Mathematics Graduate Programs Self-Study 2016-2017

M.S. IN MATHEMATICAL SCIENCES
GRADUATE CERTIFICATE IN OPERATIONS RESEARCH
GRADUATE CERTIFICATE IN STATISTICS

Annalisa Calini and Martin Jones, Program Co-directors
Robert Mignone, Chair
Department of Mathematics
I. Introduction: Program Purpose and Goals

Our Mathematics Graduate Program was founded in 1991, a year before the formal establishment of the Graduate School at the College of Charleston. Its original mission of providing high-quality graduate education in the Mathematical Sciences to serve the local community, including the Charleston area businesses and industries, has considerably broadened due to a number of factors: the booming of high-tech industries in the area\(^1\), the increased demand for bridge programs to doctoral studies, and the rise of interdisciplinary majors and double majors at our institution.

Over the last 15 years, the early focus on traditional areas of mathematics has shifted, and a number of curricular modifications were implemented to increase the program’s reach and flexibility, the latter being one of its most distinctive features. At the same time, our program has slowly become known beyond the region, in no small part because of the remarkable research breadth and strength of our graduate faculty, of which quite a number have national and international reputations.

The recent introduction of a concentration structure, with Mathematics and Statistics Concentrations, the creation and development of an accelerated BS-MS program (4+1 program), and increased efforts to reach out to industries and recruit a wider variety of students, are beginning to pay off. With the number and quality of applicants on the upswing (not only local, but also from other states as far as California) and a dramatic rise in 4+1 students, most of them double majors, our program is showing a significant potential for growth and for attracting national recognition.

With this growth and rise in quality, come both challenges and opportunities, which we will strive to meet and seize. To this end, we have identified the following priorities for the next seven-year cycle.

**GOAL 1:** Attract top graduate students, as well as increase the size of our graduate enrollments.

**Objectives:** Secure more and larger assistantship packages. Seek additional means to support our top students, e.g. external grants, local contractual work/internships for students with interests in applied mathematics and statistics, and departmental teaching for advanced students. Secure flexible funds for stipends, travel, and research support for students, as well as for recruiting.

**GOAL 2:** Enhance the quality of educational offerings for students bound to doctoral programs.

**Objectives:** Guarantee both breadth and depth of graduate course offerings. Increase opportunities for graduate theses (including rewarding faculty supervisors). Continue our tradition of personal mentoring and supervision as the student numbers grow. Establish a strong teaching preparation tradition for our graduate students. Integrate undergraduate and graduate research, by e.g. encouraging 4+1 students to continue and expand their undergraduate research projects into M.S. theses.

**GOAL 3:** Develop deeper relationships with local businesses and industry while enhancing the educational experience of locally employed part-time students and industry-bound students.

---

\(^1\) Over 200 tech companies call the Charleston region home, including Google, Boeing, Blackbaud, BenefitFocus, and BoomTown ROI. Charleston is quickly becoming known as the *Silicon Harbor.*
**Objectives:** Find ways to increase industry buy-in: e.g. by building employee pipelines, offering flexible course delivery, and establishing consulting opportunities. Increase the number and variety of internships. Incorporate real-world problem-solving components in selected courses. Strengthen summer course offerings, in particular statistics and applied courses.

**GOAL 4:** *Develop targeted programs supporting the needs of the local community.*

**Objectives:** Create additional concentrations (e.g. Operations Research and Computational Science) and new certificate programs. Collaborate with other departments to develop new interdisciplinary programs. Continue to strengthen and expand our offerings to serve the educational and research needs of the community, including a possible doctoral program in the Mathematical Sciences.

This document supports our vision and desire to take the program to the next step of not only regional, but national prominence in its category. What follows is an in-depth discussion of the program, its constituencies and context, its current status, recent developments, and the challenges it faces moving forward.

**GOAL 5:** *Increase the investment/commitment/involvement of the Department, School and Institution in our Graduate Program, and overall increase its stature at the local, regional, and (on a longer time-scale) national level.*

**Objectives:** Communicate the strengths, distinctive features, and beneficial role of the program in a primarily undergraduate institution. Create more opportunities for interaction and exchanges between undergraduate and graduate students. Create a structure within which graduate students support and enhance the undergraduate experience.

We will refer to the various Appendices for documentation and further data.

**II. Program Structure and Program Descriptions**

The Mathematics Department offers a Master of Science in Mathematical Sciences (MASC), two Graduate Certificate Degrees in Operations Research and Statistics, and an accelerated Bachelor’s-Master’s Degree (4+1 Program) in Mathematical Sciences. Furthermore, the Mathematics Department participates in the interdisciplinary Master in Environmental Studies (MES) Program together with Biology, Geology and Environmental Geosciences, Physics and Astronomy, Political Science, and Economics, and in the Master of Education in Science Mathematics, jointly offered by the School of Sciences and Mathematics and the School of Education, Health and Human Performance. Our Department contributes core and elective coursework and faculty time.

i. **Organizational Structure**

The Master’s and Certificate Programs are housed in the Mathematics Department and are currently co-directed by Annalisa Calini and Martin Jones, who report to the Chair of the Mathematics Department, Robert Mignone, and to the Dean of the School of Science and Mathematics, Michael Auerbach.
The Mathematics graduate programs are also part of the Graduate School of the University of Charleston (USCS), established by state statute in 1992 to serve "as a research institution where the graduate and research programs associated with the College are housed. UCSC provides master’s degree programs and anticipates offering a limited number of doctoral degrees should location and need warrant.”
(from the Institutional Mission Statement, latest revision of August 25, 2014.)

Our Graduate Program has its own budget, with 4.5 Graduate Assistantship lines at $12,400 (3 program GA lines, and 1.5 provided by the Graduate School), $5,000 for Director’s salary, and about $6,700 for supplies and administration costs. The FY15 adopted budget is shown below.

| Non-Personnel Items                  | 5,699.00 |
| Chair Salary                        | 5,000.00 |
| Student Employment                  | 1,000.00 |
| Program GA/TA (3 at $12,400 each)   | 37,200.00|
| **Adopted Budget FY15**             | **48,899.00** |

| Grad School GA (1.5 at $12,400 each) | 18,600.00 |
| **FY15 Available GA/TA Funds**       | **55,800.00** |

Table 1: Mathematics Graduate Program Budget FY2015.

Budgetary decisions are usually straightforward and made by the program co-directors. Whenever additional funds are needed or an advanced student teaches a class and is to be partially supported through the adjunct budget, arrangements are made in consultation with the Chair of the Mathematics Department.

Routine curricular decisions, such as course rotation, special topics and summer course offerings, are made in consultation with the Chair of the Mathematics Department. Curricular changes are usually initiated by the program director(s) in consultation with the Graduate Steering Committee and the Chair of the Mathematics Department, and require approval at all levels, from the department to the Senate or, for substantial changes, the State Committee for Higher Education.

Prospective graduate student applications are forwarded to the Steering Committee, which recommends admissions and prioritizes graduate assistantships. The final decision is made by the program director(s).

Faculty hiring recommendations have so far been made by the Department and the Graduate Program has not played a significant role in this process.

ii. Description of the Programs

[See Appendix 2 for Mission Statements]

The Master of Science in Mathematical Sciences is designed to prepare students for careers in industry, academia or government, or for doctoral studies. It also provides people in teaching

---

2 See Appendix I for the current Organizational Chart of the Graduate School.
and other professions with the means for career advancement or career change. The newly
redesigned program consists of 30 credit hours of graduate work (including an optional 3-6
credit-hour thesis) and has two concentrations, one in Mathematics and one in Statistics. The
course requirements are designed to provide a broad training and ensure some depth in a focus
area, while maintaining flexibility. Classes are offered in late afternoon/evening and summers to
accommodate working professionals. Classes are small, providing personal attention for
students who can work closely on projects with individual faculty members.

The Graduate Certificate in Operations Research is a 15 credit-hour program that allows non-
degree students to strengthen their expertise in operations research while recognizing them
with an official certificate of their achievement. The program combines a solid theoretical
foundation with a variety of applied tools and techniques to prepare the student to handle
problems in business and industry.

The Graduate Certificate in Statistics is a 15 credit-hour program that allows non-degree
students to strengthen their expertise in applied statistics while recognizing them with an
official certificate of their achievement. The program combines a solid theoretical foundation
with a variety of applied tools and techniques to prepare the student to handle statistical
problems in business and industry.

The Combined Bachelor’s-Master’s Degree in Mathematical Sciences (4+1 Program)
is designed for outstanding and motivated mathematics majors, allowing them to
earn graduate credit during their final year of their Bachelor’s degree and earn a Master’s
degree in Mathematical Sciences in a shorter time period. Students enrolled in this program
typically complete their M.S. degree within one calendar year (and in some cases within two
academic semesters) after completing their B.S. Degree. Admission to this program is highly
selective. This program provides strong mathematics and statistics students
an excellent preparation for pursuing Ph.D. degrees in mathematics or statistics. In particular,
students involved in undergraduate research are given the opportunity to further develop their
research at the graduate level into a Master’s thesis.

III. Context

i. The Mathematics Department, its Faculty, and its Initiatives

The Department of Mathematics is a research active department with 35 faculty lines and a long
and distinguished history of faculty research productivity, extramural funding, national and
international collaboration and professional involvement. (See Appendix 6 for list of roster
faculty and their research areas). For example, this spring, the department hosted the 2017
Southeastern Sectional Meeting of the American Mathematical Society. With attendance in
excess of 500 and a national and international list of participants, it stands among the largest
gathering of mathematicians in the city and state’s 370-year history. Many of the session
organizers and presenters were members of our faculty. The Department of Mathematics
supports and is committed to both undergraduate and graduate research. With a robust
undergraduate mathematics program and a well-established graduate program, our faculty
regularly direct student research and publish original work with student coauthors. Other
The Graduate Mathematics Faculty comprises all 32 Ph.D. faculty members. However, the 3 M.S. faculty members (three senior instructors including the Director of the Math Lab tutoring center) are heavily involved in supervising and mentoring our graduate assistants. The roster faculty is composed of 19 full professors (54%), 8 associate professors (23%), 3 assistant professors (with 1 M.S. instructional faculty), and 5 instructors or senior instructors (14%). The doctoral faculty is very diverse, with a high number of females (13 of 35, or 37%), and about twice the percentage of minorities receiving terminal degrees in Mathematics and Statistics.

<table>
<thead>
<tr>
<th>CIP</th>
<th>Discipline</th>
<th>Minorities</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>IPEDS</td>
<td>CoF</td>
</tr>
<tr>
<td>11</td>
<td>Computer and Information Science and Support Services</td>
<td>12%</td>
<td>15%</td>
</tr>
<tr>
<td>26</td>
<td>Biological and Biomedical Sciences</td>
<td>18%</td>
<td>3%</td>
</tr>
<tr>
<td>27</td>
<td>Mathematics and Statistics</td>
<td>9%</td>
<td>18%</td>
</tr>
<tr>
<td>40</td>
<td>Physical Sciences</td>
<td>10%</td>
<td>14%</td>
</tr>
</tbody>
</table>

Table 2: Recent percentages of minorities and women in STEM fields.
Sources: School of Science and Mathematics 2015-2016 Annual Report and IPEDS (Integrated Postsecondary Education Data System) data.

Critical Issue: At the end of this academic year, the department will lose its 2 Ph.D. assistant professors, and become even more top-heavy. With several more people expected to retire in the next few years, faculty recruitment will be critical not only for the Department, but for the future of the Graduate Program.

Research and Scholarship. The faculty have a range of research interests broadly representative of pure and applied mathematics and statistics. Other particularly strong groups are in statistics, number theory and combinatorics, topology, algebra, and mathematical physics. The great majority of Ph.D. faculty members have active research programs, in some cases comparable to faculty at mid-level Ph.D.-granting institutions, despite the College of Charleston's higher teaching load of 9 contact hours per semester, with 156 publications in the past five-year reporting period. Many faculty members involve B.S. and M.S. students in their research. Several currently have extramural research funding, which has amounted to over $1,200,000 during the last five years. The high research quality and output is reflected in the quality of journals (including, e.g., Advances in Math., Annals of Stat., Arch. Rat. Mech., Comm. Math Phys., Comm. Pure. App. Math., Complex Networks, Geom. Dedicata, J. Algebra, J. Math. Phys., J. Nonlin. Sci., J. Number Theory, Nonlinearity, Pacific J. Math., Physics D, Phys. Rev. E., Proc. of the AMS, SIAM J. App. Math., SIAM J. Comp. Math., Trans. of the AMS.), the number of presentations (almost 300 during the reporting period) including many invited seminars and plenary talks, as well as several highly regarded books (Ivey’s Cartan for Beginners, Kasman’s Glimpses of Soliton Theory, and Langville’s Who’s #1? and Google Page Rank and Beyond.
Service. The Ph.D. faculty has been vigorously involved in serving the various research communities, with extraordinary involvement in editorial and review service (over 300 such services in the reporting period). For example, three of our faculty members have served as Program Directors at the National Science Foundation, several have served on multiple grant reviewing panels, and many have organized conferences and workshops, of which notable examples are the Southeastern Geometry Conference Series, the SEAMS Workshop Series (a.k.a. Cha-Cha Days), and various SIAM-SEAS, MAA, and AMS sectional meetings. The Department also has substantial involvement with high school education and teacher preparation, through the Teaching Track of its major (part of a certification program for future high school mathematics teachers) and involvement in the Master of Education in Science and Mathematics. This program’s intention is to strengthen and broaden the practicing teacher’s science, mathematics, and education knowledge and understanding for use in K-12 classrooms. The Department also organizes the Math Meet, an annual one-day event attended by about 1,000 high school students and teachers, a large proportion traveling from other states. The Department has been a good team player in interdisciplinary initiatives. For example, the Data Science B.S. the first such program in the U.S., is a brainchild of the Computer Science and Mathematics departments, and involves a substantial number of CS, Math, and Statistics faculty; EVSS 659 Environmental Statistics, a core course in the MES Program, is taught by our faculty, which also provides extensive statistical consulting for MES student theses. In addition, individual graduate faculty are involved in a variety of interdisciplinary collaborations; recent examples are with: the Biology and Geology departments (Jones), the Psychology and Philosophy departments (Langville), the Linguistics and Neuroscience groups (Mitchener), and the nearby Medical University of South Carolina (Jones, Kai, Li).

<table>
<thead>
<tr>
<th>Mathematics</th>
<th>Publications</th>
<th>Presentations</th>
<th>Performances</th>
<th>Contracts and Grants</th>
<th>Intellectual Property</th>
<th>Unassigned</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011-2012</td>
<td>37</td>
<td>52</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>8</td>
<td>102</td>
</tr>
<tr>
<td>2012-2013</td>
<td>24</td>
<td>60</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>13</td>
<td>102</td>
</tr>
<tr>
<td>2013-2014</td>
<td>32</td>
<td>55</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>8</td>
<td>100</td>
</tr>
<tr>
<td>2014-2015</td>
<td>32</td>
<td>69</td>
<td>1</td>
<td>7</td>
<td>0</td>
<td>16</td>
<td>125</td>
</tr>
<tr>
<td>2015-2016</td>
<td>31</td>
<td>60</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>97</td>
</tr>
</tbody>
</table>

Table 3: Mathematics Faculty Research Output 2011-2016 [See Appendix 7 for selected lists.]
Source: Faculty Activity System (Note: reporting is incomplete.)

<table>
<thead>
<tr>
<th>School of Sciences and Mathematics</th>
<th>Editorial and Review</th>
<th>Professional Service</th>
<th>Public/Community Service</th>
<th>Unassigned</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011-2012</td>
<td>68</td>
<td>7</td>
<td>4</td>
<td>0</td>
<td>79</td>
</tr>
<tr>
<td>2012-2013</td>
<td>61</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>69</td>
</tr>
<tr>
<td>2013-2014</td>
<td>62</td>
<td>9</td>
<td>6</td>
<td>0</td>
<td>77</td>
</tr>
<tr>
<td>2014-2015</td>
<td>70</td>
<td>6</td>
<td>4</td>
<td>0</td>
<td>80</td>
</tr>
<tr>
<td>2015-2016</td>
<td>64</td>
<td>10</td>
<td>7</td>
<td>0</td>
<td>81</td>
</tr>
</tbody>
</table>

Table 4: Mathematics Faculty Service Activities 2011-2016 [See Appendix 8 for complete list.]
Source: Faculty Activity System (Note: reporting is incomplete.)
Teaching. The typical teaching load is 9 contact hours per semester for tenure-track faculty, and 12 contact hours per semester for instructors. Teaching reassignments are usually given for administrative duties and occasionally to junior faculty members. Tenure-track faculty is expected to teach a mix of lower and upper level classes, including general education courses. There is a fairly heavy dependence on adjunct faculty: for example, in the current semester the Department hired 13 adjuncts, and of the 18 sections of MATH 104 Elementary Statistics (one of the most populated service courses), 10 (56%) are taught by adjunct faculty. The Mathematics faculty has one of the heaviest teaching loads in the School of Science and Mathematics because of its service component, second only to the Biology Department, which has over ten times as many majors. [See Table 5 below.]

![Table 5: Faculty Workload and Declared Majors](image)

Source: School of Science and Mathematics 2015-2016 Annual Report

Faculty Involvement in the Graduate Program. Each semester, the department offers six or seven graduate courses taught by graduate faculty as part of their 9-credit teaching assignment. (More discussion of graduate course offerings will follow in Chapter III.) Several of the core courses are cross-listed as senior UG/G-level courses, as reflected in Table 6 below. After the recent institutional revision of the combined BS/MS Programs (4+1 Programs), only 4+1 students are now approved to enroll in the graduate counterpart of the cross-listed courses, while it has become far more difficult than in the past for other undergraduate student to be granted permission to enroll in graduate courses. In spite of this, due to the sharp rise in 4+1 students, we expect a fairly steady number of undergraduate students to continue taking graduate courses.
### Table 6: FTE Credit Hour Production.

<table>
<thead>
<tr>
<th>Year</th>
<th>Department</th>
<th>Undergraduate(^3)</th>
<th>Graduate</th>
<th>Total</th>
<th>FTE CH Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>MATH</td>
<td>3</td>
<td>174</td>
<td>177</td>
<td>14.70</td>
</tr>
<tr>
<td>2012</td>
<td>MATH</td>
<td>15</td>
<td>108</td>
<td>123</td>
<td>10.00</td>
</tr>
<tr>
<td>2013</td>
<td>MATH</td>
<td>0</td>
<td>144</td>
<td>144</td>
<td>12.00</td>
</tr>
<tr>
<td>2014</td>
<td>MATH</td>
<td>9</td>
<td>153</td>
<td>162</td>
<td>13.35</td>
</tr>
<tr>
<td>2015</td>
<td>MATH</td>
<td>30</td>
<td>112</td>
<td>142</td>
<td>11.33</td>
</tr>
<tr>
<td>2016</td>
<td>MASC</td>
<td>6</td>
<td>153</td>
<td>159</td>
<td>13.15</td>
</tr>
</tbody>
</table>

\(^3\)Undergraduate students taking credit hours in graduate level courses

Other faculty involvement in the Graduate Program includes the recently established Graduate Teaching Seminar, offered on demand and directed by one of our very experienced senior instructors (most recently Sofia Agrest), as well as Special Topics courses that are offered once or twice a year (rotating amongst pure math, applied math, and statistics). Also, our faculty members have directed graduate-level Independent Studies and M.S. Theses, on top of their usual course load and at times while mentoring undergraduate students. Our instructional faculty have been involved in coordinating GA assignments, in particular tutoring hours in the Math Lab Tutoring Center, and assistance with multi-section courses such as Math 101 (College Algebra), Math 104 (Elementary Statistics), Math 111 (Pre-calculus), and Math 120 (Calculus I). In some case, our best GAs assist with critical courses for the major (one example is Math 295, Introduction to Proof). In such case, the faculty member teaching the course will be the supervisor.

**Room for Improvement:** Even though M.S. thesis supervision is counted as individual instruction, given the already heavy teaching load and the effort involved in directing theses, some form of reward should be put in place, in particular now that the increase in 4+1 student is likely to lead to more students selecting the thesis option.

Since 2010, the following M.S. Theses have been completed:

2010
*Dynamics of nearly circular vortex filaments*, Sybil Prince Nelson
Advisor: Annalisa Calini

*Intelligent selection of new data for ranking algorithms*, Kirk A. Boyer
Advisor: Amy Langville

2011
*Minimum Violation Rankings*, Kathryn Pedings
Advisor: Amy Langville

*On the conserved quantities of the Vortex Filament Equation*, Elena Fenici
Advisors: Annalisa Calini and Stephane Lafortune

2012
*Modeling fluctuations in a hospital’s census*, Darby J. Smith
Advisor: Gary Harrison (now emeritus)

2014

_Bounded operators on a Hilbert space with finite z-grading,_ Robert R. Vandermolen
Advisor: Oleg Smirnov

2015

_Bounded operators on a Hilbert space with finite z-grading,_ Phillip Staley
Advisor: Annalisa Calini

_Pants decompositions of surfaces,_ Joseph M. Randich
Advisor: Andrew Przeworski

IV. The Graduate Program: A Closer Look

i. Main features

The enrollments in our program have been steady since inception, with a mix of full-time students, usually enrolled in 2-3 courses per semester, and part-time students who have full-time jobs and take 1-2 courses per semester [See Table 7]. Our program is structured in a flexible manner with interconnected directions:

1. It offers workers from local businesses and local schools and colleges, ways to further their mathematical training and advance in their careers, and supplies local businesses, schools and colleges with highly skilled employees.
2. It acts as a bridge program that provides rigorous core training for those students transitioning to doctoral programs in the mathematical sciences as well as in other scientific and technical fields.
3. It provides our top undergraduate students with an accelerated path to advanced mathematics training, and a strong preparation for teaching careers, jobs in business and industry, or doctoral studies.

To accommodate working professionals, graduate classes are offered late afternoons and evenings twice a week (the earliest time-slot is 4:00-5:15pm and the latest 7:00-8:15pm). During summers, we offer 1-2 graduate courses, recently the focus of the summer courses has been on Statistics.

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Degree</th>
<th>Major</th>
<th>Sex</th>
<th>Enrollment Status</th>
<th>Total Enrollment</th>
<th>Average Age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Male</td>
<td>Full-time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>MS</td>
<td>MATH</td>
<td>13</td>
<td>8</td>
<td>21</td>
<td>27.81</td>
</tr>
<tr>
<td>2012</td>
<td>MS</td>
<td>MATH</td>
<td>8</td>
<td>4</td>
<td>12</td>
<td>30.33</td>
</tr>
<tr>
<td>2013</td>
<td>MS</td>
<td>MATH</td>
<td>17</td>
<td>2</td>
<td>19</td>
<td>25.21</td>
</tr>
<tr>
<td>2014</td>
<td>MS</td>
<td>MATH</td>
<td>16</td>
<td>3</td>
<td>19</td>
<td>22.21</td>
</tr>
<tr>
<td>2015</td>
<td>MS</td>
<td>MATH</td>
<td>10</td>
<td>5</td>
<td>15</td>
<td>22.40</td>
</tr>
<tr>
<td>2016</td>
<td>MS</td>
<td>MASC</td>
<td>14</td>
<td>6</td>
<td>20</td>
<td>25.65</td>
</tr>
</tbody>
</table>

*Table 7: MS Program Headcount Enrollments.*
Source: Institutional Research.
Since inception, the graduate program has enhanced and supported the undergraduate program by providing more upper level courses; by guaranteeing offerings of cross-listed courses (especially in recent times as the minimum enrollment caps have been enforced more strongly); by attracting stronger faculty (by the possibility of teaching graduate-level courses) and stronger students (by the number and breadth of upper level course offerings); and by creating more opportunities for integrated student research teams. Moreover, the mix of our own CoFC students and those coming from the local workforce has helped many of our students establish relationships with employers and finding good jobs in the region.

ii. Curriculum
The program was recently restructured in two concentrations: Mathematics and Statistics and requires 30 credit hours of course work or course work plus thesis options (up to 6 credits of thesis). It has one core course Math 502, Advanced Linear Algebra (3), offered each Fall and required for both concentrations, and a set of six course courses, three mathematics and three statistics courses,

MATH 503 Applied Algebra I (3) (Spring)
MATH 511 Real Analysis I (3) (Fall)
MATH 515 Complex Analysis (3) (Spring)
MATH 530 Mathematical Statistics I (3) (Fall)
MATH 550 Linear Models (3) (Fall)
MATH 555 Bayesian Statistical Methods (3) (Spring)

out of which students are required to select three. Although usually students in the mathematics concentration will select the top three, and students in the statistics concentration will select the bottom three, a few will “mix and match” courses, especially students interested in Applied Mathematics. The newly restructured program has also a 2-sequence requirement to ensure depth, and a one-course requirement from restricted sets to enhance focus. The remaining 9 credits are electives and may include up to 6 credit hours of thesis work. [See Appendix 3 for the full course list and offering frequencies].

Critical Issue: With a small program of 20-25 students, and recent stricter enforcement of minimum enrollment caps of 8, many of second semester and more specialized courses are rarely offered (e.g. the second semester of applied algebra, numerical analysis, and partial differential equations; and courses such as dynamical systems and discrete mathematics).

Room for Improvement: Math 601, Topology, has experience a bit of a renaissance thanks for Andrew Przeworski’s popularity. Since we have an almost never offered undergraduate topology course (Math 401) and since top undergraduates have been requesting this course, we are looking into creating a cross-listed pair Math 401/Math 501 and possibly revise the Mathematics Concentration requirements to include such Topology course.

Critical Issue: Summer courses have been offered regularly, for example in Summer 2016 we offered Math 561 Time Series Analysis, and Math 589 ST: Resampling Methods, and this summer we will offer Math 560 Stochastic Processes. The minimum enrollment cap of 8 for summer courses has been particularly detrimental, since the faculty teaching the course will only be paid a pro-rated “per student” salary if the cap is not met. Given the intense summer schedule and the level of preparation, it has been difficult for us to find willing faculty to teach
these courses and even more challenging to guarantee that the courses will be offered early enough for working students to be able to plan ahead when considering enrollment. Reduction of the minimum cap rule for graduate courses that benefit professionals (paying full tuition) and that are necessary for our current student to graduate (many complete the program with a summer course) would resolve this issue and remove one small, but significant hurdle to growing program enrollments, in particular to attracting more local working students.

iii. Recent Curricular Improvements

As mentioned above, the program underwent significant restructuring during the past several years, with implementation a new concentration structure and various curricular improvements.

Why a Statistics Concentration? The modifications were in great part prompted by the rapid change in the economic outlook of the Charleston area, with Boeing opening the first of its three facilities near the Airport (15 minutes from Downtown) in 2011 and establishing the Boeing Research & Technology Center in 2014, with Volvo opening its first American factory in Berkeley County shortly after, and with many tech company and start-ups moving to the area. At this time, over 200 tech companies call the Charleston region home, including Google, Boeing, Blackbaud, BenefitFocus, and BoomTown ROI, many of which seek consulting advice from the Computer Science and Mathematics departments. Charleston is quickly becoming known as the Silicon Harbor. On the other hand, Charleston remains one of the very few metropolitan areas of its size without comprehensive doctoral-level offerings (Charleston was one of five such cities back in 2003, when we carried out study of the viability of our Graduate Program), in spite of increasing need in a variety of STEM fields, from biology and biotech, to engineering, statistics, operations research, and data science.

To meet the Statistics needs of both the Mathematics undergraduate and graduate programs, as well as of the Data Science B.S., the Mathematics Department hired several Ph.D. statisticians (Kai, Li, and Park) as well as several faculty members in more applied areas (Howell, Mitchener, and Webster), and began to offer a significant number of statistics courses. By 2012, about half of our graduate students were selecting the majority of their coursework in statistics. Reacting to this, we wrote a proposal to introduce concentrations (including, in particular, a Statistics Concentration) and guided it through the institutional and State-level approval process. The restructured and renamed Master of Science in Mathematical Sciences came into effect Fall 2016. Further reasons for the restructuring include: being able to attract students from other quantitative fields such as economics, engineering and finance, and opening up the possibility to introduce additional concentrations such as Operations Research and Computational Science. We believe that, with such changes, the program has become stronger and more flexible, and better equipped for serving the higher-education demand in our rapidly changing landscape.

The 4+1 Program. In 2011 Ben Cox, the previous Program Director, carried through approval a combined BS/MS option, a highly selective program that provides our top mathematics majors with an accelerated way to earn a Master's degree in five years, with one additional year of graduate coursework beyond the Bachelor's degree. [See Appendix 4]. The program received a facelift in Spring 2015 and we have been aggressively advertising it to our best students. The results have been dramatic: while our first four 4+1 students will graduate this spring (May 2017) with MS degrees and perfect GPA, and four are currently in the 4+1 program, 10 top undergraduates are applying for entrance to the 4+1 program over the next 2 semesters. These are outstanding students, most of them double majors, very ambitious, and want to continue
their undergraduate research. Many plan to continue on to top-notch Ph.D. programs (several in other fields than Math, including engineering, physics, biochemistry, data science, and statistics.)

**Critical Issue:** With the good news, we are heading towards a crisis. With only 4.5 graduate assistantship lines assigned to our program, we will become unable to provide support to most of our 4+1 students, who are typically academically stronger than students coming to the program from elsewhere. We will keep working with the Mathematics Department Chair to provide teaching opportunities in their last semester (thus using some adjunct funding) and we will keep seeking internship opportunities. However, these are likely to come short of demand.

**Opportunity/Issue:** We also expect increased demand for individual/team research supervision, in some cases interdisciplinary with 4+1 students continuing and expanding undergraduate research (including Honor’s Bachelor Essays, Senior Theses, senior and summer research projects). This is exciting, but may lead to uneven workloads down the road. This is something we need to watch out for and for which we need to find incentives to promote even broader involvement of faculty in student research supervision.

**The Teaching Seminar.** In 2015, in response to a request by some of the teaching graduate students for more formal teaching training, we established a new Graduate Teaching Seminar course, Math 690 [See Appendix 5 for a Syllabus]. This seminar course helps prepare graduate students for TA positions in graduate school (including our own program), and for teaching careers in high school and 2- and 4-year colleges. The seminar was developed by Kate Owen and Ms. Sofia Agrest, and has been directed by Agrest. Four students have so far completed the seminar and developed very good teaching portfolios. One of them is Erin Hausmann, who has been accepted into the Mathematics PhD program at the University of Oklahoma: not only did she greatly develop her teaching skills and a far better understanding of pedagogical aspects of teaching entry-level mathematics, but her graduate school application was significantly strengthened by this seminar. Another example is Lauren Tubbs, who after graduation has become a well-regarded lecturer in our department and at the local Trident Technical College. **Issue:** Math 690 credits do not count towards the 30-credit requirement for the MS program, although this course is required for students who want to teach a course in our department. Incentives to alleviate the extra financial burden should be put in place.

iv. Students

**Enrollments.** Our enrollments in the MS Program have been fairly steady since inception at about 20 students. This is not out of line with other similar (and often better supported) programs at master-only institutions including aspiring peers. For example, in Fall 2016 the Mathematics MS Program at Miami, OH enrolled 18 students, and that at Appalachian State had an enrollment of 15, while Wake Forest, offering very attractive assistantships and tuition packages, in spite its geographical isolation, has an enrollment of 47. **Tables 8, 9 show total enrollments and number of applications and acceptances for Fall 2011-Fall 2016, and Table 10 shows the degree awarded from AY11-12 through AY15-16, for all programs.**

**Note:** At this time, the number of MS applications for Fall 2017 is 14, with a few more expected.

---

3 Source: American Mathematical Society searchable database: [http://www.ams.org/programs/students/findgradprograms/findgradprograms](http://www.ams.org/programs/students/findgradprograms/findgradprograms)

4 Source: [https://public.tableau.com/views/ASUHeadcount_dup_2017/Overview?:embed=y&:display_count=no&:showVizHome=no](https://public.tableau.com/views/ASUHeadcount_dup_2017/Overview?:embed=y&:display_count=no&:showVizHome=no)
We graduated 1 student in Summer 2016 and in AY16-17 we will graduate 10 students.

### Total Enrollments - Fall 2011 through Fall 2016

<table>
<thead>
<tr>
<th></th>
<th>Fall 2011</th>
<th>Fall 2012</th>
<th>Fall 2013</th>
<th>Fall 2014</th>
<th>Fall 2015</th>
<th>Fall 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS</td>
<td>21</td>
<td>12</td>
<td>19</td>
<td>19</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>CERT</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CERT</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>NDG</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 8: Headcount Enrollments for all program and non-degree students. Source: Institutional Research.

### Applications, Acceptance & Enrollments

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Degree</th>
<th>Major</th>
<th>Applied</th>
<th>Accepted</th>
<th>Enrolled</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>MS</td>
<td>MATH</td>
<td>15</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>CERT</td>
<td>MATH</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>CERT</td>
<td>MOPR</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>NDG</td>
<td>MATH</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2012</td>
<td>MS</td>
<td>MATH</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>CERT</td>
<td>MATH</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>CERT</td>
<td>MOPR</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>NDG</td>
<td>MATH</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2013</td>
<td>MS</td>
<td>MATH</td>
<td>16</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>CERT</td>
<td>MATH</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>CERT</td>
<td>MOPR</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>NDG</td>
<td>MATH</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2014</td>
<td>MS</td>
<td>MATH</td>
<td>11</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>CERT</td>
<td>MATH</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>CERT</td>
<td>MOPR</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>NDG</td>
<td>MATH</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2015</td>
<td>MS</td>
<td>MATH</td>
<td>9</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>CERT</td>
<td>MATH</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>CERT</td>
<td>MOPR</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>NDG</td>
<td>MATH</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2016</td>
<td>MS</td>
<td>MASC</td>
<td>14</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>CERT</td>
<td>MATH</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>CERT</td>
<td>MOPR</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>NDG</td>
<td>MATH</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 9: Applications, acceptances, and enrollments for all program and non-degree students. Source: Institutional Research

### Degrees Awarded - College Academic Year: 2011-12 through 2015-16

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MS</td>
<td>MATH</td>
<td>8</td>
<td>9</td>
<td>7</td>
<td>10</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 10: Degree awarded for the MS Program. Source: Institutional Research
Room for improvement: Although the MS program’s enrollments have been steady and show promise for growth, and many of our degree-seeking students earn a certificate along the way, non-degree enrollments in the Certificate programs are very small. More efforts to advertise the graduate certificates to the local community may help.

Graduate Student Profile. We refer to Table 7 for data gender, enrollment, status, and average age of our student’s body for Fall 2011-2016, and to Table 11 below for race and citizenship information.

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Degree</th>
<th>Major</th>
<th>White</th>
<th>URM¹</th>
<th>Other²</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>MS</td>
<td>MATH</td>
<td>17</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2012</td>
<td>MS</td>
<td>MATH</td>
<td>11</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>MS</td>
<td>MATH</td>
<td>16</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>MS</td>
<td>MATH</td>
<td>17</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>MS</td>
<td>MATH</td>
<td>14</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>MS</td>
<td>MASC</td>
<td>19</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

¹ URM includes American Indian/Alaskan, Asian, African American, Native Hawaiian/Pacific Islander, Hispanic and Two or more races. ² Other include Non-Resident Alien and Unknown.

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Degree</th>
<th>Major</th>
<th>US</th>
<th>NO</th>
<th>PR</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>MS</td>
<td>MATH</td>
<td>18</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2012</td>
<td>MS</td>
<td>MATH</td>
<td>11</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>MS</td>
<td>MATH</td>
<td>18</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>MS</td>
<td>MATH</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>MS</td>
<td>MATH</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>MS</td>
<td>MASC</td>
<td>19</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

US - United State Citizenship, NO – Non-Resident Alien, PR - Permanent resident.

Table 11: Federal Race and Citizen Information.
Source: Institutional Research

Room for improvement: We would like to have a more diverse student body. Recruitment of underrepresented minorities and foreign students relies on institutional commitment. There is not much we can do without sustained funding, in particular to attract more out-of-state students; although we expect some improvement as we cast a broader net. We also have an opportunity to increase the number of female students (an average of 36% of the degree-seeking students during the 2011-2016 period), since the four current 4+1 students are all females, and the group of aspiring 4+1 students comprises 5 males and 5 females. We expect this will become a typical balance, since CofC has many female students and their number in STEM fields is increasing.

Financial Support. As mentioned in Section II-i, our Graduate Program is assigned 4.5 Graduate Assistantship lines at $12,400 (3 program GA lines, and 1.5 provided by the Graduate School), so many students must pay their way or seek other sources of support of financial aid [See Table
Part-time students coming from the local workforce are often supported by their employers through various levels of tuition assistance. Our full-time graduate assistant work 20hrs/week for about 15 weeks helping with entry-level mathematics courses, and in some case with critical mathematics major courses. They usually hold office hours, recitations, and study sessions, and spend a number of hours tutoring in the Math Lab (located in the Library, at the Center for Student Learning). Recently we have employed GAs to help with self-paced Alek-based Math 101 sections, and this has been very successful. Teaching assistants receive a slightly higher compensation for teaching a class, and still tutor (usually 4hrs/week) in the Math Lab.

**Room for improvement:** GA workloads have not been uniform, depending on which multi-session courses they are assigned to. Also, some GA’s are far more popular with students than others, so participation in their office hours differs greatly, and may lead to overwork. We need improved supervision and monitoring to avoid inequities in workloads.

**Critical Issue:** Supporting full-time students has been a long-standing critical issue and will be exacerbated by more top students coming to the program, especially those completing the 4+1 program. In addition, by State rule, graduate students are allowed to teach once they completed 18 credit-hours of graduate work, so only students in their last semester (assuming a full-time status of 3 courses per semester) are eligible to teach. Even for those students, securing classes to teach has been challenging as our Department Chair must guarantee classes to teach for our best adjunct faculty, who are not easy to keep. There are also very few scholarships available, although a significant number of Graduate Scholar Awards, remitting the out-of-state portion of the tuition, has been generously made available. Also, our assistantship packages are not competitive (for example, Miami, OH offers TAs with full tuition waivers, while Wake Forest offers housing subsidies in addition). A graduate assistant enrolled full-time (9 credit hours per semester) pays over $9,000 per academic year for in-state tuition (currently set at $522/credit hour), leaving only about $3,000 for living expenses. **Lack of funding has been the single biggest factor in stunting the growth of our program.** For example, of our 9 current out-of-state applicants, many of whom have shown an eager interest to join the program through personal communication, we will probably lose most to better financial offers from less desirable/suitable programs.

<table>
<thead>
<tr>
<th></th>
<th>Financial Aid - Percent of Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fall Semester</td>
</tr>
<tr>
<td>2011</td>
<td>MS</td>
</tr>
<tr>
<td>2012</td>
<td>MS</td>
</tr>
<tr>
<td>2013</td>
<td>MS</td>
</tr>
<tr>
<td>2014</td>
<td>MS</td>
</tr>
<tr>
<td>2015</td>
<td>MS</td>
</tr>
<tr>
<td>2016</td>
<td>MS</td>
</tr>
</tbody>
</table>

Table 12: Financial Aid Information.
Source: Institutional Research

**Student Placement.** Our graduates find jobs or advance in their careers very quickly upon graduation, or get accepted to good doctoral programs. Our graduates are employed in local companies (e.g., Arxis Capital Group LLC, Automated Trading Desk, Benefit Focus, Boeing, Hawkes Leaning Systems, SAIC, SPAWAR), in research institutes and companies in other states (e.g., Image

---

Insight, MatLab, MedSolutions, SAS), and in school, community colleges and universities. A few recent examples include:

- **Michael Hooi** (MS17) career advancement at Automated Trading Desk.
- **Kaitlyn Manley** (MS17) Mathematics Faculty at St. Thomas School, Pikesville, MD.
- **Casey Grimes** (MS16) hired at Booz Allen Hamilton in Arlington, VA.
- **Khylee Habermas** (MS16) SPAWAR.
- **Daniel Imholz** (MS16) Senior Analyst at Kroll Bond Rating Agency, Inc.
- **Michael Delvecchio** (MS16) Mathematics Instructor. Francis Marion University.
- **Stephanie Bradley** (MS15). Project manager at Tempur Sealy International, NY.
- **Mark Christian** (MS15) Career switch: from high school teaching to statistician at Benefit Focus.
- **Drew Passarello** (MS15) Instructor at Trident Technical College.
- **Lauren Schonheit** (MS12) Principal Student Information Analysts, NC State University.
- **Kathryn Pedings** (MS12) STEM Outreach Instructor and Program Coordinator. South Carolina Governor’s School for Science and Math.
- **Elena Fenici** (MS11) Assistant Professor, Rhodes State College. OH.

The students who continue onto Ph.D. programs find our program to be offer a solid preparation for doctoral studies. A few recent examples follow below:

- **J Truver** (MS17) Statistics, Duke University.
- **Erin Hausmann** (MS16) Mathematics, University of Oklahoma.
- **Wright Shamp** (MS15) Statistics, Florida State.
- **Bryce Pruitt** (MS15) Mathematical Sciences, Clemson University.
- **Joey Randich** (MS15) Mathematics, University of Oklahoma.
- **Fill Staley** (MS15) Mathematics. University of Oregon.
- **Thad Sulek** (MS15) Statistics, University of Georgia.
- **Robert Vandermolen** (MS14) Mathematics, University of South Carolina.
- **Sybil Nelson** (MS10) Biostatistics, Medical University of South Carolina.
- **Delia Voronca** (MS10) Biostatistics, Medical University of South Carolina.

v. **Programmatic Climate and Facilities**

Our graduate students form a fairly cohesive group, and the three cohorts (part-time students, former CofC undergraduates, and full-time students coming from elsewhere) interact well, in part due to the close interactions with faculty, a tradition that we carry over from the undergraduate program. Moreover, the 4+1 Program fosters rapport between graduate students and undergraduates and has help increase the quality of students in graduate courses. We have a Graduate Student Office equipped with computers next to the Department Office: it is accessible by a keypad lock after hours and students are allowed to use it at any time. The program directors keep a close eye on students to make they are successful and manage their time well. We a good track record at coaching at-risk students: from students with personal/health issues or learning disabilities to students with weak or limited mathematical backgrounds, and to those who are juggling graduate studies with full-time jobs and often family lives. We have also been successful at accommodating students who cannot be on campus all
the time, through helping them complete a class long-distance to offering classes in hybrid format during the summer.

During the past two years, we have organized more social activities, including pizza parties each semester. We have been also encouraging students to attend seminars and the weekly departmental colloquia, that include many talks that are applied and accessible to students and are occasionally followed by a Happy Hour. Also, several graduate students have been involved in the annual Math Meet.

Program directors work with students to find funding opportunities on and off campus, and our dedication to helping students succeed beyond graduation has been one of the strengths of the program, and students clearly appreciate this. To enhance these efforts, in 2015 we held our first Industry Open House, a very successful event leading to the establishment of an Industry Advisory Board. (Among the Board members, several are graduates from our program). This has increased the number of internships and jobs from students and graduates.

Graduate students have access to all campus facilities as well as the various clubs. There is a Graduate Student Association, but the fact that our full-time students only remain in our program only 2-3 semesters, and part-time students have full-time jobs and personal lives, has made it difficult for our students to be part of the larger graduate student community at CoC.

**Room for improvement:** We would like to further increase cohesiveness, social activities, and participation in departmental and college-wide events. Very few students attend the weekly colloquium, except when we organize Happy Hours and this has not been sufficiently consistent. The weekly colloquium schedule (3PM Friday) is not ideal. We need to be more systematic in organizing and better advertising welcome events for new graduate students and celebrations for graduating students. Being two very busy program co-directors, we will need to delegate some of this to members of our Program Steering Committee.

**Room for improvement:** In Summer 2016, two statistics courses were offered in hybrid format at the Harbor Walk location (where the CS department is currently housed), which has facilities for capturing and broadcasting lectures. Better facilities, such as the sophisticated distance learning equipment available at the North Campus (too far for our 4+1 students and Downtown students) and at the School of Business are needed to make such hybrid courses truly successful. This is a critical issue for Summer courses if we aim at attracting more working students, who may not be able to attend each class in person.

**Room for improvement:** At the institutional level, graduate students often feel like second-class citizens. For example, there are substantial funds available for undergraduate research, as opposed to minimal availability of funding for graduate research, even when graduate students work with undergraduates, unless the faculty member can support them through a research grant, support. Also, there is a limited number of study areas dedicated to graduate students on campus, and not all programs have a graduate student office. Except for the Graduate Students Association and the Graduate School, both organizing many targeted social events, graduate students are frequently not included or well informed about campus community events.

vi. **Program Assessment.**

Yearly program assessment is conducted following the guidelines of the Office of Institutional Effectiveness and Strategic Planning. See Appendix 9 for Program Assessment documents including Student Learning Outcomes (SLOs), Measures, and Rubrics for our three programs. Having formalized the assessment process only recently, the data so far collected do not yield much information other than no noticeable shortcomings in meeting the various SLOs.
As our program is relatively small, we prefer to assess it more informally and holistically, by talking to students and faculty, examining the course offerings and their contents, and periodically reviewing the curriculum. We often discuss possible changes and needed improvements with the various constituencies. In particular, we have mid-year meetings with each student as well as exit interviews (that were originally conducted by the program directors, but are now administered by the Graduate School), as well as periodic meetings with our Program Steering Committee. These practices have led to many of the recent changes and continuously inform our strategies for the future, described in the next section.

vii. Trends and Challenges

The recently implemented changes to the program have been directed to: enlarge the pool of students who can benefit from our program (statistics concentration, more flexible curriculum, 4+1 program); enhance the educational experience of our students (additional projects, internships and thesis opportunities, additional courses, especially in statistics, and overall rise in academic level related to 4+1 student infusion); seed interdisciplinary collaborations (statistics concentration, embedding projects in applied courses, and collaboration with other departments); and develop additional programs (concentration structure, broader contacts with the community).

The immediate consequences and related challenges are:

a. The Statistics Concentration is attracting students, several of them local. These local students usually pay full tuition, but need flexibility in scheduling and flexible class delivery.

b. The number of 4+1 students is rapidly increasing. These outstanding and ambitious students, most of them double majors, typically aim at expanding their undergraduate research projects during their graduate program year. Many aim at entering top-notch Ph.D. programs. This creates more need for research and thesis advisors, and possibly for additional advanced graduate course offerings. Moreover, finding ways of partially supporting these students (e.g. will the program be given access to the increased tuition revenue to offer more support to students?) will become critical, and this may create both opportunities and challenges for staffing sections of 100-level courses typically assigned to adjunct faculty. (Communication and coordination with the Mathematics Department Chair on this matter will be essential.)

c. The number and quality of out-of-state students has also been on the rise. Our program is becoming visible at the national level, this year we have applicants from NY, NJ, CA, NC, and TN. Some of them are outstanding (with GPA of 3.7 and above). The main attractions are: flexibility (in comparison with other stand-alone M.S, programs and certainly as compared to the first 2 years of a Ph.D. program), the Statistics Concentration, the wide variety of research areas of our faculty, and the small class sizes and the student-centered environment. Many of these students come from smaller colleges or need more personal attention: they see the value of our program as a bridge to doctoral programs or to good careers in industry and education.

Issue: Additional support for top out-of-state students is critical and will pay off in several ways: as the program becomes academically stronger and gains more reputation, we expect more local/regional applicants (as our program will become a better option than online programs at top institutions), but also an increased number of
strong undergraduates, attracted by the graduate offerings, and the 4+1 program. In the words of one of our top out-of-state applicants (from a small private college in NY State, Statistics Concentration, GPA: 3.94), who at the time this report is being written is still considering coming here, *I definitely have some tough decisions to make after visiting Charleston. It's definitely going to come down to where I want to go vs. the smart place to go, since Stony Brook is waiving my tuition.*

V. Conclusions

Our program has grown significantly in quality and stature within the Mathematics Department, the Institution, and our region, due to the improvements and modifications implemented over the last decade, and to the dedication of many of our faculty members, in spite of the nearly flat levels of institutional support. The supportive role played by the graduate program in our department has only grown stronger, through enhancing the quality of undergraduate education, guaranteeing many upper-level course offerings, attracting strong undergraduates from mathematics and other sciences, and helping recruit faculty with vigorous research programs. The various generations of program directors have operated on the conviction that a primary focus on undergraduate education is not in contradiction with cultivating healthy graduate programs, and that excellence in both programs can be achieved through careful allocation of resources, and through finding ways to make the two programs work in synergy.

We end with some additional comments and possible strategies regarding the goals and objectives for the next seven-year assessment cycle.

GOAL 1: Attract top graduate students, as well as increase the size of our graduate enrollments.

Objectives: Secure more and larger assistantship packages. Seek additional means to support our top students, e.g. external grants, local contractual work/internships for students with interests in applied mathematics and statistics, and departmental teaching for advanced students. Secure flexible funds for stipends, travel, and research support for students, as well as for recruiting.

Comment. A target size of 30-40 students, while maintaining or enhancing quality, would not only lead to a more vibrant and sustainable graduate program, but also to robust course offerings, including more advanced courses. Based on the interests of recent graduate student cohorts and applicants, and considering the current state of employment in the region for statistically-trained graduates, the statistics concentration has the potential to attract roughly double the number of students as does the mathematics concentration. Students from outside the region must be recruited by offering competitive assistantship or financial supports packages.

Strategy 1. This past year, we have been working with Marketing and have joined forces with the Computer Science Department on marketing and recruitment efforts. This semester we had a rare opportunity to hire a graduate assistant to help with marketing efforts such as building a social media presence, and creating more advertising materials.
Challenge: Lack of dedicated administrative support (the Program does not have an administrative assistant and the Mathematics Department is severely short-staffed) has been the main obstacle to timely implementation of many such initiatives.

Strategy 2. We will continue to capitalize on our department research strengths to attract students seeking a bridge to a Ph.D. programs. In particular, we will advertise our program personally to colleagues and research collaborators at other institutions.

Strategy 3. External faculty research grants (mostly from the NSF) have given us additional means of support for our top students, and we have been making inroads with local businesses to obtain contractual work for students with interests in applied mathematics and statistics.

Strategy 4. As the program grows, we also hope to convince the administration to provide the program with a share of the increased tuition revenue.

Comment. However, a short-term institutional investment to spur growth (in particular in the Statistics Concentration) would likely result in longer terms gains, including establishing CofC as a game-player in graduate education within the local community before other institutions move to the area with satellite programs (this has already been happening).

GOAL 2: Enhance the quality of educational offerings for students bound to doctoral programs.

Objectives: Guarantee both breadth and depth of graduate course offerings. Increase opportunities for graduate theses (including rewarding faculty supervisors). Continue our tradition of personal mentoring and supervision as the student numbers grow. Establish a strong teaching preparation tradition for our graduate students. Integrate undergraduate and graduate research, by e.g. encouraging 4+1 students to continue and expand their undergraduate research projects into M.S. theses.

Strategy 1. Early coordination among undergraduates interested in the 4+1 program, their research supervisors and potential mathematics advisors (if the former are in other departments) will lead to easier transition from undergraduate research to master’s level projects. This is critical, since 4+1 students only stay at CofC an extra year.

Challenges: In collaboration with the Chair of the Mathematics Department, we must find ways to incorporate thesis supervision into faculty workload, and ensure some compensation.

Strategy 3. We will seek incentives for students to take the Graduate Teaching Seminar, perhaps in the form of small grants (possibly seeking educational industry/private sponsorship). We will continue to work with our instructors and faculty supervisors to provide strong teaching mentorship.
**GOAL 3:** Develop deeper relationships with local businesses and industry while enhancing the educational experience of locally employed part-time students and industry-bound students.

**Objectives:** Find ways to increase industry buy-in: e.g. by building employee pipelines, offering flexible course delivery, and establishing consulting opportunities. Increase the number and variety of internships. Incorporate real-world problem-solving components in selected courses. Strengthen summer course offerings, in particular statistics and applied courses.

**Strategy 1.** We will strengthen communication with alumni working in local industries. We have already taken steps in this direction by forming an Industry Advisory Board, and by increasing the program’s social media presence (on Facebook and Linkedin). We plan to organize another Industry Open House and make it a more regular event.

**Strategy 2.** We plan to increase course offerings in hybrid-format (video captured classes allowing a choice of face-to-face or distance learning).

**Challenges:** As we need to offer the face-to-face classes Downtown (or else we’ll lose our 4+1 and full-time students), more sophisticated equipment (of the kind used at the Lowcountry Graduate Center, North Campus) is needed for successful video delivery and video capture. This might be a good opportunity for seeking industry sponsorship.

**Strategy 3.** We will explore ways to develop a statistics/operations research consulting laboratory that would provide expertise to both industries in the area and the college academic community.

**Comment:** Many graduate students in the environmental science and marine biology programs need statistical support for their thesis projects. With business and industry sponsorship, a consulting lab would help support students in applied mathematics and in the statistics concentration. It would also be a source of projects as well as expert advice for several applied and statistics courses. We would like the lab to be staffed by a small team of graduate assistants in the Statistics concentration or with applied math focus entirely dedicated to problem solving, creating instructional modules, or writing programs for class demonstrations.

**Challenges:** We will need to carefully research flexible alternatives to traditional consulting labs: such as replacing a fee structure with upfront sponsorship, and contracts with internships/externships. Staffing the lab will require substantial infusion of funds, so this will be a major issue to resolve.
**GOAL 4:** Develop targeted programs supporting the needs of the local community.

**Objectives:** Create additional concentrations (e.g. Operations Research and Computational Science) and new certificate programs. Collaborate with other departments to develop new interdisciplinary programs. Continue to strengthen and expand our offerings to serve the educational and research needs of the community.

**Strategy 1.** Increase communication with local industries, as well as with nearby K-12 schools and 2- and 4-year colleges to monitor increase in demand in additional areas of the Mathematical Sciences.

**Strategy 2.** Continue to collaborate with other departments to seek other ways of expanding graduate-level offerings or programs (e.g. Data Science and Financial Mathematics.)

**Comment:** We have been collaborating with the Computer Science Department on the development of a graduate program in Data Science, currently going through the institutional approval process.

**Comment:** A number of mathematics faculty members have repeatedly expressed interest in offering a small doctoral program in the Mathematical Sciences. Now that institutional Mission has been revised to include targeted doctoral programs, one of the major hurdles has been removed. As several have been involved in supervision of doctoral students at other institution, and breadth and depth of research achievements of our faculty compare well with mathematics departments offering doctoral programs, and given the current economic outlook of the region, this is a reasonable aspiration.

**Challenges/Opportunities:** Other universities (including, e.g. Clemson) are in the process of establishing graduate programs in the area. Does this open up avenues for collaboration or should our program move ahead with the planning of a Mathematical Sciences Ph.D. program? Although we do not believe that we need a larger M.S. program in order move to the next level, we must achieve financial stability before taking further steps. Moreover, not all mathematics faculty support a doctoral program, fearing drain of already scarce resources, however, a small “UK-style” program (based on research and independent study rather than on heavy coursework) would likely be sustainable and further enhancing the educational experience of our undergraduates.
GOAL 5: Increase the investment/commitment/involvement of the Department, School and Institution in our Graduate Program, and overall increase its stature at the local, regional, and (on a longer time-scale) national level.

Objectives: Communicate the strengths, distinctive features, and beneficial role of the program in a primarily undergraduate institution. Create more opportunities for interaction and exchanges between undergraduate and graduate students. Create a structure within which graduate students support and enhance the undergraduate experience.

Strategy 1. We will organize more regular program events inviting students, and faculty from ours and other departments.

Challenge: The level of participation level of our graduate students in campus-wide events (such as the Graduate Poster Session and the 3MT Competition) has been low and uneven. We will actively encourage students to participate and help them with preparation.

Strategy 2. We will continue to capitalize on the 4+1 program as a means to establish stronger ties between undergraduate programs (in math and in the sciences) and our graduate program.

Strategy 3. Together with the Chair of the Mathematics Department, we will establish a more formal pipeline of our advanced students into the adjunct pool, and secure a guaranteed number of teaching assignments each semester.

Challenge: Our graduate students rarely attend conferences to present their research or to network with other students and faculty. If they did, this would also help our program’s visibility. We will keep advocating the establishment of a more substantial research and travel funding for graduate students.
Appendices

The Graduate School

Director
Susan Pilatti, Graduate Admissions
Student Services Program Coordinator II, CB70/010
Kathy Olejniczak, Student Records
Student Service Manager, CB70/011
Cory Mcbry, Information & Recruitment
Public Information Dir, BC30/0016

Graduate Assistants (2)

Graduate Program Directors
Roger Daniels
Accountancy - MS

Karen Chandler
Arts Management Graduate Certificate

Mark Witte
Business Administration - MBA

Amanda Ruth-McSwain
Communication - MA

Aspen Olmedo
Computing & Information Sciences - MS

Angela Crespo Cozart
Early Childhood, Middle Grades, and Special Education - M.Ed.

Mike Duvall
English - MA

Arnetta Watson
Environmental Studies - MS

Julie Singlety Seawright
Gifted and Talented Education Grad. Certificate

Brett Lueb
Creative Writing - MFA

FY 2016 - 2017

A2. Graduate Program Mission Statements and Goals

M.S. in Mathematical Sciences

Mission Statement

The Master of Science in Mathematical Sciences provides high quality graduate-level education in the Mathematical Sciences, primarily serving the region. Central to the program mission is the training of a diverse student population, including industry workers, high school and 2-year college teachers, students getting ready for doctoral studies, and students aspiring to careers in industry or education. The program offers flexible individual-centered instruction, allowing students to design plans of study tailored to their own educational and career goals. The program continues and enhances the Mathematics Department tradition of nurturing a close-knit group of students, offering opportunities for
individual research projects and small group learning.

The program includes two concentrations: one in Mathematics and one in Statistics.

Exceptional students may complete the program in an accelerated way through the combined BS-MS degree (4+1 program).

**Program Goals**

**G1.** Develop a thorough theoretical foundation in mathematics, including retention and integration of core knowledge, as well as more specialized knowledge in pure applied mathematics, or statistics, sufficient for carrying out an independent project.

**G2.** Develop good oral and written communication skills for conveying mathematical ideas and reporting the results of mathematical studies.

**G3.** Provide a variety of project opportunities in the mathematical sciences including research theses, interdisciplinary projects, industry-inspired projects, internships, consulting, and development of educational resources.

**G4.** Prepare students for immediate employment and career advancement in industry, education or government, or for continuing their studies at the doctoral level.

---

**Graduate Certificate Program in Operations Research**

**Mission Statement**

The Graduate Certificate Program in Operations Research allows non-degree students to strengthen their expertise in operations research, linear programming, and industrial mathematics while recognizing them with an official certificate of their achievement. The Program combines a solid theoretical foundation with a variety of applied tools and techniques to prepare the student to handle a wide variety of practical mathematical and statistical problems in business and industry.

**Program Goals**

**G1.** Provide the theoretical background and applied mathematics techniques needed to work as a practicing mathematician in management and industry.

**G2.** Develop the skills necessary to communicate mathematical ideas clearly and effectively.

**G3.** Develop the ability to use the latest computational software used in operations research and industrial mathematics.

**G4.** Provide a variety of project opportunities in operations research and industrial mathematics.
Graduate Certificate Program in Statistics

Mission Statement

The Graduate Certificate Program in Statistics allows non-degree students to strengthen their expertise in applied statistics while recognizing them with an official certificate of their achievement. The Program combines a solid theoretical foundation with a variety of applied tools and techniques to prepare the student to handle statistical problems in business and industry.

Program Goals

G1. Provide the theoretical background and applied statistical techniques needed to work as a practicing statistician in business and industry.

G2. Develop the skills necessary to communicate statistical ideas clearly and effectively.

G3. Develop the ability to use the latest computational statistical software.

G4. Provide a variety of project opportunities in applied and theoretical statistics.

A3. Program Requirements (from Current Catalogue)

Admission Requirements

A bachelor’s degree in the mathematical sciences or a major with a strong mathematical background, and a minimum GPA of 3.000 in upper division mathematics and statistics courses. Entering students are expected to have courses in multivariate calculus, linear algebra and evidence of sufficient mathematical preparation. Applicants with deficiencies in the prerequisites for required courses in their chosen concentration will still be considered for the program but must make any deficiencies.

Students requesting admission should submit the following:

- A brief statement of goals.
- One official copy of a transcript from each institution of higher learning attended, including documentation of graduation from an accredited four-year college or university
- Two letters of recommendation from former professors or immediate superiors in recent employment

Program Requirements

Mathematical Sciences M.S.

- 30 credit hours
- Optional thesis
Required Courses

Core Course

- MATH 502 Advanced Linear Algebra (3)

Complete 9 credit hours from the Mathematical Science Areas

- MATH 503 Applied Algebra I (3)
- MATH 511 Real Analysis I (3)
- MATH 515 Complex Analysis (3)
- MATH 530 Mathematical Statistics I (3)
- MATH 550 Linear Models (3)
- MATH 555 Bayesian Statistical Methods (3)

Mathematics Concentration (18 credit hours)

Two sequences chosen from the following:

- MATH 503 Applied Algebra I (3)
- MATH 604 Applied Algebra II (3)
- MATH 511 Real Analysis I (3)
- MATH 612 Real Analysis II (3)
- MATH 511 Real Analysis I (3)
- MATH 515 Complex Analysis (3)
- MATH 523 Partial Differential Equations I (3)
- MATH 623 Partial Differential Equations II (3)
- MATH 545 Numerical Analysis I (3)
- MATH 645 Numerical Analysis II (3)
- MATH 551 Linear Programming and Optimization (3)
- MATH 552 Operations Research (3)

One additional course from the following:

- MATH 523 Partial Differential Equations I (3)
- MATH 545 Numerical Analysis I (3)
- MATH 551 Linear Programming and Optimization (3)
- MATH 552 Operations Research (3)
- MATH 601 General Topology (3)
- MATH 607 Discrete Mathematics (3)
- MATH 624 Dynamical Systems (3)
Statistics Concentration (18 credit hours)

Two sequences chosen from the following:

- MATH 530 Mathematical Statistics I (3)
- MATH 531 Mathematical Statistics II (3)
- MATH 540 Statistical Learning I (3)
- MATH 541 Statistical Learning II (3)
- MATH 551 Linear Programming and Optimization (3)
- MATH 552 Operations Research (3)
- MATH 560 Stochastic Processes (3)
- MATH 561 Time Series Analysis (3)
- MATH 650 Statistical Quality Control (3)
- MATH 651 Design of Experiments (3)

One additional course from the following:

- MATH 540 Statistical Learning I (3)
- MATH 551 Linear Programming and Optimization (3)
- MATH 552 Operations Research (3)
- MATH 560 Stochastic Processes (3)
- MATH 561 Time Series Analysis (3)
- MATH 650 Statistical Quality Control (3)
- MATH 651 Design of Experiments (3)

Remaining courses selected from the following:

MATH 500, 600 (excluding MATH 690 Graduate Teaching Seminar), 700 courses:

- MATH 502 Advanced Linear Algebra (3) (F)
- MATH 503 Applied Algebra I (3) (S)
- MATH 511 Real Analysis I (3) (F)
- MATH 515 Complex Analysis (3) (S)
- MATH 523 Partial Differential Equations I (3) (F)
- MATH 530 Mathematical Statistics I (3) (F)
- MATH 531 Mathematical Statistics II (3) (S)
- MATH 540 Statistical Learning I (3) (F)
- MATH 541 Statistical Learning II (3) (S)
- MATH 545 Numerical Analysis I (3) (eS/occasional)
- MATH 550 Linear Models (3) (F)
- MATH 551 Linear Programming and Optimization (3) (eF)
- MATH 552 Operations Research (3) (eS)
- MATH 555 Bayesian Statistical Methods (3) (S)
• MATH 560 Stochastic Processes (3)  (occasional/Summer)
• MATH 561 Time Series Analysis (3)  (occasional/Summer)
• MATH 580 Topics in Applied Mathematics (3)  (most S)
• MATH 585 Topics in Pure Mathematics (3)  (most F)
• MATH 589 Special Topics in Probability and Statistics (3)  (occasional S)
• MATH 601 General Topology (3)  (occasional S)
• MATH 604 Applied Algebra II (3)  (occasional)
• MATH 607 Discrete Mathematics (3)  (occasional)
• MATH 612 Real Analysis II (3)  (occasional)
• MATH 623 Partial Differential Equations II (3)  (occasional)
• MATH 624 Dynamical Systems (3)  (occasional)
• MATH 645 Numerical Analysis II (3)  (occasional)
• MATH 650 Statistical Quality Control (3)  (occasional/Summer)
• MATH 651 Design of Experiments (3)  (occasional/Summer)
• MATH 680 Special Topics in Applied Mathematics (3)  (occasional)
• MATH 685 Special Topics in Pure Mathematics (3)  (occasional)
• MATH 690 Graduate Teaching Seminar (1-3)  (by demand)
• MATH 699 Independent Study in Mathematics (3)  (by demand)
• MATH 700 Thesis (3)  (by demand)

Full Course List and Offering Frequencies

• MATH 503 Applied Algebra I (3)
• MATH 511 Real Analysis I (3)
• MATH 515 Complex Analysis (3)
• MATH 523 Partial Differential Equations I (3)
• MATH 530 Mathematical Statistics I (3)
• MATH 531 Mathematical Statistics II (3)
• MATH 540 Statistical Learning I (3)
• MATH 541 Statistical Learning II (3)
• MATH 545 Numerical Analysis I (3)
• MATH 550 Linear Models (3)
• MATH 551 Linear Programming and Optimization (3)
• MATH 552 Operations Research (3)
• MATH 555 Bayesian Statistical Methods (3)
• MATH 560 Stochastic Processes (3)
• MATH 561 Time Series Analysis (3)
• MATH 580 Topics in Applied Mathematics (3)
• MATH 585 Topics in Pure Mathematics (3)
• MATH 589 Special Topics in Probability and Statistics (3)
• MATH 601 General Topology (3)
• MATH 604 Applied Algebra II (3)
• MATH 607 Discrete Mathematics (3)
• MATH 612 Real Analysis II (3)
• MATH 623 Partial Differential Equations II (3)
• MATH 624 Dynamical Systems (3)
• MATH 645 Numerical Analysis II (3)
• MATH 650 Statistical Quality Control (3)
• MATH 651 Design of Experiments (3)
• MATH 680 Special Topics in Applied Mathematics (3)
• MATH 685 Special Topics in Pure Mathematics (3)
• MATH 699 Independent Study in Mathematics (3)
• MATH 700 Thesis (3)

A4. Five-Year Combined BS/MS (The 4+1 Program)

Purpose
Outstanding and motivated mathematics majors can earn graduate credit during their senior year and earn a Master’s Degree in Mathematical Sciences in a shorter time period. Students enrolled in this program typically complete their M.S. Degree within one calendar year (and in some cases within two academic semesters) after completing their B.S. Degree. This program allows strong mathematics and statistics students to obtain excellent preparation for pursuing Ph.D. degrees in mathematics or statistics. In particular students involved in undergraduate research are given the opportunity to further develop their research at the graduate level into a Master’s thesis.

Eligibility
• A minimum GPA of 3.5 in mathematics courses.
• Two letters of recommendation from the College of Charleston Department of Mathematics faculty.
• Junior standing and successful completion of Math 203, 295, 311, and one of 303, 323 or 350.
• Application for admission to this program should be made no later than one calendar year before completion of the B.S. Degree.

Organization
• Each student will be assigned an academic advisor from the Mathematics Faculty. The advisor will assist the student in the development of a plan of study.
• Students in this program will apply to the M.S. in Mathematical Sciences program upon completion of the bachelor’s degree.
• Students in this program, upon admission to the Graduate School, may apply up to 12 credit hours of graduate-level course work towards their M.S. Degree in Mathematical Sciences. [See Course Substitution Map below.]
• Only graduate level courses in which the student obtained a B or better may be applied to the M.S. Degree.
A5. MATH 690: Graduate Teaching Seminar Syllabus

**Course Description:** This seminar is designed for graduate students in the mathematical sciences who are interested in teaching in higher-education settings. The seminar is customizable with a range of activities addressing practical and theoretical aspects of teaching and learning: from constructing and teaching a class, including syllabus preparation and time management, to learning effective approaches to college-level teaching. Students will have the opportunity to work closely with a faculty member in an undergraduate classroom environment. Credit-hours earned in this seminar do not count toward the degree requirements for the Master of Science in Mathematics.

**Course Objectives:** This seminar course will discuss effective teaching strategies, best practices, and successful use of teaching technology tools for college-level mathematics and statistics, as well as the pedagogical research that supports them. Students will put what they learn into practice by designing lessons and assignments, teaching a class, and experimenting with a variety of teaching methods. Students who complete the course will be more informed and confident teachers, equipped for greater success in the undergraduate classroom.

**Organization and Expectations:** MATH 690 is a customizable 1-3 credit-hour seminar course based on a series of modules covering a variety of activities. Satisfactory completion of all activities in the list of Basic-Level Activities is required to earn one credit-hour. Up to two additional credit hours can be earned by completing an agreed selection of Advanced-Level Activities. Students pursuing the 3 credit-hour option are required to submit a Teaching Portfolio incorporating a well-articulated teaching philosophy and a coherent set of teaching materials. The weekly meetings will include discussion sessions on pedagogy, training seminars, and workshops, and group work.

**Basic-Level Activities:**

1. Write a teaching philosophy.
2. Observe a faculty member teach a 50-minute or 75-minute 100-level courses, at least twice.
3. Observe a faculty member teach a 50-minute or 75-minute 200-level course, at least twice.
4. Design an assignment or project for a 100-level course.
5. Create an exam for a 100-level course.
6. Design a syllabus for a 100-level course.
7. Construct an in-class activity for a 100-level course.
8. Give a 15-minute presentation in a MATH course.
9. Attend the Math Lab Tutor training sessions.
10. Volunteer in Math Tutoring Lab for three one-hour sessions.
11. Attend three teaching-related seminars—organized by the Mathematics department or by the Teaching, Learning and Technology (TLT) department—, and write reports.
12. Attend one TLT training session.
13. Keep an annotated bibliography of all the articles and books you read related to teaching, teaching in your field, uses of technology, etc.

Advanced-Level Activities:

1. Give a 50-minute lecture in a Mathematics course.
2. Serve as a grader for a semester.
3. Serve as Supplemental Instructor (SI) for a semester. (This includes completing the semester-long SI Training: a 2-day session at the beginning of the semester and bi-weekly meetings.)
4. As an SI leader for a course, develop a packet of materials that can be used for supplemental instruction in future offerings of such course.
5. Write an essay on how to build community in the classroom for a specific-sized class.
6. Write a set of activities, including group-based and individual activities, on a chosen 100-level mathematics or statistics topics.
7. Create online content, such as screencasts or mini-lecture videos, to help 100-level students in their mathematics and statistics courses.
8. Volunteer in the Math Tutoring Lab regularly for a semester, for at least one hour per week.
9. Assist an instructor with an upper-division mathematics or statistics course by holding additional office hours, recitations, or discussion sessions.
10. Attend one or more additional teaching-related seminars, or TLT training sessions.
11. Read and summarize a current research paper in peer-reviewed journal, e.g. *Journal in Research in Math Education* published by the NCTM.

Sample 2-credit Option A: All Basic Level Activities plus items 2, 5, 6 (create activities for the course you are grading for), and 10.

Sample 2-credit Option B: All Basic Level Activities plus items 2, 7 (create a set of online materials for the course you are grading for), and 10 (participate in at least 2 additional sessions related to the online content under development).

Sample 3-credit Option A: 1, 3, 4, 5, 10, and 11 (analyse a research paper relevant to the course you are leading, and discuss applicable ideas for improving the effectiveness of the course.). Develop a Teaching Portfolio.

Sample 3-credit Option B: 1, 6, 8, 9, 10, and 11 (analyse a research paper relevant to the course you are assisting with, and discuss applicable ideas for improving the effectiveness of the course.) Develop a Teaching Portfolio.

Reading Materials:

- Selection of Richard Felder’s Articles on *Active Learning, Assessment of Learning, Creative and Critical Thinking, Cooperative Learning*. (Available at www4.ncsu.edu/unity/lockers/users/f/felder/public/Papers/Education_Papers.html)
Student Learning Outcomes and Assessment Components:

I. **Students demonstrate an understanding of effective pedagogical methods and best practices in teaching lower-division mathematics and statistics courses.**
   A. Students participate in seminars and discussion sessions on pedagogy and develop an annotated bibliography of relevant reading materials. Students write essays summarizing current research on teaching and learning and/or describing their own approach to a specific aspect of teaching.

II. **Students demonstrate an understanding of content knowledge in lower level mathematics and statistics courses.**
   A. Students design, develop, and edit course documents. These include teaching-specific documents (such as sample tests, quizzes, and homework assignments) and course-specific documents (such as a sample syllabus).

III. **Students display confidence and professionalism in delivering mathematics and statistics materials designed for a student audience (including lower division class materials classes, group recitations, and help sessions).**
   A. Assignments such as mock presentations, video-recorded mini-lessons, discussion of technology, and tips for board use make students feel comfortable in their delivery of the material. Each student’s confidence in their own presentation style is surveyed at the beginning and end of the course.

IV. **Students develop, reflect upon, and refine their own teaching philosophies.**
   A. The transformation in each individual’s philosophy becomes apparent through a comparison of the student’s original teaching philosophy (written during Week 1) with his or her final teaching philosophy (submitted during Week 14).

Grading Policy:

The grade for this seminar will be based on the following components:

1. **Participation** (including group activities, training seminars and workshops, Math Lab and SI sessions).
2. **Teaching Materials** (including sample syllabi and lectures, sample assignments and group work).
3. **Writings** (including pedagogical essays or summaries, reports, and teaching philosophy).
4. **Presentations** (including lecture delivery, and oral presentations based on reading materials or teaching practice).

The weight of each component may be adjusted depending on the chosen number of credit hours. For example, for the one credit-hour option a possible weighting scheme is: Participation 20%; Teaching Materials 50%; Writing Component 15%; Presentation Component 15%.

The final grade will be calculated according to the following guidelines: at least 90% for an A, 86% for a B+, 80% for a B, 76% for a C+, 68% for a C.

Policies:
● **Attendance:** Attendance to all the organized events, including in-class lectures and group discussions and activities, is highly encouraged. Participation in class discussions, group activities, workshops, and seminars will be monitored and assessed for each student.

● **Honor Code:** The academic Honor Code forbids lying, cheating, and plagiarism. Plagiarism is defined as presenting the works of others as your own and copying sources without citation. Violations of the Honor Code, in particular plagiarism, may result in a grade of XF. The complete Honor Code can be found in the *Student Handbook* at [http://ww.cofc.edu/generaldocuments/handbook.pdf](http://ww.cofc.edu/generaldocuments/handbook.pdf).

● **American Disabilities Act:** In compliance with the Americans with Disabilities Act (ADA), all qualified students enrolled in this course are entitled to reasonable accommodations. Please notify the instructor during the first week of class of any accommodations needed for the course. You can also contact the Office of Disability Services at 843.953.1431.

**Tentative Course Schedule with Specific Topics:**

**Week 1-2: Principles of Learning**
We discuss the key learning principles that apply in general teaching contexts, the supporting research, and examples of how such principles are put into practice in mathematics and statistics classes.

**Week 3-4: Learning Objectives and Assessment of Learning**
We discuss how to design an effective learning experience for students, by establishing course goals and objectives that are meaningful, observable, and measurable. We also discuss strategies on how to develop assessment tools that are aligned with the stated objectives.

**Week 5-6 Group Learning, Peer Instruction, Lecturing**
We explore various types of learning activities of known effectiveness in 100- and 200-level mathematics and statistics classes. These include group learning in and outside the classroom, peer instruction, and traditional and non-traditional (e.g., flipped classroom) lecturing.

**Week 7-8: Inquiry-Based and Problem-Based Learning, Writing in Mathematics and Statistics Classes**
We will investigate strategies for designing and implementing inquiry-based and problem-based classroom, structuring classroom activities around challenging and interesting problems, and using formal and informal writing assignments in mathematics and statistics classes.

**Week 9-10: Technology in the Classroom**
We will learn about a number of technology tools commonly used in mathematics and statistics classes, including, e.g., computer software and applications, presentation software, and interactive class tools (e.g., instant polls and quizzes).

**Week 11: Inclusive Teaching, Learning Styles, Student Motivation**
We will focus on effective strategies for creating an inclusive learning environment where every student can become fully engaged. We will learn about learning styles and what teaching methods and activities are suitable for different learning styles. We will also address the effect of motivation on learning and how to promote student motivation.

**Week 12-13: Lesson Planning**
Students will work on creating lesson plans for a 100-level mathematics or statistics course, including learning objectives, assessment, activities (both in-class and outside class), and strategies for maintaining good levels of student engagement and motivation. During the planning process, students will provide mutual feedback on the draft lecture plans, and proposed activities, and strategies.
Week 14: Conclusion
During the final week students will give presentations on what they accomplished in this seminar class. Presentations may be in the form of a class segment (e.g. a short lecture, or in-class activity) or a brief seminar on effective pedagogical strategies or tools. Students final products (syllabi, teaching materials, and essays) will be collected and assembled in a Graduate Teaching Seminar Portfolio, to be made available to other graduate students and instructors.

Additional Reading Materials:
1. *Writings* by Paulo Freire.
2. *Writings* by Maria Montessori.

A6. Mathematics Faculty

*Sofia Agrest* (M.S., Senior Instructor, Director of South Carolina Alliance for Minority Participation).

*Iana Anguelova* (Associate Professor). Mathematical Physics, Integrable Systems, Differential Equations.

*Annalisa Calini* (Professor, Graduate Program co-Director). Integrable Systems, Nonlinear waves, Dynamical Systems. Geometric evolution equations.

*James Carter* (Professor). Algebraic Number Theory.

*Deanna Caveny* (Professor, Associate Provost for Faculty Affairs). Transcendental Number Theory, Non-associative algebras.

*Ben Cox* (Professor). Representation theory of quantum groups, Infinite-dimensional Lie Algebras.

*Beverly Diamond* (Professor). Topology, Topological Dynamics.


*Hope Florence* (Assistant Professor with tenure, Director of the Math Lab, Center for Student Learning).

*Jason Howell* (Assistant Professor). Numerical methods for Differential Equations, Applications to Newtonian and non-Newtonian Fluids.


*Debbi Jeter* (M.S., Senior Instructor, Associate Chair).

*Renling Jin* (Professor). Mathematical Logic, Nonstandard analysis, Set theory, Model theory.
Martin Jones (Professor, Graduate Program co-Director). Probability, Stochastic processes, Optimal stopping theory.

Elizabeth Jurisich (Professor). Representation theory, Free field theory, Vertex operators, Conformal Field Theory.

Bo Kai (Associate Professor). High-dimensional data analysis, Semi-parametric methods, Robust modeling, Variable selection.

Alex Kasman (Professor). Algebraic Analysis, Mathematical Physics.

Tom Kunkle (Associate Professor). Approximation Theory, Multivariate interpolation.

Stephane Lafortune (Professor). Nonlinear waves, Integrable Systems, Applications to elastic materials, flame propagation, fluids.

Amy Langville (Professor). Information retrieval, Numerical Linear Algebra, Mathematical Modeling.

Brenton LeMesurier (Professor). Nonlinear wave phenomena, Scientific computing.

Li Jiexiang (Associate Professor). Statistics, Nonparametric Estimation.

Robert Mignone (Professor and Chair). Mathematical Logic, Set Theory.

Garrett Mitchener (Associate Professor) Dynamical Systems, Probability, Applications to Biology and Linguistics.

Jin-Hong Park (Associate Professor). Dimension Reduction methods, Applied time Series, Nonparametric methods, Statistics applications to Finance and Econometric.

Kate Owens (Ph.D., Instructor) Mathematics education; universal algebra; and mathematical logic. Nonfinite axiomatizability of equational theories of finite algebras.

Andrew Przeworski (Associate Professor). Geometry and Topology of Hyperbolic 3-manifolds.

Dinesh Sarvate (Professor). Combinatorics, Block Design.

Sandra Shields (Professor). Low-dimensional Topology.

Oleg Smirnov (Professor). Lie algebras, Non-associative algebras.

Kathy Johnston-Thom (Professor.) Algebra, Theory of semigroups.

Arthur Vartanian (Professor). Asymptotic analysis, Orthogonal polynomials, Integrable Systems.

Justin Webster (Professor). Mathematical modeling, Nonlinear evolutions, Dynamical Systems, Semigroups and monotone operator theory, Coupled systems of PDE, Control of PDE.

James Young (Ph.D., Senior Instructor). Statistics, Probability, Stochastic processes, Statistical learning, Data science, Predictive analytics, Knowledge discovery, Data mining, Big data, Optimization.
Paul Young (Professor). Number Theory, p-adic analysis.

A7. Mathematics Faculty Research and Scholarship

<table>
<thead>
<tr>
<th></th>
<th>Publications</th>
<th>Presentations</th>
<th>Performances</th>
<th>Contracts and Grants</th>
<th>Intellectual Property</th>
<th>Unassigned</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011-2012</td>
<td>37</td>
<td>52</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>8</td>
<td>102</td>
</tr>
<tr>
<td>2012-2013</td>
<td>24</td>
<td>60</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>13</td>
<td>102</td>
</tr>
<tr>
<td>2013-2014</td>
<td>32</td>
<td>55</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>8</td>
<td>100</td>
</tr>
<tr>
<td>2014-2015</td>
<td>32</td>
<td>69</td>
<td>1</td>
<td>7</td>
<td>0</td>
<td>16</td>
<td>125</td>
</tr>
<tr>
<td>2015-2016</td>
<td>31</td>
<td>60</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>97</td>
</tr>
</tbody>
</table>

Lists of Contracts and Grants, Book Chapters, Books, Journal Articles, and Keynote and Plenary Talks for the period July 1, 2011 – July 31, 2016 are provided below. (Source: Faculty Activity Systems. Note: reporting by all faculty has not been consistent, so the data provide are an under-estimate.)

External Contracts and Grants


Funded: Jeter, D. W. (Supporting), Agrest, S., (Principal), "Tensor SUMMA Grant." (June 2015).


Funded: Cox, B. L. (Principal), "Collaborative work in conformal field theory," $35,000.00. (September 2014 - August 2019).


Submitted: Jin, R. (Principal), "Nonstandard analysis: Theoretical research and applications to algebra, combinatorics, and geometry," $92,000.00. (September 2013 - August 2017).


**Publications (Books, Book Chapters, Journal Articles only)**

**Books**


**Book Chapters**


**Journal Articles**

Iana Anguelova


Anguelova, I. (2014). Virasoro representations with central charges $\frac{1}{2}$ and 1 on the real neutral fermion Fock space $\mathit{F}^{\otimes \frac{1}{2}}$. *Journal of Physics: Conference Series*, 563, 11 pages, 012001.


Anguelova, I., Cox, B. L., Jurisich, E. G. (2013). Representations of $a_{\infty}$ and $d_{\infty}$ with central charge 1 on the single neutral fermion Fock space $\mathit{F}^{\otimes 1/2}$. *Journal of Physics A*, 474 (1), 20.


Annalisa Calini


James Carter


Deanna Caveny-Noecker


Ben Cox


Cox, B. L., Im, M. S. (2016). Families of orthogonal Laurent polynomials, hyperelliptic Lie algebras and elliptic integrals. Integral Transforms And Special Functions 27 (11), 899-919.


Jason Howell


Thomas Ivey


Renling Jin


**Martin Jones**


**Elizabeth Jurisich**


**Bo Kai**


**Alex Kasman**


**Mukesh Kumar**

Kumar, M., Kvamsdal, T., Johannesen, K. Superconvergent patch recovery and a posteriori error estimation technique in adaptive isogeometric analysis. Elsevier.

Kumar, S., Kumar, M. A second order uniformly convergent numerical scheme for parameterized singularly perturbed delay differential problems. Springer.

**Thomas Kunkle**


**Stephane Lafortune**


Amy Langville


Brenton LeMesurier


Jiexiang Li


**Garrett Mitchener**


**Jin-Hong Park**


Andrew Przeworski


Dinesh Sarvate


Mwesigwa, R., Sarvate, D. G., Zhang, L. (2016). Group Divisible Designs of four groups and block size 5 with configuration \((1,1,1,2)\). *Journal of Algebra Combinatorics Discrete Structures and Applications* 3(3).


Ndungo, I., Sarvate, D. G. (2016). GDD(n,2,4,\(\lambda_1,\lambda_2\)) with equal number of even and odd blocks. *Discrete Mathematics*, 339, 1344-1354.


**Sandy Shields**


**Justin Webster**


**Keynote and Plenary Addresses**

[Exclude invited seminars and colloquia at other departments.]


Anguelova, I., Banff International Research Station (BIRS) Workshop 16w5070 - Vertex Algebras and Quantum Groups, "Towards quantum chiral algebras," Banff International Research Station (BIRS) for Mathematical Innovation and Discovery, BIRS, Banff, Canada. (February 2016).


Ivey, T. A., Quinn, I., Bridges Lecture Series, University of Waterloo, "In Time and Out of Tune: Some perspectives on consonance and dissonance," St. Jerome's University/University of Waterloo, Waterloo, Ontario. (March 2013).


Jurisich, E. G., Special Colloquium, "Introduction to "Monstrous Moonshine"," Xiamen University, China, Xiamen University. (May 2013).


Langville, A. N., Mercer University MAA Georgia State Meeting, "My Life as a Mathematical Consultant," Georgia State MAA State Dinner, Macon, Georgia. (February 2015).

Langville, A. N., Mercer University Undergraduate Research in Mathematics Conference, "Random Search, Ordered Results: How search engines use mathematics to organize the Web," Georgia State MAA Meeting, Macon, Georgia. (February 2015).


Langville, A. N., MAA State Dinner, "Random Search, Ordered Results: how search engines use mathematics to organize the Web," MAA, Coastal Carolina University. (October 2013).

Langville, A. N., Kennesaw State University Infinite Horizons Lecture, "My Life as a Mathematical Consultant," Kennesaw State University, Atlanta, Georgia. (September 2013).

Langville, A. N., Kennesaw State University Infinite Horizons Lecture, "Random Search, Ordered Results: how search engines use mathematics to organize the Web," Kennesaw State University, Atlanta, Georgia. (September 2013).


Sarvate, D. G., 10th MUST Annual Research Dissemination Conference, "Introduction to Combinatorial Designs," The Mbarara University of Science and Technology, Mbarara, Uganda. (December 2014).


**A8. Mathematics Faculty Service Activities**

<table>
<thead>
<tr>
<th>School of Sciences and Mathematics</th>
<th>Editorial and Review</th>
<th>Professional Service</th>
<th>Public/Community Service</th>
<th>Unassigned</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011-2012</td>
<td>68</td>
<td>7</td>
<td>4</td>
<td>0</td>
<td>79</td>
</tr>
<tr>
<td>2012-2013</td>
<td>61</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>69</td>
</tr>
<tr>
<td>2013-2014</td>
<td>62</td>
<td>9</td>
<td>6</td>
<td>0</td>
<td>77</td>
</tr>
<tr>
<td>2014-2015</td>
<td>70</td>
<td>6</td>
<td>4</td>
<td>0</td>
<td>80</td>
</tr>
<tr>
<td>2015-2016</td>
<td>64</td>
<td>10</td>
<td>7</td>
<td>0</td>
<td>81</td>
</tr>
</tbody>
</table>

A list of service activities for the period July 1, 2011 – July 31, 2016 are provided below. Source: Faculty Activity System. Note that not all faculty members report consistently on the Faculty Activity System, so what is presented below is an incomplete list.

**External Grant Reviewer/Panelist/Major Professional Service/Editorial Service**

**Calini, Annalisa M.**


Grant Reviewer—Panel, National Science Foundation. 2/2016.

Program Director, Applied Mathematics, Division of Mathematical Sciences, NSF, 2011-2013

**Carter, James E.**

Associate Editor, "20 Years of the Vojtěch Jarník Competition," James E Carter, Jaroslav Hančl, Ondřej Kolouch, František Konopecký, Lukáš Novotný, Jan Štěpnička and Jan Šustek, editors. (October 2010 - August 2015).

**Cox, Ben L.**

Grant Reviewer—Panel, NSA. (April 2015).

**Diamond, Beverly Esther Jean**

Grant Reviewer—Panel, "postdocs--grant proposals," National Science Foundation. (December 2013).

**Ivey, Thomas A.**

Program Director, Geometric Analysis, Division of Mathematical Sciences, NSF, 2016-present.

**Jin, Renling**
Advisory Board, Logic and Analysis, Board Member. (August 2008 - May 2015).

Editor, Logic and Analysis. (January 2007 - May 2014).

Grant Reviewer—Ad Hoc, Czech Science Foundation. (October 2012 - November 2012).

Jurisich, Elizabeth G.


Grant Reviewer—Panel, National Science Foundation. (December 2015 - January 2016)

Grant Reviewer—Panel, National Science Foundation. (December 2012 - February 2013).

Grant Reviewer—Panel, AAUW American Fellowships Program. (January 2012 - March 2012).

Conference Program Organizer, Southeastern Lie Theory Workshop. (December 2012).

External Grant Proposal Reviewer, American Association of University Women, Member. (December 2011 - February 2012).

Langville, Amy N.

Editorial Board Member, SIAM Polya Prize Committee. (March 2016 - November 2017).

Editorial Board Member, "Complex Networks." (January 2012 - January 2017).


Invited Member, Special Session on Future of Data Science, National Science Foundation. (March 2016 - April 2016).

Committee Chair, SAMSNI Education and Outreach. (August 2006 - Present).

Committee Member, MAA Math Awareness Month, Member. (November 2015 - May 2016).

External Grant Proposal Reviewer, National Science Foundation-Future of Data Science Panel. (April 2016).

External Grant Proposal Reviewer, National Science Foundation-Math and Stat Training and Development Panel. (May 2013).

Committee Member, Women in Mathematics Committee of the ACM, SIAM, MAA, AAS, Member. (January 2009 - December 2012).

Sarvate, Dinesh G.

Editor, "Special Issue of JCMCCC." (October 2015 - October 2016).

Grant Reviewer—Panel, the Natural Sciences and Engineering Research Council of Canada (NSERC), Govt of Canada. (December 2015 - January 2016).
Member of the Council, "The Institute of Combinatorics and its Applications." (September 2010 – March 2018).


**Webster, Justin**

Grant Reviewer—Ad Hoc. (December 2015 - January 2016).

---

### Conference Organization

**Calini, Annalisa M.**


Conference Program Organizer, Institute for Computational and Experimental Research in Mathematics (ICERM), Member. (September 2014 - June 2015).


Conference Session Chair, 2014 SIAM Conference on Nonlinear Waves and Coherent Structures, Member. (October 2013 - August 2014).

**Carter, James E.**

Conference Program Organizer, Special session “Hopf Algebras and Galois Module Theory”, 2012 Spring Southeastern Section Meeting of the AMS, University of South Florida, Tampa, FL. (June 2011 - March 2012).

**Howell, Jason S**

Conference Session Chair, AMS/MAA Joint Meetings. (January 2014).

**Ivey, Thomas A.**

Conference Chairperson, Southeast Geometry Conference. (January 2012 - March 2012).

**Jurisich, Elizabeth G.**


Conference Program Organizer, Southeastern Lie Theory Workshop. (December 2012).

**Kai, Bo**


Lafortune, Stephane


Mitchener, W.


Park, Jin-Hong

Conference Chairperson, Joint Statistical Meetings. (July 2012 - August 2012).

Przeworski, Andrew


Sarvate, Dinesh G.


Conference Program Organizer, 27th MCCCC, Member. (November 2012 - October 2013).

Conference Program Organizer, 26th MCCCC, Member. (November 2011 - October 2012).

Webster, Justin T

Conference Program Organizer, American Mathematics Society. (October 2015 - October 2017).

________________________________________

Public and Community Service

England, Michael R.


Howell, Jason S
Content Developer, Charleston STEAM Institute Summer Camp. (May 2014 - June 2014).

**Jeter, Deborah W.**

College Representative, Cradle to Career Math Pathways Committee, Member. (October 2015 - June 2016).

College Representative, Academic Affairs Office of the Provost. (May 2014).

**Jurisich, Elizabeth G.**

College Representative, Girl's Day Out summer program. (July 2014).

Committee Member, College of Charleston Math Meet, Member. (August 1999 - February 2014).

**Kasman, Alex**

Lowcountry Science Fair Judge. (March 2015).

Lowcountry Science Fair Judge. (March 2012).

**Lafortune, Stephane**


Science Fair judging panel member, Science Fair at Charleston Day School, Member. (February 2016).

Science Fair judging panel member, Science Fair at Charleston Day School, Member. (March 2015).

Invention Convention judging panel member, Invention Convention at Charleston Day School, Member. (March 2014).

Science Fair judging panel member, Science Fair at Charleston Day School, Member. (February 2014).

**Langville, Amy N.**

Folly Beach Trash Sweeps. (January 2014 - Present).

Volunteer Teacher, Gracie Self-Defense Academy. (January 2012 - Present).


Committee Member, Chad K. Haynes Memorial Foundation. (May 2005 - January 2012).

**Li, Jiexiang**

Teacher, Charleston Chinese learning center, Member. (January 2011 - December 2012).

**Mignone, Robert J.**

College Representative, Tri-County Cradle to Career Collaborative. (August 2015 - Present).

Committee Member, Math Meet. (August 1981 - February 2016).
Mitchener, W.
Co-chair, Math Meet. (February 2014 - February 2016).

Judge, Lowcountry Regional Science & Engineering Fair. (March 2015).

Sarvate, Dinesh G.
Student internship, Montessori School, Mt Pleasant. (February 2016).
Guest speaker, Mason Prep school, Charleston. (October 2015).


Webster, Justin T.
Volunteer, Department of Mathematics. (February 2016 - Present).

---

Editorial Review/Referee Activities

Anguelova, Iana
Invited Manuscript Reviewer or Referee, "Symmetry, Integrability and Geometry: Methods and Applications (SIGMA)," Editor of SIGMA. (May 2015 - September 2015).


Calini, Annalisa M.


Invited Manuscript Reviewer or Referee, "Physics D." (May 2014 - June 2014).
Invited Manuscript Reviewer or Referee, "Journal of Physics A." (May 2014).


Invited Manuscript Reviewer or Referee, "Physics D." (August 2013 - September 2013).

Carter, James E.


Invited Manuscript Reviewer or Referee, "Classes de Steinitz, codes cycliques de Hamming et classes galoisienes r' ealisables d'extensions non ab' eliennes de degr'e p^3," University of Valenciennes, France. (March 2016 - May 2016).

Invited Manuscript Reviewer or Referee, "On the mean number of 2-torsion elements in the class groups, narrow class groups, and ideal class groups of cubic orders and fields," Zentralblatt Math. (October 2015 - May 2016).

Invited Manuscript Reviewer or Referee, "Classification of algebraic function fields with class number one," MathSciNet. (November 2015 - February 2016).


Invited Manuscript Reviewer or Referee, "On the second class group of real quadratic number fields," Zentralblatt MATH. (July 2014 - October 2014).


Invited Manuscript Reviewer or Referee, "Construction of cyclic number fields with prime degree and their Frobenius automorphisms," Zentralblatt MATH. (February 2013 - June 2013).


Proofreader of journal article, "Irrationality measure of periodic continued fractions," Jaroslav Hancl, author. (December 2012).


Invited Manuscript Reviewer or Referee, "On the content bound for real quadratic field extensions," Axioms. (November 2012).


Proofreader of journal article, "Lebesgue measure and Hausdorff dimension of special sets of real numbers from (0, 1)," Jaroslav Hancl, Author. (August 2011 - September 2011).

Cox, Ben L.

Invited Manuscript Reviewer or Referee, "Communications in Algebra." (May 2015).


Invited Manuscript Reviewer or Referee, "Advances in Mathematics." (January 2015).

Invited Manuscript Reviewer or Referee, "Communications in Mathematical Physics." (October 2014 - December 2014).


Invited Manuscript Reviewer or Referee, "AMS Contemporary Mathematics." (May 2013).


Invited Manuscript Reviewer or Referee, "Frontiers of Mathematics." (September 2011 - October 2011).


Howell, Jason S


Grant Reviewer—Panel, National Science Foundation. (February 2014 - March 2014).


Invited Manuscript Reviewer or Referee, "AMS Mathematical Reviews." (August 2012 - November 2012).

Invited Manuscript Reviewer or Referee, "Mathematics of Computation." (September 2012).


Ivey, Thomas A.


"Referee," Results in Mathematics. (September 2014).


Jin, Renling


63


External letter to the committee for Isaac Goldbring's tenure and promotion to associate professor, departmental committee for tenure and promotion to associate professor in the University of Illinois at Chicago. (May 2015 - June 2015).


**Jones, Martin L.**


**Jurisich, Elizabeth G.**


**Kai, Bo**


Invited Manuscript Reviewer or Referee, "Computational Statistics and Data Analysis." (December 2015 - January 2016).


Invited Manuscript Reviewer or Referee, "TEST." (September 2013 - December 2013).


Invited Manuscript Reviewer or Referee, "Biometrika." (June 2012 - August 2012).


Invited Manuscript Reviewer or Referee, "Journal of Statistical Planning and Inference." (February 2012 - May 2012).


Invited Manuscript Reviewer or Referee, "Journal of Statistical Planning and Inference." (January 2012 - April 2012).


Invited Manuscript Reviewer or Referee, "Statistical Methods in Medical Research." (January 2012 - February 2012).


Invited Manuscript Reviewer or Referee, "Bernoulli." (September 2011 - November 2011).


Kasman, Alex

Invited Manuscript Reviewer or Referee, "Journal of Mathematical Physics." (May 2016).


Invited Manuscript Reviewer or Referee, "SIGMA." (May 2014).

Invited Manuscript Reviewer or Referee, "Physica D." (June 2013).

Invited Manuscript Reviewer or Referee, "Physica D." (February 2013 - March 2013).

Invited Manuscript Reviewer or Referee, "Proceedings of the AMS." (May 2012).

Invited Manuscript Reviewer or Referee, "SIGMA." (March 2012).


Kumar, Mukesh


Promotion to full Professor at UNLV, "Review report for the promotion to full Professor, Department of mathematical sciences, University of Nevada, Las Vegas." (July 2015 - September 2015).

Kunkle, Thomas J.


Lafortune, Stephane


Invited Manuscript Reviewer or Referee, "Ultradiscrete limit of Bessel function type solutions of the Painlevé III equation," SIGMA. (October 2014 - November 2014).


Invited Manuscript Reviewer or Referee, "Do ultradiscrete systems with parity variables satisfy the singularity confinement criterion?," Journal of Mathematical Physics. (December 2011).


Langville, Amy N.


Invited Manuscript Reviewer or Referee, "CofC SSM Sabbatical Review Committee." (December 2012).


Invited Manuscript Reviewer or Referee, "Internet Mathematics." (September 2012).


Invited Manuscript Reviewer or Referee, "Linear Algebra and its Applications." (August 2012).

Invited Manuscript Reviewer or Referee, "Theoretical Computer Science." (July 2012).


Invited Manuscript Reviewer or Referee, "Workshop on Web Algorithms." (February 2012).


Li, Jiexiang


Mitchener, W.


Invited Manuscript Reviewer or Referee, PsychoCompLA workshop. (September 2011).


Park, Jin-Hong


Przeworski, Andrew


Sarvate, Dinesh G.


Invited Manuscript Reviewer or Referee, "JCMCC." (September 2015 - December 2015).


Smirnov, Oleg N.


Invited Manuscript Reviewer or Referee, "Communications in Algebra." (November 2011 - December 2011).

Webster, Justin T

Invited Manuscript Reviewer or Referee, "Discrete and Continuous Dynamical Systems: A." (December 2015 - March 2016).


Invited Manuscript Reviewer or Referee, "Nonlinear Analysis A." (September 2015 - January 2016).


Young, Paul T.


Invited Manuscript Reviewer or Referee, "INTEGERS." (January 2015 - December 2015).


Invited Manuscript Reviewer or Referee, "INTEGERS." (January 2014 - December 2014).


Editorial Board Member, "Research and Communications in Mathematics and Mathematical Sciences." (January 2011 - December 2014).


A9. Assessment Documents

Master’s Degree Program in Mathematical Sciences Assessment Plan: 2016-2017

Students Learning Outcomes (SLO) and Assessment Measures (M)

SLO1. (Retention of core knowledge) Students will be able to demonstrate knowledge of the main theoretical results and key methods of core graduate areas in their chosen concentration early in the Program of Study. In particular, students will be proficient in Linear Algebra and in Analysis (Mathematics Concentration) or Statistics (Statistics Concentration).

M1.1. (Final Exam Questions—Linear Algebra) The final exam of Math 502 (Advanced Linear Algebra) will include a question assessing graduate-level core knowledge. The questions will be collected for all students and assessed by the Graduate Steering Committee according to scoring rubrics. It is expected that 70% of students will be rated acceptable or above on this category.

M1.2. (Final Exam Questions—Core Courses) The final exams of Math 511 (Real Analysis I) or Math 515 (Complex Analysis), and the final exams of Math 530 (Mathematical Statistics I) or Math 550 (Linear Models) will include a question assessing graduate-level core knowledge. The questions will be collected for all students and assessed by the Graduate Steering Committee according to scoring rubrics. It is expected that 70% of students will be rated acceptable or above on this category.

M1.3. (Student Progress Interview.) The progress of each graduate student will be assessed (by the Program Director, or Advisor) at the end of his/her first year. It is expected that at least 80% of students will have completed Math 502 by the end of their first year, at a level rated as acceptable for continuing in the program.
SLO2. (Integration of core knowledge.) Students will be able understand and employ the basic tools and methods of core graduate areas in their chosen concentration. Such tools and methods range from theoretical techniques to the construction of models and solution methods. In particular, students will be able to demonstrate mastery in Linear Algebra, and in Analysis (Mathematics Concentration) or Statistics (Statistics Concentration).

M2.1 (Final Exam Questions—Linear Algebra) The final exam of Math 502 (Advanced Linear Algebra) will include a question assessing the integration of core knowledge in the discipline. The questions will be collected for all students and assessed by the Graduate Steering Committee according to scoring rubrics. It is expected that 70% of students will be rated acceptable or above on this category.

M2.2. (Final Exam Questions—Core Courses) The final exams of Math 511 (Real Analysis I) or Math 515 (Complex Analysis), and the final exams of Math 530 (Mathematical Statistics I) or Math 550 (Linear Models) will include a question addressing the integration of core knowledge in the discipline. The questions will be collected for all students and assessed by the Graduate Steering Committee according to scoring rubrics. It is expected that 70% of students will be rated acceptable or above on this category.

SLO3. (Communicating Mathematics) Students will be able to communicate mathematical arguments, and present the results of a mathematical/statistical study in a clear, coherent, and convincing manner, both orally and in writing.

M3.1. (Oral Presentations) All thesis defenses, poster sessions and in-class oral presentations will be used to assess the graduate-level competence in communicating mathematics/statistics by the Graduate Steering Committee according to a scoring rubric. It is expected that 70% or higher will be judged to be of an acceptable level or better.

M3.2. (Independent Projects) All main projects including theses, final class projects and reports, independent study projects or reports, internship or consulting projects, and seminar reports, will be collected at the end of each semester and used to assess the graduate-level competence in communicating mathematics/statistics by the Graduate Steering Committee according to a scoring rubric. It is expected that 70% of students will be rated acceptable or above on this category.

SLO4: (Independent Project) Students will be able to conduct supervised, independent projects in the mathematical sciences. In particular, students will be able to formulate, investigate and analyze either a theoretical question or a model of a phenomenon or of data, guided by prior research in theory and/or applications.

M4.1. All major projects including Theses, final class projects and reports, Independent Study projects or reports, internship or consulting projects, and seminar reports, will be collected at the end of each semester and used to assess graduate-level proficiency in independent projects by the graduate steering committee according to a scoring rubric. It is expected that 70% of students will be rated acceptable or above on this category.

M4.2. A post-graduation survey containing both direct and indirect questions measuring graduate-level proficiency in independent projects. The survey will be administered 3-to-6 months after graduation. Questions will be chosen specific to SLO4 and assessed by the graduate steering committee (based on a scoring rubric). It is expected that 80% of the responding students report that they felt adequately prepared.
### MASC Assessment Map

<table>
<thead>
<tr>
<th>Elements\SLOs</th>
<th>SLO1 Retention of Core Knowledge</th>
<th>SLO2 Integration of Core Knowledge</th>
<th>SLO3 Communicating Mathematics/Statistics</th>
<th>SLO4 Independent Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math 502</td>
<td>I/R</td>
<td>I/R</td>
<td>I/R</td>
<td></td>
</tr>
<tr>
<td>Math 511</td>
<td>I/R</td>
<td>I/R</td>
<td>I/R</td>
<td></td>
</tr>
<tr>
<td>Math 515</td>
<td>I/R</td>
<td>I/R</td>
<td>I/R</td>
<td></td>
</tr>
<tr>
<td>Math 503</td>
<td>I/R</td>
<td>I/R</td>
<td>I/R</td>
<td></td>
</tr>
<tr>
<td>Math 530</td>
<td>I/R</td>
<td>I/R</td>
<td>I/R</td>
<td></td>
</tr>
<tr>
<td>Electives Pure &amp; Applied Math</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math 523</td>
<td>R</td>
<td>R/E</td>
<td>I/R</td>
<td>I</td>
</tr>
<tr>
<td>Math 545</td>
<td>R</td>
<td>R/E</td>
<td>R/E</td>
<td>I/R/E</td>
</tr>
<tr>
<td>Math 551</td>
<td>I/R</td>
<td>R</td>
<td>R</td>
<td>I/R/E</td>
</tr>
<tr>
<td>Math 552</td>
<td>I/R</td>
<td>R</td>
<td>R</td>
<td>I/R/E</td>
</tr>
<tr>
<td>Math 601</td>
<td>R</td>
<td>R/E</td>
<td>R/E</td>
<td>I</td>
</tr>
<tr>
<td>Math 604</td>
<td>R/E</td>
<td>R/E</td>
<td>R/E</td>
<td>I/R</td>
</tr>
<tr>
<td>Math 607</td>
<td>R</td>
<td>R/E</td>
<td>R/E</td>
<td>I</td>
</tr>
<tr>
<td>Math 612</td>
<td>R/E</td>
<td>R/E</td>
<td>R/E</td>
<td>I/R</td>
</tr>
<tr>
<td>Math 623</td>
<td>R</td>
<td>R/E</td>
<td>R/E</td>
<td>I/R</td>
</tr>
<tr>
<td>Math 624</td>
<td>R</td>
<td>R/E</td>
<td>R/E</td>
<td>I/R</td>
</tr>
<tr>
<td>Math 645</td>
<td>R</td>
<td>R/E</td>
<td>R/E</td>
<td></td>
</tr>
<tr>
<td>Electives Statistics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math 531</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>Math 540</td>
<td>I/R</td>
<td>R</td>
<td>R</td>
<td>I/R</td>
</tr>
<tr>
<td>Math 541</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>I/R</td>
</tr>
<tr>
<td>Math 550</td>
<td>I/R</td>
<td>R</td>
<td>R</td>
<td>I/R</td>
</tr>
<tr>
<td>Math 555</td>
<td>I/R</td>
<td>R</td>
<td>R</td>
<td>R/E</td>
</tr>
<tr>
<td>Math 560</td>
<td>R/E</td>
<td>R/E</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Math 561</td>
<td>R/E</td>
<td>R/E</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Math 650</td>
<td>R</td>
<td>R</td>
<td>R/E</td>
<td>I/R</td>
</tr>
<tr>
<td>Math 651</td>
<td>R</td>
<td>R</td>
<td>R/E</td>
<td>I/R/E</td>
</tr>
<tr>
<td>Major Projects</td>
<td>Theses; Final class projects and reports; Independent Study projects and reports, Internship or Consulting projects; Seminar reports.</td>
<td>R</td>
<td>R/E</td>
<td>R/E</td>
</tr>
</tbody>
</table>

Map Key: I = Introduced, R = Reinforced, E = Emphasized

**Graduate Certificate Program in Statistics Assessment Plan: 2016-2017**

**Students Learning Outcomes (SLO) and Assessment Measures (M)**
SLO1. (Core theoretical knowledge and skills.) Students will be able to demonstrate knowledge of the main theoretical results and key methods used in the development of statistical models.

M1.1. (Final Exam: Math 530) The final exam of Math 530 (Mathematical Statistics I) will include a question assessing core theoretical knowledge and skills. The question will be collected for all students in the course and assessed by the Graduate Steering Committee according to a scoring rubric. We expect that 75% of these assignments be will be rated acceptable or above on this category.

M1.2. (Final Exam: Statistics Course) On a rotating basis amongst the statistics courses Math 531 (Mathematical Statistics II), Math 540 (Statistical Learning Theory I), Math 541 (Statistical Learning Theory II), Math 550 (Linear Models), and Math 555 (Bayesian Statistical Methods), each year the final exam of one such course will contain a question addressing core theoretical knowledge and skills. The question will be collected for all students in that class and assessed by the Graduate Steering Committee according to a scoring rubric. We expect that 75% of these assignments be will be rated acceptable or above on this category.

SLO2. (Core modeling knowledge and skills.) Students will be able to recognize and choose the appropriate statistical models to use for given data analysis tasks.

M2.1 (Final Exam: Math 530) The final exam of Math 530 (Mathematical Statistics I) will include a question addressing core modeling knowledge and skills. The question will be collected for all students in the course and assessed by the Graduate Steering Committee according to a scoring rubric. We expect that 75% of these assignments be will be rated acceptable or above on this category.

M2.2. (Final Exam: Statistics Course) On a rotating basis amongst the statistics courses Math 531 (Mathematical Statistics II), Math 540 (Statistical Learning Theory I), Math 541 (Statistical Learning Theory II), Math 550 (Linear Models), and Math 555 (Bayesian Statistical Methods), each year the final exam of one such course will contain a question addressing core modeling knowledge and skills. The question will be collected for all students in that class and assessed by the Graduate Steering Committee according to a scoring rubric. We expect that 75% of these assignments be will be rated acceptable or above on this category.

SLO3. (Model construction and analysis.) Students will be able to construct statistical models for actual data sets using statistical software and use these models to make inferences and predictions.

M3.1. (Modeling Projects) On a rotating basis amongst the statistical modeling courses Math 540 (Statistical Learning Theory I), Math 541 (Statistical Learning Theory II), Math 550 (Linear Models), and Math 555 (Bayesian Statistical Methods), each year one class project will be selected, collected for all students in the course, and used to assess the graduate-level competence in constructing and analyzing models by the Graduate Steering Committee according to a scoring rubric. It is expected that 75% of the projects will be rated acceptable or above on this category.

M3.2. (Survey) In a survey of students who complete the program, students will be asked if the program provided them with the ability to use statistical software to construct models and make inferences and predictions in situations encountered after completing the program. It is expected that 80% of the responding students report that they felt adequately prepared.

SLO4. (Communicating Statistics) Students will be able to describe statistical models and present the results of statistical studies using correct terminology in a clear, coherent, and effective manner.

M4.1. (Projects) On a rotating basis amongst the statistical modeling courses Math 540 (Statistical Learning Theory I), Math 541 (Statistical Learning Theory II), Math 550 (Linear Models), and Math 555 (Bayesian Statistical Methods), each year one class project will be selected, collected for all students in the course, and used to assess the graduate-level competence in communicating statistics by the Graduate Steering Committee according to a scoring rubric. It is expected that 75% of the projects will be rated acceptable or above on this category.
M4.2. **(Survey)** In a survey of students who complete the Program, students will be asked whether the program provided them with the ability to communicate mathematical ideas and results of statistical modeling outcomes clearly, coherently, and effectively to their supervisors and/or clients. It is expected that 80% of the responding students report that they felt adequately prepared.

Graduate Certificate Program in Statistics Assessment Map

<table>
<thead>
<tr>
<th>Core Requirements</th>
<th>Selected Electives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 530</td>
<td>Math 531</td>
</tr>
<tr>
<td><strong>SLO1</strong></td>
<td><strong>SLO2</strong></td>
</tr>
<tr>
<td>Core theoretical knowledge and skills</td>
<td>Core modeling knowledge and skills</td>
</tr>
<tr>
<td>I/R</td>
<td>I/R</td>
</tr>
<tr>
<td>R</td>
<td>R/E</td>
</tr>
<tr>
<td>R/E</td>
<td>R/E</td>
</tr>
<tr>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>R/E</td>
<td>R/E</td>
</tr>
</tbody>
</table>

Map Key: I = Introduced, R = Reinforced, E = Emphasized


**Students Learning Outcomes (SLO) and Assessment Measures (M)**

**SLO1. (Core theoretical knowledge and skills)** Students will be able to demonstrate knowledge of the main theoretical results and key methods used in operations research and in the development of models for management and industry.

**M1.1. (Final Exam: Math 502)** The final exam of Math 502 (Advanced Linear Algebra) will include a question assessing core theoretical knowledge and skills. The question will be collected for all students in the class and assessed by the Graduate Steering Committee according to a scoring rubric. We expect that 75% of these assignments be will be rated acceptable or above on this category.

**M1.2. (Final Exam: Math 550 or Math 551)** The final exam of Math 550 (Linear Models) or Math 551 (Linear Programming and Optimization) will include a question assessing core theoretical knowledge and skills. The question will be collected for all students in the class and assessed by the Graduate Steering Committee according to a scoring rubric. We expect that 75% of these assignments be will be rated acceptable or above on this category.

**SLO2. (Core modeling knowledge and skills)** Students will be able to recognize and choose the appropriate deterministic and probabilistic models used in management and industry operations.

**M2.1. (Final Exam: Math 502)** The final exam of Math 502 (Advanced Linear Algebra) will include a question assessing core modeling knowledge and skills. The question will be collected for all students in the class and assessed by the Graduate Steering Committee according to a scoring rubric. We expect that 75% of these assignments be will be rated acceptable or above on this category.
M2.2. (Final Exam: Math 550 or Math 551) The final exam of Math 550 (Linear Models) or Math 551 (Linear Programming and Optimization). The question will be collected for all students in the class and assessed by the Graduate Steering Committee according to a scoring rubric. We expect that 75% of these assignments be will be rated acceptable or above on this category.

SLO3. (Constructing and analyzing models) Students will be able to construct deterministic and probabilistic models for concrete situations arising in management and industry using appropriate computational software, and use these models to make inferences and predictions.

M3.1. (Modeling Projects) On a rotating basis amongst the modeling classes Math 551 (Linear Programming and Optimization), Math 552 (Operations Research) and Math 550 (Linear Models), each year one class project will be selected, collected for all students in the course, and used to assess the graduate-level competence in constructing and analyzing models by the Graduate Steering Committee according to a scoring rubric. It is expected that 75% of the projects will be rated acceptable or above on this category.

M3.2. (Survey) In a survey of students who complete the program, students will be asked whether the program provided them with the ability to use appropriate software to construct models and make inferences and predictions in situations encountered after completing the program. It is expected that 80% of the responding students report that they felt adequately prepared.

SLO4. (Communicating modeling outcomes) Students will be able to describe deterministic and probabilistic models and present the results of model application using correct terminology in a clear, coherent, and effective manner.

M4.1. (Projects) On a rotating basis amongst the modeling classes Math 551 (Linear Programming and Optimization), Math 552 (Operations Research) and Math 550 (Linear Models), each year one class project will be selected, collected for all students in the course, and used to assess the graduate-level competence in communicating modeling outcomes by the Graduate Steering Committee according to a scoring rubric. It is expected that 75% of the projects will be rated acceptable or above on this category.

M4.2. (Survey) In a survey of students who complete the Program, students will be asked whether the program provided them with the ability to communicate mathematical ideas and results of operations research modeling outcomes clearly, coherently, and effectively to their supervisors and/or clients. It is expected that 80% of the responding students report that they felt adequately prepared.
Sample Rubrics for SLO Measures

Dear XXX,

While conducting the assessment of our graduate program, we are seeking your help as the instructor of a (core or elective) elective graduate course.

1. For the substantial project components (including written and oral presentations, and any project conducted by students as part of your course), we ask that you collect one or more projects for all students and assess the following Student Learning Outcomes:

   a. One question that addresses Communicating Mathematics (Student Learning Outcome 3, SLO3: Students will be able to communicate mathematical arguments and present the results of a mathematical study in a clear, coherent, and convincing manner.)

   b. One question that addresses Independent Project (Student Learning Outcome 2, SLO4: Students will be able to formulate, investigate, and analyze a research question or a model of a phenomenon or of data, guided by prior research in theory and/or applications.).

2. You score each of these questions according to following coarse rubric for the student performance on the specific question:

   a. 0 = Below the acceptable level.
   b. 1 = At the acceptable level.
   c. 2 = Above the acceptable level.

3. On the Final Exam for this course, we ask that you identify:

   a. One question that addresses Retention of Core Knowledge (Student Learning Outcome 1, SLO1: Students will be able to demonstrate knowledge of the main theoretical results and key methods of core graduate areas in their chosen concentration early in the Program of Study. In particular, students will be proficient in Linear Algebra and in Analysis (Mathematics Concentration) or Statistics (Statistics Concentration).)
Such a question could be stating a theoretical result, proving a basic theorem, or demonstrating knowledge of a key method.

b. One question that addresses **Integration of Core Knowledge** (Student Learning Outcome 2, SLO2: Students will be able understand and employ the basic tools and methods of core graduate areas in their chosen concentration. Such tools and methods range from theoretical techniques to the construction of models and solution methods. In particular, students will be able to demonstrate mastery in Linear Algebra, and in Analysis (Mathematics Concentration) or Statistics (Statistics Concentration). )

Such a question would involve combining core theorems and techniques.

c. One question that addresses **Communicating Mathematics** (Student Learning Outcome 3, SLO3). Note: this question may be the same as for SLO2. If you choose the same question, please indicate so.

2. You score each of these three questions according to following coarse rubric for the student performance on the specific question:

   a. 0 = Below the acceptable level.
   b. 1 = At the acceptable level.
   c. 2 = Above the acceptable level.

It would help if you can send us scanned copies of the projects and final exams with SLOs and scores clearly identified. If you prefer, we can also collect the scored projects and finals from you, make copies with names removed, and return them to you as soon as possible. Note that this is only one part of a broader assessment plan, so the rubric is intentionally coarse.

Thank you very much for your help on this. Let us know if you have any question and if you have suggestions for making this process as simple as possible for you.

Anna and Martin