Spring 2013 Mathematics Department Self-Review
By Brad Jackson, Math Dept. Chair and Bem Cayco, Incoming Math Dept. Chair

Introduction
The Department of Mathematics last had an external review by Sheldon Axler, Dean of the College of Science at San Francisco State University in Spring 2009. Starting in Fall 2013 the Department of Mathematics has asked to change its name to the Department of Mathematics and Statistics because we now have an undergraduate as well as a graduate program in Statistics and at the present time approximately 30% of our majors are Statistics majors.

From Fall 2003-2008 the number of tenured and tenure-track faculty in the Department of Mathematics was fairly constant at around 35 tenured and tenure-track faculty and 30 PT faculty. After 2008 the budget crisis hit and the number of tenured and tenure-track faculty dropped steadily to 26 faculty in Spring 2012 while the number of part-time faculty increased steadily to about 41 in Fall 2011. At this point less than a third of the classes in the Mathematics Department are taught by tenured and tenure-track faculty. Given that the president would like to admit 500 more engineering majors in Fall 2013 it is likely that the amount of classes taught by tenured and tenure-track faculty in the Math Department will drop below 25% during Fall 2013 which is certainly abysmal. Recruiting additional tenured and tenure-track faculty is a high priority for the Department of Mathematics.

From 2003 – 2011 the Department of Mathematics generally had a student-faculty ratio of about 24:1 in the fall and 21:1 in the spring (the difference between the fall and the spring mainly has to do with the number of developmental math large lectures offered in the fall). Unfortunately as the budget crisis worsened the Math Department SFR rose to 26.5 in Fall 2011, 22.8 in Spring 2012, and 28.0 in Fall 2012. Because teaching Mathematics is such a labor-intensive process given that a large amount of homework must be assigned, collected, graded and discussed to help facilitate student success it is important to maintain a reasonable student-faculty ratio in the Department of Mathematics. Another consequence of the bad budgets for SJSU and the CSU in general, the cancellation of small classes (upper division classes with fewer than 15 and graduate classes with fewer than 10) also causes problems for students who often need these classes to graduate in a timely manner and since almost every section is full students complain that they aren’t always able to get the Math courses that they need to take even when there are multiple sections. This problem is worse in Math and other STEM majors because students are often expected to take long sequences of math courses, each course a prerequisite of the next one in the sequence. Many upper division and graduate math classes are only offered once a year or in many cases once every 2 years so it is a great inconvenience for the students if these class are cancelled and they need such a class to graduate. There is especially a problem with courses that are the second semester of a sequence. Generally the Department of Mathematics has the lowest passing rates of any department in the university. This is especially true in lower division math courses where students tend to have a rough time making the transition from high school mathematics courses to university-level math courses. Passing rates (C- or higher) in lower division mathematics courses can occasionally be lower than 60% though with the implementation of workshops for a lot of the lower division math courses these passing rates are now generally around 70%.

The Department of Mathematics is the largest department in the University in terms of FTES. In Fall 2011 the Math Department FTES reached an all-time high of 1442 FTES which was about 6% of the total San Jose State FTES and in Spring 2012 the Math Department had about 1076 FTES which was roughly 5% of the total San Jose State FTES for that semester. The Math Department houses the developmental math program, as well as undergraduate and graduate programs in Mathematics, Mathematics Education, Statistics, and Applied Mathematics. The Mathematics Department is mainly a service department offering mathematics courses for students majoring in science, engineering, business and economics. The Mathematics Department has roughly 850-1450 FTES per semester with only about 7% of our FTES from teaching math majors, 13% from teaching other science majors and 80% from teaching students outside of the College of Science, mainly the College of Engineering and the College of Business and also students taking a GE Math
course. Each spring semester the Mathematics Department FTES are roughly 80% of what they are in the preceding fall semester.

From Fall 2003-Spring 2010 the number of majors in the Department of Mathematics was fairly constant with a total of roughly 170 math majors, about 35 majors in Applied Mathematics and Statistics (about 20% of the total), about 100 BA Math majors, and about 35 MA/MS Math majors. Starting in Fall 2010 the Department of Mathematics implemented 3 new concentrations in Applied Mathematics; Statistics; Economics and Actuarial Science; Applied and Computational Mathematics. A new MS Statistics program, which is an officially approved Professional Science Masters program, was implemented in Fall 2011. By Fall 2012 the number of majors in the Department of Mathematics had increased to 228, with about 103 majors in Applied Math and Statistics (45% of the total). We expect that the number of math majors will continue to increase for the next few years. Each year the Department of Mathematics also has roughly 100 students majoring in science, engineering, and other related topics who minor in Mathematics. There are also a significant number of students who double major in Mathematics and another related area.

II. The role of the Math Dept. at SJSU

The following is the mission statement of the Mathematics Department at San Jose State University.

**Mission statement:** The mission of the Mathematics Department at San Jose State University is to offer undergraduate degrees and graduate degrees in mathematics that prepare students to pursue continuing graduate study, to work in industry, and to teach in secondary schools or community colleges. We strive to teach our students to communicate mathematical ideas effectively and to use basic computational skills, mathematical models and technology to solve practical problems. The Mathematics Department offers a variety of courses that serve students in other departments, notably engineering, science, and business, to help them use mathematics and quantitative analysis effectively in their chosen field. The Mathematics Department strives to teach well, maintain high standards for student performance, and keep its curriculum up to date. The Department also takes pride in a faculty that is active in scholarship and research, including the encouragement and supervision of student research in Center for Applied Mathematics, Computation and Statistics (CAMCOS) projects and masters theses.

III. Analysis of Program Quality

**Math Dept Faculty**

Math department faculty members have a variety of different interests and activities. We have many excellent teachers in our department. Professor Mohammed Saleem from the mathematics department was given one of the SJSU Teacher/Scholar Awards in 2005, Professor Joanne Becker, a distinguished mathematics educator from our department, was given the same award in 2006, and Professor Ferdinand Rivera, another of our mathematics educators received this award in 2007. Professor Tatiana Shubin, was given the MAA Distinguished Teaching Award for the Nor. Cal., Hawaii, and Nevada section in 2006. Professor Shubin also received a certificate of recognition from the MAA for her new book “Mathematical Adventures for Students and Amateurs” which is based on the Bay Area Mathematical Adventures lecture series (BAMA) that she helped to found and organize. Our newest tenure-track professor Dr. Andrea Gottlieb who teaches probability and statistics classes already seems to be one of our best and most popular teachers. And these are just a few of the excellent teachers in the mathematics department at SJSU.

There are many math department faculty members who work hard in serving the students, the department, and the university. Our associate chair Marilyn Blockus serves virtually every year on the department and college curriculum committees as well as helping the department in many other ways, Dan Goldston has served for more than fifteen consecutive years on the College of Science RTP committee, and our Math Ed faculty do yeoman’s work in organizing special programs to help local schools increase the number of credentialed math teachers they have. Susan McClory is the Developmental Math Coordinator and for the past several years she has also been the Associate Vice Chair of the
Academic Senate and in 2005, Susan was the first recipient of the SJSU Outstanding Lecturer Award. Math faculty have also helped organize a variety of outreach activities, including BAMA (Bay Area Mathematical Adventures), the San Jose Math Circle, Math Field Day, Mathcounts, and EYH (Expanding Your Horizons) which encourage the interest of middle school and high school students in math and science. Math Department faculty have also helped organize a number of conferences in San Jose including a special session on Industrial Mathematics at the 2007 summer MathFest, a Northern California Undergraduate Math Conference in Spring 2010, as well as a BAD (Bay Area Discrete) Math Day in Spring 2013.

We also have many active researchers in the mathematics department. Dr. Ed Schmeichel has over 80 publications in graph theory. Dr. Roger Dodd has over 60 publications in applied mathematics. Dr. Roger Alperin has over 50 publications in Algebra and has helped supervise the research of more than a dozen master’s degree students. Dr. Joanne Becker has at least 50 publications in Mathematics Education, she has been awarded a large number of grants, and she has helped supervise the research of more than fifteen master’s degree students, and these are just a few of the distinguished researchers in the mathematics department at San Jose State University. Likely our most famous researcher is Dr. Dan Goldston, who recently proved an important result about the spacing of primes, which many of his colleagues in number theory are saying is one of the important number theory results in the last 50 years. During the last five years Dr. Goldston has been asked to give more than thirty lectures around the world to explain this fundamental result. Overall he has more than 50 publications in number theory. In 2006, Dr. Goldston was the recipient of the 2006 SJSU Scholar of the Year Award. One of our newest faculty members Jared Maruskin (in his 5th year at SJSU) has recently published two books, one called “Introduction to Dynamical Systems and Geometrical Mechanics” and the second called “Essential Linear Algebra, and recently he has written a new textbook on differential equations. A number of other Math Department faculty have received NSF grants to help support their research including Plamen Koev, Dan Goldston, Maurice Stanley, and Ferdinand Rivera. Our Math Education group receives numerous grants each year to fund workshops for training HS math teachers.

These are by no means the only accomplishments of the Math department faculty members in the last five years. During the years 2008-2013 the math dept. faculty members were active in publishing their research, papers, technical reports, book chapters, and books. In spite of the high costs of traveling and the often inadequate funding they receive at SJSU, the faculty, were also very active in traveling to present their research to various audiences throughout the state, the country, and the world. Just as importantly some of the mathematics faculty members that are the most active researchers in the mathematics department also do an excellent job of supervising student research, supervising teams of students working on real-world problems in CAMCOS projects as well as working with individual students on their master's theses and other independent research projects.

In Fall 2006 the Math Department had 36 tenured and tenure-track faculty and in Fall 2012 we are now down to 28 tenured and tenure-track faculty. We also have roughly 40 part-time faculty members and TAs who teach courses in the Mathematics Department. All of our developmental math classes and workshops are taught by part-time faculty members, TAs, and student assistants. In Fall 2011 less than 33% of our WTUs were taught by tenured and tenure-track faculty. Presently, we are down to 3 faculty members in mathematics education (and one of those is on sabbatical), 4 statisticians, and the remaining faculty members are split nearly equally between math and applied math. Fortunately our department is generally quite collegial and these groups all seem to work together very well. Contrary to the usual stereotypes the Math faculty members are a diverse group. According to the IEA office 24 out of 60, 40% of the math faculty members are women and 24 out of 60, 40% are minorities (Asian, Filipino, Hispanic, African-American, and others). Also we have roughly 30% of the faculty members in the Math Dept. who were born in countries other than the U.S.

At any one time there are roughly 35-45 part-time faculty in the Math Dept. Included in this dedicated group are 5 faculty members with Ph.Ds, about 10-15 TAs who start by teaching discussion sections for the large lecture classes in developmental math, and about 25-30 other lecturers with Masters degrees. The part-time instructors teach all of the developmental math classes, most of the GE and Precalculus courses as well as an increasingly larger fraction of the calculus and other more advanced courses. In addition we have a number of part-time faculty, often retired HS math teachers, who supervise student teachers in math.
Math Dept Students
Since 2008 the number of mathematics majors has been gradually increasing (see Table 4 below). The number of undergraduate mathematics majors increased from 125 in 2008 to 146 in 2012 (an increase of about 15%). The number of graduate mathematics majors has increased from 35 in 2008 to 81 in 2012. This large increase was due to the implementation in Fall 2011 of a new MS Statistics program which has been officially approved as a Professional Science Masters degree. With the addition in Fall 2010 of our new BS Applied Math program with Concentrations in Economics and Actuarial Science, Statistics, as well as Applied and Computational Math, and the addition of our new MS Statistics and a possible new MS Applied Math, the number of undergraduate and graduate applied math and statistics majors should continue to increase. The mathematics majors are a diverse group. In 2012, 111 out of 227 (49%) of mathematics majors were female. By ethnicity 26% of math majors were white, 32% were Asian, 15% were Hispanic, 18% were Foreign, and 1% were African-American.

Since 2007/08 the number of math department baccalaureate graduates has been fairly constant (around 25 see Appendix B) though the numbers should start increasing since the number of majors has been increasing recently. The number of masters degrees awarded was likewise fairly constant (around 8) since 2007/08 though that number should also start increasing rapidly soon once some of the MS Statistics students start graduating at the end of this year.

To help prepare students for a variety of careers, the Math Department has a number of programs including a BA Math, BA Math Preparation for Secondary Teaching, BS Applied Math with 3 concentrations, Applied and Computational Math, Economics and Actuarial Science, and Statistics, MA Math, MA Math Concentration in Mathematics Education, MS Math, as well as a newly implemented MS Statistics. The Math Department is also proud of its CAMCOS (Center for Applied Math, Computation, and Statistics) program. In CAMCOS, a team of students works under the supervision of a professor on a problem supplied by a local industry or government agency sponsor. CAMCOS participants receive a valuable internship-like experience which helps them prepare for careers in business, government or industry. Every year the Math Dept. awards roughly 10 master's degrees and 30 baccalaureate degrees, about 430 graduates since 2000. In this illustrious group of students we have one student (Faun Maddux) who received the SJSU outstanding graduating senior award in 2002 and two students (James Kittock and Katherine Nolan) who received SJSU outstanding thesis award in 2004 and 2008 respectively. The Math Dept. graduates have included numerous outstanding TAs, winners of various awards and scholarships, and many outstanding problem solvers in Math Dept. as well as nationwide problem solving competitions. There have also been many Math Dept. graduates who have been coauthors of mathematical research papers as well as many students that have presented their research at mathematics conferences and meetings. Using LinkedIn and Google we have checked to see what kind of jobs our recent graduates (2000-2012) are getting. LinkedIn is especially good for keeping track of graduates in business and industry and Google seems to be good for keeping track of people in academia. I could find more than 40% of the recent graduates (about 186 out of 430 or so). Out of our 186 or so graduates since 2000 that I could find, 25 are teaching in high schools or middle schools (14%), and 49 are teaching at community colleges or colleges (26%) throughout the Bay area and California. In addition about 30 students have gone to graduate school (8 received PhDs and 22 are PhD students). Math Dept students who have gone on to get a PhD have ended up in various university jobs (CSU East Bay, Sonoma State, San Jose State, Fresno State, Chico State, CSU East Bay, Naval Postgraduate School, Caltech, Wisconsin, UCLA, Stony Brook, SUNY Buffalo, ...) including, professor, dean, and even university president. About 46 recent Math Dept graduates are working at jobs in a variety of businesses (25%) as analysts, actuaries, managers, quality control specialists, ..., and 36 are working in computer/engineering jobs (19%) as engineers, software engineers, research scientist, and programmer. There are SJSU math majors working at a variety of high-tech companies in Silicon Valley (Hewlett-Packard, IBM, Intel, Cisco, Borland, Microsoft, Adobe, Oracle, ...), research labs (Lawrence Livermore National Labs, IBM Almaden, Sandia, ...), defense contractors (Lockheed, Loral, ESL, TRW, ...) and a variety of other companies. SJSU Math Dept graduate have also help found a number of large and small companies including Oracle, RasterOps, Western Mountaineering, Asante Technologies and many others.

Math Dept Programs

Baccalaureate Degrees
The BA Math degree is our most flexible degree and it can be used to satisfy the subject matter preparation for a single subject teaching credential in mathematics (BA Math, Preparation for Teaching), to prepare for going to graduate school
in mathematics, or it can be used by students who just want to study a variety of different areas of mathematics. The BS Applied and Computational Math degree is designed for students who want to apply mathematics in business, government, or industry. The BS Applied Math has three different concentrations, a concentration in Statistics, a concentration in Applied and Computational Math, and a concentration in Economics and Actuarial Science. Students interested in applied mathematics can also participate in one of our Center for Applied Math, Computation, and Statistics (CAMCOS) projects, which have a professor supervising a team of students working on a real-world problem provided by a sponsor from a local company or business. Many students, especially those majoring in computer engineering, computer science, and physics are required to take a large number of mathematics courses and many of them will end up getting a minor in mathematics, or in some cases they will get a double major in mathematics and another field.

**Graduate Degrees**

The Mathematics Department has three graduate degrees. The MA Math degree is useful for high school teachers who want advanced preparation (MA Math Concentration in Mathematics Education) in mathematics and for others who want to pursue a master's in math with lower course requirements (for entrance and graduation) than our MS program. The MS Math degree is useful for students who want a stronger background in mathematics and is often used by students interested in community college teaching, part-time teaching at a university, or pursuing a Ph.D. in mathematics. In Fall 2011 we implemented a new MS Statistics degree for students who want to learn how to apply the statistical analysis of data in business, government, and industry. This degree has been approved as a Professional Science Master’s degree by the Council of Graduate Schools. We have also created a new MS Math Emphasis in Applied Math for students interested in a career as an industrial and applied mathematician.

**Math Dept Assessment**

In 2004/05 the Math Dept. developed an assessment plan based on the following learning objectives for our undergraduate students. The assessment plan and the associated learning objectives were developed in a series of department meetings in the academic year 2004/05 under the guidance of the interim math dept. chair, Eloise Hamann. The goals listed below match the goals in the curriculum guidelines of the MAA (Mathematical Association of America) and SIAM (Society of Industrial and Applied Mathematics). Interestingly enough regarding Goal 2 below, Judith Hilliard the Math 100W instructor for our department, thinks that of the many departments that she has taught 100W in, that math majors tend to be the best at writing possibly because of their proficiency in logic. Instructors assess each of these goals using embedded exam questions and other assignments in certain specified courses. The instructors then submit the data to the Math Dept chair and the undergraduate (or graduate) curriculum committee for their review to see what (if any) additional action needs to be taken. Most of the Math Department assessment materials are now posted online on the Math Department webpage at [http://www.sjsu.edu/math/programs/Assessment_of_Undergraduate_Programs/](http://www.sjsu.edu/math/programs/Assessment_of_Undergraduate_Programs/), and [http://www.sjsu.edu/math/programs/Assessment_of_Graduate_Programs/](http://www.sjsu.edu/math/programs/Assessment_of_Graduate_Programs/).

**Goal 1** The ability to use and construct logical arguments.

**Goal 2** The ability to communicate mathematics effectively.

**Goal 3** The ability to perform standard mathematical computations.

**Goal 4** The ability to use technology to solve mathematical problems.

**Goal 5** The ability to use mathematical models to solve practical problems.

**Learning objectives for the BA Math degree**

The degree requirements and learning objectives for the BA Math degrees were developed after consulting with the latest MAA (Mathematical Association of America) curriculum guidelines which can be found at [http://www.maa.org/cupm/cupm2004.pdf](http://www.maa.org/cupm/cupm2004.pdf). Goals 1-4 listed above were chosen as the most important learning objectives for our BA Math students. We recently added an upper division Introduction to Proofs course, Math 108, to our curriculum so this became the natural place to test how well students are mastering learning objective 1, the ability to use and construct logical arguments. Learning to write proofs takes a long time for most students but so far it seems that students are making reasonable progress on learning this skill in the Math 42 Discrete Math and Math 108 Introduction to Proof courses which all BA Math majors are required to take. This class and learning objective were assessed in 2005/06 and again in Spring 2011. BA Math majors are required to take several theoretical math courses to
enhance their proof writing skills, including Math 128A Abstract Algebra I, Math 129A Linear Algebra I, and Math 131A Real Analysis I, as well as a second semester course, either Math 128B, 129B, 131B, 138, or 175.

For BA Math students the assessment point for learning objective 2, the ability to communicate mathematics effectively, was chosen to be Math 104 History of Math. This class and learning objective were assessed in 2006/07 and is again being assessed in Spring 2013. The instructors in this class will assign writing projects and/or oral presentations to assess the communication skills of their students. Probably the most effective way to improve the communication skills of the math majors is to have instructors in a wide variety of upper division math classes assign writing projects and oral presentations for their students. The Math Department chair conducted a technology and communication survey of the Math Dept faculty in Fall 2011 to determine what courses and what instructors were requiring students to write reports, give oral presentations, write computer programs, and use other kinds of technology as part of the course. See Appendix C for the results of the technology and communication survey. It is important to encourage Math Dept faculty to assign writing projects and oral presentations in their upper division and graduate math classes to their students to enhance their writing and communication skills. A capstone course where students work on a project and either write it up or present it orally might be a way to further enhance the communication skills of our students.

The assessment point for learning objective 3, the ability to perform standard mathematical computations, will be Math 138 complex analysis. The instructors will assign exam and homework problems on which to assess the basic computational skills of their students. This class and learning objective was assessed in 2007/08 and again in Fall 2012. Students seem to be making satisfactory progress on learning how to use limits, derivatives, regions of convergence, and properties of algebraic and transcendental functions. At this point the standard mathematical skills assessed are skills learned in Calculus and expanded on in other analysis classes. There has been some discussion that the standard mathematical skills assessed should be expanded to include skills learned in Math 42 Discrete Math and Math 129A Linear Algebra which are also required of all math majors. In that case it might be more appropriate to assess these skills by giving an exam to junior and senior level students to see how well they are learning these skills. These issues are still under discussion.

The assessment point of learning objective 4, the ability to use technology to solve mathematical problems, was chosen to be one of our Numerical Analysis classes Math 143C or Math 143M. The instructors in these classes generally assign computer projects, which require students to write programs in MATLAB (or other languages) to solve applied problems, so this course is a natural one for assessing how well the students can use technology to solve mathematical problems. This class and learning objective were assessed in 2007/08 and again in Fall 2010. At this point it seems that our students are making satisfactory progress in learning how to use programming and mathematical software to solve mathematics problems, though there is always room for improvement. Again the best way for our students to improve their skill in using technology will be to have instructors assign projects requiring the use of technology in a wide variety of upper division mathematics classes. See the results of the Fall 2011 Technology and Communication survey in Appendix C for information on how technology is used in a wide range of math classes. In Math 129A Linear Algebra math majors are assigned a variety of MATLAB exercises to introduce students to the use of technology. In our last external review it was suggested that we needed to find another place to introduce our students to the use of mathematical software, possibly in the Calculus sequence. We are still grappling with this issue. Two new mathematical software courses were recently introduced Math 167 Programming in SAS and Math 109 Mathematical Software which covers Programming in MATLAB or Maple.

A summary of the Math Dept. assessment schedule is given in Table 15 below.

**Table 15 The Math Dept. Assessment Schedule**

<table>
<thead>
<tr>
<th>Students</th>
<th>Skill</th>
<th>learning objectives</th>
<th>Course</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS Applied Math</td>
<td>mathematical modeling</td>
<td>LO 5</td>
<td>Math 178</td>
<td>S11</td>
</tr>
<tr>
<td>BA Math</td>
<td>proof writing</td>
<td>LO 1</td>
<td>Math 108</td>
<td>S11</td>
</tr>
<tr>
<td>BA Math</td>
<td>oral/written communication</td>
<td>LO 2</td>
<td>Math 104</td>
<td>S13</td>
</tr>
<tr>
<td>BS Applied Math</td>
<td>oral/written communication</td>
<td>LO 2</td>
<td>Math 161B</td>
<td>S13</td>
</tr>
<tr>
<td>MA/MS Math</td>
<td>oral/written communication</td>
<td>LO 7</td>
<td>thesis defense</td>
<td>F10</td>
</tr>
</tbody>
</table>
BS Applied Math

Our BS Applied Math degree has a concentration in applied and computational math, a concentration in statistics, as well as a concentration in economics and actuarial science. The degree requirements and learning objectives for the 3 concentrations of the BS Applied Mathematics degree were chosen after consulting the guidelines of the appropriate professional organizations, the American Statistical Society [http://www.amstat.org/education/curriculumguidelines.cfm], the Society of Actuaries [http://www.beanactuary.org/], and SIAM (Society for Industrial and Applied Mathematics) [https://www.siam.org/students/resources/guidelines.php]. Several changes in the BS Applied Math curriculum have been made recently to make our program conform more closely to the Society for Industrial and Applied Mathematicians (SIAM) guidelines. All applied math majors are now required to take mathematical (or statistical) modeling. Also applied math majors are now allowed more flexibility in choosing an interdisciplinary application area (8 units of lower division courses and 6 units of upper division courses in business, economics, science, or engineering). In 2006 a new BS Applied Math Concentration in Economics and Actuarial Science was approved. It is designed to prepare students for careers where they apply mathematics in business, including actuarial careers. This new concentration seems to be pretty popular already and could lead to an increase in the number of undergraduate math majors. Our BS Applied Math concentration in Applied and Computational Mathematics prepares students for careers applying math in business and industry. Many of the applied math graduates of our department end up in careers where they work with computers, as software engineers or computer programmers. Students graduating with a BS Applied Math Concentration in Statistics degree would be well prepared for a variety of careers applying statistics in business, government, or industry and they would also be prepared for graduate study in statistics.

Applied math students at San Jose State University also have the opportunity to participate in our Center for Applied Math, Computation and Statistics (CAMCOS) program. In this program, students work in teams under the supervision of a professor on a problem provided by a local sponsor from business or industry. We've had many CAMCOS projects working with sponsoring scientists at NASA and last semester we also had a project sponsored by Volkswagen of America regarding the detection of speed bumps in point cloud data. Students participating in these projects get valuable experience working on their teamwork, modeling, computing, and communication skills. All of these skills are important for students wanting a career in applying mathematics in business and industry. It is hard to fund a program, like CAMCOS if the sponsors have to pay the full cost but fortunately we have our Woodward fund, which partially funds some of the CAMCOS projects. Only a very small portion of the CAMCOS program is funded by state money.

Goals 2-5 listed above were chosen as the most important learning objectives for our BS Applied Math students. Math 178 An Introduction to Mathematical Modeling was recently added as a requirement for all BS Applied Math students (though students whose concentration is in statistics are now allowed to take a course in statistical modeling instead) so this became the natural place to test how well students are mastering learning objective 5, the ability to use mathematical models to solve practical problems. This class and learning objective were assessed in 2005/06 and again in Spring 2011. Adding Math 178 will certainly add to the competence of our students in mathematical modeling and students in this course are generally required to work on a large modeling project. There are also several other applied math courses notably Math 133AB and Math 177 where students encounter a variety of mathematical models. It seems that students in Math 178 are making satisfactory progress in learning how to create and solve a variety of mathematical models.

For BS Applied Math students the assessment point for learning objective 2, the ability to communicate mathematics effectively, was chosen to be Math 161B Applied Statistics II. This class and learning objective were assessed in 2006/07 and will again be assessed in Spring 2013. The instructors in this class will assign writing projects and/or oral presentations to assess the communication skills of their students. As with the BA Math students our assessment of the
BS Applied Math students are generally making satisfactory progress in learning their communication skills. A requirement that all students complete a modeling project and either write it up or present it orally might be a way to further enhance the communication skills of our applied math students.

The assessment points and assessment schedules for learning objective 3, the ability to perform standard mathematical computations, and learning objective 4, the ability to use technology to solve mathematical problems, are the same as described above for the BA Math degree. The SIAM guidelines also mention teamwork as an important skill, for those students preparing for a career in applied math. Certainly those students that work on a CAMCOS project will get valuable experience working on a team.

MA/MS Math Learning objectives
In 2005/06 the Math Dept. developed an assessment plan based on the following learning objectives for our graduate students. Learning objectives 6 and 7 were assessed in Fall 2010/Spring 2011. At that time it was decided that the thesis requirement was doing a good job of helping our graduate students learn good communication skills. The assessment point for both objectives was the thesis defense. A form has been developed by the graduate curriculum committee to help the committees evaluate the communication skills (oral and written) exhibited by our master’s degree students in writing their thesis and during their thesis defense. The assessment data will be collected and then reviewed by the math dept. chair and the graduate curriculum committee, to determine if any additional action is required. Since all of our graduate students are required to write a thesis (or writing project) and defend it this is already a major step in getting our master’s students to work on and improve their communication skills. Since graduate students are all required to take at least one 2-semester sequence another place where they could be asked to write a report or give an oral presentation is in the 2nd semester of this 2-semester sequence. Unfortunately due to the budget most of the second semester courses are being cut because they tend to have lower enrollment than other graduate courses. In the future it was decided that goal 6 should be evaluated after the student’s qualifying exam which tests their understanding of the mathematics in area that they want to write a thesis in.

Goal 6: The ability to read, understand, and explicate journal articles in mathematics related to the student’s area of specialty.
Goal 7: The ability to communicate mathematics effectively.

We have two graduate degrees, an MA Math, and an MS Math degree. The MA Math degree has an associated concentration in Mathematics Education for HS mathematics teachers interested in advanced preparation in mathematics. Students receiving MA/MS degree in mathematics at SJSU sometimes pursue careers in teaching mathematics (high school or community college), careers in applied math in business, government, and industry, as well as going on to pursue a Ph.D degree in mathematics.

MS Statistics
Our department has also recently developed a new MS Statistics degree which is a Professional Science Master’s Degree. A new assessment plan for the MS Statistics is being developed. After consulting with curriculum guidelines posted by the American Statistical Society, the guidelines for a Professional Science Masters’ Degree posted by SIAM, and in consultation with the MS Statistics Industrial Advisory Board, the Statistics faculty in the Math Department have chosen the following learning objectives as the most important. These student learning objectives will be assessed within the next few years after our upcoming external review in Fall 2013.

Goal 1: Students should develop the ability to communicate statistical ideas and data analysis conclusions effectively to a wide range of audiences. This goal will be assessed in Math 269 Statistical Consulting.
LO 1: Students should be able to locate appropriate scholarly journal articles on a given topic and be able to present the content, methods and results to statistical colleagues in an oral presentation including slides, handouts and demonstrations.
LO 2: Students should be able to communicate statistical concepts and analytical results orally and in writing in a manner understandable to researchers in other fields.
LO 3: Students should be able to write coherent and accurate reports of data analysis problems and analyses thereon.
Goal 2: Students should develop the ability to implement modern methods of computational statistics to analyze potentially large data sets. This goal will be assessed in Math 267 Statistical Computing.

LO1: Understand the theory and methods for generating random variables from both standard and nonstandard distributions.

LO2: Use different methods (deterministic and stochastic) to solve an optimization problem and understand the limitations of these methods.

LO3: Design appropriate resampling methods to estimate standard errors, construct confidence intervals, and test hypotheses.

LO4: Implement the above methods.

Goal 3: Students should develop the ability to implement applicable statistical models and draw appropriate conclusions in analyzing data for a wide variety of applied problems. This goal will be assessed in Math 261A

LO 1: Students should be able to identify an appropriate statistical model to account for the source(s) of variation in a given experiment.

LO 2: Students should be able to fit a statistical model to a given data set, formulate testable hypotheses for the model and draw conclusions from appropriate inference procedures. Students should be able to formulate their conclusions in the context of the experiment for a general audience of non-statisticians.

LO 3: Students should be able to verify the validity of a chosen model for a given data set.

General Education Assessment

The Math Dept. GE courses, Math 8 (College Algebra and Trigonometry), 10 (Math for General Education), 12 (Number Systems), 19 (Pre-calculus), undergo yearly assessment. During each year one of the 3 learning objectives listed below is assessed. STEM majors are generally exempted from the B4 GE requirement if they take one of the following more advanced quantitative classes, Math 30 (Calculus I), 30P (Calculus I with pre-calculus), 70 (Finite Math), and 71 (Calculus for Business and Aviation) though they are technically no longer classified as GE courses. Assessment for Math 8, 10, 12, and 19 is coordinated by the associate chair for the Mathematics Department. Math 12 is taken by prospective elementary teachers, and that course is assessed by the math education faculty in the Mathematics Department. Assessment for Math 100W is carried out by Judy Hilliard, the instructor of Math 100W.

Every semester, the instructors of Math 8, 10, 19, 30, 30P, 70, and 71 are asked to submit a copy of their greensheet and quantitative information regarding student success in mastering the learning objectives for Mathematical Concepts courses. The three learning objectives are:

1. Mathematical concepts courses should prepare the student to use mathematical methods to solve quantitative problems, including those presented in verbal form.
2. Mathematical concepts courses should prepare the student to demonstrate the ability to use mathematics to solve real life problems.
3. Mathematical concepts courses should prepare the student to arrive at conclusions based on numerical and graphical data.

Each semester, one learning objective is addressed. Instructors are asked to submit questions that were embedded in their exams to assess the students’ ability with the selected learning objective. Instructors submit a report indicating how many students took the exam and how many students achieved a score of at least 70% for the embedded question. The associate chair collects the information from the instructors, reviews their reports, and writes up the GE assessment report. Overall our assessment indicates that San Jose State students in GE Math courses are developing the quantitative skills needed to apply mathematics appropriately. Students are only required to take one GE Math course. To help students further develop their quantitative skills they should also be required to use these skills in other GE courses and quantitative courses in their major.

Developmental Math Assessment

Students requiring two semesters of remediation Math 3AB or Math 6AB
At San Jose State students who score 40 or less on the ELM2 exam are required to take two semesters of remediation, either Math 3AB (score of 30 or less on the ELM2) or Math 6AB (score of 31-40 on the ELM2). In Fall 2011, 391 students started in Math 3A. Of those students, 298 (76%) passed both Math 3A and Math 3B completing their remediation, 32 (8%) passed Math 3A but not 3B, 22 (6%) passed Math 3A but did not take Math 3B in spring 2012, and 39 (10%) did not pass Math 3A. In Fall 2011, 411 students started in Math 6A. Of those students, 251 (61%) passed both Math 6A and Math 6B completing their remediation, 48 (12%) passed Math 6A but not 6B, 48 (12%) passed Math 6A but did not take Math 6B in spring 2012, and 64 (15%) did not pass Math 6A.

Of the 298 students who completed their remediation by passing Math 3A and Math 3B in Fall 2011 and Spring 2012, 76 students took Stat 95 in Fall 2012 with 52 students receiving a C- or higher (68%), 48 students took Math 8 College Algebra in Fall 2012 with 31 students receiving a C- or higher (65%), 27 students took Math 10 Math for GE in Fall 2012 with 21 students receiving a C- or higher (78%), and 15 students took Math 19 Precalculus with 4 students receiving C or higher (27%). Of the 251 students who completed their remediation by passing Math 6A and Math 6B in Fall 2011 and Spring 2012, 49 students took Stat 95 in Fall 2012 with 38 students receiving a C- or higher (78%), 50 students took Math 8 in Fall 2012 with 35 students receiving a C- or higher (70%), 24 students took Math 10 in Fall 2012 with 19 students receiving a C- or higher (79%), and 27 students took Math 19 with 15 students receiving C or higher (56%).

For the other students (excepting the Math 3AB and 6AB students mentioned above) taking Stat 95, Math 8, Math 10, or Math 19 in Fall 2012, the percentage of students getting a C- or higher was 85% in Stat 95, 78% in Math 8, 87% in Math 10, and 73% in Math 19. For the students completing their remediation in Fall 2011 and Spring 2012 by passing either Math 3AB or Math 6AB, their passing rates were only slightly lower than the other students in Stat 95, Math 8 or Math 10, but in Math 19 the passing rates were noticeably less, especially for those students who completed their remediation by passing Math 3AB.

**Students requiring one semester of remediation Math 6D or Math 6L**

In Fall 2011, 464 students started in Math 6D (students scoring 46-49 on the ELM2) or Math 6L (students scoring 41-49 on the ELM2). Of those students, 366 (79%) completed their remediation in the Fall by passing their remedial course. Of the 366 students who completed their remediation by passing Math 6D or Math 6L in Fall 2011, 66 students took STAT 95 in Spring 2012 with 53 students receiving a C- or higher (80%), 57 students took Math 8 in Spring 2012 with 43 students receiving a C- or higher (75%), 29 students took Math 10 in Spring 2012 with 25 students receiving a C- or higher (86%), and 49 students took Math 19 with 30 students receiving C or higher (61%). For the other students taking these courses in Spring 2012 the percentage of students getting a C- or higher was 82% in Stat 95, 70% in Math 8, 84% in Math 10, and 72% in Math 19. For the students completing their remediation in Fall 2011 by passing Math 6D or Math 6L, their passing rates in STAT 95, Math 8, or Math 10, were about the same as the passing rates for the other students in these courses but the passing rates for these students in Math 19 was still a bit less than the passing rate for the other students. Overall the developmental math program seems to be doing a very good job of developing the math skills in those students admitted to San Jose State who do not pass the ELM exam.

**STATWAY**

In Fall 2011, San Jose State agreed to participate in a pilot project funded by the Carnegie Foundation to create an alternative developmental math program called STATWAY. In this program, students mainly those majoring in the social sciences who would normally take STAT 95 as their GE quantitative reasoning course, take a 2-semester sequence called STATWAY to simultaneously complete their remediation and get GE credit for a course equivalent to STAT 95. UNVS 15ABC is a sequence of 2 5-unit semester courses, UNVS 15A and UNVS 15BC which mainly covers Statistics and a small amount of Algebra II needed to understand the Statistics. The hope is that more students will be able to pass the STATWAY sequence than the traditional developmental math sequence which consists mainly of Algebra II. At least for the first year this seems to be the case since of the 74 students who started in UNVS 15A in Fall 2011, 66 students
passed each of the three courses UNVS 15ABC (89%). In comparison, for students required to take Math 3AB 76% completed their remediation in Fall 2011 and Spring 2012 and of these students who continued on to take STAT 95 in Fall 2012 68% received a C- or higher in STAT 95. STATWAY is somewhat controversial since traditionally all CSU graduates have been expected to learn Algebra II and one additional GE quantitative reasoning course which requires the use of Algebra II. Students who satisfy their remediation using the STATWAY sequence would be at a disadvantage if they switched to a major requiring them to take a Math course because at the present time they are learning very little Algebra II in the STATWAY sequence. It’s not clear how the STATWAY students might perform in an intermediate STAT course like STAT 115 but it might be nice to check on this before a decision to approve STATWAY is considered. In Fall 2013 a new STATWAY sequence UNVS 16AB will be implemented for Social Science majors who would normally be required to take Math 6AB to complete their remediation.

Early Start
In Summer 2012, all CSU campuses were required to implement Early Start programs, which required all first-time freshmen entering CSU in Fall 2012, who were needing remediation in Math (or English) to start their remediation in the summer. At San Jose State 570 students took a 1-unit ELM Review course or a 1-unit course using ALEKS to improve their Algebra II skills and 53 students participated in a summer bridge program which required them to take Math 3A over the summer, and 126 students did not participate in Early Start. At the end of Early Start all of the students were then required to retake the ELM exam. Of the San Jose State students in Early Start who initially required 2 semesters of remediation, 69 students reduced their required remediation to one semester, and 54 students completed their remediation. Of the San Jose State students in Early Start who initially required one semester of remediation, 92 students completed their remediation. The Early Start program was quite successful in reducing the total amount of remediation in Math needed by the incoming freshman however it did also make it hard to predict how many sections of remedial courses to offer since the results of the Early Start program were not known until mid-August. An online Math 6L course will be added to the Early Start options in summer 2013.

IV. Changes since the last external review

During our last external review in the Spring of 2009, Sheldon Axler made the following suggestions for improving the math department. In response to those suggestions and our own assessments we have made many changes.

1) Offer Reduced Workloads for Faculty with Active Research Programs
In our last external review it was suggested that the Math Dept needed to find a way to offer reduced teaching loads to faculty members with active research programs. Excessive workloads increase the likelihood of an early burnout resulting in faculty decreasing or giving up entirely on their research programs as well as a reduction in faculty morale and a discouragement to faculty who might want to pursue creative new curriculum ideas to help the students. In the past, several faculty groups (algebra and number theory, graph theory and combinatorics, applied math) have had their own seminars but lately these have disappeared. The math dept. faculty, are generally still quite active in research, but the disappearance of the seminars could be an early symptom of a burnout. In 2005/06 the department bought some extra desks and asked the university to increase the capacities of the rooms in MacQuarrie Hall from 35 to 42. Since then we have been allowing faculty the option of teaching, 7 large sections (capacity = 40-42) or 8 normal sections (capacity = 35). In this way faculty can have reduced teaching loads without any adverse effect on the Math Dept budget. The faculty members with the most active research programs can sometimes receive an additional 3 units of assigned time for research, this means that many of the faculty with active research programs will be able to have 9 unit teaching loads per semester. To fund this extra assigned time these faculty are sometimes asked to teach extra large sections (45-50 students), get grants which buoyant some of their teaching or supervise student research on masters theses and CAMCOS projects. All new probationary faculty members teach 9 units per semester. The typical teaching load for faculty who have active research programs is now generally 9/9 or 9/12 and for other faculty it is 9/12 or 12/12 depending on whether or not they are willing to teach large sections. As the recent rapid rise in the Math Department
SFR (from 24.1 in Fall 2010 to 26.6 in Fall 2011 to 28.6 in Fall 2012) shows this is being done without an adverse effect on the Math Department budget.

2) Technology: Increase the Student Exposure to Mathematical Software, Increase the Number of Smart Classrooms Available to the Math Faculty
In our last external review Sheldon Axler suggested that the department needed to work harder at introducing the use of computers and technology into the mathematics curriculum. A good goal would be to introduce students to mathematical software (Maple and MATLAB) in their first two years and this would encourage instructors in upper division classes to experiment with ways of assigning projects to students which would require them to use mathematical software and write programs in these upper division classes. We have discussed the best way to introduce students to mathematical software at several department meetings but it has been hard to reach a consensus on the best way to do this. To get students to learn Maple and MATLAB two approaches have been suggested, requiring instructors in Calculus II and Calculus III to assign some simple exercises in Maple to the students and a second approach is to require all math majors to take a mathematical software class or complete an independent software project class. All students are required to take Math 129A, Linear Algebra and instructors are asked to assign MATLAB (which is a kind of mathematical software) exercises for the students to work on. Instructors that teach applied statistics, Math 161B, usually introduce the students to some kind of statistical software and students are required to do some programming in our numerical analysis sequence, Math 143C/M. In our basic mathematical modeling course students get acquainted with the use of simulation programs to analyze certain applied math problems. Two new programming courses were recently introduced, Math 109 Mathematical Software, and Math 167 Programming in SAS. All statistics majors are required to take Math 167 and BA Math majors can use Math 109 to satisfy their computing requirement. There is still, room for improvement in this area and the department should probably continue to look for a way to introduce mathematical software to students taking Calculus. On a positive note the university now has plans to put projectors in almost all of the classrooms used by the Math Department (except for our workshop rooms in WSQ 1 and possibly some of the classrooms used for developmental math).

3) Obtain Private Offices for Full-time Faculty
Space is a precious commodity at San Jose State and it does not seem that we will be able to offer individual offices to tenured and tenure-track math dept. faculty in the near future even though it would be nice.

4) Increase Passing Rates for Precalculus and Calculus
In our last external review it was suggested that the passing rates for Math 19 Precalculus were too low. Apparently the national average for passing rates in Precalculus and Calculus is around 50-60%. Passing rates in Precalculus and Calculus increased significantly with the introduction of Math Dept workshops in Precalculus and Calculus starting in Fall 2008. In Math 19, 30, 30P, 31 and 71 students are now required to sign up for the workshop when they register for the course though they can later opt out of the workshop by coming to the math office. In Math 8, 32, and 42 workshops are strictly voluntary. For students in Math 19 Precalculus the passing rate increased from about 56% to 71% with about 90-95% of the students taking the workshop, in Calculus I the passing rates increased from about 67% to 76% with about 85-90% of the students taking the workshop and in Math 31 Calculus II the passing rate increased from about 61% to 70% with 80-85% of the students taking the workshop. Starting this spring Math 71 students are also required to sign up for the workshop when they register but as of now we don’t have any data on how this will affect the passing rate in that course. The Math Department now needs about 3-4 extra rooms each semester to hold workshops in. There is a plan to partition WSQ 1 into 5 rooms including 4 workshop rooms and hopefully this will be completed in the summer of 2013. Since the president is planning to admit 500 additional students in engineering starting this fall the Math Dept may yet need one more workshop room in the near future.

5) Find a Place for Students to Study and Hang Out Together
The Math Dept is now using DH 280 as a room for the Math Club. This became available after the Math Department was given access to WSQ 1 for workshop rooms and a space for CAMCOS. Because of this our Math Club seems to be very active and is growing quickly.

6) Recruit More Undergraduate Math Majors
Faculty members have been encouraged to talk about mathematical careers to students in our lower division service courses populated by science and engineering majors. Many students in other disciplines can easily obtain a math minor, or sometimes a double major in math, and occasionally might be interested in changing majors. In addition, having a modern up-to-date web page will be helpful. Dr. Bem Cayco does an excellent job of maintaining our web page.

7) Require/Offer More Advising for Math Majors

It used to be that all math faculty were required to do advising but unfortunately not all of them were good advisors so recently we have been selecting our best advisors to do all of the advising and assigning other faculty to other duties. Each prospective math major is assigned one of these people as an advisor. Within the past several years, all Math and COS majors have been required to see an advisor each semester. If they do not, then an advising hold is placed on them and they will not be able to register for classes until they talk with an advisor and get an advising release form signed. The dept. chair also has a weekly office hour during the summer that students can use when their regular advisor is unavailable. The university has mandatory orientations throughout the summer for entering freshman and there are also TIP sessions for entering transfer students. Either the math dept. chair or the assoc. chair attends these orientation sessions. Students must also see an advisor again before they graduate to get their major form approved. We note that the first year retention rates for math majors have increased significantly since about 2008 so these advising changes and the offering of Precalculus and Calculus workshops may be partially responsible for the increase.

8) Find a Better Way to Check Prerequisites More Thoroughly

Prerequisite checking is especially important in Math classes where the skills learned in one class often depend on the skills learned in a previous class. Except for beginning calculus courses like Math 30, 30P, 60, and 71 where a placement exam is required and courses where the satisfaction of the ELM requirement is the only prerequisite (Math 8, Math 10, Math 19, Math 70), all prerequisite checking is left up to the instructor. Unfortunately, some instructors do not do a good job at checking prerequisites. In the past this has evidently caused some problems for the College of Engineering with their accreditation process. A first day class roster indicating all those students for which it can be verified that they satisfy the prerequisites of the course would be a great help to the instructors. That would at least reduce the number of students to check. Better prerequisite checking would also be helpful in improving retention rates for math, science, and engineering students. All Math instructors are encouraged to require students to show proof that they have completed the course prerequisite and instructor drop those who do not. The passing rate of those students who receive less than a C- in a prerequisite course is typically only about 30%.

9) Create a Center of Excellence

In our last external review it was suggested that the department needed to create a center of excellence in the hope of attracting more funding from the university. Actually mathematics education has always been considered to be a center of excellence by the university but we are trying to create a 2nd center of excellence in applied math. A more applied Math Department (soon to be Mathematics and Statistics Department) can act as an important interdisciplinary hub for the university. Three new BS Applied Math concentrations were recently approved and they seem to be attracting quite a few new majors. The number of applied math majors has increased to the point where at least 35% of the undergraduate math majors are majoring in applied math. We have also just added an MS Statistics program which started in Fall 2011. This degree has been designated by the Council of Graduate Schools as a Professional Science Masters. This degree is designed to train students in the skills necessary to use statistics while working in business, government, and industry. So far we are getting a large number of students in our MS Statistics program which after only 2 years is up to 50-60 majors and could get close to 100 students eventually. To help our MS Statistics students gain valuable consulting experience the department is considering starting a Statistical Advising Center to help university researchers and others with their data analysis problems and give valuable consulting experience to our MS Statistics students. Our CAMCOS (Center for Applied Math, Computation, and Statistics) is a perfect cornerstone for our other applied math programs since it helps give students valuable experience working in teams on applied math and statistics problems which are important in business, government, and industry. Eventually we hope to create a new professional science master’s degree in applied math for students interested in applying mathematics in careers working in business,
government, and industry. Our CAMCOS (Center for Applied Math, Computation, and Statistics) program is an excellent cornerstone for an applied math program. In CAMCOS teams of students supervised by a professor work on problems provided by a business, government, or industry sponsor.

V. Plans for the Future
In this last section we discuss the future plans of the Math Dept. Our most important goals for the near future will include the following. The Math Dept. will continue to work on increasing the passing rates in our lower division service courses as well as increasing the retention rate of STEM majors helping San Jose State to increase the vital supply of scientists, mathematicians, statisticians, scientists, engineers, and mathematics and science teachers in Silicon Valley and California. We will work on improving the communication skills and technology skills of our graduates, which are so important to the success of their future careers. We will continue with our plans to make the applied math portion of our program a center of excellence, which now includes a BS Applied Math degree with 3 concentrations, an MS Statistics program which has been approved as a Professional Science Masters degree. Eventually we would also like to develop a professional science master’s degree in applied math.

A. Online Courses/Flipped Courses
In the past Professors Bozovic, Sliva and others have taught a variety of online courses for the Math Dept. Professor Bozovic started by teaching online sections of Math 70 and she also taught online sections of Math 19 and Math 129A. A thorough assessment of the effectiveness of these online Math 70 courses, was undertaken by the dept. chair and the undergraduate curriculum committee. As one might expect the passing rate for the online sections of Math 70 are slightly lower than the passing rate for the regular sections of Math 70, but surprisingly the number of students receiving A’s and B’s is higher. Many of San Jose State’s students lack the self-motivation to learn a difficult subject online though the students who are highly motivated can do quite well in an online course. Overall it was determined that Dr. Bozovic did an excellent job of teaching her online courses and that these online courses are an effective way of serving their clientele, which includes many working students who would not otherwise be able to take a regular on campus lecture class. This semester Professors Sliva and DeSousa are teaching online courses in college algebra and developmental math which are being developed with the help of Udacity. The experimental courses being taught online this semester are Math 6L Developmental Math and Math 8 College Algebra. For this first semester at least it appears that the passing rates for these Udacity courses will not match the passing rates for the regular lecture sections. It may be that strictly online math courses will always end up with lower passing rates and that regular classes enhanced with online video lectures and other materials will end up being the best way to go. In the past the Math Dept has offered its courses from early morning to late evening to accommodate working students who would often find it inconvenient to take a daytime class. These online courses might also be an alternate way of helping the Math Department meet the needs of the working students who want to attend San Jose State. It would also be nice to offer a few online upper division and graduate math/statistics courses each semester. A reasonable goal for the near future would be to have at least one section of each of our main service courses offered online to accommodate students who might find it difficult to attend a lecture course in person on campus. Recently some concerns have been raised about the online courses created with the help of Udacity regarding the number of hours of proctored exams and another concern is to make sure that these courses meet the 1500-word writing requirement which is the standard for GE math courses and certainly desirable for other math courses as well. The department will meet in the near future to discuss policies regarding online courses. In the fall semester our incoming chair Dr. Bem Cayco plans to implement a common final for Math 8 so we can compare the results for the online section and the regular lecture sections of Math 8. Our incoming chair Dr. Bem Cayco also plans to encourage experiments with flipped courses in many of our lower division math courses, Starting with Math 8 College Algebra, Math 19 Precalculus, Math 30/30P Calculus I, and Math 42 Discrete Math. Online video lectures were created for Math 6L and Math 8 in cooperation with Udacity. Also the College of Engineering is applying for a WIDER grant that will fund some experimenting with flipped classes in precalculus, calculus, and discrete math to help with the passing rates in these lower division classes and with the retention of STEM majors.

B. Five Year Plan for Recruiting
Recruiting new tenure-track faculty members is a high priority for the math department. As noted earlier the number of tenured and tenure-track faculty in the Math Department is now down to 27 from a high of about 37-38 in the early
2000’s. In Fall 2005 about 57.7% of math classes were taught by tenured and tenure-track faculty but by Fall 2011 the percentage of math classes taught by tenured and tenure-track faculty had dropped to just less than one third, 32.8%. Given that the president has plans to admit 500 more engineering majors the Math Department FTES will increase significantly and the percentage of classes taught by T/TR faculty will go down even farther without significant recruiting efforts by the Math Department. We have 5 FERP faculty (Becker, Beeson, Foster, Kellum, Schmeichel) who will be leaving the department within the next two years and about 10 faculty (Alperin, Dodd, Goldston, Jackson, Obaid, Ng, Pence, Peterson, Pfiere, Rivera, Saleem) who are within 5 years of retirement and another 4 faculty within 10 years of retirement (Katsuura, Kubelka, Shubin, Stanley). In the next two years we expect the following retirements, in 2013/2014 we will have 2.5 expected retirements (Kellum end FERP, Alperin begin FERP, Peterson retire, Pfiere begin FERP), and in 2014/15 we will have 4.5 expected retirements (Dodd retire, Pence retire, Saleem begin FERP, Becker end FERP, Foster end FERP, Beeson end FERP, Schmeichel end FERP). It will be hard to maintain a sufficient level of faculty in the Math Dept at the present levels of recruitment. To keep up with the pace of retirements it is imperative that the Math Department hire at least 2 new faculty per year for the next 5 years. We are down to 2 full-time Math Ed faculty in the fall so recruiting an additional Math Ed faculty member is a high priority.

To serve all of it students the Math Department needs an adequate number of faculty in Math, Math Education, Applied Math and Statistics. Hiring additional math education faculty members in the near future would allow us to reopen our MA Math Concentration in Mathematics Education (which had to be temporarily closed due to the fact that we will be down to only two math education faculty this fall) and to increase the number of credentialed math teachers trained at San Jose State. Given that a large number of our majors go into careers teaching math at various levels (middle school, high school, community college, university) we need to hire mathematicians in a variety of areas to teach our courses in algebra, analysis, number theory, and other areas of pure math which are important for teachers. We hired a new statistician Andrea Gottlieb in Fall 2012 and we have recently hired a new applied mathematician Elizabeth Gross. Recruiting faculty members in applied math and statistics will make it easier to find supervisors for CAMCOS projects, supervise our BS Applied Math concentrations, to teach new graduate courses in applied math and statistics that we plan to offer as part of our proposed new MS Statistics and our MA/MS Math Emphases in applied math and statistics. It has been suggested that the following specialties in applied math would best fit the needs of our students and programs, mathematical biology, optimization, numerical linear algebra, and applied discrete math. In our last external review, Sheldon Axler suggested that we conduct broad searches and indeed we often end up with applicant pools of 400 or more applicants which allows us to hire some of the very best possible candidates if we are more flexible in terms of the areas that we are hiring in.

### Math Dept. retirements/recruitments

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### Recruitment Plan

- 2013/14 Big Data/Statistics
- 2014/15 Applied Math, Math Ed
- 2015/16 Math, Applied Math
- 2016/17 Math Ed, Math
- 2017/18 Applied Math, Statistics

### C. Increased Retention of STEM majors

In 2007/2008 the College of Science was awarded a STEP grant. The Math Department was the biggest beneficiary of this grant and we used a lot of the money from that grant to implement precalculus and calculus workshops starting in Fall 2008. These workshops were very successful and the passing rate in Math 19 Precalculus rose from about 56% to
71%, the passing rate in Calculus I rose from about 67% to 76% and the passing rate in Calculus II rose from about 63% to 70.5%. This fall the College of Engineering has applied for a continuation of the original STEP grant to increase the retention of STEM majors at San Jose State. If the grant is awarded, then the plan will be to experiment with some of the lower division math and engineering courses, to try to illustrate the applications of this beginning material, assign word problems, show students how to use technology to solve math problems, etc. to motivate the students in the hope of increasing the retention rate of these STEM majors which nationwide is often as low as 50%. Another thing that might help is to smooth the transition from high school math to college math. The Math Department already has a placement exam to try to place students in the correct beginning math course. Students who do not pass the Calculus placement exam might be asked to retake the entire Precalculus course even if they are only deficient in one or two areas. Presently about 60% of STEM majors at San Jose State start in Precalculus and only 40% start in Calculus I. Many of the students taking Precalculus, have already taken Precalculus in High School and in some case they have taken Calculus in High School as well. Possibly a short online review of Precalculus might be enough for some of these students to prepare them for taking Calculus without having to retake the complete 5-unit Precalculus course. Getting students started sooner in Calculus I, might help increase the retention rate for the STEM majors and others taking Calculus. The Math Department already has a slower 5-unit version of Calculus I which allows for some review of Precalculus at crucial times and it might be possible to allow more incoming freshman to start in this course. We would want to make sure that any such action doesn’t significantly lower the passing rate in Calculus I.

D. Math Education - Increasing the Number and Quality of HS and Middle School Math Teachers
Increasing the number and quality of K-12 Math Teachers is always an important consideration. We would like to increase the number of teacher credential candidates for mathematics from the present level which is about 8-12 up to at least 20. Recently the Math Department has been teaching a CSET Prep class to increase the number of potential candidates for a teaching credential in mathematics. Unfortunately in the Fall, with one Math Ed faculty member on sabbatical and likely to retire a year after she returns, one FERPing for at most two more years, one who left to pursue other opportunities in 2011, and one now on leave to work for the NSF (and likely not to return) there is a great need to recruit at least 2 new tenure-track Math Ed faculty in the near future. In addition to teaching a variety of Math and Math Ed courses for K-8 teachers and math teaching credential candidates, training potential math teachers in the use of manipulatives and technology, supervising student teachers in Math, the Math Ed faculty also administer a large number of grants which help pay for teacher training workshops which help train local math teachers in middle school and high school. Recently we had to suspend the MA Math Concentration in Mathematics Education program due to the lack of tenured and tenure-track Math Ed faculty members. The present plan is to introduce a non-thesis option for this program and once we are able to hire some new Math Ed faculty members, reopen the MA Math Concentration in Mathematics Education program to provide training and revitalization for HS mathematics teachers.

E. Preparation of Majors
The Math Department is still working to figure out the best way to increase the crucial communication skills and technology skills of our majors. In this regard a Communication and Technology survey was conducted in Fall 2011 to figure out what instructors are doing in this regard (Appendix C).

Improved Communication Skills
Of all the learning objectives in our assessment plan, the number one concern of employers seems to be getting our graduates to have good communication skills. This can probably best be done, by getting a large number of instructors to assign writing projects and/or oral presentations, in their upper division math classes. An appropriate place to do this might be in the second semester course of a two-semester sequence that each of our majors is required to take. Another possibility would be to require each math major to take a capstone course before they graduate. A required mathematical modeling project or CAMCOS project might be an appropriate capstone for applied math majors.

Integrating Technology into the curriculum
In our last external review Sheldon Axler suggested that the department needed to work harder at introducing the use of computers and technology into the mathematics curriculum. After much discussion about whether or not to
introduce the use of mathematical software into the already crowded Calculus curriculum no consensus was reached and instead the department decided to introduce two math courses which cover the uses of mathematical software, Math 109 Mathematical Software and Math 167 Programming in SAS. Math 167 is required of all Statistics majors and because of this as well as a fair number of students in other majors who want to take it we actually have two sections of Math 167 each year. BA Math and BS Applied Math are required to take one programming course and except for the BS Applied Math Concentration in Applied and Computational Math, Math 109 is one of the options. Only a small number of students are taking Math 109 so likely we will need to do something different. For example, we might be able to increase the number of required programming units from 3 to 5 and either keep Math 109 or introduce several optional 1-unit mathematical software supplements to Calculus, linear algebra, and other beginning courses.

F. Open Source Textbooks
Our incoming math chair Bem Cayco would like to experiment with open source textbooks to help reduce the costs of math courses for San Jose State students. There is an open source textbook initiative sponsored by AIM (American Institute of Mathematics) and they can probably help us with some of the needed resources.

G. Applied Math Center of Excellence
In our last external review it was suggested that the department needed to create a center of excellence in the hope of attracting more funding from the university. A Math Department which is more applied could be an important interdisciplinary hub at San Jose State University. We feel that CAMCOS (Center for Applied Math, Computation, and Statistics) is an important component of our applied math program. A student participating in one of our CAMCOS (Center for Applied Math, Computation, and Statistics) projects will typically gain experience in communication, modeling, technology, and teamwork skills which are all important in business and industry. Every semester CAMCOS offers 1-3 projects, which consist of a team of students supervised by a professor working jointly on a problem supplied by a sponsor from a local business or industry. Presently CAMCOS is funded entirely from the Math Dept.’s own Woodward fund and contributions from our industry sponsors.

We now have 3 different concentrations for our BS Applied Math degree, a Concentration in Statistics, a Concentration in Economics and Actuarial Science, as well as a Concentration in Applied and Computational Math. A new BS Applied Math, Concentration in Economics and Actuarial Science was recently approved and it seems to be attracting quite a few new majors. A BS degree is just a starting point for a career as an actuary since it takes years of work experience and the passage of a series of actuarial exams to become a full-fledged actuary. A good goal for this new program would be to train and assist students interested in actuarial careers so that they can pass at least the first two actuarial exams as well as covering the VEE (Validation by Educational Experience) topics, Economics, Corporate Finance, and Applied Statistical Methods. We already have a course Math 163 which provides good preparation for those students who want to take the first actuarial exam on Probability and we are in the process of designing a course which will help students prepare for the second actuarial exam on Financial Mathematics. In the meantime we have purchased several books for students to use in preparing for the first two actuarial exams. Students graduating with a BS Applied Math Concentration in Economics and Actuarial Science would be prepared for a career as an actuary or actuarial assistant as well as for a variety of other careers applying mathematics in a business or financial setting. Students at San Jose State can evidently cover VEE topics in Economics by passing Econ 101 and 102, Applied Statistical Methods by taking (Math 161B or 261A) and Math 265. It is not clear if there is any course(s) that students can take to cover the VEE Corporate Finance area.

We have also added a new MS Statistics program which has been designated as a Professional Science Masters by the Council of Graduate Schools and we are considering the possibility of adding a new MS Applied Math program which we would hope would also qualify as a Professional Science Masters. This should increase the number of graduate students and TAs in the department so it should have the effect of allowing us to teach certain classes more cheaply as well as increasing the enrollments in our upper division and graduate courses. Eventually we would also like to create a new Professional Science Master’s degree in Applied Math since this would be a good fit for our CAMCOS program. A Professional Science Master’s Degree is designed to be a terminal degree for students who want the best possible preparation for applying mathematics in business and industry. Such a program usually includes components to help students learn the technology, teamwork, communication, and modeling skills that are so important for an applied
mathematician working in industry. There is a Professional Science Masters in Industrial Mathematics at Michigan State University that we might hope to emulate [http://www.math.msu.edu/Academic_Programs/graduate/msim/](http://www.math.msu.edu/Academic_Programs/graduate/msim/). We would also hope to increase the number of MA/MS Math graduate students we have from about 40 to 60 to go along with the roughly 60 MS Statistics students that we now have. These increases would mainly be in the areas of applied math and statistics. Certainly in a large metropolitan area like the Bay area, many career opportunities exist for students trained in applied math and/or statistics, working in business or industry. Also we feel that our CAMCOS program is an important part of an expanded applied math/statistics program. CAMCOS projects cover a variety of topics in applied mathematics with about half of our CAMCOS projects containing some statistical component. Because of the recent large increase in the number of Statistics majors in our department we will be changing the name of the Mathematics Department to the Department of Mathematics and Statistics. In conjunction with our MS Statistics program we have also thought about opening up a San Jose State Statistical Consulting Center. Working in the statistical consulting center would provide our MS Statistics students with valuable statistical consulting experience and we hope that their statistical expertise would be a help to a variety of researchers at San Jose State and possibly others.

### H. TA training

The Math Dept has a large number of TAs who help with the teaching of discussion sections in developmental math lectures, as workshop facilitators, graders, tutors, and as teachers in some of the college algebra and precalculus classes as well. A large number of our Math graduate students go on to pursue teaching careers either at a community college or at a university, with many of them still teaching at San Jose State. Our incoming chair would like to enhance the training that we give our TAs. In the past we have had a TA coordinator who met with the TAs before the semester to talk with them about teaching, met with them regularly during the semester to talk about any issues that came up during their classes, and also came to visit their classes at least once each semester to evaluate their teaching. The enhanced TA training would have a 2-day TA boot camp at the start of the year and meetings every two weeks throughout the year. Teaching tips (organizing a class, teaching pedagogies, creating green sheets, assignments, tests, and quizzes, how to use interactive lectures and group work, etc.), how to use technology in teaching (online homework, software, projectors, CANVAS and other online tools), classroom management, accommodating students with disabilities, and ethics. TA training might eventually become a new course.

### VI. Resource Analysis

In this last section we will discuss the additional resources that will be needed by the Math Department to carry out these plans. The Math Department is already the largest department on campus in terms of FTES and it may get up to 20% larger given the President’s plan to admit 500 more engineers per year is implemented. The Math Department teaches developmental math, GE Math, math, applied math, statistics, and math education courses at a variety of different levels. Mathematics is an inherently difficult subject to learn and passing rates in lower division Math courses are among the lowest on campus even after precalculus and calculus workshops were implemented to help raise the passing rates. A good Math Department is even more important at San Jose State than it might otherwise be at another university given SJSU’s location in the heart of Silicon Valley. An important part of San Jose State’s mission is to train computer scientists and engineers for careers at high-tech companies in Silicon Valley. CS majors and engineering majors usually take at least 15 and up to 30 units of math courses at SJSU. There is a nationwide shortage of STEM graduates in the United States and the retention rate for STEM majors nationwide is just over 50%. A well-funded math department with adequate resources is a must for a university that wants to provide a large number of STEM graduates for the Silicon Valley workforce. To maintain a high quality Math Department, the university will need to provide us with more tenured and tenure-track faculty, an adequate budget, as well as sufficient space.

#### Mathematics office

The math office is responsible for managing about 30 tenured and tenure-track faculty and 40 or more part-time faculty and TAs. Entering students at San Jose State University who want to take first semester calculus, Math 30, 30P, 60, or 71 (including most science, business and engineering majors), are now asked to take the Calculus Placement Exam (CPE).
The Calculus Placement Exam which is taken by almost 1000 students per year is administered by the math office. Given the president’s long term plan to increase the number of engineering majors by 500 per year then the Math Dept FTES may rise to as much as 1700 FTES each fall and 1400 FTES each spring. The math office is responsible for answering questions from 6000-8000 students per semester regarding developmental math, the Calculus Placement Exam, registration problems involving math courses and workshops as well as the workshop opt-out process for Math 19, 30, 30P, 31, and 71 and other math-related issues. Presently we have 2 full-time staff persons in the math office and they generally need 2 student assistants to help them with the massive workload required in running the math office. An additional staff person in the math office would be a great help.

B. Math Dept. Budget
Almost every student at San Jose State takes one or more math classes. The Math Dept. needs to have an adequate budget to serve the students well. Without adequate funding to be able to offer enough sections of our service courses to allow students to satisfy their math requirements in a timely manner many students will have their graduation delayed. The passing rates for lower division math courses are among the lowest in the university and the Math Dept. also needs adequate funding to provide the resources necessary to assist students in passing their required math courses without unduly lowering the retention rates of SJSU students, especially those in STEM disciplines which are crucial to the vitality of local business and industry in Silicon Valley. There is not enough money in the general fund to meet all of the department needs. With our CE money and any extra funds that we have, we usually pay for graders (which are certainly necessary because of the low passing rates in most lower division math courses), computers, software, and other necessary technology upgrades (which are necessary to instruct our students in the use of technology that they need to be prepared for careers in applied math), as well as various other miscellaneous expenses. We usually don’t get any help from the university or the college of science with these kinds of expenses. This year we will need to spend about $30,000 on graders and lab monitors, $20,000 on replacement computers, computer upgrades and software, as well as $20000 in travel money for math dept. faculty to cover the increasing costs of traveling, and an additional $15,000 or so for various miscellaneous expenses. At the present time we are able to cover some of these expenses using about $60-70,000 in Continuing Ed money and the roughly $12-15,000 in CPE fees paid by students which are stored in the Calculus fund each year.

Space Requirements
The Mathematics and Computer Science department split in the fall of 2002 into separate departments. This split was made without providing either department with any additional space and since then the Math Department has been short of this precious commodity. The main space needs are 1) additional storage space, 2) a meeting room, and 3) space for a 21st century Math lab with space for math tutors and wireless access for students who want to log into the Math Dept computers to get access to mathematical and statistical software. At this point the Math Dept now has two small storage closets (each 8’ x 9’), which seems to be adequate for now, though larger items which are delivered to the Math office occasionally need to be stored in the department chair’s office temporarily until they are installed, so some additional storage space would be nice. We also have 19 2-person faculty offices and a 1-person dept. chair office for our full-time faculty as well as 4 larger rooms with desks for our part-time math faculty, part-time developmental math faculty, and TAs. We also have one room in Duncan Hall for our Math Club, and one room in WSQ 1 for CAMCOS. The Math Dept has two separate computer labs, a Math computer lab in MH 221 and a Math Ed computer lab in MH 426. The Math Dept. still has no separate meeting room and meetings are generally held in the common room except during lunch hours (or in the Hoggatt reading room during lunch), which leads to quite a few interruptions. It would be nice to have a dedicated meeting room (preferably somewhere in MacQuarrie Hall). Given the shortage of tenured and tenure-track faculty in the Math Dept these days we might be able to use an empty faculty office as a meeting room. At the present time our part-time faculty offices are bulging and the university needs to allow us to hire more tenure-track faculty. Recently the Math Dept. was given control of WSQ 1 to provide space for 4 workshop rooms as well as a room for our CAMCOS program. This allowed us to use DH 280 as a space for the Math Club. Given their new expanded space the Math Club seems to be thriving.
Since our last external review the university has made great strides in updating the technology in the classrooms used by the Math Dept so that now almost all of these classrooms have projectors. Given that SJSU will try to admit 500 extra engineering majors per year the Math Dept may need one additional classroom and one additional workshop room.

21st Century Math Lab

At the present time the Math Dept has an open computer lab staffed with lab monitors for about 50 hours/week. This allows math, science, and engineering students taking math and statistics classes to have access to the appropriate kinds of software when they need it for their classes. In addition the Math Dept hires tutors each semester to help students taking upper division math and statistics classes (and lower division courses as time permits). Given the present lack of space these tutors are also housed in MH 221. If the Math Dept were able to get some additional space a room for a tutoring room which also had tables and chairs, outlets for laptops and wireless access, where students could study and get help get help with their math would be an excellent use of space. Given the new Student Success Fees that San Jose State is collecting from the students it would be nice if some of these fees could be used to help reimburse the Math Dept for the funds it uses in purchasing the software and hiring the tutors for the benefit of the students.

Concluding Remarks

In conclusion, we hope that everyone will agree that San Jose State University needs to have a high quality Mathematics Department, which deserves more than a bare bones budget and barely adequate space to best serve the San Jose State students. The department also needs to be able to upgrade our computer labs and smart classrooms as befitting a mathematics program training applied mathematicians/programmers to work in the heart of Silicon Valley.

In short, given adequate funding there are many important contributions that the math department can make to the students and the university and the community as a whole. Foremost, the math department would hope to offer enough sections of our service courses so that all students will be able to take the courses necessary to satisfy their math requirements in a timely manner. The math department would also hope to take any reasonable steps necessary to increase the passing rates and retention rates for STEM majors and others required to take mathematics courses. The math department also hopes to expand its applied math and statistics programs at the undergraduate and graduate levels, so that it can serve the university as an interdisciplinary hub for students who want to pursue careers using quantitative analysis in their chosen fields in business, economics, science, and engineering. The Math Dept. would also like to play its part in increasing the number and quality of math teachers in high schools and community colleges throughout the area. And finally the math dept. would like to offer reasonable teaching loads to its dedicated faculty to help them achieve excellence in research and allow them to make contributions to the valuable service and outreach programs in their field.

This self-review was written by Brad Jackson the Math Dept. Chair, with the help of several of the industrious and hard-working members of the Math Department.

Appendix A

Math Dept Grades Fall 2012

Lower Division Classes
Passing Rates for Math Dept. Classes
Since the implementation of the Math Dept. workshops almost all lower division math courses now have a passing rate (C- or better) of at least 70%, the exceptions being Math 32 and 71 both of which had voluntary workshops in Fall 2012. Before the implementation of the workshops passing rates in many of the lower division were between 55-65%. In courses with voluntary workshops anywhere from 15-35% of the students take these workshops. Starting in Spring 2013 students in Math 71 will be required to sign up for the workshop and only Math 8, 32, and 42 will have voluntary workshops. In Math 19, 30, 30P, 31, and 71 students will be required to sign up for the workshop when they sign up for
the course but they can later opt-out of the workshop by coming to the math office. In these courses between 80-95% of the students take the workshop.

<table>
<thead>
<tr>
<th>Course</th>
<th>A- or &gt;</th>
<th>B- or &gt;</th>
<th>C- or &gt;</th>
<th>Total</th>
<th>% A-</th>
<th>% B-</th>
<th>% C-</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>83</td>
<td>196</td>
<td>309</td>
<td>407</td>
<td>20.39%</td>
<td>48.16%</td>
<td>75.92%</td>
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<tr>
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<td>68</td>
<td>175</td>
<td>230</td>
<td>272</td>
<td>25.00%</td>
<td>64.34%</td>
<td>84.56%</td>
</tr>
<tr>
<td>12</td>
<td>37</td>
<td>95</td>
<td>114</td>
<td>124</td>
<td>29.84%</td>
<td>76.61%</td>
<td>91.94%</td>
</tr>
<tr>
<td>19</td>
<td>117</td>
<td>287</td>
<td>409</td>
<td>573</td>
<td>20.42%</td>
<td>50.09%</td>
<td>71.38%</td>
</tr>
<tr>
<td>30</td>
<td>62</td>
<td>137</td>
<td>210</td>
<td>250</td>
<td>24.80%</td>
<td>54.80%</td>
<td>84.00%</td>
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<tr>
<td>30P</td>
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<td>109</td>
<td>167</td>
<td>236</td>
<td>18.22%</td>
<td>46.19%</td>
<td>70.76%</td>
</tr>
<tr>
<td>31</td>
<td>83</td>
<td>216</td>
<td>348</td>
<td>473</td>
<td>17.55%</td>
<td>45.67%</td>
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<td>32</td>
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<td>155</td>
<td>227</td>
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<td>42</td>
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<td>71</td>
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<td>205</td>
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<tr>
<td>70</td>
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<td>71</td>
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<td>355</td>
<td>18.87%</td>
<td>44.23%</td>
<td>67.32%</td>
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</table>

**Upper Division Classes**

In upper division math courses generally at least 80% of the math majors pass these courses. In some of the upper division service courses like Math 129A Linear Algebra, Math 133A Ordinary Differential Equations, and Math 161A there are a significant number of non-math majors and the passing rates in these courses are usually 70% or lower. Also in some of the more theoretical proof-oriented math courses (Math 113, Math 128AB, 129AB, 131AB) the passing rates also tend to be around 70% or lower. A Math 108 Introduction to Proof course was added in the last few years to help increase the passing rates in these theoretical courses which used to be around 50%.

<table>
<thead>
<tr>
<th>Course</th>
<th>A- or &gt;</th>
<th>B- or &gt;</th>
<th>C- or &gt;</th>
<th>Total</th>
<th>% A-</th>
<th>% B-</th>
<th>% C-</th>
</tr>
</thead>
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<td>87.50%</td>
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</table>

**Graduate math courses**

Out of 102 students in Math Department graduate courses in Fall 2012, 78% received an A, 20% received a B, there were only two grades below a B (2%) and one grade below a C (1%).
Appendix B  Retention/Graduation Rates
One of the most important issues facing any department is the retention of its majors and trying to get them to graduate in a timely manner. Retention and graduation rates for math and science majors are given in the tables below.

Retention Rates of Math and Science Majors

<table>
<thead>
<tr>
<th>Science Retention</th>
<th>Math Retention</th>
</tr>
</thead>
<tbody>
<tr>
<td>FT Frosh 1 yr F09-F11 87.7%</td>
<td>F02-F08 80.4% F08-F11 85.5% F02-F07 75.7%</td>
</tr>
<tr>
<td>FT Frosh 6 yr F99-F06 57.7%</td>
<td>F97-F98 44.5% F00-F06 53.3% F97-F99 38.8%</td>
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<tr>
<td>New Transfer 1yr F09-F11 89.6%</td>
<td>F02-F08 78.6% F09-F11 91.0% F97-F08 70.7%</td>
</tr>
<tr>
<td>New Transfer 3 yr F09 77.5%</td>
<td>F00-F08 64.9% F09 85.7% F97-F08 58.8%</td>
</tr>
<tr>
<td>Graduate 1yr F09-F11 70.0%</td>
<td>F97-F08 64.5% F08-F11 84% F97-07 62.1%</td>
</tr>
<tr>
<td>Graduate 3 yr F97-F09 52.6%</td>
<td>F08-F09 82.3% F97-07 43.1%</td>
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</table>

Graduation Rates of Math and Science Majors

<table>
<thead>
<tr>
<th>Science Graduation</th>
<th>Math Graduation</th>
</tr>
</thead>
<tbody>
<tr>
<td>FTFrosh 6 yr F99-F06 42%</td>
<td>F97-F98 33% F97-F06 38.1%</td>
</tr>
<tr>
<td>FTFrosh 8 yr F99-F04 55%</td>
<td>F97-F98 44% F02-F06 61.9% F97-F01 39.9%</td>
</tr>
<tr>
<td>New Transfer 3 yr F08-F09 33.5%</td>
<td>F97-F07 28.2% F03-F09 38.4% F97-F02 24.0%</td>
</tr>
<tr>
<td>New Transfer 5 yr F02-F07 55.0%</td>
<td>F97-F01 48.8% F02-F07 59.9% F97-F01 43.2%</td>
</tr>
<tr>
<td>Graduate 3 yr F97-F09 34.7%</td>
<td>F07-F09 42.9% F97-F06 16.0%</td>
</tr>
<tr>
<td>Graduate 5 yr F97-F09 52.6%</td>
<td>F05-F07 51.7% F97-F04 29.9%</td>
</tr>
</tbody>
</table>

Retention rates and graduation rates for math and science majors have shown a significant rise most notably since Fall 2008 and Fall 2009. Since that time the 1 yr. retention rate for math majors who are first time freshman has risen from 76% to 85%, for new transfer students has risen from 71% to 91%, and for new graduate students has risen from 62% to 82%. A greater emphasis on advising at the university, college, and department levels, the implementation of precalculus and calculus workshops, the offering of first year courses Science 2 and Science 90T for freshman and transfers are all possible contributing factors. In the Math Department we changed our system of advising from a system where everyone shared the advising duties equally to one where our best advisors are doing all of the advising.

Retention and Graduation Rates

1 year retention rates – First Time Freshman

<table>
<thead>
<tr>
<th>Year</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
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</thead>
<tbody>
<tr>
<td>Percent</td>
<td>72.7%</td>
<td>66.7%</td>
<td>92.3%</td>
<td>50.0%</td>
<td>54.5%</td>
<td>71.4%</td>
<td>88.9%</td>
<td>86.4%</td>
<td>95.0%</td>
<td>75.0%</td>
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<tr>
<td>Total</td>
<td>11</td>
<td>6</td>
<td>13</td>
<td>10</td>
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<td>10</td>
<td>16</td>
<td>19</td>
<td>19</td>
<td>21</td>
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</table>

1 year retention rates – Transfers
<table>
<thead>
<tr>
<th>Year</th>
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<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent</td>
<td>75.0%</td>
<td>72.7%</td>
<td>87.5%</td>
<td>61.5%</td>
<td>73.9%</td>
<td>60.0%</td>
<td>80.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>84.6%</td>
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<tr>
<td>Total</td>
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<td>23</td>
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<td>15</td>
<td>13</td>
<td>22</td>
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<td>15</td>
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</table>

1 year retention rates – Graduates

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<th>2006</th>
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<th>2010</th>
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<tbody>
<tr>
<td>Percent</td>
<td>72.7%</td>
<td>66.7%</td>
<td>92.3%</td>
<td>50.0%</td>
<td>54.5%</td>
<td>71.4%</td>
<td>88.9%</td>
<td>86.4%</td>
<td>95.0%</td>
<td>75.0%</td>
</tr>
<tr>
<td>Total</td>
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<td>6</td>
<td>13</td>
<td>10</td>
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</table>

Appendix C Technology and Communication Survey and Results

Technology and Communication Survey  Return to Brad Jackson or Renee by Tues. Oct. 25, 2011

Name ___________________________

Assessment of the Math Department Curriculum regarding student opportunities to practice/enhance their mathematical communication skills.

In which classes that you have taught recently have you

1) talked to students about what constitutes a clear write-up of their solutions to homework problems.

2) asked students to explain solutions to homework problems at the board.

3) asked students to write a report or give an oral presentation of a project related to the material in the course.

4) asked students to work on problems in groups.

5) asked students to work on a group project.

6) Describe below other things you do in your classes to help students develop their oral and written communications skills.

Name ___________________________

Assessment of the Math Department Curriculum regarding student opportunities to practice their skills in using technology to solve mathematics problems.

In which classes that you have taught recently have you

1) demonstrated the uses of mathematical/statistical software (name the software) in solving problems.

2) asked students to write a computer program to solve a problem (what language?)

3) talked about random numbers/computer simulation.

4) used Desire2Learn or had students do homework online.

5) asked students to use the internet to look up information.

6) What courses (if any) would you be willing to teach online?
7) What kinds of technology do you use (if any) in teaching Math 129A?

8) What kinds of technology do you use (if any) in teaching calculus?

9) Describe below other things you do in your classes to help students develop their skills in using technology.

Results of the Communication/Technology Survey

Many thanks to the 35-40 folks who turned in their Communication/Technology Surveys. Here is a summary of the results.

Teaching Communication Skills

Classes requiring written reports/oral presentations
I’ve heard it mentioned by several past COS deans that in their talks with employers, communication skills, was the number one area where employers felt that they would like to see improvement in our graduates. Having students write reports and give oral presentations is an excellent way for them to practice their communication skills. Many Math 10 instructors (Kovaleva, Arabhi, Tanniru, DeSousa, Strong) require their students to write a report which is probably appropriate for a GE course since there is generally a certain minimum amount of writing required for a GE course. Written reports/oral presentations are also assigned for a variety of Statistics courses, Crunk, Bremer Kovaleva in Math 161B, 162, 261A, 261B, and 265; also for a variety of Math Ed courses Roper in Math 12, 105, 106; Becker in Math 201A and 394; for numerical analysis courses, Foster, Saleem in Math 143M and 143C; as well as a smattering of other math courses, Math 104 Shubin, Alperin; Dodd 109, 235; Kovaleva 133A; Stanley 229; and Obaid 238. If the department felt it was important to get more students to work on their writing and oral presentations then it might work to require BA Math students to write a project or give an oral presentation in one of the required second semester courses Math 128B, 129B, 131B, 138, or 175. It would also be possible to offer a senior project/capstone course where students would be asked to write a project or give an oral presentation on a topic of their choice. Of course CAMCOS Math 203 students are required to write reports and give oral presentations.

Classes requiring group work/group projects
Teamwork and the ability to work in groups is another important skill for our graduates out in the working world. Students in Precalculus and Calculus workshops work on problems in groups of 3-4 and that has helped raise the passing rates in these courses significantly. More than half of the instructors said that they had students in various classes working on homework problems in groups or working on group projects. Certainly the department chair encourages faculty to incorporate group work into their courses. Talk to the following people if you want to get some ideas on how to incorporate group work/group projects into one of your classes: Math 10 Arabhi, Kovaleva, Tanniru, DeSousa, Zabric, Strong; Crunk 161B, 261A, 265; Foster 143M, 243B; Roper 12, 105,106; Kovaleva 133A, 261B; Arabhi 8; Dodd 109, 235; Saleem 30, 112, 143C; Becker 201A, 394; Shubin Calculus, 104, 108; Fan 31; Ahmed 30P; DeSousa 10, 19; Stanley 229, 271; Fish 70; Mathews 8; Obaid 138, 238; Strong Calculus; Bremer 129A, 161B, 162; Alperin 221B; Jordan 71.

Classes requiring students to clearly explain their solutions to problems in writing or orally
Communicating solutions to math problems clearly and logically is certainly one of the skills we expect from our students. About three fourths of the instructors said that they emphasized to students the value of clearly explaining their solutions to problems in writing and/or orally. This happens in courses at all different levels. This is a convenient way to get students to work on their communication skills that works for most classes. The following instructors indicated that they required students to clearly explain solutions to problems in writing or orally at the board: Bremer 129A, 162; Schmeichel 142; Strong Calculus; Peterson all classes; Blockus 10; Obaid 138, 238; Mathews 8; Fish 10, 70; Saleem workshops, 30, 112, 143C; Katsuura all classes; Zabric 19; Stanley all classes; DeSousa 10,19; Beeson 134; Ahmed 10, 30P; Tanniru 8, 10, 30, 31; Fan 31; Shubin 30P, 31, 104, 108; Becker 201A, 394, TG Nguyen 10, 31, 70; Tran 10, 32;
Teaching students to use Technology in Solving Problems

Technology in Calculus
11 respondents said that they required the use of a graphing calculator, 8 respondents said that they used mathematical software (like Maple, MathXpert, or webassign) during the class.

Technology in Linear Algebra
It seems that most of the Linear Algebra instructors require students to use some kind of mathematical software, 8 respondents said that they used mathematical software (like MATLAB or Octave) in Math 129A.

Classes requiring programming or the use of mathematical software
R, Minitab, and SAS are used in various statistics classes, 161A, 161B, 162, 167, 196U, 261A, 261B, 265 by Crunk, Bremer; Geometer’s Sketchpad, Geogebra, Fathom, Excel and Calculators are used in various Math Ed classes; Geometer’s Sketchpad is used in Math 115 by Pfiefer; Excel is used by some instructors in Math 10, Math 70, Math 71 Maple is used in a variety of classes.

Classes using Online Homework or Desire2Learn
Many Precalculus and Calculus instructors use the Webassign online homework system and one person uses Math Xpert and for other classes some use MyMathLab. A few instructors seem to use D2L (Kovaleva, Fish, Pfiefer, Becker, Bremer. About half of the instructors do not use D2L or any online homework system. Professor Sliva (Math 8) and Professor (Math 106) will be teaching online courses in the fall and presumably will be using D2L and an online homework system.