Reviews and Projections 2004-2005

Department of Mathematics and Statistics
University of South Alabama

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The reviews and projections for 2004-2005 will be developed according to the following outline. First, we develop in narrative fashion an analysis of the reviews and projections from the 2003-2004 academic year. This analysis will articulate the goals and objectives that were achieved and those in which our efforts were lacking. Second, we address the learning objectives for the major, discuss our assessments of these learning objectives, and develop actions based on these assessments. Third, we do the same for the gradaute program. Fourth, we articulate goals and objectives for the current academic year, and charge the relevant committees with the achievements of these objectives. Fifth, we develop the learning objectives and departmental objectives within the boxed matrix form that is required of us by the institutional administration.

Part 1: Summary of the 2002-2003 Reviews and Assessments

This section is edited (for typesetting purposes and to be current) and annotated (to describe our successes and failures) from the reviews and projections that were available on our departmental web site at

`http://www.southalabama.edu/mathstat/info/from_chair/Annual-Report-2003.shtml`

Achievements:

The following goals were articulated for the 2002-2003 academic year:

1. To attract more students to continue to study and apply their knowledge of the mathematical sciences.

2. To maintain a viable and dynamic master's degree program.

3. To improve the education of students in lower division courses.

4. To recruit and to support a high quality diverse faculty with broad research and teaching interests.

5. To encourage and support faculty research and scholarship.

In our narrative of these goals, we enumerated a variety of successes including the growth of the major, the effect that "No Child Left Behind" has had on our program, the recruitment of new faculty, the development of our graduate program, and a variety of grants and contracts that were awarded to the department.

We developed some longer range goals on job and graduate student placement, assessing learning outcomes, and measuring the success of the use of graduate students as teaching assistants. These longer range goals will be addressed herein under our current reviews and projections.

The following goals and objectives for 2003-2004 were achieved (or not) as indicated.

1. To attract more students to major and minor in mathematics and statistics.

   We have been fantastically successful in this endeavor.

   i. To double the number of students majoring in Mathematics and Statistics.

      As of Fall 2004, there are close to 132 students who list mathematics and statistics as one of their majors.

   ii. To offer 300 and 400 level courses on a regular basis during the summer.

      We offered Statistics 335 and Math 413 this past summer. Both courses had significant enrollments. We are planning on offering other sections of upper division courses in Summer 2005.

   iii. To offer enrichment seminars and courses.

      We hosted a Putman team. Undergraduates routinely attended seminars and colloquia.

   iv. To assist graduates in obtaining employment or graduate admission.

      Some students were admitted into our own graduate program. Others have gone to professional careers. Our survey of recent graduates, however, is incomplete.

   v. To award scholarships for Academic Excellence in Mathematics and Statistics.

      Eight Mathematics Scholarships were awarded as were the Sushila Mishra, Blanco and Nash Scholarships.

vi. To investigate the feasibility of offering different upper level mathematics courses.

This goal was neglected. However, a number of our majors have benefitted from independent studies and topics courses.

vii. To continue to provide on-line resources such as syllabi, class notes, and exam archives to enhance instruction.

We can improve on this account. Some professors do not update their exams on line. Others do not release this information. The syllabi are available, but some lack explicit learning objectives having been articulated. This goal is ongoing and will continue to draw our attention.

viii. To include colloquium speakers who discuss teaching and employment issues.

One of our colloquium speakers talked to students about mathematical experiences in Canada. This endeavor was not as successful as one might have hoped.

2. To improve the master's degree program.

Many improvements have been made including a vibrant collection of dedicated graduate students who are currently enrolled. Courses are being taught to enhance these students' mathematical and statistical knowledge.

i. To solicit EPSCoR support for mathematics and statistics program across the state.

This remains an unfulfilled objective. Some action was taken on the part of the chair. Specifically, an email correspondence about this possibility was made. It remains an objective that we feel strongly about.

ii. To expand the use of GTAs to MA 112 and ST 210.

This has begun, but further work is needed. Specifically, a complete course redesign is needed for MA 112 in which specific lab hours are set aside.

iii. To obtain funds for individual graduate students.

Some recent NSF awards have included graduate student support as a line item. More action can be taken in the future, but we are headed in the right direction on this.

iv. To recruit graduate student assistant for the Center for Statistical Consulting.

This endeavor was less than successful during the 2003-2004 academic year. Recruitment efforts ran into difficulty with the INS.

3. To assess the education of students in lower division courses.

   While it would have been desirable to have assessment tools in place by December 2003, it was neither politically nor bureaucratically practical. Assessment in these courses is progressing, and more in the 2004-2005 projections will address these.

   i. To assess learning outcomes for MA 110, 112, 113, and 115.

      A set of learning objectives were articulated for MA 112 in May 2004. During the summer, these were mapped to specific problems within the text. In Fall 2004, instructors were asked to include these problems among homework, tests, and quizzes. We anticipate more work in this regard during the 2004-2005 academic year.

   ii. To provide Computer assisted instruction in MA 112, 201, 202, ST 210.

      Many, but not all, sections of MA 112 are using CAI. It is available for MA 201 and MA 202 and also available in some sections of ST 210. We will continue to examine this learning tool and its efficacy in achieving our educational goals.

   iii. To provide up-to-date syllabi in all courses.

      Syllabi can be found at our web site. Many need to have learning objectives further articulated.

   iv. To examine texts in calculus and business calculus

      The business calculus text has been selected.

4. To recruit and to support a high quality diverse faculty with broad research and teaching interests.

   Faculty recruitment efforts went quite well. The research endeavors of the current faculty are second to none in the state.

   i. To hire 3 to 5 full-time tenure-track faculty in Mathematics and Statistics.

      We recruited three new faculty members during the academic year 2003-2004.

   ii. To work with College of Education on their recruiting.

      The College solicited our feedback on their job candidates for secondary mathematics education. We also provided contacts within the field for the College. So far nothing has panned out, but we are very pleased with their new academic advisor.

5. To encourage and support faculty research and scholarship.

Some efforts in this regard are routine. For example, we acknowledge publication with a hearty thanks. We check the recent preprints available on the mathematics archive and direct faculty attention to those items that may be of interest. Furthermore, we inform the Dean when articles which site our faculty's work appear in print. We lobby intensely for re-assigned time for faculty research. Other more tangible support, however, is needed.

A nearly complete dossier of the research efforts of the faculty is archived within the College of Arts and Sciences Annual Report. To help put this research in a broader perspective 11 *faculty members published* 18 *refereed articles and published or edited three books. The standard in the field of mathematics is roughly one research article per eighteen month period. (See "Towards Excellence," published by the American Mathematical Society). The articles that were published tended to appear among the top twenty journals in the field as determined by various independent measures.*

i. To increase externally funded research, scholarship, and teaching related projects.

   By the end of the 2003-2004, academic year we received one new NSF grant. Faculty are to be congratulated for their successes in securing grants. Each program directorate in the NSF is able to fund about 30% of the proposals submitted. Furthermore, not every researcher in the area is willing to submit a proposal; the expected payoff is considered to be too small given the effort.

ii. To support an active colloquium series.

   We supported a number of visitors to give colloquium talks. These are not all documented on our colloquium homepage.

iii. To maintain quality research.

   Many faculty gave plenary talks at national and international venues. We supported travel for all faculty who delivered talks. The faculty deserve special commendations for their outstanding work. It is they who maintain the high quality research for which this department is known.

iv. To maintain membership in professional societies.

   Most, if not all faculty, are members of the AMS, ASA, IMS, or the MAA. Others are involved in teaching organizations.

v. To institute faculty seminars.

   We held active analysis and algebra seminars last year.

Part 2: Learning Objectives for the Major

Here we describe our assessment methods, results of these assessments, and the learning objectives for the major.

Assessment of Learning Outcomes
Bachelor of Science Program in Mathematics and Statistics

The assessment of student achievement of learning objectives is accomplished primarily by a three-step process.

1. Periodic departmental review of curricula and major requirements to ensure that they encompass all of the learning objectives. The department Curriculum Committee is charged with making this assessment and presenting recommendations for change to the department.

   As a result of departmental discussion, the curriculum committee is currently considering a recommendation to make advanced calculus Math 334 an undergraduate requirement. The major motivating factor is that our own graduate program requires this course for admission.

   In an unrelated question, the curriculum committee is reviewing having mathematical modeling a required course.

2. Monitoring of each student's progress by the student's advisor. The advisor designs an appropriate program of study that accomplishes core objectives in a timely fashion and is tailored to the student's interests and career goals.

   Students who major in mathematics and statistics are required to see their advisor each semester. This policy is enforced through advising holds implemented by the BANNER registration system.

3. Assessment of the student's attainment of learning objectives in the context of the relevant courses. Students are evaluated by exams, written assignments and oral presentations. Exams are graded according to objective standards. Assessment and grading policies of junior faculty are reviewed for appropriateness to department standards. Student mastery of material and methods is necessary for success in subsequent coursework. Thus basic knowledge of core knowledge is tested not only in core courses, but repeatedly in advanced elective courses. Gradual mastery of key skills such as mathematical reasoning and proof, problem-solving and communication is evaluated throughout the curriculum, with rising expectations in the upper level courses.

   As a result of informal discussions, some faculty have come to the opinion that the concept of proof needs to be integrated throughout the curriculum. We are now examining the feasibility of introducing such a policy.

4. The professional culture is communicated in diverse ways, in the classroom and in individual contacts with faculty and visitors, through the student Math-Stat Club, department colloquia and other department events. The Student Affairs Committee and Colloquium Committee are primarily responsible for these activities, which are in the scope of the annual department assessment of its accomplishments.

   Our approach to communicating the professional culture seems to be effective at this point.

Specific Learning Objectives

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1. Working knowledge of core subjects: calculus and differential equations, linear algebra, statistics. Required courses: MA 125, 126, 227, 237, 238, 354; ST 210 or 315, ST 335.

   As a result of discussions with faculty who are teaching upper level courses, we are examining the efficacy of using the graphing calculator towards our pedagogical goals.

2. In-depth knowledge of many areas of modern mathematics and statistics. Elective upper-division courses.

   Faculty are rotated among the elective courses. In this way, we can best determine who among our majors will need mentoring in difficult concepts.

3. Understanding of the role of proof in mathematics, with the ability to construct simple proofs. Gradually developed throughout the curriculum, with increased emphasis in MA 237, 311, 316, 320, 321, 367, 334, 335, 413, 414, 434, 437 and 451.

   We are examining whether proof needs to be integrated into our lower level courses. Part of this examination will include the technique for said introduction.

4. Problem solving: the ability to develop and use mathematical and statistical models, devise problem-solving strategies, collect and analyze data, locate suitable reference materials, and use appropriate technology. Developed throughout the curriculum, with particular emphasis in the core courses and modeling courses (ST 335 and MA 354), MA 436 and 458, and all upper-level statistics courses.

5. Communication skills: proficiency in technical and expository writing, including writing proofs, and in oral presentation of technical material. Addressed most

particularly in our W courses (MA 320, 354, 410, 413, 414, 458 and ST 480) and the Seminar in Contemporary Mathematics and Statistics (MA 150/ ST 150). Department colloquia provide students with additional models for oral expository and technical communication.

6. Familiarity with the use of mathematics and statistics in other disciplines. Applications are a prominent feature of all of the core courses and modeling courses, and many upper-division courses. Use of mathematics and statistics in other disciplines is addressed explicitly in courses in those disciplines. Majors are required to take natural science courses as part of the Arts and Sciences core, and directed by advisors toward additional extra-disciplinary courses appropriate to their interests and career goals.

7. Awareness of professional culture: Familiarity with the history and modern developments of mathematics and statistics, its scope, and the wide range of occupations in which mathematicians and statisticians are currently employed. The history and development of mathematics and statistics are the subjects of MA 410 and MA 150/ ST 150. In addition, they are incorporated at relevant points in other coursework, with recent developments appearing particularly in 300 and 400-level courses. Department colloquia given by faculty and visitors help accomplish this objective, as well as resources posted on our website and bulletin boards.

Part 3: Learning Objectives for the Master's Degree Program

Assessment of Learning Outcomes
Master of Science Program in Mathematics

The Department of Mathematics and Statistics offers a flexible master's degree program to meet the needs of a diverse population of students with varied interests and career goals. Not all students enter the program with an undergraduate degree in mathematics or statistics, so that the first learning objective may be to rectify deficiencies through advanced undergraduate coursework. On completing the degree, students may go on to a doctoral program in the mathematical sciences, or take a job in industry, government or teaching.

New graduate students are required to meet with the Graduate Coordinator to determine appropriate educational objectives and devise a projected plan of study that will accomplish them. These objectives combine core program objectives with personalized goals. The Graduate Coordinator continues to meet with students on

a regular basis to update the plan of study, assess the student's progress toward the objectives and assure that appropriate courses or directed study will be available.

Student achievement of specific objectives is assessed:

1. In the context of courses, through written assignments, presentations and exams. Most graduate courses require students to submit extensive written work that is carefully evaluated for both content and clarity of presentation. Exams are given in most courses, but a final project may be required instead.

2. By a comprehensive written exam. This is normally taken in the student's final semester. The examination covers real analysis and two other subjects chosen by the student subject to approval of the Graduate Coordinator. It is graded by a committee of graduate faculty. A passing grade on each section is required for graduation. Students who do not pass the exam on the first attempt may be given a second opportunity if their coursework is satisfactory.

3. Thorough evaluation by faculty of research done for a thesis or other directed study. Completion of a thesis is an option that is encouraged, particularly for stronger students and those planning to pursue an advanced degree.

The department regularly assesses the program requirements and department activities such as colloquia and seminars to see if they are consistent with learning objectives. This is chiefly the responsibility of the Graduate Committee but also falls under the purview of the department's annual self-assessment.

Specific Learning Objectives

Specific objectives are listed below with the courses or activities that address them.

1. Core knowledge of subject matter: analysis, algebra. Students with a deficient undergraduate mathematics background may be required to take one or more of MA 316 (Linear Algebra II), MA 413-4 (Algebra), MA 334-335 (Advanced Calculus). MA 535-536 (Real Analysis) is required for all students, and is a mandatory topic on the comprehensive exam. Mastery of core material is essential to success in subsequent courses, where it is evaluated and strengthened.

2. In-depth knowledge of several areas of modern mathematics and statistics. Elective coursework including at least one additional 2-course sequence. Comprehensive exam (exam topics must include an additional 2-course sequence).

3. Ability to formulate conjectures and construct proofs or counterexamples. Covered throughout the curriculum and in the comprehensive exam. A master's thesis usually includes the formulation and proof of new results.

4. Ability to conduct research in the mathematical sciences by finding, understanding and applying relevant source material. Students preparing for a career in research are encouraged to write a thesis. Students may serve as research assistants in faculty research projects. Smaller research projects are assigned in some advanced courses. The Graduate Seminar also requires students to locate and assimilate source material.

5. Ability to communicate advanced material in oral and written presentations at an expository or technical level. Oral presentation is addressed particularly in the Graduate Seminar (MA 592), which students must take in at least two semesters. Written communication is a major part of the thesis option and is also addressed throughout the curriculum, especially in project-oriented advanced courses. Faculty colloquia and seminars provide additional models of presentation, and there are opportunities for students to present their research in seminars and conferences.

6. Ability to teach or tutor mathematics at the undergraduate level. This is important for students preparing for academic employment or a teaching assistantship in a Ph.D. program. Most students on assistantship work as teaching assistants for undergraduate courses and/or tutors in the department tutoring lab. Acquisition of teaching skills is assessed by the faculty members the students are assisting.

Part 4: Projections for the Academic Year 2004-2005

A. Underlying assumptions:

University purpose: To serve others through excellence in teaching, research, creative activity, health care, and other public service.

College purpose: To provide every undergraduate student at the University the fundamentals of a liberal arts education; to enhance undergraduate and graduate students' knowledge and create an atmosphere in which students develop their own critical thinking, communication skills, and the tools with which to carry out independent thinking; to create and apply knowledge in the arts and sciences through dedicated research, scholarship, teaching and creative works; and to encourage and support the application of knowledge in service to the University, the Mobile area and the wider society.

Department or unit purpose: The purpose of the Department of Mathematics and Statistics at the University of South Alabama is to provide high

quality instruction in mathematics and statistics and to encourage the professional growth of its faculty through study, research, and consulting.

B. Departmental Goals:

1. To further develop high quality education for undergraduate students in mathematics and statistics.

   a. To develop a method of integrating the ideas of proof, beauty, and applicability throughout the curriculum.
   The assessment committee has been charged with this action.

   b. To develop a set of questions that will be common to all sections of each of the courses MA 112, MA 113, MA 115, and MA 125 to ensure that all students have minimal competencies on those learning objectives that these problems address.
   The instructors in Ma 112, Ma 113, and Ma 115 will develop such lists and make them available through the computer assisted instruction software. The assessment committee will advise on the desirability to do so in the calculus sequence.

   c. To examine the calculus text for Fall 2005.
   The Curriculum Committee has been charged with this selection.

   d. To continue to recruit students to the major.
   This recruitment effort is the charge of all faculty members.

   e. To examine the requirements for the major.
   The curriculum committee has undertaken this assignment.

   f. To provide sound academic advice for all of our majors.
   Each faculty member has between 3 and 6 advisees. Each student should be advised once a semester. An advisee should be provided with a "check-sheet" that she/he can fill out to ensure that core courses are completed in a timely fashion.

2. To grow and sustain our graduate program.

   a. Recruit and retain high quality graduate students.
   This item is under the purview of the graduate committee. Several efforts are being made in this regard.

   b. Request support through NSF grants.
   This item has been completed by those faculty members who have submitted standard grant proposals.

   c. Seek other outside funding sources.
   This item is primarily the responsibility of the Graduate Committee and the Departmental Chair. In particular, it is up to us to uncover

funding sources that suits our model. Such sources may include EPSCoR, NSF-GK12, or other NSF opportunities.

d. Continue internal funding sources.
This item is dependent upon the good graces of the administration who in turn are willing to support the graduate program as it positively impacts our undergraduate and our service mission. It is incumbent upon us to do all that we can to make our graduate instructors help us achieve better learning outcomes in our service courses.

3. To sustain and support the research and scholarship endeavors of the faculty.
   a. Submit research grants that support the efforts of the individual faculty member.
   Grant application season is nearly complete. Four faculty members asked for support from the National Science Foundation.
   b. Write and publish research papers in high quality journals.
   This is the responsibility of the individual faculty members.
   c. Maintain editorial posts in high level journals. *At least three members of the department are editors of journals in their areas of research.*
   d. Develop an active colloquium series.
   e. Continue active faculty seminars.
   f. Direct Statistical Research Forum.
   g. Host a regional conference in knot theory during early spring 2005.
   h. Faculty continue their work in refereeing and writing for Math Reviews and Zentralblatt.
4. To provide professional service to the community.
   a. Provide professional mentoring for public school teachers.
   This idea was initiated by Susan Santoli in Spring 2004. At that time, three upcoming graduates in secondary mathematics were slated for professional mentoring. Under our current program, each academic advisor is considered the professional mentor of an individual when that individual graduates. We envision that the mentor will be available for technical expertise, and may be invited to speak to high school students about mathematics.
   b. Continue departmental support for the Mobile Mathematics Circle.
   Support comes in several flavors. The department and the dean of admissions match funding that is granted by the Alabama Space Grant Consortium. Several faculty members are actively involved

in the Mathematics Circle. Either they attend the circle regularly, or they give presentations. Some others provide problems for the Mobile Mathematics Olympiad. The Principal Investigators on the Math Circle Grant write the grant and submit reports in a timely fashion.

c. Direct the Regional Science Fair and provide judging in several categories.
   The Director of the Mobile Regional Science Fair is within our department. He depends on the good graces of the faculty to assist him.

d. Provide *ad hoc* support for other mathematical events in the area such as the Mobile Maysview Mathematics Initiative.

e. Develop a method to promote mathematical awareness within the community with items that include an event during Mathematics Awareness Month (April) and other community activities.