Department of Mathematics and Statistics

SJSU Annual Program Assessment Form
Academic Year 2014-2015

Electronic copy of report is due June 1, 2015. Send to Undergraduate Studies (academicassessment@sjsu.edu), with cc: to your college’s Associate Dean and college Assessment Facilitator.

Department: Mathematics and Statistics
Program: BA Mathematics, BS Mathematics, MA/MS Mathematics, MS Statistics
College: College of Science
Website: http://www.sjsu.edu/math/
X Check here if your website addresses the University Learning Goals.
http://www.sjsu.edu/math/assessment/index.html
Program Accreditation (if any): None
Contact Person and Email: Dr. Bem Cayco, bem.cayco@sjsu.edu
Date of Report: June 1, 2015

Part A
1. List of Program Learning Outcomes (PLOs)
   No changes from last year.
2. Map of PLOs to University Learning Goals (ULGs)
   No changes from last year.
3. Alignment – Matrix of PLOs to Courses
   No changes from last year.
4. Planning – Assessment Schedule
   No changes from last year.
5. Student Experience
   No changes from last year.
### Item 6. Graduation Rates by Entering Cohorts: Mathematics

<table>
<thead>
<tr>
<th></th>
<th>First-Time Freshmen</th>
<th>Undergraduate Transfer</th>
<th>New Credential</th>
<th>First-Time Graduate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Program Cohort Size</td>
<td>Program Grad Rate</td>
<td>Program Grad Rate</td>
<td>Program Grad Rate</td>
</tr>
<tr>
<td>Fall 2008 Cohort: 6-Year Graduation Rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>College Average Grad Rate - All Students Who Entered This College</td>
<td>15</td>
<td>73.30%</td>
<td>45.00%</td>
<td>49.70%</td>
</tr>
<tr>
<td>University Average Grad Rate - All Students Who Entered the University</td>
<td>22</td>
<td>54.50%</td>
<td>47.40%</td>
<td>55.30%</td>
</tr>
<tr>
<td>Fall 2011 Cohort: 3-Year Graduation Rate</td>
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<td></td>
<td></td>
<td></td>
</tr>
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<td>55.30%</td>
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<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>73.30%</td>
<td>45.00%</td>
<td>49.70%</td>
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<tr>
<td>URM</td>
<td>2</td>
<td>0.00%</td>
<td>26.50%</td>
<td>40.70%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50.00%</td>
<td>47.60%</td>
<td>40.70%</td>
</tr>
<tr>
<td>Non-URM</td>
<td>12</td>
<td>83.30%</td>
<td>49.10%</td>
<td>53.30%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>59.00%</td>
<td>44.40%</td>
<td>54.90%</td>
</tr>
<tr>
<td>All others</td>
<td>1</td>
<td>100.00%</td>
<td>52.80%</td>
<td>52.90%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>62.50%</td>
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<td></td>
<td>64.90%</td>
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<tr>
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<td></td>
<td></td>
<td>56.90%</td>
</tr>
</tbody>
</table>
7. **Headcounts of program majors and new students (per program and degree)**

### Fall 2014

<table>
<thead>
<tr>
<th></th>
<th>New Students</th>
<th>Continuing Students</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FT Admit</td>
<td>New Transf</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>67</td>
<td>38</td>
<td>297</td>
</tr>
<tr>
<td>BA</td>
<td>5</td>
<td>15</td>
<td>84</td>
</tr>
<tr>
<td>MS</td>
<td>32</td>
<td>62</td>
<td>94</td>
</tr>
<tr>
<td>BS</td>
<td>28</td>
<td>23</td>
<td>110</td>
</tr>
<tr>
<td>MA</td>
<td>2</td>
<td>7</td>
<td>9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Retn.Tranf</th>
<th>Trnst-Ugrd</th>
</tr>
</thead>
<tbody>
<tr>
<td>FT Admit</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>New Transf</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Fall 2014

<table>
<thead>
<tr>
<th>Subject Headcount per Section</th>
<th>College Headcount per Section</th>
<th>University Headcount per Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Division</td>
<td>39.4</td>
<td>48.7</td>
</tr>
<tr>
<td>Upper Division</td>
<td>38</td>
<td>24.8</td>
</tr>
<tr>
<td>Graduate Division</td>
<td>7</td>
<td>5.1</td>
</tr>
</tbody>
</table>
8. **SFR and average section size (per program)**

<table>
<thead>
<tr>
<th></th>
<th>Fall 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Subject</td>
</tr>
<tr>
<td>SFR</td>
<td>SFR</td>
</tr>
<tr>
<td><strong>Lower Division</strong></td>
<td>37.6</td>
</tr>
<tr>
<td><strong>Upper Division</strong></td>
<td>35.6</td>
</tr>
<tr>
<td><strong>Graduate Division</strong></td>
<td>11.8</td>
</tr>
</tbody>
</table>

9. **Percentage of tenured/tenure-track instructional faculty (per department)**

<table>
<thead>
<tr>
<th></th>
<th>Fall 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Department FTEF #</td>
</tr>
<tr>
<td><strong>Tenured/Tenure-track</strong></td>
<td>25.0</td>
</tr>
<tr>
<td><strong>Not tenure-track</strong></td>
<td>9.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>34.9</td>
</tr>
</tbody>
</table>
Part C
11. Closing the Loop/Recommended Actions
12. Assessment Data
13. Analysis
14. Proposed changes and goals

Part C for B.A. Math
We are not assessing a PLO this year.
Part C for BS Math

10. Closing the Loop/Recommended Actions
This year the BS Math Program chose to assess PLO #1 in the Math 178 course. PLO #1 states: The student will use mathematical models to solve practical problems.

11. Assessment Data

Assessment of Student performance in Math 178 Introduction to Mathematical Modeling

Math 178 An Introduction to Mathematical Modeling is a course specifically designed to help students learn about the process of using mathematical modeling to analyze problems involving a variety of applications, using many different kinds of applied mathematics. The mathematics covered includes about two weeks each of several of the basic topics in applied mathematics, 1) difference equations, 2) proportionality and geometric similarity, 3) best-fit lines using least squares and Chebyshev criterion, 4) curve fitting using one term models, polynomials, and splines, 5) optimization, linear programming and unconstrained optimization, 6) differential equations and systems of differential equations. The Spring 2015 Math 178 Final contained 10 problems testing students on different aspects of the use of mathematical models in solving applied math problems. There were 2 problems testing students ability to use difference equations to analyze different applications in financial math and business, 1 problem testing the students’ ability to use proportionality to model an application in physics, 3 problems testing the students’ ability to find best-fit functions of various types to model a given data set, one problem testing the students’ ability to use linear programming to model a business application, and two problems testing the students’ ability to use differential equations to analyze applications in biology and learning theory. There were 35 students in this class and two of these students did not take the final. The overall results of this test indicate that 6 students have an excellent understanding of mathematical modeling, 9 students have a very good understanding of the uses of mathematical modeling, 15 students have a satisfactory understanding of mathematical modeling, 2 students have a slightly below average understanding of mathematical modeling, and 3 students have an unsatisfactory understanding of mathematical modeling. Here are the results on the individual problems.

Characterization of student performance on individual problems and skills related to mathematical modeling
a) excellent understanding/mastery  9 or 10 out of 10 points
b) satisfactory-good understanding partial mastery mastering most but not all of the topics 6-8 out of 10 points
c) unsatisfactory understanding mastery of at most a small portion of the topics less than 6 out of 10 points

Results of Student Performance on Individual Problems
1) Application basic financial mathematics – credit card balance. Mathematics required basic algebra, geometric sequences, difference equations. 31 out of 33 students had an excellent understanding of
this problem (at least 9 out of 10), and only one student had an unsatisfactory understanding (less than 6 out of 10).

2) Application transition between states (Markov chain) Mathematics required basic algebra, difference equations, computation of equilibrium values. 17 out of 33 students had an excellent understanding of this problem and 10 out of 33 students had an unsatisfactory understanding of this problem.

3) Application physics terminal velocity of a small raindrop Mathematics required proportionality, geometric similarity, physics of a falling body including air resistance One of the two most challenging problems on the exam. Many of the students only had a partial understanding of the underlying physics. Only 4 out of 33 students had an excellent understanding of this problem and 15 out of 33 students had an unsatisfactory understanding.

4) Application finding best fit lines, polynomials, and other curves using least squares criterion and Chebyshev criterion. Mathematics required algebra, linear algebra, optimization of a function, data transformation (logarithms) 37 out of 99 solutions showed an excellent understanding, 29 out of 99 solutions showed an unsatisfactory understanding.

7) Application: Simple linear program model for a business application Mathematics required linear equations model for an objective function and constraints of a linear programming model. 27 out of 33 students had an excellent understanding of this problem and only 5 out of 33 students had an unsatisfactory understanding of this problem.

8) Application: Maximizing the profit of a business with variable pricing for a single product Mathematics required: Modeling using a single variable function unconstrained optimization 20 students out of 33 had an excellent understanding of this problem.

9) Application: Biological example of exponential decay. Mathematics required: Solving a simple differential equation using separation of variables, computing the initial level of a population given another data point. Only 11 out of 33 students had an excellent understanding of this problem and 20 out of 33 had an unsatisfactory. I’m not quite sure why students had so much trouble with this problem.

10) Application: Setting up a differential equation model for a problem in learning theory. Mathematics required: Differential Equations, Using derivatives to model the rate of change of a function. 14 out of 33 students had an excellent understanding and 12 out of 33 had an unsatisfactory understanding.

12. Analysis
Math 178 Introduction to Mathematical Modeling is a valuable course for our students, which teaches them about mathematical modeling in solving a variety of applied problems. In addition to mathematical modeling skills students also learn the use of technology in modeling and solving models. Students mainly use MATLAB and Excel. Students are also asked to write up a computer simulation.
project and a final mathematical modeling project. Some students give an oral presentation of their final project for extra credit. Overall a large majority of the students show at least a satisfactory understanding of mathematical modeling and the associated skills by the end of the semester. Most of the students who don’t make satisfactory progress usually don’t put in a sufficient effort.

13. **Proposed changes and goals (if any)**
None.
Part C for MA/MS Math

10. Closing the Loop/Recommended Actions

This year, the MA/MS Math program chose to assess PLO #1 which states: The student will read, understand, and explicate journal articles in mathematics related to students area of specialty.

The assessment will be done during the thesis defenses for Fall 2014.

11. Assessment Data

Three students defended their thesis/writing projects that semester.

<table>
<thead>
<tr>
<th></th>
<th>Excellent</th>
<th>Very Good</th>
<th>Satisfactory</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating of student’s oral presentation skills</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall rating of student project</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Strengths of oral presentations:
- Well organized
- Good examples of complicated theory
- Ability to answer questions
- Accessible presentations of technical details

Weaknesses of oral presentations:
- Sometimes difficult to understand English
- Too much material to present
- Some slides have too much content

Strengths of writing in the thesis or projects:
- Careful detailed presentation
- Written with great deal of attention to completely understanding highly technical theorems and proofs
- One thesis contained original work.

Weaknesses in the writing of thesis or writing projects:
- Use of English
- Sometimes, it was difficult to explain complex ideas to non experts.

12. Analysis

These students were all successful in writing and presenting their projects. By the time the students are ready to graduate, they reach a level of expertise in their chosen field of study. The best student in the group finished in 3.5 years. Another student took 4.5 years to finish the degree. The third student took longer to finish but there were extenuating circumstances.

13. Proposed changes and goals (if any)

We are introducing a non-thesis option to our degrees. See below.
Part C for MS Statistics

10. Closing the Loop/Recommended Actions

This year the MS Statistics Program chose to assess PLO #1 in the Math 269 course in Fall 2014. PLO #1 states: The student will communicate statistical ideas effectively.

11. Assessment Data

The Program Learning Outcome under study is evaluated through three course learning objectives (CLO’s) in Math 269:

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.
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.
3. Students should be able to write coherent and accurate reports of data analysis problems and analyses thereon.

The course is roughly divided into four components (the first three comprising approximately 31% of the course time each, and the last using the remaining 7%) as follows:

1. The students are provided a reading list of some fifty journal articles on working as a professional statistician (the papers are broken down into nine categories: Introduction, Structuring Statistical Problems and Analyses, Statistical Criticism, The Statistician in Industry and in Clinical Trials, Statistics and Law, Principles of Practice, Writing and Speaking, Examples, Statistician Role Models). As this is a small seminar-style course, the enrollment is usually limited to approximately 13 students, however during the semester in question the enrollment was 18. The journal articles are divided among the students, who are then responsible for locating the article, providing the document to their colleagues (who are then to preview the paper before it is presented in class), providing an in-class eight minute overview of the paper, and lead a discussion of the paper. This activity is spread throughout the semester. This portion of the course addresses course learning objective one.

2. The students are provided a list of approximately 20 advanced topics in statistics which are usually not covered as a part of their curriculum. Students are assigned to groups of 2-3 students each and assigned topics from the list. The students must research the topic and then present the topic in a 45 minute class presentation. This portion of the course addresses course learning objectives one and two. Additionally, it provides the students with a brief overview of advanced statistical techniques, shows the students that there are many topics in statistics which they have not covered in their coursework,
and teaches them how to research new statistical techniques when the need arises in their professional lives.

3. During the semester we advertise the availability of statistical advice to be provided by the students in the class. Clients will include students and perhaps faculty members from throughout the university who are not statisticians by training, but who intend to make use of data and statistics as a portion of their research. Advice only will be provided. The service may NOT be used for course work, rather it is intended to provide statistical assistance for research activities, where statistics is used as a tool in the research and is not an end objective in and of itself. The service may is not used as a tutorial for either statistics or for the usage of software. Most clients are masters students on content areas who need help analyzing data as a portion of their thesis, though several faculty members have also made use of this service. Students come back to class to discuss their advising activities, both in terms of the use of statistics as well as in dealing with non-statisticians. This portion of the course addresses course learning objectives two and three.

4. A small portion of the class time is used in discussing current events as they are related to statistical analysis. This portion of the course addresses course learning objective two.

All the students performed at an acceptable level.

12. Analysis
The students communicate statistical ideas effectively.

13. Proposed changes and goals (if any)
None
Other Efforts

We continue to evaluate our current programs and offerings and make improvements when we can. This sections lists other activity in the department that contributes to the mission of the department and the university.

A. Action Plan from Program Review and Planning

   a. Submit program review of GE courses in the department.

      Status: Completed

   b. Take steps to advance assessment of student learning, specifically to update program goals and learning outcomes and to continue to advance and improve assessment methodologies.

      Status: Completed

   c. Continue to build upon current efforts to manage enrollment and improve graduation rates in both undergraduate and graduate programs and come up with a plan to improve rates across the department.

      i. For the graduate programs, explore effectiveness of introducing a comprehensive exam option, streamlining curricula to remove obstacles and to have more similar requirements to comparable graduate programs, and tailoring paths to degree for common placements upon graduation such as industry, community college instruction, or further graduate study.

         Status: Ongoing. We revamped our MS/MA Math degrees. Our proposals will be making their way through the appropriate committees. We introduced a non-thesis option to allow students to graduate in a reasonable amount of time. We are also working on a “promised course offering” schedule that would allow the students to build their academic plan.

      ii. For the undergraduate programs, explore effectiveness of instituting probation and disqualification in the major; and increasing motivation and engagement of majors, with focus on freshman.

         Status: Ongoing. We are trying to find space for our students in the hopes of building a community. (see e). Our advising model works extremely well because we have group of dedicated advisors who handle all issues relating to our programs.

   d. Continue efforts to increase student success. Work with the AVP of Institutional
Effectiveness and Analytics to identify courses with high failure rates and continue to track and explore improvements. Work with the AVP of Faculty Development on best practices, resources, and/or training on effectively teaching large lecture sections.

Status: Ongoing. We received grants from the Chancellor’s office for Promising Practices in Course Redesign with Technology in an effort to improve student learning in our large lecture Math 30p and Math 31 classes. (See below.)

e. **Work with Dean to develop a plan to realize the vision of an updated, 21st century math lab, which would benefit the department and the university as a whole.**

Status: Ongoing. Our biggest problem is finding a large space in MH to house the math lab. We requested some space and submitted a proposal but the decision is still pending.

f. **Continue to work with Dean to hire tenure-track faculty based on the trends of increasing student enrollment and decreasing faculty staffing over the past five years.**

Status: Ongoing. We successfully hired 4 tenure track faculty last year. Our request for 4 more tenure lines for 2015-2016 has been approved.

g. **Next Review is planned for Fall 2018.**

B. TA (Teaching assistant) Training
Most of our MS/MA Math students end up teaching at a community college or 4 year institution. Our TA’s teach Math 8 (College Algebra), Math 19 (Precalculus) and Developmental Math under the supervision or our TA supervisor and Developmental Math coordinator. Some TA’s also teach Math 71. Our TA training program is very successful. We also opened this program to credential students. But their very hectic schedule sometimes prevents them from participating in the program.

C. Course redesign for Large Lecture Math 30p and Math 31 classes
Work is underway in the development of materials to be used in these classes. A major problem with our workshops is the composition of the students in the classes – the students attend different lecture classes and are often are not studying the same material at the same time. We designed a course, Math 30PL, that is taught in large lecture format. Students taking this course are required to take the workshops which will be aligned with the course. Math 30PL will be offered for the first time in Fall 2015.

D. Developmental math
We are reviewing the developmental math curriculum.

E. MS Stat Courses
We continue to update existing courses and develop new courses to provide training to our MS stat students. These new courses give them more options when selecting electives.
F. New courses that have been approved by our department. Some of them are still waiting approval from other curriculum committees.

a. **Math 30PL – Calculus 1 with Precalculus**
   The course covers selected topics in Precalculus and introduction to Calculus, including limits, continuity, differentiation, applications and introduction to integration. Graphical, algebraic and numerical methods of solving problems will be studied. (6 units). (Note: This course is taught in large lecture format and required workshop.)

b. **MTED 184S – Math Ed Phase II Seminar**
   This seminar will support the student teaching field experience. Students will be asked to extend their pedagogical content knowledge in light of their phase II experiences and will be supported in the preparation of their Performance Assessment for California.

c. **Math 257 - Multivariate Data Analysis**
   Multivariate normal distribution, Hotelling’s T-squared distribution, data reduction techniques including principal component and factor analysis, canonical correlation analysis, discrimination and classification techniques. Intensive use of computer analysis and real data sets.

d. **Math 263, Stochastic Processes**
   Introductory course in stochastic processes and their applications. The course will cover random walks, discrete time Markov chains, the Poisson process, continuous time Markov processes, renewal theory and queuing theory.

e. **Math 264 – Bayesian Data Analysis**

f. **Math 275A Topology:**
   Topological spaces and associated concepts (e.g., subspaces, product spaces, quotient spaces); continuous functions; compactness, connectedness (including path connectedness) and their local versions; countability and separation axioms; compactifications and Tychonoff’s Theorem; paracompactness and metrization theorems.

g. **MATH 275B Advanced Topics in Topology**
   A course specializing in one or more topics from advanced topology such as homotopy and the fundamental group, homology groups of spaces, continuum theory, function spaces, metrization, dimension theory, manifolds, topological groups.