PROGRAM REVIEW REPORT

COLLEGE OF THE PACIFIC

Department of Mathematics

FINAL Report

1 September 2006
INTRODUCTION

Late in the Fall semester of 2005, the Provost's Office appointed the following as a panel to review the Department of Mathematics in the College of the Pacific:

- William Ford, Professor, Computer Science (SoECS)
- Larry Spreer, Professor, Chemistry (CoP)
- John Livesey, Associate Professor, (TJLSOPHS)
- Henry Zhang, Student

The Mathematics Program Review (MathPR) Panel was provided with the current Program Review Guidelines for Academic Programs and a self-study prepared by the Department of Mathematics. The latter document will be referred to throughout the report as the Mathematics Self Study (MathSS). The Panel also gathered information from the University General Catalog (2005-2006), the Institutional Research office, the Provost's Office and the offices of the Dean of the College. Meetings were held with the Dean of the College, the Mathematics faculty and selected students. Surveys were conducted to solicit feedback from students presently enrolled in Mathematics courses.

SUMMARY OF RECOMMENDATIONS

Members of the MathPR Panel provide the following recommendations:

1. **The Math Program Review Panel strongly recommends that two additional tenure track faculty positions be added to the Department of Mathematics over the next two or three years.**

2. Should the Administration choose to ignore our first recommendation, one or two of the current Adjunct Instructor positions must be converted to Visiting Assistant Professor positions of maximum 3-year duration.

3. If recommendations 1 and 2 are both denied, at the barest minimum the Department of Mathematics should be allowed to offer three-year contracts to their choices of Adjunct Instructors to provide some stability.

4. The department operating budget must be increased by 50% over and above the proportional increase required by Recommendation #1.

5. Current plans for refurbishment of the White Computer Laboratory must be implemented without delay.
Panel Members unanimously concur with these recommendations and urge their adoption by the College and University administrations.

William Ford, Ph.D.
Professor

Date

John Livesey, Ph.D.
Associate Professor

Date

Larry O. Spreer, Ph.D.
Professor

Date

Henry Zhang
Student

Date
I. CURRENT STATE OF THE PROGRAM

PLACE OF MATHEMATICS IN THE
MISSION AND VISION OF THE UNIVERSITY

The Department of Mathematics plays an important role in securing progress toward achieving the University's Mission and Vision. Many units throughout the University, including programs in the College as well as in the schools of Education, Business, Pharmacy & Health Sciences, International Studies, and the Conservatory, depend on the Mathematics Department for coursework supporting their curricular requirements involving quantitative data. The Major has attracted many more students to the study of Mathematics, both as BA/BS students, as double majors and as students working toward a Single Subject Mathematics Credential.

The Program Review Panel decided to first consider the role of the Department in the College and the University before making any recommendations. Should the Math Department be predominately a service department, or should it enhance its major or should it focus on the single subject credential in Mathematics education? The answer to this question will have a dominant effect on any curricular or staffing decisions.

Seven College Departments and all the Stockton Campus schools require their students to take at least one mathematics course. A majority of all Pacific students therefore will get part of their education from the department. The department taught 1,716 student course places in 2004-2005 (IRIS data) and over 900 in the fall semester 2005. The success of the department is extremely important to Pacific. Roughly seventy percent of the courses offered by the department are service only or service/major courses. Twenty eight percent of the math courses are designed for the 45 math majors or are taken as electives by Engineering or Physics students. These major courses will typically have less than 20 students. The vast majority, probably 90 %, of the student course places taught by the department are in a service capacity.

In light of this critical role of Mathematics service teaching, the panel examined the best way to teach these course places to (as thoroughly as possible) ensure high quality instruction leading to quality learning by students of the University. We unanimously concluded that by far the best and most reliable way to achieve this result was with tenure-track faculty.

NATIONAL NORMS AND DIVISION OF EFFORTS

The Mathematics Department is experiencing the same problems as most other mathematics departments around the country. The service load has increased significantly, the major count has grown after experiencing a drop-off in the late 1990s, and there is an ever-increasing reliance on adjunct faculty. It is the contention of this panel that the Department can maintain and further build a quality major program that will attract a good number of excellent students while improving their service courses. The primary resource is faculty, and it is impossible to build a quality major program and provide excellent service courses using a large portion of adjunct faculty.
Dr. Sarah Merz contacted 26 Mathematics Departments at comparison schools to obtain information on number of majors in the program, staffing, class size and faculty teaching load. The comparison schools were

American University, Baylor, Boston, Clarkson, Clark, Creighton, Dartmouth, George Washington, Loyola Marymount, Loyola University Chicago, Marquette, Pepperdine, Santa Clara, Southern Methodist, Syracuse, Texas Christian, Trinity, Tufts, Tulane, University of Denver, University of Richmond, University of Rochester, University of San Diego, University of San Francisco, Vanderbilt, Villanova, Wake Forest

Twenty-four schools responded with data. The data collected is summarized in bulleted items. In each case, the Mathematics Department at Pacific is very similar to the comparison group. In some cases, the data makes it clear that the department needs additional resources.

- The mean number of mathematics graduates is approximately 15. Eleven comparison schools reported 12 or fewer graduates.
  - The department had 11 graduates in 2005, 13 graduates in 2004 and expects 11 graduates in spring 2006.
- Samples of the ratio of mathematics majors graduating to tenured faculty includes 1.0 at Santa Clara, Creighton 1.43, Boston 1.67, Wake Forest 2, and Vanderbilt 3.87.
  - The ratio of mathematics majors graduating from Pacific to tenured faculty is 1.44 for 2004.
- Comparison departments reported tenured faculties of from 7 to 30 members.
  - Pacific’s Department has 9 tenure track faculty members and 3.2 adjunct staff members.
- The percentage of sections taught by adjunct faculty was 0-59% in comparison schools.
  - In the Mathematics Department at Pacific, in fall 2005, 43.9% of the students enrolled in courses were being taught by adjunct faculty (as of the last day to add). Pacific has a University wide rate of 83% full time faculty with perhaps a higher rate on the Stockton campus. Mathematics’ rate is 73.8% (9/12.2) so Mathematics is considerably lower in its percent of tenure track faculty.
- At comparison schools, after elimination of extremes, the mean class size was about 32.
  - At Pacific, the nominal size of Calculus classes is 35. This limit was exceeded in fall 2005 in Calculus II (40, 39 students) and Differential Equations (49 students).
- At comparison schools, percent of sections above 50 students varied from 1-25%.
  - In the Mathematics Department, classes with enrollments over 40 were 18/59 sections or 30% in 2005. Data indicates that the Mathematics Department is one of the more efficient departments in delivering instruction. The total cost per unit in 2004 was $128 which was both embarrassingly low and one of the lowest costs on the Stockton Campus. This data was provided by Planning and Research in August, 2005.

Planning and Research has verified about 40 students as mathematics majors as of August 2005. The number of majors at this time is 45 according to data compiled by the chair of the Mathematics Department. The number of minors is difficult to estimate because students can declare a minor without notifying a department. At this time there are at least 10 minors and also at least 5 multi-subject credential candidates with math concentrations. The following graph shows that the trend in majors has been generally upward since 2000.
During this period of increased majors, the total enrollment has increased significantly. A significant factor in this enrollment growth is the increase in the number of statistics sections the department is offering.

The graph below shows the number of tenure track faculty and the number of adjunct faculty employed yearly. There has been no increase in tenure-track faculty since 2002. During this time the number of adjunct faculty increased.
The data presented shows that the Department, despite a heavy service load and increasing reliance on adjuncts, has increased the number of mathematics majors significantly. If the Department is provided additional resources and makes some adjustments in the curriculum, there is the potential for more majors. We will consider each of these items separately.

The panel recommends the addition of one new tenure track position to begin in the academic year 2007-2008. The 3.2 adjuncts are currently covering 17 sections of mostly lower-division courses. If a new tenure track position is allocated, the Department will need to cover 12 sections with adjuncts. Two full-time adjuncts can handle 12 courses, leaving two sections uncovered. By carefully looking at its offerings, the Department should be able to delete two course slots from its schedule. Additional resources must include modern computer hardware and software. Like many disciplines, mathematics relies more and more on the use of computation. State of the art equipment will aid in the recruitment of outstanding students. The panel has been told by Dean Miller that a major upgrade of the Department's computer laboratory is scheduled, so progress is being made on this resource need. The panel urges no backsliding on this important need (Recommendation #5).

A superficial reading of the catalog appears to indicate that the Department has four distinct programs that make separate demands on the course offerings. These majors include the BS in mathematics, the mathematics education program, the BA in mathematics, and the BS in applied mathematics. However, this is not the case. The courses in the BA in mathematics and the mathematics education program are a subset of the courses provided for the BS in mathematics. The BS in applied mathematics again uses the same set of courses and requires that the student select courses from another department that apply mathematics. It is clear that the Department has economized its course offerings in order to offer its degree programs. However, within the current offerings there should be one or two courses that can be dropped and replaced by courses taught by other departments. The loss of carefully chosen courses should not affect a student's ability to enter graduate school. Most graduate programs will allow a student to remedy a deficiency by taking an advanced undergraduate course such as modern algebra or topology. Additional courses may be found that could be taught on an every-other-year schedule, requiring careful advising but not impairing student progress toward the BS degree. It will not be difficult to find additional courses for mathematics majors outside the Department. For instance, only the mathematics education program requires COMP 51, Computer Science I. It seems to the panel that a basic knowledge of...
computer science is necessary for the modern mathematician. Other courses in computer science that would serve the mathematics major well include data structures (COMP 53) and the theory of computation (COMP 147). Other departments such as Economics and Physics will likely have courses that can serve the mathematics major well.

If the Department implements appropriate reductions in major and service course slots, the panel recommends that an additional tenure track position be allocated to begin in academic year 2008-2009. At this point, the Department will need to rely on only one adjunct.

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QUALITY

Mathematics is a required subject for nearly every major at Pacific, so departmental quality must meet a standard that is reliable and competitive. Engineering students must finish their required math courses with sufficient mathematics facility to advance to their upper division courses. The quality of the Mathematics instruction must be within the expectations of the job market. The School of Engineering and Computer Science has been able to provide supplemental instruction for many upper division math courses. There is a good relationship between the Department and the School of Engineering and Computer Science and the only concern expressed was that this good relationship continue after the retirement of the current Chair. The overall quality of the Mathematics department is very satisfactory. In surveys of current students, there was a high degree of satisfaction with the Mathematics department’s methods of teaching, course structure, and accessibility of professors outside of class. Nearly every student surveyed found the math courses in which they are enrolled are preparing them for their major.

Mathematics majors are very satisfied with the faculty and gave descriptive information on how each professor has his or her own unique method of teaching. However, some students surveyed are not happy about the upper division mathematics courses that are only offered once a year or two. The classroom environment was mentioned several times, with recommendations for improvements to be made.

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ASSESSMENT

The Mathematics Department has been active in investigating and improving assessment for students enrolled in mathematics classes. Beginning in 1999, the department has employed assessment tools that include a national subject matter test for junior and senior mathematics majors (the ETS Field Test) as well as teaching evaluations which include open response as well as multiple choice questions, exit interviews for graduating seniors, portfolios for Mathematics Education majors and innovative classroom experiences.

The ETS Field Test has been employed by the department for several years. In the most recent data available, sixteen mathematics major students took the exam in the Spring of 2005. The mean score was 156.4, comparing favorably with the national institutional median of 151.8. Among the eight senior students taking the exam during this administration, the mean score was 167, placing this group in aggregate at the 90th percentile among 218 institutions nationwide.

Among Mathematics Education majors and credential candidates, students' portfolios and self-assessment reflections have led to adjusting course material in the required mathematics methods course (MATH166).
Across multi-section courses (the calculus sequence and statistics courses), common examinations and syllabi have increased consistency and reproducibility of student experiences. Since the assessment program in the Mathematics Department is of such high quality, the change from reliance on adjunct faculty to tenure track faculty should be quantified in programmatic quality measures. The department should be commended for their creative and diligent efforts to improve assessment over the last 5 year period.

FACULTY ISSUES

Current Situation
There are currently nine tenure track positions and 3.2 adjunct faculty. In fall 2006, there will be two full, four associate, and three assistant professors, with one full professor planning to retire in 2007. Two of the adjuncts have been employed on a continuing basis for four or more years. During Spring semester 2006, adjuncts taught 8 of the 29 sections (28%). Since adjuncts teach in the larger service or service/major courses they typically teach 35 to 40% of the total student course places. Fulltime Adjunct faculty teach 3 courses per term and receive an annual stipend of $30,000 plus benefits if they have been employed for two consecutive years. They are eligible for small raises after two years. They are responsible for keeping regular office hours but have none of the other faculty duties such as advising, committee work, or scholarship. Often they teach other math classes at local community colleges in order to earn a living wage. For the coming academic year 3 fulltime adjuncts are scheduled to teach 18 sections.

There are a number of serious issues in conjunction with this large dependence on temporary faculty. Among these problems are stability, quality control, and public relations.

STABILITY
In May 2006 the Department has a relatively good situation with regard to adjunct staffing. Two of the three fulltime Adjuncts have multiple years at Pacific, and one will be in his second year. This cannot be expected to continue.

As recently as Fall 2004 the Department faced a crisis when one of the Adjuncts got a permanent position and resigned; over the summer they had to hire a replacement. (Note that it was the Department’s task to find an emergency teacher and not the Administrators who had made the decision to rely on temporary faculty.) On the basis of a one day interview and reasonable letters of recommendation they hired someone for the fall and felt lucky to do so. It turned out to be a bad situation: there were numerous student complaints about the instructor, some going to the Associate Dean of the College. This situation of having to hire emergency replacements over the summer is not uncommon when relying on temporary faculty and will very likely happen again. The Adjuncts cannot be blamed if they have an unexpected opportunity to gain some stability for their own lives.

QUALITY CONTROL
Adjunct faculty often teach at several institutions and have a hectic life with long commutes and complex schedules. Not surprisingly they frequently seek ways to streamline and simplify their lectures. The way to minimize student requests for help and complaints is to make the course easy and give lots of good grades. The Math Program Review Panel understands that such a situation of uneven expectations is a problem this semester. The retiring Chair of the Mathematics department had to make up a final exam for several sections of Statistics and grade it by herself in an attempt to resolve the situation.
Another problem is availability to students. Adjunct faculty teach their courses on a MWF schedule and are typically not on campus on Tuesday and Thursday. Pacific students are used to having ready access to their professors (an institutional Core Value) so this violation is a problem.

PUBLIC RELATIONS
One of the current Adjunct instructors also teaches at Delta and another at Columbia Junior College. What will Pacific tell the student or a parent when they learn that their professor is giving the exact same course at a local junior college? Will they think the high tuition is justified?

Visiting Assistant Professor
If the Administration chooses to ignore our strong recommendation that two tenure-track positions be added to the Department, there is one alternative that has a good chance of improving the teaching and overall situation.

At least one and perhaps two of the fulltime Adjunct positions should be converted to three year Visiting Assistant Professor positions.

Such a position would be attractive to recent Math PhDs who want to gain teaching experience to help them in searching for permanent academic jobs. A disadvantage would be that the applicant would start with very limited teaching experience so the Math faculty would have to be conscientious in mentoring. An advantage over the current situation would be that the Visiting Faculty would be very motivated to do a good job. Another positive factor would be that if good decisions are made in hiring, the visitor would have research interests that complement one or more of the permanent faculty and some productive collaborative scholarship might occur. One of the current Assistant Professors came to Pacific from a Visiting Professor position at the University of Arizona; the person hired to replace Dr. Christianson also gained experience in the same program. The term for a Visiting Assistant Professor would be limited to a maximum of three years. Of course the University would have to pay the visitors more than it pays Adjuncts, possibly a few thousand less than a starting Assistant Math Professor.

Three Year Contracts

The addition of several tenure-track positions in the Department of Mathematics will improve the delivery of mathematics service courses and will lead to improvements in the major curriculum and likely increase the number of mathematics majors. Converting Adjunct Instructor positions to Visiting Assistant Professor positions would likely be an improvement in instruction in service courses and may improve scholarship opportunities. If these recommendations are not followed at the very least the Department should be authorized to offer three-year contracts to individual Adjunct Instructors whom they choose.

PROGRAM BUDGET AND PLANNING

The Mathematics Department has an operating budget of $12,883 for 2005, 2006. This is supplemented by a small fee ($12) charged to Math 37 students to defray the cost of paper, software and lab manuals for the Statistics Labs (White Computer Lab). For a department with 9 tenure track faculty, 3.2 adjunct staff members, and one of largest service loads in the University, this budget seems far too small. This small budget must handle duplicating costs, refreshing of faculty computers on a 4-year schedule, teaching technology such as overhead projectors, calculator and computer projection systems, and software and classroom supplies. In addition, the Department regularly hires students to assist with paper grading, supplemental instruction and laboratory assistance, and there is
a demand for more supplemental instruction. An increase in operating expenses is necessary as enrollment in mathematics courses continues to grow.

The budget does not provide funds for upgrading the computers in the White Computer Laboratory, which is an important part of instruction in Mathematics. Its current hardware situation is untenable. The Dean of COP has told the program review committee that this situation will be remedied. The committee senses serious frustration with the present situation, and the laboratory upgrades need to be completed as quickly as possible for the benefit of Mathematics Department students and faculty.

The instructional cost per unit in mathematics is the lowest for any department or school at Pacific, and was $128 in 2004 according to Planning and Research data. During the last program review the cost per unit was $111 indicating an incredibly small increase over a five-year period. In the opinion of the department, this low cost is explained by a small departmental operating budget, large class sizes and the reliance on non-tenure track instructional staff.

After the Biology Department moves to its new facilities, there will be additional space available on the second floor of the Classroom Building. Although Biology will retain some space, additional space should be available for Mathematics, Chemistry and Physics. The Mathematics Department has need for more smart classrooms, an intermediate size classroom and two or three offices for faculty. More student study space in the building is needed to promote faculty/student interaction. The committee suggests that the Mathematics Department should be included in planning for the space usage on the second floor of the Classroom Building.
II. FUTURE DIRECTIONS FOR THE PROGRAM

FIVE YEAR PLAN

It is clear that the Mathematics Department is aware of its need to provide service to the entire University, and the department does this well. However, the department views itself as having a faculty skilled in research as well, and it prefers to be known as department with an outstanding major program that provides excellent service. The professional success of its faculty members and the accomplishments of its students clearly indicate this. A five-year plan should address how the department can continue to maintain excellence in professional work, increase its majors, and maintain its service load. The Mathematics Program Review Panel feels that the department can accomplish these goals. To do so, it must find ways to economize on its service load, particularly in the area of statistics. Possibilities for doing this include large lecture sections with accompanying recitations sections and support from student TAs. Some economy in upper division offerings should be considered. For instance, is a second semester of real analysis necessary? The department is currently considering cross-listing its discrete mathematics course, MATH 74, with the Computer Science Department’s COMP 47. If the departments alternate instruction of this course, each department saves one course slot every two years. Are partnerships like this possible with other departments within the University? To increase enrollment, as much as possible courses in the department should appeal to other departments as well. A good example of this is MATH 148, Cryptography. The course is very contemporary and is appealing to students in computer science and other disciplines. The department chose to offer this course rather than a classical course in number theory that will appeal primarily to pure mathematics majors. Is it possible to create other courses like this that will have a broad appeal and that can replace lower enrollment in more classical courses?

To allow the department to attain its vision as a department with an outstanding, growing, major program, administrative support will be necessary. While some adjunct professors are excellent teachers, they do not have a long-term commitment to working with the department to build an outstanding major program. The department cannot attain its goals without at least two new tenure track positions. The energy and enthusiasm of young tenure track faculty will assist the department in increasing its reputation professionally and will in turn increase enrollment of highly qualified students.

MARKETING AND RECRUITMENT

There are about 50 students majoring in mathematics at Pacific. Many more are engineers planning to minor in mathematics. Engineers have to enroll in at least four mathematics courses to complete their major requirements, so it can be advantageous to take a few more math courses, especially since having a degree in math would increase an engineer’s competitiveness in the job market.

Majoring in mathematics is different than other majors. The discipline can be more conceptual with less ambiguity, and is attractive for students wanting no argument between right and wrong answers.

Other students who choose mathematics as a major may find that they are particularly good at mathematics. They have grown to have the natural skills to solve quantitative problems. Then there’s the final and most obvious reason, these students may just really enjoy mathematics.
THE PANEL’S RESEARCH METHOD

The panel’s data sources included:

1. An interview with the Dean of the College.
2. A group interview with full-time tenured and tenure-track faculty.
3. Individual interviews with each faculty member in the department, including adjunct faculty.
4. Interviews with the Associate Dean of the College and the Associate Dean of Engineering and Computer Science.
6. Paper-based surveys of students currently enrolled in Mathematics courses.
   a. The panel received 57 student comments.
7. Concerns expressed by the Dean of the College and the Provost, dated 22-May-2005 and 24-May-2005, respectively.
8. Data provided by Institutional Research dated 3-May-2004 and 17-Dec-2004 on degree trends and program efficiency.