic: some students may choose projects in the Senior Seminar in Mathematical Modeling which deal with stochasticity, and sometimes a few days are spent covering probabilistic topics. Of course, students who take Probability see a stochastic view.

Theoretical: Introductory Analysis, Geometry, Algebraic Structures I and II, and Linear Algebra are very theoretical. There are theoretical aspects to most of our courses.

Applied: Calculus I-III, Elementary and Intermediate Differential Equations are very applied.

There is a good mix of theory and application across required courses, including in the Senior Seminar in Mathematical Modeling.

In Computer Science, there is certainly a mix of theoretical and applied; continuous and discrete. Breadth is also provided with various programming paradigms: functional, imperative, object-oriented, and event-driven. Various courses provide this breadth, in particular Programming Languages, Functional Programming, and Algorithms.

[CUPM Question #29, portion]. By graduation, does every major know several substantial applications?

Differential equations deals with applications of physics or chemistry as well as applications of mathematics, such as solving linear systems of equations. The Senior Seminar in Mathematical Modeling deals with applications to Biology, Economics, and other areas in the coursework, and students must apply mathematics to their project.

All Computer Science courses deal with applications, so all Computer Science and Computational Mathematics majors see a variety of applications.

[CUPM Question #29, portion] By graduation, does every major know a number of contemporary open questions?

Algebraic Structures deals with computing on a scale beyond our brain's capacity. Discrete Mathematics, which is an option for Mathematics majors but a requirement for others, deals with NP-complete issues. We provide opportunities for students who seek these out, such as Independent Studies.

[CUPM Question #39, portion] Do our math majors preparing for the nonacademic workforce complete courses in programming and a related area as recommended in D.2?

Mathematics majors are required to take a programming course, and programming is used in the Senior Seminar.

[CUPM Question #39, revised] Do our math majors preparing for the nonacademic workforce complete courses in statistics and a related area as recommended in D.2? *In particular, it is recommended that such students take, at least one data-oriented statistics course past the introductory level and coursework in a related area.*

As stated before, we offer a single introductory statistics course which does not count toward the major. We agree with the recommendation that our majors would be well served by taking such a course. Good students may take an Independent Study in intermediate data analysis. Some students choose a project in the Senior Seminar in Mathematical Modeling which requires data analysis. Others would like to but lack the statistical background to do so.

Several respondents to the Departmental Online Alumni Survey indicated that they took Introduction to Statistics and found it useful; others indicated how useful a Statistics course

would have been.

The Department hopes to be granted an additional tenure track faculty position and to fill it with a statistician. Only then will we be able to fill this gap.

[CUPM Question #40, revised] Do our majors preparing for the nonacademic workforce complete an internship or a project involving a contemporary application?

Mathematics majors are required to complete a project in the Senior Seminar, and to date these have always involved contemporary applications.

Majors in Computer Science are required to complete a project in the Senior Seminar that is client-based, providing excellent preparation for the workforce.

We are cautiously open to academic internships; a few students have completed a non-academic internship.

[CUPM Questions #42, 43, and 44, revised] Do we inform students about special opportunities like internships, summer research programs, and visiting programs at other universities? Do we advise students about post-baccalaureate study?

The Department has done a better job in this area, as is evident from the description in other sections.

[CUPM Questions #41 and 44, revised] Are students prepared for post-baccalaureate study or the workplace?

Graduates are satisfactorily progressing through or have completed graduate programs at multiple institutions, including Rice University. In the past Chapman received informal anecdotal feedback that programs are satisfied with our students.

Graduates are finding employment.

The analysis of the Departmental Online Alumni Survey reveal a high rate of satisfaction among our graduates, as described elsewhere. Alumni were asked specifically to rate preparation for graduate school and for employment.

D. Education of Prospective Teachers

The *CUPM Guide* contains several portions specific to the education of those preparing to teach K-12. Following each relevant suggested survey question and recommendation is our self evaluation. Dr. Sawyer has been primarily involved in this area, and much of the work has been done in recent years.

The primary CUPM Recommendation, reiterated below, also applies to prospective teachers.

CUPM Recommendation 1: Mathematical sciences departments should

- Understand the strengths, weaknesses, career plans, fields of study, and aspirations of the students enrolled in mathematics courses;
- Determine the extent to which the goals of courses and programs offered are aligned with the needs of students as well as the extent to which these goals are achieved;
- Continually strengthen courses and programs to better align with student needs, and assess the effectiveness of such efforts.

There are essentially four routes by which a Southwestern student may become a K-12 teacher in mathematics. These involve combinations of math content and certification. Either major in Mathematics or minor in Mathematics with an additional six hours of Mathematics; either certify through Southwestern's program or complete alternative certification after graduation. Our students do not always know that they will teach until after they graduate. Also, some students believe they will teach but end up not teaching. Wilshire, for instance, majored in Mathematics, did not take Statistics, completed alternative certification, and is teaching high school. Hightower majored in Mathematics, took Statistics as a general elective, completed a Master's in teaching at Rice, and has begun to teach high school. Wolff majored in Mathematics and completed Southwestern's certification program; Statistics would have been a good general elective. Current seniors McCall and Yoder are planning to take this route also; Gage is considering it. Yoder also took the History of Mathematics course in S04, as Knief did in S99; Knief is currently teaching pre-college. Kuttesch received a Mathematics minor and six more hours of Mathematics, including Statistics, completed alternative certification, and is teaching. All these students should take Statistics and Mathematical Concepts, but these courses will not count toward the major or minor in Mathematics. A new course in Statistics and Probability that also counted toward the major would serve them well.

The State of Texas requires a certain number of hours, including a certain number which must be advanced, but does not list particular courses. We require specific courses to meet national standards as well as our own ideas of what prospective teachers need. These specific requirements were already in place in 1993-94, the year of the last major program review.

[CUPM Question #8]. Have we used *The Curriculum Foundations Project: Voices of the Partner Disciplines* to initiate and support conversations with faculty in other disciplines?

Sawyer was part of a focus group at a national workshop to consider the 2001 Draft of the CUPM Guidelines, a portion of which evolved into *Voices*. Sawyer began using *Voices* from the draft to have conversations with the Education Department.

[CUPM Question #22]. Have we consulted with colleagues in education about our programs for prospective teachers?

Sawyer has consulted extensively with colleagues in education about our programs for prospective teachers. She began discussions in S03, both with individual faculty members and with the entire Education Department at several of their department meetings. When our department considered a request from the Education Department that we offer two more courses which would serve prospective teachers, Sawyer was able to provide background and rationale. (Our Department is unable to comply with the requests, given current staffing resources.)

In F03 and in S04 Sawyer was a consulting participant in the Math Methods I and II courses taught by Kamen in the Education Department. Sawyer provided mathematical expertise and gained insights into the education of prospective teachers.

In F04, Kamen sat in on Sawyer's Independent Study, providing expertise on Education, for three students planning on teaching mathematics at the high school level. Two students were math majors who took the course as their mathematics capstone; the other is a math minor. This has been the only course designed to aid prospective teachers in making explicit connections, as strongly recommended by national guideline, between the mathematics they learn in their undergraduate education and what they will teach in high schools.

[CUPM Question #23]. Do we offer a program for prospective elementary and middle school teachers that satisfies Recommendation B.4? [Additional numbering has been added to the CUPM wording to facilitate reference.]

B.4. Pre-service elementary (K–4) and middle school (5–8) teachers

Mathematical sciences departments should create programs of study for pre-service elementary and middle school teachers that help students develop

[B.4.i] • *A solid knowledge—at a level above the highest grade certified—of the following mathematical topics: number and operations, algebra and functions, geometry and measurement, data analysis and statistics and probability;*

[B.4.ii] • *Mathematical thinking and communication skills, including knowledge of a broad range of explanations and examples, good logical and quantitative reasoning skills, and facility in separating and reconnecting the component parts of concepts and methods;*

[B.4.iii] • *An understanding of and experience with the uses of mathematics in a variety of areas;*

[B.4.iv] • *The knowledge, confidence, and motivation to pursue career-long professional mathematical growth.*

Some mathematical topics in Recommendation [B.4.i] of the CUPM Curriculum Guidelines for prospective teachers are covered to varying degrees in multiple courses, some of which are required for those students seeking certification to teach through Southwestern's program. Some topics are covered in elective courses in our Department or in courses in the Education Department. Mathematical Concepts and Geometry are the two main required courses, though they also serve other needs. Introduction to Statistics is required for a Specialization in Elementary Education as of F04. Elementary Function Theory may be taken as an elective. Probability is an option for students with Calculus II; it is offered Spring of odd years. In the Department of Education, there are two Math Methods courses, designed and taught by Education faculty. These courses have a strong component of mathematical content; the catalog description includes applications.

“Number and operations” are covered extensively in Mathematical Concepts as well as in Elementary Function Theory. “Algebra and functions” are covered to some extent in Mathematical Concepts and are covered extensively in Elementary Function Theory. There is an entire course in Geometry. “Measurement” is covered minimally in Introduction to Statistics and is covered well in Math Methods. “Data and statistics” are best covered in Introduction to Statistics. “Probability” is covered minimally at least and sometimes fairly well in Introduction to Statistics. “Probability” has been added to Math Methods. Although there is an entire course in “Probability”, in recent years it has focused on continuous distributions. The prospective teachers would be served better by seeing more discrete distributions and combinatorics. In former years, these latter topics were included in Probability, to the detriment of other crucial topics.

The Department is currently unable to fully comply with these national guidelines because of staffing limitations.

Beginning in F00, Mathematical Concepts has been taught using the Starbird text recognized nationally for its excellence. For S01 and F01, the course was taught by McCarthy, an auxiliary faculty member with a new PhD in Mathematics Education; he had taught with us for many years but always as part time. When a new adjunct taught the course in S03, Sawyer worked extensively with him to ensure consistency in focus, pedagogy and content. Sawyer had

been working on education for prospective teachers for several years. In F04, Sawyer guided the tenured faculty member who taught Mathematical Concepts. As discussed elsewhere, Sawyer served as a consulting participant in the F03-S04 Math Methods I and II. Sawyer has applied newly gained expertise in manipulatives, which are physical devices designed to enhance the teaching and learning of pre-college topics. Among these are Algebra Tiles, an algebra balance pan, special card games, dice, two-sided counters, graphing calculators, and the software package Geometer's Sketchpad. It should be noted that Sawyer's work has been as a voluntary and as yet uncompensated overload.

Every course we offer is designed to develop many of the elements in Recommendation [B.4.ii] of the CUPM Guidelines, especially skills in mathematical thinking, communication, logic, and quantitative reasoning. In most courses, the focus for communication skills is in writing, although several courses develop oral communication skills as well. In the last several years in Mathematical Concepts, for instance, students have been guided through individual projects in which they write a paper and make an oral presentation to the class. This was begun by McCarthy and continued by others. These and the other elements of Recommendation [B.4.ii], in particular developing a facility in separating and reconnecting the component parts of concepts and methods, are included in the Department's Mathematical Concepts course and the Education Department's Math Methods I and II.

The development of "an understanding of and experience with the uses of mathematics" in Recommendation [B.4.iii] is implicit in Elementary Function Theory and Mathematical Concepts and is explicit in Calculus I-III and other courses in the Department. The University's General Education requirement of a Natural Science Perspective on Knowledge course makes use of mathematics in Physics and Chemistry. The Department of Education's Math Methods I and II courses deal with this to some extent. Statistics is used in multiple psychology courses, some of which are required for prospective teachers.

Our entire program strives to meet Recommendation [B.4.iv], "to develop the knowledge, confidence, and motivation to pursue career-long professional mathematical growth". Moreover, this is exactly the point of the Mathematical Concepts course as taught with the Starbird text.

[CUPM Questions #37 and 38] Does our program for prospective teachers of secondary mathematics include the topics listed in Recommendation D.1? Which courses provide these experiences? [Additional numbering has been added to the CUPM wording to facilitate reference.]

D.1. Majors preparing to be secondary school (9–12) teachers

In addition to acquiring the skills developed in programs for K–8 teachers, (B.4.) mathematical sciences majors preparing to teach secondary mathematics should

[D.1.i] • *Learn to make appropriate connections between the advanced mathematics they are learning and the secondary mathematics they will be teaching. They should be helped to reach this understanding in courses throughout the curriculum and through a senior-level experience that makes these connections explicit.*

[D.1.ii] • *Fulfill the requirements for a mathematics major by including topics from abstract algebra and number theory, analysis (advanced calculus or real analysis), discrete mathematics, geometry, and statistics and probability with an emphasis on data analysis;*

[D.1.iii] • *Learn about the history of mathematics and its applications, including recent work;*

[D.1.iv] • *Experience many forms of mathematical modeling and a variety of*

technological tools, including graphing calculators and geometry software.

Recommendation [D.1.i] regarding explicit connections is only guaranteed through the F04 alternative capstone experience which three prospective teachers took with Sawyer, taught as an overload. The Department will consider trying to offer the opportunity more regularly. When McCarthy taught Mathematical Concepts, he took pains to provide additional opportunities for prospective teachers.

Most of the topics from Recommendation [D.1.ii] are guaranteed for those majoring in mathematics and are options for others. "Abstract algebra" is covered extensively in Algebraic Structures I and II, as is a small amount of number theory. In F01 we offered a Selected Topics course in Computational Number Theory. "Real analysis" is covered extensively in Introduction to Analysis. In S00 we offered a Selected Topics course in Analysis, which was a regular capstone course through F97. Discrete Mathematics has been offered for many years as a Computer Science course, and it was cross-listed with Mathematics. We offer a Geometry course every Fall and a Probability course (without an emphasis on data analysis) every other Spring. Some Probability is often covered in the Mathematics Capstone.

All of these courses may count toward the Mathematics major. Algebraic Structures I and Introduction to Analysis are required. Students must take a second course in one of three areas, and Algebraic Structures II is one of the options.

Introduction to Statistics is available and emphasizes data analysis as recommended, but it will not count toward a Mathematics major. Some data analysis is usually included in the Senior Seminar in Mathematical Modeling. Students have the option to perform extensive data analysis in their major project in the Modeling course.

In many courses throughout the curriculum, little snippets of the history of mathematics are included. However, the history element of Recommendation [D.1.iii] is best satisfied with the Selected Topics course "History of Mathematics", taught when resources allow: S04 and S99.

Applications of mathematics, including recent work, other elements of the Recommendation, are always explicit in Introduction to Statistics, Calculus I-III, Elementary Differential Equations, Intermediate Differential Equations, and the Senior Seminar in Mathematical Modeling; they are sprinkled in other courses as well. Applications are also incorporated into courses in Computer Science, Physics, Chemistry, Biology, Psychology, and more.

Intermediate Differential Equations may be taken either as an elective or as the second in a year-long sequence. All mathematics majors must take at least one Computer Science course and some course for the Natural Science Perspective on Knowledge General Education requirement. Psychology is recommended for prospective teachers.

There are several ways that students are exposed to recent work in mathematics, as needed for Recommendation [D.1.iii]. In one section of Calculus I in S04 and sometimes in the Senior Seminar in Mathematical Modeling, students are required to read and process a recent journal article, either with written or oral presentation or both. When a relevant speaker is invited to campus, students in multiple classes are encouraged and even required to attend. A number of students who have completed special research have presented on campus, either through the math and computer science club forums or through the annual Research and Creative Works Symposium.

Some mathematical modeling is implicit in Introduction to Statistics, Calculus I-III, Elementary Differential Equations, Intermediate Differential Equations. The mathematical

modeling element of Recommendation [D.1.iv] is primarily satisfied through the Senior Seminar in Mathematical Modeling.

Recommendation [D.1.iv] also suggests experience with “a variety of technological tools, including graphing calculators and geometry software.” Introduction to Statistics usually involves the use of some software, often through a companion CD supplied with the text, and usually supports the use of graphing calculators. At one time, graphing calculators were required in Calculus I. They are often used in Calculus I-III. The computer algebra system Mathematica has been used in Calculus I-III, Elementary Differential Equations, Intermediate Differential Equations, Algebraic Structures, and the Senior Seminar in Mathematical Modeling. Calculators and Geometer’s Sketchpad were used in F04 in the alternative Capstone for pre-service teachers. Geometer’s Sketchpad was used in the F03 offering of Geometry but is not usually used. Matlab and/or Mathematica are usually used in Linear Algebra.

E. Partner Disciplines

[CUPM Question #9, revised] Has at least one member of our department recently had a conversation with a faculty member from another discipline (specifically with someone from the biological sciences? business or economics? chemistry? engineering? physics?) about a course we offer that their students take?

A number of us have such discussions periodically. For instance, Shelton has discussed how well Calculus III and both differential equations students serve Physics and the Dual Degree Program, especially with Drs. Roeder and O’Brien. Sawyer has had extensive conversations with faculty in Education, particularly Drs. Adrian and Kamen, including for the course Mathematical Concepts. Shelton has also talked with Kamen and Adrian. Shelton has recently spoken with Drs. Kain and Hilliard in Sociology, Dr. Sheller in Biology, and Drs. Muir-Broadus and Osbaldistan in Psychology, all regarding the Introduction to Statistics course.

In addition, Shelton has emailed all academic advisors about low level Mathematics and Computer Science courses for students who need no specific course. Shelton and Owens also provided advice about low level courses to participants in a campus Advising Workshop.

[CUPM Question #9, part b, revised] Has at least one member of our department recently had a conversation with a faculty member from another discipline (specifically with someone from the biological sciences? business or economics? chemistry? engineering? physics?) about a course we might offer that would be valuable for their students?

Shelton, Chapman, and Potter have discussed an intermediate or advanced statistics course with Drs. Muir-Broadus and Guiliano in Psychology as well as with members of Biology and Chemistry.

Sawyer engaged in discussions with Drs. Adrian and Kamen regarding the requests from Education for new mathematics courses.

The low level Mathematical Modeling course would serve many students well, so Shelton emailed all department chairs to determine demand. Only two chairs responded.

[CUPM Question #9, part c, revised] Has at least one member of our

department recently had a conversation with a faculty member from another discipline (specifically with someone from the biological sciences? business or economics? chemistry? engineering? physics?) about applications to their field that we might include in a course we teach?

Buchele has talked to Dr. Alexander from Physics about topics for Computer Graphics.

[CUPM Question #9, part d, revised] Has at least one member of our department recently had a conversation with a faculty member from another discipline (specifically with someone from the biological sciences? business or economics? chemistry? engineering? physics?) about possible undergraduate research projects?

Potter has spoken with Dr. Alexander from Physics. Less recently, Richards and Early co-taught an Independent Study in Economics.

[CUPM Question #9, part e, revised] Has at least one member of our department recently had a conversation with a faculty member from another discipline (specifically with someone from the biological sciences? business or economics? chemistry? engineering? physics?) about team-teaching (or guest lectures in) a course or a unit within a course

Sawyer and Dr. Kamen from Education collaborated extensively in courses in both departments recently. See the section using the CUPM Guide to evaluate our contributions to Education.

Owens had Dr. Hopkins from Religion and Philosophy guest lecture in the First Year Seminar.

Shelton helped Dr. Taub plan to introduce modeling in a Biology class taught S05.

F. CUPM Guide and Faculty Support

[CUPM Question #14] Are faculty in our department rewarded for extra teaching effort (such as learning substantial new material, extensive consultation with colleagues outside the department, or taking leadership of the curriculum and teaching of a multi-section introductory course) by one or more of the following? Released time. Credit toward merit pay, promotion or tenure. Travel money for professional development. Institutional recognition (teaching awards etc.).

There is little evidence to support the existence of such rewards in general at Southwestern. The administration seems to consider the mentioned activities to be part of our regular teaching load.

Independent Studies and Honors work have been compensated with released time for two faculty only for 04-05, and this compensation is at a level that is scaled down from what is in the *Faculty Handbook*.

Merit pay is out of our hands. Recent budget cuts have precluded merit pay increases except for those promoted. Prior to that, there were a few years in which department chairs were expected to rank faculty to indicate who might be eligible for a merit increase.

Perhaps credit is given toward promotion or tenure, but the credit is indirect.

There are limited funds for travel from the University's Abercrombie Travel Fund. Sometimes funds have been sought from the Provost or the Department.

There is a University teaching award that is student initiated, but this is for general excellence, not the extra work mentioned above. Southwestern also has an advising award and has access to the BHEM award.

Work with student organizations, surveying alumni, providing information to students about extra opportunities (summer research, etc.), coordinating with other disciplines, program assessment, etc. are all worthy activities. We have relied upon them heavily in our assessment as indicators of the high quality of our academic program. They take considerable time and effort on the part of faculty, but they count little toward tenure or promotion. We have counseled our newer faculty not to do too much, but they are often the best suited to take charge of some of these activities.

[CUPM Question #15] Are faculty in our department offered support in using new technology or in learning new pedagogical strategies by one or more of the following? In-house workshops. Support to attend workshops/minicourses off campus. Released time. Extra student assistants.

There are workshops on campus offered through ACS, ITS, and SU pedagogy lunches. Off campus workshops include the ACS annual teaching workshop at Rollins and other ACS workshops (for example, Calculus and Information Fluency). The Cullen Faculty Development Fund can provide limited support, although recently these funds have been slashed. The Department has a long-standing tradition of minimally supporting workshops. Occasionally, the Provost has provided funding for individual faculty members. There is no released time, unless we count a sabbatical. Student workers can perform clerical duties, which is not helpful in these categories.

G. Looking to the Future

Our Department does a very good job in general serving its many constituents with its current resources.

Our Department would like to do the following:

- investigate the use of portfolios for courses
- investigate the use of portfolios for individual students
- reduce the size of introductory courses
- continue to advise students of opportunities for summer research and similar opportunities
- regularly offer seminars and selected topics courses to accommodate student interest and variations in preparation (graduate school vs employment, for instance)
- improve written communication skills for our majors, including technical writing, perhaps as a one-hour additional course
- improve oral communication skills for our majors
- improve recruitment and retention of majors, especially in Computer Science
- improve course offerings in Statistics and Probability
- investigate the feasibility of improving course offerings to support K-12 education
- improve record keeping to facilitate program assessment
- investigate meeting the requests for additional courses from the Education department
- continue conversations with other departments about how well our courses serve them
- continue conversations within the Department to improve our program
- continue to improve coordination with ITS on maintaining the Whitmore Lab.

Improvements could be realized with the following:

- addition of a tenth tenure track position
- the filling of this position with a statistician
- better recognition of and support for faculty efforts, particularly with regards to efforts in
 - pedagogy
 - technology, which includes pedagogical issues
 - curriculum revisions
 - internships, Independent Studies, Honors Projects
 - mentoring/advising/work with student organizations
 - program assessment
- regularization of maintenance and replacement of equipment, particularly in the Whitmore Lab
- maintain software to support the program such as Latex (or other mathematical typesetting) and needs specific to Computer Science
- increased budget and specific budget allocations, including program assessment and upkeep of the Whitmore Lab.

References

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.../about/about~2010.html for the Strategic Plan, .../about/about-core.html for Core
Purposes and Core Values; .../paideia/ and subsequent pages for the Paideia program;
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Southwestern's petition for Pi Mu Epsilon.

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by Dr. Kendall Richards in Dec 2004. See
<http://www.ams.org/government/MentoringWorkshop.html> .

Appendix I. Abbreviations

ACM - Association for Computing Machinery

ACS - Associated Colleges of the South

AMS - American Mathematics Society

CC 2001 - *Computing Curricula 2001 Computer Science.*

CCSC - Consortium for Computing in Small Colleges

COMAP - Consortium for Mathematics and its Applications

CRAFTY - CUPM's subcommittee on Curriculum Renewal Across the First Two Years

CUPM - the MAA Committee on the Undergraduate Program in Mathematics

CUPM Guide - CUPM Curriculum Guide 2004: Undergraduate Programs and Courses in the Mathematical Sciences

MAA - Mathematical Association of America

NSF - National Science Foundation

Appendix II. 2004-05 Catalog Descriptions

Mathematics (MAT)

- 52-103 MATHEMATICAL CONCEPTS.** An introduction to some of the important ideas in mathematics illustrating the scope and spirit of mathematics and emphasizing the role that mathematics plays in society from a historical point of view. Topics include number systems, algebra, geometry, and measurement. This course is designed for those seeking EC-4 or 4-8 teacher certification, however the course is suitable for a general audience with a broad spectrum of backgrounds and abilities. May not be used for Mathematics major or minor. (Each semester)
- 52-113 INTRODUCTION TO STATISTICS.** Designed to provide students in the social and biological sciences with the skills necessary to perform elementary statistical analysis. Descriptive measures, probability, sampling theory, random variables, binomial and normal distributions, estimation and hypothesis testing, analysis of variance, regression and correlation, nonparametric methods. May not be used for Mathematics major or minor. (Each semester)
- 52-123 ELEMENTARY FUNCTION THEORY.** Relations, functions, and general properties of functions. Some of the elementary functions considered are polynomials, rational functions, exponentials, logarithms, and trigonometric functions. An objective of this course is to prepare students for Calculus I. May not be used for Mathematics major or minor. (Fall)
- 52-154 CALCULUS I.** Functions and graphs; derivatives, applications of differentiation. Exponential, logarithmic and trigonometric functions, integration, applications of integration. The course includes a laboratory component designed to explore applications and to enhance conceptualization. Prerequisite: Departmental approval. (Each semester)
- 52-173 MATHEMATICAL MODELING.** A course designed to introduce the application of mathematics to the social and natural sciences. Topics may include linear and non-linear difference equations and probabilistic models. The course is project-driven and requires written reports of the mathematics interpreted within the context of the particular project. Prerequisite: Consent of instructor. (Spring, even years)
- 52-253 CALCULUS II.** Numerical integration, methods of integration, applications of the definite integral, improper integrals, sequences and series, Taylor's Formula and approximation, polar coordinates. Prerequisite: 52-154 Calculus I. (Each semester)
- 52-353 CALCULUS III.** A course in multivariable calculus. Vectors, vector functions, and curves. Functions of several variables, partial differentiation, multiple integration, applications of partial differentiation and of multiple integrals. Vector calculus, line integrals, Green's Theorem, surface integrals. Prerequisite: 52-253 Calculus II. (Each semester)
- 52-383 DISCRETE MATHEMATICS.** See Computer Science 54-383. (Fall)
- 52-403 GEOMETRY.** Topics to be selected from synthetic geometry, analytic geometry,

- projective geometry, Euclidean and non-Euclidean geometry. Prerequisite: Consent of instructor. (Spring)
- 52-523 INTRODUCTION TO NUMERICAL ANALYSIS.** Emphasizes the derivations and applications of numerical techniques most frequently used by scientists: interpolation, approximation, numerical differentiation and integration, zeroes of functions, and solution of linear systems. Prerequisites: 52-253 Calculus II, 52-673 Linear Algebra, and 54-183 Introduction to Programming. Also 52/54-523 Introduction to Numerical Analysis. (Fall, odd years)
- 52-573 PROBABILITY.** Random variables and distributions, sequences of random variables, and stochastic processes. Prerequisite: 52-253 Calculus II. (Spring, odd years)
- 52-673 LINEAR ALGEBRA.** Linear equations and matrices, vector spaces, linear mappings, determinants, quadratic forms, vector products, groups of symmetries. Prerequisite: 52-253 Calculus II or consent of instructor. (Each semester)
- 52-683 ALGEBRAIC STRUCTURES I.** Sets, relations, functions, group theory, ring theory. Prerequisite: 52-673 Linear Algebra or consent of instructor. (Fall)
- 52-693 ALGEBRAIC STRUCTURES II.** Vector spaces, algebraic field theory. Prerequisite: 52-683 Algebraic Structures I. (Spring, odd years)
- 52-753 ELEMENTARY DIFFERENTIAL EQUATIONS.** Topics include first order differential equations, separable equations, exact equations, linear differential equations of order $n > 1$, homogeneous equations with constant coefficients, non-homogeneous equations and the method of undetermined coefficients, variation of parameters, power series solutions, and applications. Prerequisite: 52-673 Linear Algebra, as well as co-requisite or prerequisite of 52-353 Calculus III, or consent of instructor. (Fall)
- 52-763 INTERMEDIATE DIFFERENTIAL EQUATIONS.** Topics include the Laplace transform, linear systems, numerical solutions, and nonlinear systems. An introduction to partial differential equations may also be included. Prerequisites: 52-353 Calculus III and 52-753 Elementary Differential Equations, or consent of instructor. (Spring, even years)
- 52-843 SEMINAR IN SPECIAL TOPICS.** A limited enrollment seminar in a major area of mathematics not generally covered in other courses. Topics may include but are not limited to advanced analysis, combinatorics, logic, history of mathematics. May be repeated for credit as topics vary. Prerequisite: 9 hours at the 200 level or above and consent of instructor.
- 52-853 INTRODUCTORY ANALYSIS.** Topics may include completeness, topology of the reals, sequences, limits and continuity, differentiation, integration, infinite series, and sequences and series of functions. A rigorous approach to learning and writing proofs is emphasized. Prerequisite: 52-353 Calculus III or consent of instructor. (Spring)
- 52-863 COMPLEX ANALYSIS.** Algebra and geometry of complex numbers. analytic and harmonic functions, series, contour integration, conformal maps, and transforms. Prerequisite: 52-353 Calculus III or consent of instructor. (Fall, even years)
- 52-883 TOPOLOGY.** Topology of the line and plane, limit points, open sets, closed sets, connectedness, compactness. Continuous functions, homeomorphisms. Prerequisite: 52-253353 Calculus II. (Fall, odd years)
- 52-893 SENIOR SEMINAR IN MATHEMATICAL MODELING.** This course will fulfill

the capstone requirement in mathematics. Since it serves as a culmination of the student's undergraduate mathematical experience, a balance is sought between application and theory. Topics may include linear and non-linear differential and difference equations and stochastic methods. Topics may vary with the instructor. Applications will be taken from the social and natural sciences. A major semester project is expected from each student, as well as significant class participation and presentation. Prerequisites: 21 hours in the major at the 200-level or above, 3 hours of Computer Science at the 100-level or above, and consent of instructor. (Fall)

52-001, 002, 003, 004 SELECTED TOPICS. May be repeated with change in topic.

52-301, 302, 303, 304 SELECTED TOPICS. May be repeated with change in topic.

Prerequisite:

Consent of instructor.

52-951, 952, 953, 954 INDEPENDENT STUDY.

52-983 HONORS. By invitation only.

Computer Science (CSC)

54-143 INTRODUCTION TO PROGRAMMING. An introduction to computer programming in an object-oriented style for practical application. Topics include class definition, basic program constructs, basic data structures, interactive user interfaces, and encapsulation. This course satisfies the General Education Mathematics requirement. (Each semester)

54-183 COMPUTER SCIENCE I. Computer programming in an object-oriented style. Topics include primitive types and operations, assignment, selection, iteration, arrays, classes, methods, recursion, encapsulation, type extension, inheritance, and reasoning about programs. Prerequisite: Previous programming with Departmental approval, or 54-143 Introduction to Programming. (Each semester)

54-191 SEMINAR IN ELEMENTARY SOFTWARE ENGINEERING. Project-based (one credit hour) course emphasizing current tools and methodologies. Students may work in groups on projects chosen in conjunction with the instructor. Prerequisite: Consent of the instructor. This course may be repeated for credit.

54-283 COMPUTER SCIENCE II. A continuation of 54-183 Computer Science I, with an emphasis on abstract data objects such as lists, stacks, queues, trees, and graphs. Topics include algorithms for searching, sorting, traversing, inserting, and deleting, and reasoning about these algorithms. Prerequisite: 54-183 Computer Science I, or consent of instructor. (Each semester)

54-291 RAPID APPLICATION DEVELOPMENT. This course will develop skills needed for the rapid development of programming solutions to problem specifications. This course (or, prior enrollment in this course) is required for students wishing to attend the South Central Programming Contest. This course may be repeated for credit. May not be counted toward the major or minor. Prerequisite: 54-183 Computer Science I. (Fall)

- 54-383 DISCRETE MATHEMATICS.** Concepts for modeling discrete phenomena. Topics include: logic, set theory, order theory and lattices, graphs, induction, and recurrence relations. Prerequisites: 52-253 Calculus II and 54-283 Computer Science II, or consent of instructor. Also 54/52-383 Discrete Mathematics. (Fall)
- 54-393 COMPUTER ORGANIZATION.** Computer architecture, internal representation of data, assembly language programming, subroutines and parameter passing, design of machine language instruction sets, bus structure, datapath and command interpreter. Prerequisite: 54-283 Computer Science II or consent of instructor. (Fall)
- 54-453 ALGORITHMS** (Formerly: Data Structures). Algorithms for finding paths and spanning trees in graphs, analysis of algorithms for sorting, searching, and merging files, complexity of algorithms, hashing methods. Prerequisite: 54-283 Computer Science II or consent of instructor. (Spring)
- 54-473 PROGRAMMING LANGUAGES.** Principles and practice in the design and implementation of imperative, functional, and object-oriented programming languages. Prerequisite: 54-393 Computer Organization or consent of instructor. (Fall)
- 54-513 DATABASE MANAGEMENT.** Logical and physical organization of data in conventional database systems. Topics include: functional dependencies and normal form; relational and other data models; indexing; and concurrency control. Prerequisite: 54-283 Computer Science II or consent of instructor. **(Fall, odd years)**
- 54-523 INTRODUCTION TO NUMERICAL ANALYSIS.** See Mathematics 52-523. (Fall, odd years)
- 54-533 FUNCTIONAL PROGRAMMING.** Introduction to functional programming. Topics include functions, lists, types, induction and recursion, pattern matching, infinite lists and trees. A functional programming language such as Lisp, ML or Gofer will be used in the course. There will be a large number of programming projects. Prerequisite: 54-283 Computer Science II, or consent of instructor. (Spring)
- 54-553 COMPUTER GRAPHICS.** Introduction to 2D and 3D graphics. Topics include: display hardware, graphics primitives and data structures, geometric transformations and modeling, 2D display algorithms, 3D viewing, clipping, hidden line and surface removal, illumination, and shading. Prerequisite: 52-673 Linear Algebra, and 54-393 Computer Organization and 54-453 Algorithms, or consent of instructor. (Spring)
- 54-573 ARTIFICIAL INTELLIGENCE.** Introduction to a functional programming language; study of tree and graph searching, heuristics, knowledge representation schemes, predicate logic, resolution theory, natural language and vision processing, and expert systems. Prerequisite: 54-283 Computer Science II or consent of instructor. (Fall, even years)
- 54-633 COMPUTER ARCHITECTURE.** Introduction to computer architecture and analysis of the performance of computer systems, especially with respect to architectural and organizational issues. Topics include memory instruction set architecture, pipelining, and memory hierarchy (including cache and virtual memory). Prerequisites: 52/54-383 Discrete Mathematics and 54-393 Computer Organization, or consent of instructor. (Fall, even years)
- 54-643 COMPUTER SYSTEMS.** Introduction to operating systems and computer networks. Process control and scheduling, threads, concurrency, memory management and virtual

memory, network protocol layers, packets and routing, and network security.
Prerequisite: 54-393 Computer Organization. (Spring)

54-683 THEORY OF COMPUTATION. Finite state systems, finite automata, formal language theory. Context-free grammars, regular expressions, pushdown automata, Turing machines, decidability, switching theory. Prerequisite: 52/54-383 Discrete Mathematics. (Fall, even years)

54-843 SEMINAR IN SPECIAL TOPICS. A limited enrollment seminar in a major area of computer science not generally covered in other courses. May be repeated for credit as topics vary. Prerequisites: 9 hours of 200-level courses or higher and consent of instructor.

54-893 SENIOR SEMINAR IN SOFTWARE ENGINEERING. Introduction to techniques and theories for the development of large software systems. This course will fulfill the capstone requirement in Computer Science. Topics include: software design and quality, ethics, professional issues, and the study of current software engineering trends, theory, and practice. A major semester project is expected from each student, as well as significant class participation and presentation. Prerequisite: 21 semester hours in the major at the 200-level or above including 54-383, 54-453, 54-473, and consent of instructor. (Spring)

54-001, 002, 003, 004 SELECTED TOPICS. May be repeated with change in topic.

54-301, 302, 303, 304 SELECTED TOPICS. May be repeated with change in topic.

Prerequisite: Consent of instructor.

54-951, 952, 953, 954 INDEPENDENT STUDY. May be repeated with change in content.

54-983 HONORS. By invitation only.

Appendix III: Selected Previous Course Descriptions

Senior Seminar in Analysis: "Real numbers, set theory , Euclidean spaces, continuity, differentiation, and integration." [1996-97 *Catalog*] (Prior to 1997)

Seminar in Compiler Design: "A study of the theoretical aspects of parsing context-free languages, translation specifications, and code optimization. Topics include context-free grammars, lexical scanning, symbol tables, and parsing by the method of recursive descent." [1996-97 *Catalog*] (Prior to 1999)

Appendix IV: Detail for Outside Reviewer

A. Review Requirements

The following augments the initial description of the requirements of this Self Evaluation that is found in Section I.

[2004-05 *Faculty Handbook*]

Each full review is intended to be in-depth and normally requires a series of meetings by the department or program committee and full data gathering, including an in-depth review of the department's annual reports. Departments or programs should consult national studies related to the study of their field in liberal arts colleges, and compare their curricula with those of similar departments in other colleges.

...

The full review is intended to produce a report to the Academic Affairs Council that provides

- a description of the curriculum under review,
- a self-evaluation by the department or program committee, and
- an identification of changes and future plans.

For the purposes of the review report, members of the review committee should assume that no additional institutional resources will be devoted to the department or program over the next five years. The department or program may make staffing, faculty, equipment, and budget requests to the Provost after the Academic Affairs Council has received and discussed the review.

B. Capstone

The following augments the description of the Capstone that is found in Section II.

[2004-05 *Catalog*, p15]

An "Integrative or Capstone Experience" is required of every student who graduates from Southwestern University.

One of the objectives of the study of a subject in depth is the development within students of the ability to organize and integrate their knowledge and experience within the field. A major ... is not simply a collection of courses; it involves the mastery of the subject and the ability to include an appropriate summary or capstone course. This may be a special course, a project in which students are expected to bring together and apply what they have learned, a comprehensive written and/or oral examination, or other experience...

C. Description of Paideia Program

From Dec 13, 2004 Campus Notices broadcast from Dr. S. Fabritius, slightly modified

The Paideia Program, still in its early years, is a program about connections, about exploring areas that would otherwise go unexplored, about three-year long relationships among a small group of 10 students and a Paideia Professor, and about being intentional about one's

education. The five strands of the program include: rigorous academics, intercultural experiences, leadership, collaborative or guided research and creative works, and community-based learning (service-learning). The Program is able to accept up to 100 rising sophomores each year.

The role of a Paideia Professor is critical in helping students reach the goals of learning about connections, exploring otherwise unexplored areas, becoming more intentional, and developing long-term relationships. [A] Paideia Professor [is] frequently the one who has to give the nudge so that Paideia Scholars push themselves harder than they otherwise would. The Paideia Professor is also essential in facilitating the discussions that require the history major to connect with the reading that was brought in by the chemistry major.

While all of the Paideia Seminars share the common goals described in the first paragraph, the actual flavor of each seminar is considerably different. The Paideia Professors meet and settle upon what components of the syllabus are required in each seminar, and then build their syllabus from there. In this way, the development of the Seminar is thoroughly flavored by the Paideia Professor and the Paideia Scholars within. The development of the common materials truly represents a collaborative venture among all of the Paideia Professors. The details of the Paideia Program can be found on the [Paideia website](http://www.southwestern.edu/paideia/) < <http://www.southwestern.edu/paideia/>>. And we recommend that you talk to the current Paideia Professors to get a more full understanding of what the program involves and the rewards that it offers.

The 2004-2005 Paideia Professors include: Dr. Dirk Early (Economics), Dr. Rebecca Sheller (Biology), Dr. Hal Haskell (Classics), Mr. John Ore (Theatre), Dr. Tim O'Neill (Political Science), Dr. Suzanne Buchele (Computer Science), Dr. David Gaines (English), Mr. Patrick Veerkamp (Studio Art), Dr. Sherry Adrian (Education), Dr. John Chapman (Math), and Dr. Jim Hunt (Provost & Dean of the Faculty, Education).

D. List of Items Provided the Reviewer

The following list may be incomplete but includes items to be provided to the external reviewer in addition to a printed version of this document.

Printed Materials

Faculty Handbook 2004-05.

Course Catalog 2004-05.

course syllabi

"essential topics" list drafts

faculty vita

Campus Facilities

a small office (MBH 237) with phone, desk, and computer (with access to the Internet and campus printing network).

E. Itinerary of the Visit

Monday March 28

- 1:44pm Arrive by plane, shuttle to hotel. Airport Flash toll free #: 866-930-7433. Holiday Inn Express Confirmation #: 61582201.
- 3:30 _____ to pick up for ride to Campus. Office set up, Mood #237.
- 4:00 **interview with Dr. Jim Hunt, Provost and Dr. Therese Shelton, Chair of Math and Computer Science Department. Provost office, Cullen.**
- 4:30 Meet with **Dr. Michael Kamen, Dept. of Education, Mood #237.**
- 5:00 Meet with **Dr. Fay Guarraci, Dept. of Psychology, Mood #237.**

Tuesday, March 29

- 9am breakfast at hotel ride to campus by ? Tour?
- 9:30 Meet with **Bob Paver, Director of Information Technology Services, SLC 114A**
- 10:15 Meet with **Dr. Bob Snyder, Dept. Chair-Political Science, in Mood #237**
- 11 Meet with **Monty Curtis – Admissions Dept in Mood #237**
- 11:45-1 lunch with non major students- Merzbach (Erin Crockett)
- 1 Meet with **Dr. Gary Richter in Mood #237**
- 1:45 Meet with **Dr. Kendall Richards in Mood #237**
- 2:30 Meet with **Dr. Cami Sawyer in Mood #237**
- 3:15 Meet with **Dr. Suzanne Buchele in Mood #237**
- 4:00 Meet with **Dr. John Chapman in Mood #237**
- p.m Dinner with Math/CS Department and Outside Faculty Member Don Parks at Wildfire restaurant.

Wednesday, March 30

- 8am breakfast at hotel, ride to campus
- 8:45 Meet with **Dr. Barbara Owens in Mood #237**
- 9:30 Meet with **Dr. Bill O'Brien, Dept. Chair-Physics, in FJS #124**
- 10:15 Meet with **Dr. Walt Potter in Mood #237**
- 11 Meet with **Dr. Kerry Bruns Dept. Chair-Chemistry, in FJS #316**
- 11:45-1 Lunch with majors in **Roy Shilling Room (reserved) (Chris Scott, Hilari Tiedeman, Morgan Sweatt, Dan Parker)**
- 1:15 Jt. Meeting with **Dr. Don Parks & Dr. John Delaney, outside committee member and Dept. Chair-Economics and Business in Mood #237**
- 2:00 Meet with **Dr. Rebecca Sheller, Dept. Chair-Biology, in FJS #240**
- 2:45 Meet with **Dr. Richard Denman in Mood #237**
- 3:30 break
- 4:00 Meet with **Dr. Jim Hunt and Dr. Therese Shelton, Provost office-Cullen**
- 4:30 Meet with **Department – Mood 133, Whitmore Lab/Lounge**

Thursday, March 31

- 8:45am breakfast at hotel
- 9:30 Shuttle to airport for 11:59 flight

Appendix V: Department Online Alumni Survey

A text version of the form found at <http://csmath.southwestern.edu/alumn-form.html>.

Alumni Information Survey

Please provide us with the following information. We would like our current students to be able to contact alumni regarding career opportunities, graduate school or selection of a major. If you are willing to have a link to your e-mail address on the Mathematics and Computer Science Department Alumni page, please indicate that below.

First name: Last name: Maiden Name:

E-mail address:

You may post my e-mail address on the Department Alumni page.
Please do NOT post my e-mail address on the Department Alumni page.

Personal webpage URL:

You may post my webpage URL on the Department Alumni page.
Please do NOT post my webpage URL on the Department Alumni page.

Is this your first time to submit information or is it an update?

Unfortunately, we have received messages from people who were never affiliated with Southwestern University. Please give a daytime phone number so we can verify the information if any questions arise. Area Code: Number:

What was your major at Southwestern University? If other, please list:
If you had a second major, please indicate that below. If other, please list:
If you had a minor, please indicate that below. If other, please list:

What year did you graduate from Southwestern University?

What is your current title/position?
Name of company, institution, or organization
City: State: Country:

If you received or are receiving a graduate degree or any other post-undergraduate certification, please indicate the degree(s), the university/institute, and the year of completion.

Enter any comments to share with other alumni, current students, or faculty below:
(We might link some of this information to the Alumni page.)

Please provide us with your current address for our records.
(This information will NOT be posted).

Street Address: Apartment #: City: State: Country: Zip code:

The following questions are included to help us evaluate the math and computer science program. Please help us improve our program by giving your honest responses. All information will be kept strictly confidential; feel free to leave any items blank.

How would you best describe the setting of your current position?

How long have you been at your current position? Years Months

For your current position, how would you describe the preparation you received from SU's math or computer science program?

Poor Fair Good Very Good Excellent No Comment

If you attended (or are attending) graduate school, how would you describe the preparation you received from SU's math or computer science program?

Poor Fair Good Very Good Excellent No Comment

Looking back, how satisfied are you with the degree in math or computer science you received at Southwestern University?

Dissatisfied Satisfied Very Satisfied No Comment

The following questions are included to help us further evaluate the math and computer science program, and to give current students a feeling for the program. We might link some of the comments from our websites. If you would prefer not to be referenced please say so.

In retrospect, what math- or computer science-related experiences or courses were MOST VALUABLE (i.e., in your career or in your life in general)?

Knowing what you know now, do you have any suggestions for ways in which the math or computer science program could be improved?

SUBMIT REQUEST NOW START OVER

Thanks for completing the Alumni Information Form!

Return to: [SU Math/CS Department Homepage](#) [Alumni Information Webpage](#)

If you discover any errors on this page please inform C. Sawyer.

Appendix VI: Senior Survey

(room for comments has been omitted)

Your responses will aid the Department of Mathematics and Computer Science in its review process. Your responses are confidential and voluntary. Thank you in advance for your thoughtful responses, regardless of whether they are positive, negative, or neutral. Our Department is interested in knowing what we do well and what needs improvement.

1. Did you engage in a major collaborative project with faculty here at SU (indicate the number of such engagements if more than 1)

Mundy Faculty Fellowship, Independent Study Honors Thesis
 Summer REU other (specify) none

If you participated in a major collaborative project here, please assess the quality of the each experience: 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent.

2. Please assess your facility with problem-solving skills:

1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent.

3. Please assess your facility with mastery of the core content in required areas for your field(s):
Mathematics -- calculus, differential equations, algebra, analysis.

0 = not applicable, 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent.

Computer Science -- computer programming, algorithmic development, computer organization, programming language paradigms, discrete mathematics, software engineering.:

0 = not applicable, 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent.

4. Please assess your facility with appropriate technology for your field(s) and specify the technology:

1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent.

5. Please add any additional comments that you feel would be helpful.

Appendix VII: Detail on Recent Programming Contests

Rick Denman took two teams of computer science students to Baton Rouge, La., the first of November to compete in the 2002 ACM South Central USA Programming Contest. One of the teams, consisting of students Clint Calhoun, Tim Moore, and Karlie Verkest, scored 19th (out of 79 teams) overall. More impressive, however, is the fact that they scored 3rd overall among teams from schools with no graduate programs in computer science (teams may have at most one graduate student). This is a very impressive finish for our students! The other team consisted of Shane Baumgartner, Robert Brown, and Jeremy Russell. The alternate was David Shilkun.

On November 7-8, 2003, the Department of Math and Computer Science took two programming teams to the Association for Computing Machinery South Central Region Programming Contest at LSU in Baton Rouge, LA. One of the teams, consisting of students Kelson Gist, Jacob Schrum, and Morgan Sweatt, scored 24th (out of 79 teams) overall, and they scored 3rd overall among teams from schools with no graduate program in computer science (teams may have one graduate student). The other team consisted of David Luna, Tim Moore, and Nathan Roe, with alternate Tim Given. This team placed 48th overall and 8th among teams from schools with no graduate program. This is a very impressive showing.¹

F04: Our ACM programming contest team ("su root") performed remarkably well at the South Central Region ACM Programming Contest. They solved four problems, and placed 12th place in a field of 77 teams. Four problems is only one less than the number solved by the top team, Texas A&M, which advances to the world championship contest in Shanghai. This 12th place finish is the highest ever achieved by a Southwestern entry, by 7 places. Among schools with no graduate CS program, SU placed second.

¹ <http://cs.southwestern.edu/new.htm>

Appendix IX: Detail on Recent Modeling Contests

2003	Conrad Miller	Honorable Mention
	Daniel Morris	
2002 TEAM 1	Conrad Miller	Honorable Mention
	Arthur Sloan	
	Daniel Morris	
2002 TEAM 2	Amaya de la Garza	Successful Participant
	Pamela Hightower	
	Jason Jones	
2001	Conrad Miller	Successful Participant
2000	Kevin Hiam	Successful Participant
	Stephanie Miller	
	Katie Seawell	

Additional detail available upon request.

Appendix IX: Data Collection and Analysis Notes

The purpose of the detail given here is to provide evidence of efforts to provide a solid analysis of the data.

Data Requests

The data files were requested by Shelton, in consultation with members of Academic Computing and the Registrar's Office. Gatlinger (Academic Computing) provided the files, often after direction by O'Daniel (Academic Computing), and Shelton manipulated the data.

Requests were spurred by the outline of information expected for the review found in the *Faculty Handbook* as well as the Recommendations and Sample Survey Questions of the *CUPM Curriculum Guide*.

DATA FILE 1: for all sections of MAT52- or CSC54- courses

** course and section number, 12th day enrollment, course name, instructor, final enrollment, and semester; broken down by student status (FR, etc.)

** FILE 1a: F00-F04; FILE 1b: F98-S00; FILE 1c: F93-S98 without student status breakdown.

PURPOSE: To determine enrollments in our courses and student classification. To compare part time vs full time numbers of sections and section size.

NOTE: FILE 1c was of limited aid since much of the information had been purged from the Southwestern database.

DATA FILE 2: for all students enrolled in regular MAT52- or CSC54- courses by the 12th day of class; omit "special courses" mentioned in Data File 4: MAT52- or CSC54- 30X Selected Topics, 95X Independent Study, 843 Seminar in Special Topics, 983 Honors where X=1,2,3,4; CSC54-191, CSC54-291

** from Fall 2004 back through Fall 2000

** student ID number and name, student classification (FR, etc.), course and section number, course name, semester, instructor, grade, major(s)/minor(s) and semester of graduation for those who graduated, gender, race, indicator of student teaching (had one of EDU 41-, 42-, 43-, or 44- prefixes for 803 or 806), term of study abroad if applicable

** FYS instructor if Denman or Owens, which is for Falls of 2003 (Denman and Owens), 2002 (Owens), and 2001 (Owens). (Since this part is only for subsequent course taking, we do not need 2004.)

PURPOSE: To determine "subsequent course-taking"; do students who take one course in the program go on to take another? To understand the strengths and weaknesses of our students. To track success and retention. To track those intending to teach pre-college. To see if people seem to have conflicts between being in our program and study-abroad (had a lot of courses but quit after study abroad).

DATA FILE 3: for all students receiving transfer or AP credit for MAT52- or CSC54-

** from Fall 2004 back through Fall 1998

** student ID number, student classification (FR, etc.), classification by the end of the semester following entrance, transfer course credit, AP course credit, and semester the credit was received or awarded (whichever is recorded), major(s)/minor(s) and semester of graduation for those who graduated, gender, race, indicator of student teaching (had one of EDU 41-, 42-, 43-, or 44- prefixes for 803 or 806)

PURPOSE: to determine trends in credit received outside of SU.

NOTE: "next semester classification" is requested since some students' transfer requests have not been processed by the 12th day of class.

DATA FILE 4: for all students who completed a "special course" in our program: MAT52- or CSC54- 30X Selected Topics, 95X Independent Study, 843 Seminar in Special Topics, 983 Honors, where X=1,2,3,4; CSC54-191, CSC54-291

** from Fall 2004 back through Fall 1995

** student ID number, student classification (FR, etc.), course and section number, course name, semester, instructor, major(s)/minor(s) and semester of graduation for those who graduated, gender, race

PURPOSE: to determine the extent to which we offer a flexible program and respond to student interests

DATA FILE 5: for all students who indicated an interest in mathematics or computer science at the time of their application

** student ID number, area of interest at the time of application, semester of entrance to the university, classification at time of entrance if different from FR, classification by the end of the semester following entrance, major(s)/minor(s) and semester of graduation for those who graduated, gender, race

** from Spring 2004 through Fall 1998

PURPOSE: to determine changes in career plans, fields of study, and aspirations of students; to determine number of transfer students.

NOTE: Data File 4 determines who began with an interest in our program and whether they stayed with that interest. "next semester classification" is requested since some students' transfer requests have not been processed by the 12th day of class.

DATA FILE 6: for all students who graduated with a major or minor in math or CS (math major, computer science major, computational mathematics major, math minor, computer science minor)

** from Spring 2004 back through Fall 1995

** student ID number, semester of graduation, BA or BS, list of majors and minors, area of interest indicated at the time of application, gender, race,

PURPOSE: to determine career plans, fields of study, and aspirations of our graduates

NOTE: Data File 5 determines who ended up finishing in our program and whether they began with that interest (as well as what other main interests they had).

Registrar Stones recommended that it was appropriate for Shelton to have personally identifiable information, such as the name, was appropriate for data validation purposes and investigation of questionable data or events; this was indeed helpful. He cautioned that care be taken in general, per the Family Educational Rights and Privacy Act, to avoid a general

presentation of the full academic record to any, including faculty, whose need to know was beyond question. Aggregate information was allowed to be presented, except that cases involving small numbers of students might lead to identification. We believe such care has been taken.

Data Manipulation

Shelton has no expertise in databases, but her mathematical skills and use of Excel seemed to suffice. In many instances, indicator functions were used in a series of columns, such as for semester or course; dot products of these vectors with enrollments, for instance, resulted in summary enrollment information. Sorting, "IF" functions, and accumulating sums were used extensively, such as to tally enrollments over all sections of a course in a given semester.

The data were reviewed manually for several reasons, including changes in the course numbering system. For instance, MAT52-843 was the capstone until 1996-97 although it remained in the catalog until the following year. Then the number was recycled to represent any upper-level seminar in selected topics but not for capstone credit. Introduction to Statistics changed from 213 to 113. Software Engineering began as CSC54-303, a selected topics course, but later became the capstone CSC54-893, replacing the former CS capstone of Compiler Design. Some numbers were recycled and some courses renamed.

On several occasions, others reviewed selected data for apparent inconsistencies, such as Bonner and Sanderfer of the Registrar's office. Some requests were modified and resubmitted. For instance, the original request for transfers and AP credit showed multiple people apparently receiving credit for both as well as two pairs of students with the same first and last names but different student IDs receiving credit for the same courses. Investigation revealed that the data included students who never matriculated, so the data gathering process was changed and a new file used. Those with separate IDs truly were separate people. Some students did receive credit for a course through an AP exam and later complete the same course; the student did not receive double credit, and adjustments were made in the report.

In the data for Independent Studies by course, instructor information did not always match the information gathered on individual students, particularly in the name of the instructor. Only sometimes was the topic indicated. In some cases, there were two entries, one with the topic listed and one without for the same student in the same semester. These were considered duplicates.

The data was provided in comma delimited ASCII files, which Shelton imported into Excel, manipulated, and copied results into Word. Some major technical difficulties periodically arose and resulted in repeated file corruption, apparently from two sources: switching between Mac and Windows systems and transporting information from Excel to Word. Efforts were made to overcome these difficulties, and some spot checks were made for accuracy.

Further detail is available upon request.

Appendix XI: 2004-05 Assessment Grid

See attached five pages.

Academic Departments/Programs Annual Assessment

Academic Department/Program Name: Department of Mathematics and Computer Science

Individual Completing Form: Dr. Therese Shelton, chair

School Year: 2004-05

Date Submitted: February 25, 2005, year of the Major Program Evaluation

University Core Purpose: Fostering a liberal arts community whose values and actions encourage contributions toward the well-being of humanity.

Program Mission: It is the purpose of the Department of Mathematics and Computer Science to develop students' concise and logical patterns of mathematical and algorithmic reasoning. The courses and experiences offered by the Department of Mathematics and Computer Science contribute to students' understanding of the liberal arts and sciences and prepare students for postgraduate education and careers. The faculty in the department teach the breadth and depth of the mathematical and computer sciences with rigorous academic standards and a commitment to preparing students to be life-long learners.

Goals	Learning Outcomes	Assessment Mechanisms	Assessment Results	Improvements
<p>"Develop students' concise logical patterns of mathematical and algorithmic thinking" (Dept mission statement)</p> <p>Develop the "ability to ... apply the knowledge and skills of their discipline" (University Strategic</p>	<p>Students will be able to use and extend their knowledge in mathematics and computer science.</p>	<p>Respondents to the Departmental Online Alumni Survey will indicate at least:</p> <p>a. "Good" to describing the preparation from our program for employment. Target 80%</p> <p>b. "Good" to describing the preparation from our program for graduate school. Target 60%</p> <p>c. "Satisfied" about their degree. Target 80%</p>	<p>a-c. The 2004-05 Major Program Evaluation document includes a breakdown of ratings in each category.</p>	<p>Data indicate a high success rate for our students based on good preparation. The department will continue to maintain currency with national standards for the computer science undergraduate curriculum. Freestyle comments from the online departmental alumni survey indicated the worth of addressing job and graduate school opportunities. The Department is exploring ways to enhance our ability to provide these opportunities.</p>

Goals	Learning Outcomes	Assessment Mechanisms	Assessment Results	Improvements
Plan)		d. Graduates will either engage in continuing education or find full-time employment. Target 50%. (Post-Graduation Survey, Departmental Online Alumni Survey)	d. The 2004-05 Major Program Evaluation document includes additional reporting of employment and graduate school.	

<p>"Help students...develop intellectual skills in viewing problems from a variety of perspectives" (University Strategic Plan)</p>	<p>Students will demonstrate a facility with problem-solving skills.</p>	<p>a. Capstone students will be rated by the supervising faculty as doing an "acceptable" job on the Capstone Project. Target 100%</p> <p>b. During a three year period, a group of majors will successfully participate in an appropriate contest external to Southwestern.</p> <p>c. The periodic (five and ten year) department reviews will assess the quality of students' problem-solving skills.</p>	<p>a. Math Fall 2004: 100% of those who completed the capstone; CS Spring 2005: in progress</p> <p>b. (see note 3) Math -- COMAP: S05: 0 students S04: 0 students S03: 2 students, Honorable Mention</p> <p>CS -- ACM: F04: 1 team of 3 students; solved 4 problems and ranked 12/77 overall and 2nd among teams from undergraduate only institutions. S04: 2 teams of 3 students; team 1 solved 5 problems and ranked 24/79 overall and 3rd among teams from undergraduate only institutions; team 2 solved 3 problems. S03: 2 teams of 3 students; team 1 solved 3 problems and ranked 19/79 overall and 3rd among teams from undergraduate only institutions; team 2 solved 0 problems.</p> <p>c. See the 2004-05 Program Evaluation.</p>	<p>a. The capstone experiences have been very successful.</p> <p>b. The Department needs to increase its efforts to encourage students to participate in the modeling contest. Participation has decreased since the Faculty sponsor has taken on the duties of Department chair. Next year we will be at 68% of our full time staffing, so it is unlikely we will be able to increase efforts toward the COMAP contest.</p> <p>Our ACM programming contest team ("su root") performed remarkably well at the South Central Region ACM Programming Contest. Four problems is only one less than the number solved by the top team, Texas A&M, which advances to the world championship contest in Shanghai. This 12th place finish is the highest ever achieved by a Southwestern entry, by 7 places.</p> <p>The programming contest is a good opportunity and should continue to be supported. The course CSC 54-291 Problem Solving for Rapid Application Development has yielded great rewards and needs to continue. We cannot expect that the course continue being offered as an uncompensated overload for the faculty member.</p> <p>c. See the 2004-05 Program Evaluation.</p>
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<p>Provide students "...the opportunity to participate in [a] collaborative learning experience that will accomplish ... transformation of theoretical knowledge into experience" (University Strategic Plan)</p>	<p>Students will engage in a major collaborative project with faculty (eg. Mundy Faculty Fellowship, Independent Study, Honors Thesis, Summer Research (REU), or other).</p>	<p>a. Graduating majors will have engaged in such a project. Target 10%.</p> <p>b. The periodic (five and ten year) department reviews will assess quality and quantity of such engagement.</p>	<p>a. One faculty-student team refused to work under the greatly reduced funding allotted. One faculty-student team will engage in a Mundy supported project next year.</p> <p>For 2003-2004, capstone survey and departmental information indicate 46.2% (6/13).</p> <p>b. The 2004-05 Major Program Evaluation found that we perform well, given our current staffing and funding resources.</p>	<p>a-b. The 2004-05 Major Program Evaluation found that we perform well, given our current staffing and funding resources. Although REU funding has been somewhat restored for next year, our faculty will be pushed to the limit to perform usual functions, given a 32% reduction in full time faculty resources. We were able to provide a one-course release to two faculty members to compensate them partially for a backlog of Independent Study and Honors projects.</p>
<p>"Establish a teaching and learning initiative to put Southwestern at the forefront of liberal arts colleges in terms of equipment, software, and pedagogy. (University Strategic Plan)</p>	<p>Students will be exposed to appropriate use of current computer technology and software.</p>	<p>a. The periodic (five and ten year) department reviews will assess the quality and extent of students' use of technology.</p> <p>b. Capstone students will indicate confidence in their technical skills in a survey. Target 90%</p>	<p>a. See the 2004-05 Program Evaluation.</p> <p>b. S04 CS: avg response of 9 respondents was 3.48, where 5 indicates "excellent"</p>	<p>a. See the 2004-05 Program Evaluation.</p> <p>b. The Department will consider ways to improve technical skills and also refine what this means.</p>

Develop the "ability to communicate ... the knowledge and skills of their discipline" (University Strategic Plan)	Students will be able to communicate effectively and rigorously.	a. Over three years, of those who engaged in a collaborative project, 80% will give a public presentation on their project and 10% will present external to SU. b. Capstone students will be rated by the supervising faculty as doing an "acceptable" job on the presentation of their Capstone Project. Target 100%	a. 100% for 2002-03 graduates presented publicly and 85.7% (6/7) presented externally. b. Math Fall 2003: 100% of those who completed the capstone; CS Spring 2004: 100%.	a. The high number for 2002-2003 was due primarily to the summer 2002 REU. Cuts in funding for this program have had a detrimental effect. b. The format of the Capstone courses has been very successful in honing students' communication skills which are built in other courses.
Expose students to the breadth and depth of the mathematical and computer sciences with rigorous academic standards and commitment to student learning. (Department Mission Statement) "[Develop] a self-critical, tough-minded community of scholars that maintains rigorous academic standards." (University Strategic Plan)	1. Majors will demonstrate mastery of the core content in required areas: Mathematics -- calculus, differential equations, algebra, analysis. Computer Science -- computer programming, algorithmic development, computer organization, programming language paradigms, discrete mathematics, software engineering.	1. a. SU chapters of the Honorary Societies in Mathematics and Computer Science, PME and UPE, will induct new members annually. b. Whenever the MFAT is administered, the department will rank in the top 50%, based on average score. c. Capstone students will indicate confidence in their mastery of core content areas in a survey. Target 80%.	1. a. UPE: 2003-04 5 new students; 02-03 7; 01-02 inauguration with 5 students and 4 faculty. PME:: 2003-04 12 new students; 02-03 8; 01-02 inauguration with 19 students and 5 faculty. b. CS S03: SU average score 167.7 was at the 92nd percentile for the 24 institutions which administered the exam according to the Spring 2002 Data. Math F02: SU average score 164.9 was at the 88th percentile for the 197 institutions which administered the exam according to the 1999-2001 Data. c. S04 CS: avg response of 9 respondents was 3.59 in math and 4.17 in computer science, where 5 indicates "excellent"	1. a. The department will continue to ensure the curriculum challenges exceptional students. b. This outside and independent exam gave us encouragingly high results. This may be due to an exceptionally good graduating class of students. The department will administer it again in 2004-05. Further analysis will occur during the departmental review in 2004-05. The department will continue to ensure the curriculum adequately prepares all of our majors. b. The Department will continue to revise its curriculum and pedagogy and will consider ways to assess these skills.

(continued)	2. Math majors will be exposed to important supplementary skills, such as probability and statistics.	<p>2. a. Respondents to the Departmental Online Alumni Survey will indicate that their preparation was at least good.</p> <p>b. The periodic (five and ten year) department reviews will assess the quality of students' problem-solving skills.</p>	<p>2. a. Freestyle comments from the Online Departmental Alumni Survey indicated the need to improve offerings in probability and statistics for our math majors.</p> <p>b. upcoming 2004-05</p>	<p>2. The Department acknowledges that we lack the resources to provide our majors with a firm foundation in probability and statistics.</p>
Provide " ...society with ... bright ... leaders." (University Strategic Plan)	Students will demonstrate leadership skills on campus.	The officers of the student chapters of the math and computer science organizations will plan and execute at least two meetings per year.	2004-2005: Goal accomplished.	The Department will continue to encourage membership in active organizations. Next year we must shift faculty sponsorship because of the 38% reduction in our usual full time staffing (sabbaticals).

note 1: According to the Summer 2003 analysis of cumulative survey results, which included responses from 81 separate people, 3 of whom also gave updates. See <http://csmath.southwestern.edu/alumn-form.html> and attachment.

note 2: Numbers obtained from the 2002 Post-Graduation Survey distributed by Career Services, reflecting career status as of Spring 2003. Adjustments were made not to double-count double majors.

note 3: COMAP - Consortium for Mathematics and its Applications; two contests are available; see <http://www.comap.com/undergraduate/contests/>.
 ACM - Associated Computing Machinery; see <http://icpc.baylor.edu/icpc/> for the International Collegiate Programming Contest; see <http://acm2003.csc.lsu.edu/> for the 2003 South Central Programming Contest.