Mathematics Graduate Programs Self-Study 2016-2017

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

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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.*

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[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)[2], 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 offers. 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

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[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

notable recent innovation is the Mathematical Dissection Lab created by Amy Langville as part of her NSF CAREER award, which involved numerous undergraduates in research projects related to optimization.

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.

		Minorities		Women	
CIP	Discipline	IPEDS	CofC	IPEDS	CofC
11	Computer and Information Science and Support Services	12%	15%	19%	23%
26	Biological and Biomedical Sciences	18%	3%	53%	30%
27	Mathematics and Statistics	9%	18%	29%	32%
40	Physical Sciences	10%	14%	34%	35%

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.*

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

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

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).

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

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.]

FACULTY WORKLOAD
Enrollments 2015-2016

Department		Fall 2015		Spring 2016	
		G	U	G	U
Biology	BIOL	128	4549	133	4482
	TOTAL	136	5160	133	4482
Chemistry and Biochemistry	CHEM		1819		1724
	TOTAL		1819		1724
Computer Science	CSCI		1049		1034
	CSIS	26		39	
	CITA				36
	DATA		52		66
	TOTAL		1144	39	1136
Geology and Environmental Geosciences	GEOL		2234		2097
	TOTAL		2234		2097
Mathematics	MATH	48	3612	43	2848
	TOTAL	48	3612	43	2848
Physics and Astronomy	ASTR		628		567
	PHYS		995		888
	TOTAL		1623		1455
School Total		206	14981	215	13742

Declared Majors

Major	U	G
Biology	746	
Marine Biology	174	45
Biochemistry	69	
Chemistry	85	
Computer & Info Sciences		27
Computer Info Systems	73	
Computer Science	262	
Computing in the Arts	58	
Data Science	32	
Environmental Studies		43
Environmental/Dual Pro		18
Geology	131	
Mathematics	75	18
Astronomy	1	
Astrophysics	30	
Physics	65	
School Total	1828	149

Table 5: Faculty Workload and Declared Majors
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.

Fall Semester	Department	Undergraduate[3]	Graduate	Total	FTE CH Production
2011	MATH	3	174	177	**14.70**
2012	MATH	15	108	123	**10.00**
2013	MATH	0	144	144	**12.00**
2014	MATH	9	153	162	**13.35**
2015	MATH	30	112	142	**11.33**
2016	MASC	6	153	159	**13.15**

[3]*Undergraduate students taking credit hours in graduate level courses*

Table 6: FTE Credit Hour Production.
Source: Institutional Research.

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 surfac*es, 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.

			Sex		Enrollment Status		Total Enrollment	Average Age
Fall Semester	**Degree**	**Major**	**Male**	**Female**	**Full-time**	**Part-time**		
2011	MS	MATH	13	8	13	8	21	27.81
2012	MS	MATH	8	4	5	7	12	30.33
2013	MS	MATH	17	2	11	8	19	25.21
2014	MS	MATH	16	3	8	11	19	22.21
2015	MS	MATH	10	5	8	7	15	22.40
2016	MS	MASC	14	6	7	13	20	25.65

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 of 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[3], and that at Appalachian State had an enrollment of 15[4], 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.

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[3] Source: American Mathematical Society searchable database: 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

We graduated 1 student in Summer 2016 and in AY16-17 we will graduate 10 students.

Total Enrollments - Fall 2011 through Fall 2016		Fall 2011	Fall 2012	Fall 2013	Fall 2014	Fall 2015	Fall 2016
MS	MATH	21	12	19	19	15	20
CERT	MOPR	0	0	1	0	1	2
CERT	MSST	2	4	2	1	3	2
NDG	MATH	1	1	0	2	1	1

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

Applications, Acceptance & Enrollments					
Fall Semester	Degree	Major	Applied	Accepted	Enrolled
2011	MS	MATH	15	11	7
	CERT	MATH	2	0	0
	CERT	MOPR	0	0	0
	NDG	MATH	3	2	2
2012	MS	MATH	5	5	5
	CERT	MATH	5	5	5
	CERT	MOPR	2	2	2
	NDG	MATH	2	2	2
2013	MS	MATH	16	13	11
	CERT	MATH	2	1	1
	CERT	MOPR	1	1	1
	NDG	MATH	1	1	1
2014	MS	MATH	11	8	5
	CERT	MATH	2	1	1
	CERT	MOPR	1	0	0
	NDG	MATH	1	1	1
2015	MS	MATH	9	8	7
	CERT	MATH	2	2	2
	CERT	MOPR	1	1	1
	NDG	MATH	1	1	1
2016	MS	MASC	14	12	7
	CERT	MATH	3	1	1
	CERT	MOPR	1	1	1
	NDG	MATH	1	1	1

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						
Degree	Major	2011-12	2012-13	2013-14	2014-15	2015-16
MS	MATH	8	9	7	10	4

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.

Federal Race						
Fall Semester	**Degree**	**Major**	**White**	**URM**[1]	**Other**[2]	
2011	MS	MATH	17	2	2	
2012	MS	MATH	11	1		
2013	MS	MATH	16	3		
2014	MS	MATH	17	2		
2015	MS	MATH	14	1		
2016	MS	MASC	19	1		

[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.

Citizenship					
Fall Semester	**Degree**	**Major**	**US**	**NO**	**PR**
2011	MS	MATH	18	2	1
2012	MS	MATH	11		1
2013	MS	MATH	18		1
2014	MS	MATH	19		
2015	MS	MATH	15		
2016	MS	MASC	19		1

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

11.] 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[5], 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.

Financial Aid - Percent of Enrollment						
Fall Semester	**Degree**	**Major**	**Loans**	**Loans with Other**	**Other**	**No Aid**
2011	MS	MATH	38%	14%	14%	33%
2012	MS	MATH	50%	0%	8%	42%
2013	MS	MATH	47%	11%	0%	42%
2014	MS	MATH	32%	11%	5%	53%
2015	MS	MATH	20%	20%	20%	40%
2016	MS	MASC	30%	10%	25%	35%

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

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

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 CofC.

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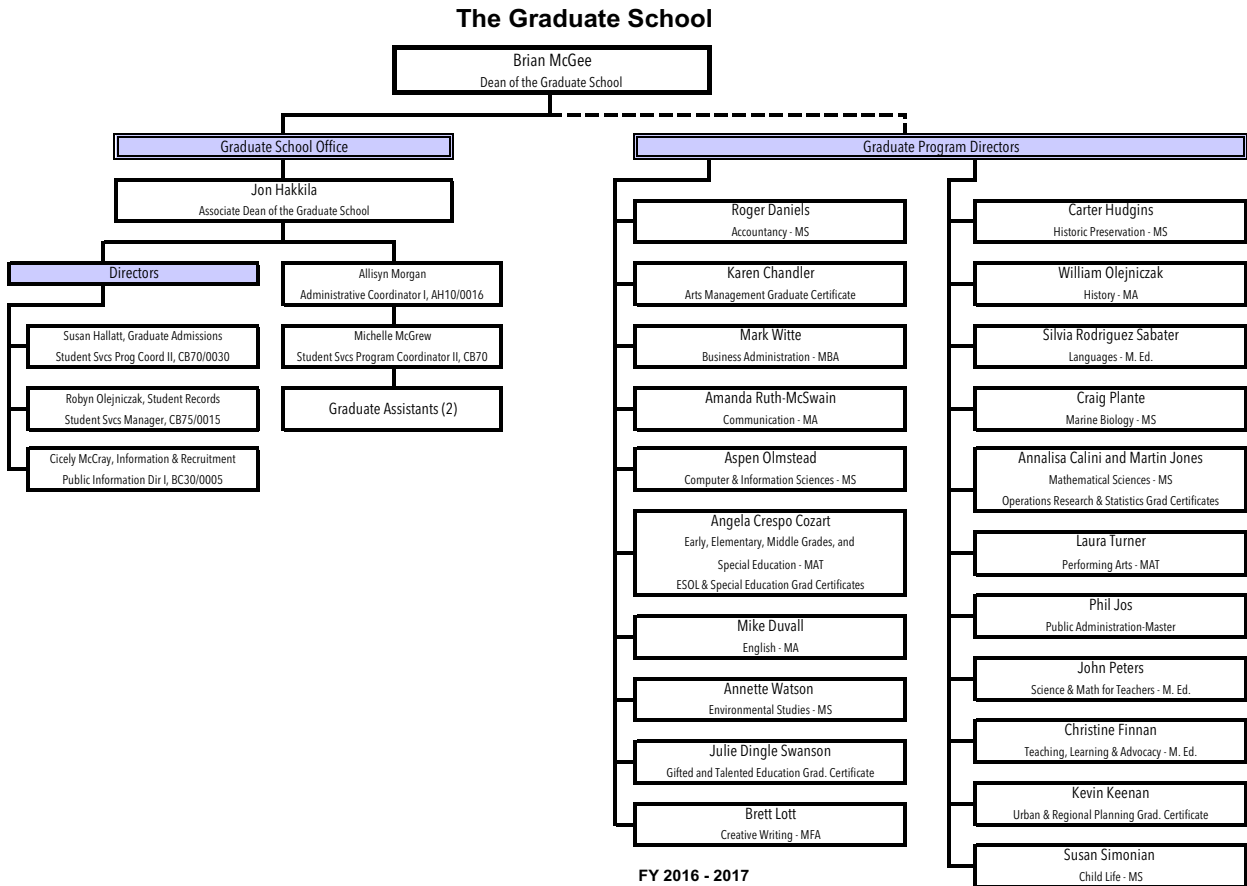
Strategy 2. We will continue to capitalize on the 4+1 program as a means to establish stronger ties between undergraduate programs (in math and in the sciences) and our graduate program.

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

A1. Organizational Chart of the Graduate School (2016-2017)

COLLEGE of CHARLESTON
GRADUATE SCHOOL
UNIVERSITY OF CHARLESTON, S.C.
1770

The Graduate School

Brian McGee
Dean of the Graduate School

Graduate School Office

Jon Hakkila
Associate Dean of the Graduate School

Directors

Susan Hallatt, Graduate Admissions
Student Svcs Prog Coord II, CB70/0030

Robyn Olejniczak, Student Records
Student Svcs Manager, CB75/0015

Cicely McCray, Information & Recruitment
Public Information Dir I, BC30/0005

Allisyn Morgan
Administrative Coordinator I, AH10/0016

Michelle McGrew
Student Svcs Program Coordinator II, CB70

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 Olmstead
Computer & Information Sciences - MS

Angela Crespo Cozart
Early, Elementary, Middle Grades, and
Special Education - MAT
ESOL & Special Education Grad Certificates

Mike Duvall
English - MA

Annette Watson
Environmental Studies - MS

Julie Dingle Swanson
Gifted and Talented Education Grad. Certificate

Brett Lott
Creative Writing - MFA

Carter Hudgins
Historic Preservation - MS

William Olejniczak
History - MA

Silvia Rodriguez Sabater
Languages - M. Ed.

Craig Plante
Marine Biology - MS

Annalisa Calini and Martin Jones
Mathematical Sciences - MS
Operations Research & Statistics Grad Certificates

Laura Turner
Performing Arts - MAT

Phil Jos
Public Administration-Master

John Peters
Science & Math for Teachers - M. Ed.

Christine Finnan
Teaching, Learning & Advocacy - M. Ed.

Kevin Keenan
Urban & Regional Planning Grad. Certificate

Susan Simonian
Child Life - MS

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) (oF)
- 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.

Mathematics Course Substitution Map

Undergraduate Course	Graduate Course Equivalent
MATH 402: Advanced Linear Algebra	MATH 502: Advanced Linear Algebra
MATH 415: Complex Analysis	MATH 515: Complex Analysis
MATH 423: Partial Differential Equations	MATH 523: Partial Differential Equations
MATH 430: Mathematical Statistics I	MATH 530: Mathematical Statistics I
MATH 430: Mathematical Statistics II	MATH 531: Mathematical Statistics II
MATH 440: Statistical Learning I	MATH 540: Statistical Learning I
MATH 441: Statistical Learning II	MATH 541: Statistical Learning II
MATH 445: Numerical Analysis	MATH 545: Numerical Analysis
MATH 449: Linear Models	MATH 550: Linear Models
MATH 451: Linear Programming	MATH 551: Linear Programming
MATH 452: Operations Research	MATH 552: Operations Research
MATH 455: Bayesian Methods	MATH 555: Bayesian Methods

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:

- *How to Teach Mathematics*, Steven G. Krantz, American Mathematical Society, 2nd edition.
- Moore, T. L. (2000), *Teaching Statistics: Resources for Undergraduate Instructors*, MAA Notes no. 52.
- *On proof and progress in mathematics*, William P. Thurston. Bulletin of the American Mathematical Society 30, no. 2 (1994), 161–177.
- 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)

- *Handbook of Writing for the Mathematical Sciences,* Nicholas J, Higham, SIAM: Society for Industrial and Applied Mathematics; 2nd edition, 1998.
- *Frames of Mind: The theory of multiple intelligences,* Howard Gardner. Fontana Press, 2nd edition, 1993.

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.

- **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.
3. *Outliers: The Story of Success,* Malcolm Gladwell. Little, Brown and Company, 2*008.*
4. *Higher Learning in the Nation's Service*, Ernest L. Boyer and Fred M. Hechinger. Carnegie Foundation for the Advancement of Teaching, 1981.
5. *College: The Undergraduate Experience in America,* Ernest L. Boyer. New York: Harper & Row, 1987.
6. *The Uses of the University*, Clark Kerr. Harvard University Press, 2001
7. *Handbook of Writing for the Mathematical Sciences*, Nicholas J. Higham, SIAM, 2nd ed., 1998

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.

Michael (Ron) England (Ph.D., Senior Instructor). Elasticity.

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.

Thomas Ivey (Professor). Differential Geometry, Differential Equations.

Debby 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, Probablity, 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

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

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: **Agrest, S.** (Principal), "LS-SCAMP 2013-2018, Year 3," $115,000.00. (October 2013 - August 2018).

Funded: **Agrest, S.** (Principal), "LS-SCAMP 2013-2018, Year 2," $115,000.00. (January 2016 - August 2016).

Funded: **Agrest, S.** (Principal), "Tensor SUMMA Math Camp, year 2," $6,000.00. (June 2015 - May 2016).

Funded: **Agrest, S.** (Principal), "Tensor SUMMA Math Camp," $6,000.00. (June 2015 - August 2015).

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

Funded: **Agrest, S.** (Supporting), "Howard Hughes Medical Institute Grant," $500.00. (August 2014 - December 2014).

Submitted: **Anguelova, I.** (Principal), "Chiral algebras with Gamma-type singularites," $35,000.00. (September 2014 - August 2019).

Submitted: **Anguelova, I**. (Principal), "Chiral Algebras and their Morphisms," $39,904.00. (September 2016 - August 2017).

Submitted: **Anguelova, I.** (Principal), "Sabbatical Support," $34,462.00. (July 2016 - June 2017).

Submitted: **Anguelova, I.** (Principal), "Chiral algebras with Gamma-type singularites," $40,000.00. (March 2015 - February 2017).

Funded: **Anguelova, I.** (Principal), "AWM-NSF Travel Grant: presentation at the XXIInd International Conference on Integrable Systems and Quantum symmetries (ISQS-22), "Chiral algebras with Gamma-type singularites and Virasoro structures"," $2,670.00. (June 2014 - July 2014).

Funded: **Calini, A. M. (Principal),** "Collaborative Research, RUI: Nonlinear Schroedinger Models in Fluid Dynamics: Rogue Waves and Vortex Filaments," $174,104.00. (August 2011 - July 2014).

Funded: **Calini, A. M. (Principal)**, "Collaborative: Southeastern Atlantic Mathematical Sciences Workshop," $36,324.00. (September 2008 - August 2011).

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

Submitted: **Diamond, B. E.** (Principal), "New Science Center Biology Outfit for Biomedical and Behavioral Research," $8,587,975.00. (April 2010 - March 2015).

Submitted: **Howell, J. S.** (Principal), "A Proposal for a Southeastern Atlantic Mathematical Sciences (SEAMS) Workshop," $0.00. (September 2015 - August 2018).

Funded: **Przeworski, A.** (Co-Investigator), **Ivey, T. A.** (Principal), "Southeast Geometry Conference, 2010-2012," $22,440.00. (April 2010 - March 2013).

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

Funded: **Jones, M. L.** (Principal), "POST-INSTITUTE IMPLEMENTATION SENCER NSF 2014-2016 SUB-AWARDS," $3,000.00. (January 2015 - December 2016).

Submitted: **Jones, M. L.** (Principal), "Tropical Environmental Studies," $56,859.00. (September 2009 - August 2011).

Funded: **Jurisich, E. G.,** Barron, K., Li, H., Milas, A., "Conference: Lie Algebras, Vertex Operator Algebras, and Related Topics," $47,000.00. (August 2015).

Funded: **Kai, B. (Principal),** "Statistical Analysis and Modeling for MUSC," $14,500.00. (June 2012 - August 2012).

Funded: **Lafortune, S.** (Principal), "Simons Foundation Collaboration Grant," $35,000.00. (September 2016 - August 2021).

Submitted**: Lafortune, S.** (Principal), "Numerical and Analytical Aspects of the Evans Function," $164,711.00. (May 2016 - May 2019).

Submitted: **Lafortune, S.** (Principal), "2013 Simons Foundation Collaboration Grant," $35,000.00. (September 2013 - August 2018).

Funded: **Lafortune, S.** (Principal), "RUI: Stability analysis for solutions of the Vortex Filament equation and beyond," $137,721.00. (June 2009 - May 2012).

Submitted: **Langville, A. N.** (Principal), "AF: Small: RUI: Ranking and Matching under Preferences: Project Summary," $399,129.00. (July 2016 - June 2019).

Funded: **Langville, A. N. (Principal**), "AF: Small: RUI: Ranking and Clustering by Integer and Linear Optimization," $491,305.00. (September 2011 - August 2014).

Submitted: **Langville, A. N. (Principal),** "Cluster Aggregation of Biomedical Data," $190,893.00. (January 2011 - December 2012).

Funded: **Langville, A. N. (Principal),** "CAREER: Information Retrieval and Mathematical Dissection Lab, Year 5 Supplement," $10,000.00. (February 2006 - January 2012).
Submitted: **Sarvate, D. G.** (Principal), "SCAMP FY08 - FY12," $215,000.00. (July 2007 - June 2012).

Publications (Books, Book Chapters, Journal Articles only)

Books

Langville, A. N., Meyer, C. D. (2012). *Who's #1?: The Science of Rating and Ranking* (pp. 253). Princeton, NJ: Princeton University Press.

Book Chapters

Jin, R. (2015). Density Problems and Freiman's Inverse Problems. In Peter A. Loeb and Manfred P.H. Wolff (Ed.), Nonstandard Analysis for the Working Mathematician, 2nd edition (pp. 40). Springer Netherlands.

Kasman, A. (2012). A Survey of Fictional Mathematics in Literature. In E. Sklar and J. Sklar (Ed.), Mathematics and Popular Culture: Essays on Appearances in Film, Fiction, Games, Television and Other Media. McFarland.

Journal Articles

Iana Anguelova

Anguelova, I. (2015). Multilocal bosonization. *Journal of Mathematical Physics, 56*, 13 pages, 121702.

Anguelova, I. (2014). Virasoro structures in the twisted vertex algebra of the particle correspondence of type C. In V. Dobrev (Ed.), "Lie Theory and Its Applications in Physics", in Springer Proceedings in Mathematics and Statistics, 111, 435-446.

Anguelova, I., Cox, B. L., Jurisich, E. G. (2014). N-point locality for vertex operators: normal ordered products, operator product expansions, twisted vertex algebras. *Journal of Pure and Applied Algebra, 218* (12), 2165-2203.

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. (2014). Boson-fermion correspondence of type D-A and multi-local Virasoro representations on the Fock space $\mathit{F^{\otimes \frac{1}{2}}}$. *Journal of Mathematical Physics*, 23 pages.

Anguelova, I. (2013). Boson-fermion correspondences, bicharacters and twisted vertex algebras. *Journal of Mathematical Physics, 54*, 38.

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 F^{1/2}. *Journal of Physics A, 474* (1), 20.

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Lasiecka, I., **Webster, J. T.** (2014). Kutta-Joukowski flow conditions in flow-plate interactions: subsonic case, *Nonlinear Anal. B* 17, 171–191.

Chueshov, I., Lasiecka, I., **Webster, J. T.** (2014). Attractors for delayed, non-rotational von Karman plates with applications to flow-structure interactions without any damping. *Commun. PDE* 39(11), 1965–1997.

Geredeli, P. G., **Webster, J. T.** (2013). Decay rates to equilibrium for nonlinear plate equations with degenerate, geometrically-constrained damping. *Appl. Math. Optim.* 68(3), 361–390.

Chueshov, I., Lasiecka, I., **Webster, J. T.** (2013). Evolution semigroups in supersonic flow-plate interactions. *J. Diff. Eqns.* 254(4), 1741–1773.

Lasiecka, I., **Webster, J. T.** (2013). Generation of bounded semigroups in nonlinear subsonic flow–structure interactions with boundary dissipation. *Math. Meth. Appl. Sci.* 36(15), 1995–2010.

Geredeli, P. G., Lasiecka, I., **Webster, J. T.** (2013). Smooth attractors of finite dimension for von Karman evolutions with nonlinear frictional damping localized in a boundary layer. *J. Diff. Eqns*. 254(3), 1193–1229.

Lasiecka, I., **Webster, J. T.** (2012). Generation of Bounded Semigroups in Nonlinear Subsonic Flow-Structure Interactions with Boundary Dissipation, *Math. Meth. Appl. Sci.,* 36, pp. 1995–2010.

Webster, J. T. (2011). Weak and strong solutions of a nonlinear subsonic flow–structure interaction: Semigroup approach. *Nonlin. Anal. A*, 74(10), 3123–3136.

Young, P. T. (2016). Bernoulli and poly-Bernoulli polynomial convolutions and identities of p-adic Arakawa–Kaneko zeta functions. *Int. J. Number Theory* 12(5), 1295-1309.

Young, P. T., Cenkci, M. (2015). Generalizations of poly-Bernoulli and poly-Cauchy numbers. *Euro. J. Mathematics* 1(4), 799-828.

Young, P. T. (2015). The p-adic Arakawa-Kaneko zeta functions and p-adic Lerch transcendent. *Journal of Number Theory*, 155, 13-35.

Young, P. T. (2014). Symmetries of Stirling number series. *The Fibonacci Quarterly*, 52(5), 205-211.

Young, P. T. (2014). "Symmetries of Bernoulli polynominal series and Arakawa-Kaneko zeta functions". *Journal of Number Theory*, 143, 142-161.

Young, P. T. (2013). Rational series for multiple zeta and log gamma functions. *J. Number Theory* (133.12), 3995-4009.

Young, P. T., Tangedal, B. (2013). Explicit computation of Gross-Stark units over real quadratic fields. *J. Number Theory* (133.3), 1045-1061.

Young, P. T., Luca, F. (2012). On the number of divisors of n! and of the Fibonacci numbers. *Glasnick Matem.* 47(67), 285-293.

Young, P. T., Luca, F. (2012). On the log-concavity of the degenerate Bernoulli numbers. *Int. J. Number Theory* (8.3), 789-800.

Young, P. T. (2011). Bernoulli numbers and generalized factorial sums. *INTEGERS* (11A), Article 21 (electronic).

Young, P. T., Luca, F. (2011). Coincidences of Catalan and q-Catalan numbers". *INTEGERS* (11A), Article 16 (electronic).

Young, P. T., Tangedal, B. (2011). On p-adic multiple zeta and log gamma functions. *J. Number Theory* (131.7), 1240-1257.

Young, P. T., Luca, F. (2011). On the binary expansion of the odd Catalan numbers. *Aportaciones Matem., Investigacion* (20), 185-190.

Young, P. T., Luca, F. (2011). Some p-adic congruences for pq-Catalan numbers. *Aportaciones Matem., Investigacion* (20), 191-197.

Keynote and Plenary Addresses

[Exclude invited seminars and colloquia at other departments.]

Agrest, S., South Carolina Council of Teachers of Mathematics 2011 Conference, "Math and Science, Working Together," SCCTM, Charleston, SC. (October 2011).

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).

Calini, A. M., Lafortune, S., Ivey, T. A., Eighth Conference of the Euro-American Consortium for Promoting the Application of Mathematics in Technical and Natural Sciences, Keynote talk on "Stability of Vortex Filaments," Euro-American Consortium and SIAM, Albena, Bulgaria. (June 2016).

Calini, A. M., Charleston Chapter of Sigma Xi Annual Meeting, "Modeling and Forecasting Rogue Ocean Waves," Charleston Chapter of Sigma Xi, The Citadel. (April 2015).

Calini, A. M., Ivey, T. A., Lafortune, S., International Conference of Mathematics of Nonlinearity in Neural and Physical Sciences, Plenary talk: "Stability of Vortex Filaments," New York University, Shanghai, Shanghai, China. (June 2015).

Calini, A. M., Program in Applied Mathematics 35th Anniversary Meeting., "Soliton equations that come from geometry.," University of Arizona, Tucson, AZ. (April 2014).

Calini, A. M., Ivey, T. A., Lafortune, S., Geometrical Aspects of Hydrodynamics Workshop, Plenary talk: "Methods of integrable systems for vortex filament flows.," Simons Center for Geometry and Physics, Stony Brook, NY. (May 2014).

Calini, A. M., Ivey, T. A., Lafortune, S., Conference on Integrable Systems, Random Matrices, and Combinatorics., Plenary talk: "Integrable dynamics of vortex filaments.," University of Arizona, Tucson, AZ. (October 2013).

Calini, A. M., Ivey, T. A., Lafortune, S., ESF-EMS-CRM-Pi Conference on 'KNOTS & LINKS', "Integrable evolution of closed vortex filaments: finite-gap solutions and their linear stability," European Science Foundation (and also European Math Society and Centro di Ricerca Matematica-Pisa), Pisa, Italy. (July 2011).

Calini, A. M., Escuela de Verano, Ecuaciones de Ondas Dispersivas, IIMAS, UNAM, Four Lectures on: " Integrable Equation Describing the Motion of Vortex Filaments: Knotted
Solutions and their Stability," Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas, UNAM, UNAM, Mexico City, Mexico. (June 2012).

Ivey, T. A., Ionel, M., New Directions in Exterior Differential Systems, "Austere Submanifolds in Euclidean Space," National Science Foundation, Estes Park, Colorado. (July 2013).

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).

Ivey, T. A., Summer School on Differential Geometry, Ewha University, "Five Lectures on Moving Frames," Ewha Womans University, Seoul, South Korea. (July 2012).

Ivey, T. A., Ionel, M., Workshop: Manifolds with special holonomy and their calibrated submanifolds, "Austere Submanifolds in Complex Projective Space," NSF, NSERC, and the province of Alberta, Banff International Research Station (BIRS). (April 2012).

Jones, M. L., Invited Lecture for STEM Scholars, "Statistical Modeling and Computation," Lenoir-Rhyne University, Hickory, NC. (February 2012).

Jones, M. L., Invited Lecture for STEM Scholars, "Statistical Modeling and Computation," Columbia College, Columbia, SC. (November 2011).

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

Kasman, A., "Mathematical Fiction : A Quick Tour of the Landscape of Imagined Mathematicians and Fantastical Mathematics," Politecnico di Torino / ISMB / ICMC / Citta di Torino, Torino (Turin), Italy. (May 2015).

Kasman, A., Mathematics for Everyone Lecture Series, "A Glimpse of Soliton Theory," University of Notre Dame, South Bend, IN. (November 2013).

Kasman, A., Solitons in Two-Dimensional Water Waves and Applications to Tsunami, "A Glimpse of Soliton Theory," NSF / CBMS / UTPA, University of Texas - PanAmerican. (May 2013).

Kasman, A., Gathering 4 Gardner, "Why Mathematical Fiction?," University of Northern Colorado, Greeley, CO. (November 2011).

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., Machine Learning Conference, "Machine Learning Algorithms," Atlanta, GA. (September 2014).

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).

Langville, A. N., Carolina Sports Analytics Meeting, Invited Panelist, Furman University, Furman University. (April 2013).

Langville, A. N., Museum of Mathematics, "Random Search, Ordered Results: How search engines use mathematics to organize the Web," Math Encounters Lecture, New York, NY. (January 2013).

Langville, A. N., Neural Information Processing Systems, "Ranking with Optimization," Social Choice Workshop, Lake Tahoe, Nevada. (December 2012).

Langville, A. N., Tech Talk with Michael Kastler, "Who's #1?: The Science of Rating and Ranking," Chicago WRLR 98.3FM, Chicago, IL. (April 2012).

LeMesurier, B. J., Escuela de Verano, Ecuaciones de Ondas Dispersivas, IIMAS, UNAM, Four Lectures on: "Conservative Discretization Methods for Wave Equations, Lattice Equations, and Conservation Laws," Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas, UNAM, UNAM, Mexico City, Mexico. (June 2012).

Mitchener, W. G., Evolution of Language (Evolang), "How selection for language could distort the dynamics of human evolution," Tulane University, New Orleans, LA. (March 2016).

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

Sarvate, D. G., National Mathematics Day Celebration, 127th Birth Anniversary of Ramanujan, "Combinatorial Designs, Some Variations and an Application," Nowrosjee Wadia College, Pune, India, Pune, India. (December 2014).

Young, J. E., T.H. Lee Technology and Leadership Conference, "Predictive Analytics in the Real World," Thomas H. Lee Partners, Boston. (October 2015).

Young, J. E., SPARC Lecture Series, "Data Science and Predictive Analytics," SPARC, Charleston, SC. (November 2013).

A8. Mathematics Faculty Service Activities

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

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.

Program Director (elected) of the Society for Industrial and Applied Mathematics (SIAM) Activity Group on Nonlinear Waves & Coherent Structures (NWCS). 1/2015-12/2016.

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.

Editor, "Proceedings of the Conference on Lie Algebras, Vertex Operator Algebras, and Related topics," American Mathematical Society. (December 2015 - August 2016).

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).

Editorial Board Member, "Mathematics Awareness Month," Joint Policy Board for Mathematics, AMS, AMSTAT, SIAM, MAA. (September 2015 - June 2016).

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

Committee Chair, SAMSI 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).

Editorial Board Member, "Journal of Combinatorics, Information and System Sciences." (October 2007 - December 2011).

Webster, Justin

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

Conference Organization

Calini, Annalisa M.

Chief Conference Organizer. The 2016 SIAM Conference on Nonlinear Waves and Coherent Structures. January 2015-August 2016.

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

Conference Session Chair, The Ninth IMACS International Conference. (October 2014 - April 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, International Symposium on Biomathematics and Ecology: Education and Research (BEER-IX). (January 2016 - October 2016).

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

Kai, Bo

Conference Program Organizer, The 2nd Institute of Mathematical Statistics Asia Pacific Rim Meeting. (July 2011 - July 2012).

Conference Session Chair, 2011 Joint Statistical Meetings. (August 2011).

Lafortune, Stephane

Conference Program Organizer, 2015 SIAM Conference on Analysis of Partial Differential Equations. (September 2015 - December 2015).

Conference Program Organizer, Ninth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena. (January 2015 - April 2015).

Conference Program Organizer, SIAM Conference on Nonlinear Waves. (May 2014 - August 2014).

Conference Program Organizer, SIAM Conference on Nonlinear Waves. (May 2014 - August 2014).

Conference Program Organizer, SIAM Conference on Dynamical Systems. (January 2013 - May 2013).

Mitchener, W.

Conference Program Organizer, Midwestern Conference on Combinatorics and Combinatorial Computing. (October 2014 - October 2015).

Park, Jin-Hong

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

Przeworski, Andrew

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

Sarvate, Dinesh G.

Conference Chairperson, Midwestern Conference on Combinatorics and Combinatorial Computing. (October 2014 - November 2015).

Conference Program Organizer, ICDMAS2014: International Conference on Discrete Mathematics and Applied Sciences, Bangkok, Thailand., Member. (February 2014 - May 2014).

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.

Facilitator, Math Meet. (January 2015 - February 2015).

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

Presenter, Charleston Charter School for Math and Science STEM Night. (April 2016).

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).

Webmaster, Web mining website. (May 2005 - 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).

Cultural and religious teaching. (August 1988 - May 2012).

Water Mission International. (March 2012).

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).

Invited Manuscript Reviewer or Referee, "Journal of Pure and Applied Algebra," Editor, Journal of Pure and Applied Algebra. (June 2014 - September 2014).

Invited Manuscript Reviewer or Referee, "Springer Proceedings," Editor, Springer Proceedings. (February 2014 - April 2014).

Invited Manuscript Reviewer or Referee, "Journal of Mathematical Physics," Editor, Journal of Mathematical Physics, AIP. (October 2013 - November 2013).

Calini, Annalisa M.

Invited Manuscript Reviewer or Referee, "Journal of Differential Geometry," Journal of Differential Geometry. (February 2016 - March 2016).

Invited Manuscript Reviewer or Referee, "Journal of Mathematical Physics," American Institute of Physics. (March 2015 - May 2015).

Invited Manuscript Reviewer or Referee, "Journal of Physics A," IOP Publishing. (February 2015 - March 2015).

Invited Manuscript Reviewer or Referee, "Journal of Optics." (November 2014 - December 2014).

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, "Journal of Geometry." (March 2014 - April 2014).

Invited Manuscript Reviewer or Referee, "Nonlinearity." (January 2014 - February 2014).

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

Carter, James E.

Invited Manuscript Reviewer or Referee, "Non-norm-Euclidean fields in basic Z_l-extensions," MathSciNet. (April 2016 - July 2016).

Invited Manuscript Reviewer or Referee, "Classes de Steinitz, codes cycliques de Hamming et classes galoisiennes ŕealisables d'extensions non ab́eliennes de degŕe 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, "A determinant formula for the relative class number of an imaginary abelian number field," Zentralblatt Math. (April 2015 - July 2015).

Invited Manuscript Reviewer or Referee, "On tamely ramified Iwasawa modules for Z_p-extensions of imaginary quadratic fields," MathSciNet. (April 2015 - July 2015).

Invited Manuscript Reviewer or Referee, "Power integral bases for certain pure sextic fields," Zentralblatt Math. (January 2015 - February 2015).

Invited Manuscript Reviewer or Referee, "On p-class groups and the Fontaine-Mazur conjecture," MathSciNet. (December 2014 - January 2015).

Invited Manuscript Reviewer or Referee, "Linear forms on Sinnott's module," MathSciNet. (July 2014 - November 2014).

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, "An explicit candidate for the set of Steinitz classes of tame Galois extensions with fixed Galois group of odd order," MathSciNet. (November 2013 - January 2014).

Invited Manuscript Reviewer or Referee, "Realizable Galois module classes over the group ring for non abelian extensios," MathSciNet. (October 2013 - December 2013).

Invited Manuscript Reviewer or Referee, "Origami rings," MathSciNet. (August 2013 - September 2013).

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

Invited Manuscript Reviewer or Referee, "On metacyclic extensions," MathSciNet. (January 2013 - April 2013).

Invited Manuscript Reviewer or Referee, "The class number one problem for some non-normal CM-fields of degree 2p," MathSciNet. (October 2012 - January 2013).

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

Invited Manuscript Reviewer or Referee, "On counting rings of integers as Galois modules," MathSciNet. (August 2012 - December 2012).

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

Proofreader of journal article, "Partial fractions and an irrationality measure of e," Jaroslav Hancl et al., authors. (June 2012 - July 2012).

Invited Manuscript Reviewer or Referee, "On the fundamental units of a totally real cubic order generated by a unit," MathSciNet. (April 2012 - May 2012).

Invited Manuscript Reviewer or Referee, "Differents, discriminants and Steinitz classes," Bulletin of the London Mathematical Society. (March 2012 - May 2012).

Invited Manuscript Reviewer or Referee, "Steinitz classes of tamely ramified nonabelian extensions of odd prime power order," MathSciNet. (December 2011 - January 2012).

Proofreader of journal article, "Productly linearly independent sequences," Jaroslav Hancl, Author. (November 2011 - December 2011).

Proofreader of journal article, "A Criterion for linear independence of infinite products," Jaroslav Hancl, Author. (October 2011).

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, "The Royal Society of Edinburgh: Proceedings A." (May 2015).

Invited Manuscript Reviewer or Referee, "Journal of Algebra." (February 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, "Springer Graduate Texts in Mathematics." (May 2014 - December 2014).

Invited Manuscript Reviewer or Referee, "Letters in Mathematics Physics." (September 2014 - November 2014).

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," AMS. (January 2013 - July 2013).

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

"Mathematical Reviews," AMS. (January 2013 - April 2013).

Invited Manuscript Reviewer or Referee, "Communications in Algebra." (January 2013 - February 2013).

Invited Manuscript Reviewer or Referee, "Journal of Algebra." (January 2013 - February 2013).

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," American Mathematical Society. (February 2012).

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," American Mathematical Soceity. (January 2012).

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," American Mathematical Soceity. (January 2012).

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

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," American Mathematical Society. (July 2011).

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," American Mathematical Society. (June 2011 - July 2011).

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," AMS. (January 2011 - July 2011).

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," AMS. (January 2011 - July 2011).

Howell, Jason S

Invited Manuscript Reviewer or Referee, "Advances in Applied Mathematics and Mechanics." (December 2015 - February 2016).

Invited Manuscript Reviewer or Referee, "Mathematics and Computers in Simulation." (December 2015 - February 2016).

Invited Manuscript Reviewer or Referee, "SIAM Journal on Numerical Analysis." (December 2015 - February 2016).

Invited Manuscript Reviewer or Referee, "Journal of Computational and Applied Mathematics." (July 2015 - September 2015).

Invited Manuscript Reviewer or Referee, "Numerical Algorithms." (April 2015 - June 2015).

Invited Manuscript Reviewer or Referee, "Numerical Methods for Partial Differential Equations." (January 2015 - March 2015).

Invited Manuscript Reviewer or Referee, "SIAM Journal on Numerical Analysis." (January 2015 - March 2015).

Invited Manuscript Reviewer or Referee, "Computer Methods in Applied Mathematics and Engineering." (March 2014 - December 2014).

Invited Manuscript Reviewer or Referee, "Computers and Mathematics with Applications." (June 2014 - July 2014).

Invited Manuscript Reviewer or Referee, "Applied Mathematical Modeling." (May 2014 - July 2014).

Invited Manuscript Reviewer or Referee, "Applicable Analysis." (February 2014 - March 2014).

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

Invited Manuscript Reviewer or Referee, "Numerische Mathematik." (November 2013 - December 2013).

Invited Manuscript Reviewer or Referee, "Applied Numerical Mathematics." (August 2013 - September 2013).

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

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

Invited Manuscript Reviewer or Referee, "Numerical Methods for Partial Differential Equations." (August 2012).

Ivey, Thomas A.

Invited Manuscript Reviewer or Referee, "Referee," Journal of Geometry and Physics. (June 2016).

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

"Referee," Selecta Mathematica. (March 2014).

Invited Manuscript Reviewer or Referee, "Referee," Monatschefte fur Mathematik. (December 2013 - January 2014).

Invited Manuscript Reviewer or Referee, "Referee," Differential Geometry and its Applications. (August 2013 - December 2013).

Invited Manuscript Reviewer or Referee, "Referee," Journal of Geometry and Physics. (March 2013 - July 2013).

Invited Manuscript Reviewer or Referee, "Referee," Central European Journal of Mathematics. (December 2012 - January 2013).

"Referee," Selecta Mathematica. (August 2012 - December 2012).

Jin, Renling

Invited Manuscript Reviewer or Referee, "The Electronic Journal of Combinatorics," Editor Catherine Greenhill. (June 2016 - October 2016).

Invited Manuscript Reviewer or Referee, "The Journal of Symbolic Logic," The Journal of Symbolic Logic Editor, Thomas Strahm. (June 2016 - August 2016).

Invited Manuscript Reviewer or Referee, "Combinatorica," Managing Editor Viktor Harangi. (May 2016 - August 2016).

Invited Manuscript Reviewer or Referee, "INTEGERS: The Electronic Journal of Combinatorial Number Theory," The journal managing editor Bruce Landman. (April 2016 - August 2016).

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," Mathematical Reviews Editorial Board. (June 2016 - July 2016).

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," Mathematical Reviews Editorial Board. (April 2016 - May 2016).

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," Mathematical Reviews Editorial Board. (March 2016 - April 2016).

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," Mathematical Reviews Editorial Board. (March 2016 - April 2016).

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," Mathematical Reviews Editorial Board. (March 2016 - April 2016).

Invited Manuscript Reviewer or Referee, "The Journal of Number Theory," David Goss, Ph.D., Editor-in-Chief. (December 2015 - March 2016).

Invited Manuscript Reviewer or Referee, "Foundations of Science," Journal Editor-in-Chief, Diederik Aerts. (December 2015 - February 2016).

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," Mathematical Reviews Editorial Board. (December 2015 - January 2016).

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," Mathematical Reviews Editorial Board. (June 2015 - August 2015).

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," Mathematical Reviews Editorial Board. (May 2015 - August 2015).

Invited Manuscript Reviewer or Referee, "Monatshefte für Mathematik," Prof. Sy Friedman, associate editor. (May 2015 - August 2015).

Invited Manuscript Reviewer or Referee, "Transaction of American Mathematical Society," Editor, Vitaly Bergelson. (May 2015 - August 2015).

Invited Manuscript Reviewer or Referee, "Monatshefte für Mathematik," Prof. Gerald Teschl , associate editor. (April 2015 - July 2015).

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).

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," Mathematical Reviews Editorial Board. (March 2015 - April 2015).

Invited Manuscript Reviewer or Referee, "Journal of Combinatorics," International Press of Boston. (December 2014 - March 2015).

Invited Manuscript Reviewer or Referee, "Advances in Mathematics," Journal Editor, Jerome Keisler. (July 2014 - October 2014).

Invited Manuscript Reviewer or Referee, "Acta Mathematica Sinica, Chinese series," Journal Managing Editor. (June 2014 - September 2014).

Invited Manuscript Reviewer or Referee, "Foundations of Science," Journal Editor-in-Chief, Diederik Aerts. (July 2014).

Invited Manuscript Reviewer or Referee, "Transaction of American Mathematical Society," Editor, Vitaly Bergelson. (July 2014).

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," Mathematical Reviews Editorial Board. (January 2014 - February 2014).

Invited Manuscript Reviewer or Referee, "Illinois Journal of Mathematics," Assistant Managing Editor, Debbie Broadrick. (October 2013 - January 2014).

Invited Manuscript Reviewer or Referee, "Foundations of Science," Journal Editor-in-Chief, Diederik Aerts. (August 2013 - October 2013).

Invited Manuscript Reviewer or Referee, "Acta Mathematica Sinica," The journal editor Qi Feng. (June 2013 - October 2013).

Invited Manuscript Reviewer or Referee, "INTEGERS: The Electronic Journal of Combinatorial Number Theory," The journal managing editor Bruce Landman. (June 2013 - September 2013).

Invited Manuscript Reviewer or Referee, "Proceedings of American Mathematical Society," Editor, Mirna Dzamonja. (May 2013 - July 2013).

Invited Manuscript Reviewer or Referee, "Mathematica Bohemica," Mathematica Bohemica Editor, Dagmar Medkova. (December 2012 - July 2013).

Invited Manuscript Reviewer or Referee, "Arabian Journal of Mathematics," Editor, Hichem Ben-El-Mechaiekh. (April 2013 - May 2013).

Invited Manuscript Reviewer or Referee, "The Journal of Logic and Analysis," The Journal of Logic and Aalysis Editor, Karel Hrbacek. (February 2013 - March 2013).

Invited Manuscript Reviewer or Referee, "The Journal of Logic and Analysis," The Journal of Logic and Aalysis Chief Editor, Nigel Cutland. (January 2013 - February 2013).

Invited Manuscript Reviewer or Referee, "The Journal of Symbolic Logic," The Journal of Symbolic Logic Editor, Alessandro Berarducci. (December 2012 - February 2013).

Invited Manuscript Reviewer or Referee, "Advances in Mathematics," Journal Editor, Jerome Keisler. (November 2012 - February 2013).

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," Mathematical Reviews Editorial Board. (November 2012 - December 2012).

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," Mathematical Reviews Editorial Board. (September 2011 - October 2011).

Invited Manuscript Reviewer or Referee, "Advances in Mathematics," Journal Editor, Jerome Keisler. (July 2011 - September 2011).

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," Mathematical Reviews Editorial Board. (May 2011 - September 2011).

Invited Manuscript Reviewer or Referee, "The Journal of Symbolic Logic," Editor, Alessandro Berarducci. (May 2011 - September 2011).

Jones, Martin L.

Invited Manuscript Reviewer or Referee, "Discovering Statistics 2e," WH Freeman Publishers. (May 2014).

Invited Manuscript Reviewer or Referee, "Statistical Investigations," John Wiley and Sons Publishers. (January 2013).

Invited Manuscript Reviewer or Referee, "Statistics: Unlocking the Power of Data," John Wiley and Sons Publishers. (April 2012).

Jurisich, Elizabeth G.

Invited Manuscript Reviewer or Referee, "Mathematical Reviews," American Mathematical Society. (December 2014 - December 2015).

Invited Manuscript Reviewer or Referee, "Journal of Pure and Applied Algebra," Elsevier. (February 2014 - June 2014).

Invited Manuscript Reviewer or Referee, "Annals of Combinatorics," Birkhauser-Science. (June 2013 - September 2013).

Invited Manuscript Reviewer or Referee, "Contemporary Mathematics," American Mathematical Society. (June 2013 - July 2013).

Kai, Bo

Invited Manuscript Reviewer or Referee, "Statistica Sinica." (September 2015 - May 2016).

Invited Manuscript Reviewer or Referee, "Statistica Sinica." (June 2015 - May 2016).

Invited Manuscript Reviewer or Referee, "Journal of Econometrics." (May 2015 - May 2016).

Invited Manuscript Reviewer or Referee, "Statistica Sinica." (March 2015 - February 2016).

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

Invited Manuscript Reviewer or Referee, "Journal of the American Statistical Association." (October 2015 - November 2015).

Invited Manuscript Reviewer or Referee, "Statistics and Its Interface." (March 2015 - May 2015).

Invited Manuscript Reviewer or Referee, "Journal of Computational and Graphical Statistics." (December 2014 - April 2015).

Invited Manuscript Reviewer or Referee, "Journal of Multivariate Analysis." (November 2014 - February 2015).

Invited Manuscript Reviewer or Referee, "Annals of Applied Statistics." (September 2014 - November 2014).

Invited Manuscript Reviewer or Referee, "Annals of Statistics." (September 2014 - November 2014).

Invited Manuscript Reviewer or Referee, "Scandinavian Journal of Statistics." (September 2014 - November 2014).

Invited Manuscript Reviewer or Referee, "Communications in Statistics - Theory and Methods." (August 2014 - November 2014).

Invited Manuscript Reviewer or Referee, "Statistica Sinica." (August 2014 - November 2014).

Invited Manuscript Reviewer or Referee, "Scandinavian Journal of Statistics." (July 2014 - October 2014).

Invited Manuscript Reviewer or Referee, "Technometrics." (July 2014 - August 2014).

Invited Manuscript Reviewer or Referee, "Annals of the Institute of Statistical Mathematics." (May 2014 - August 2014).

Invited Manuscript Reviewer or Referee, "Annals of Statistics." (May 2014 - July 2014).

Invited Manuscript Reviewer or Referee, "Statistica Sinica." (April 2014 - July 2014).

Invited Manuscript Reviewer or Referee, "Annals of Applied Statistics." (February 2014 - April 2014).

Invited Manuscript Reviewer or Referee, "Statistical Papers." (November 2013 - February 2014).

Invited Manuscript Reviewer or Referee, "Journal of the American Statistical Association." (October 2013 - December 2013).

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

Invited Manuscript Reviewer or Referee, "Journal of the American Statistical Association." (September 2013 - November 2013).

Invited Manuscript Reviewer or Referee, "Metrika." (August 2013 - November 2013).

Invited Manuscript Reviewer or Referee, "Scandinavian Journal of Statistics." (June 2013 - August 2013).

Invited Manuscript Reviewer or Referee, "Communications in Statistics - Simulation and Computation." (May 2013 - August 2013).

Invited Manuscript Reviewer or Referee, "Journal of Statistical Planning and Inference." (May 2013 - July 2013).

Invited Manuscript Reviewer or Referee, "Biometrics." (April 2013 - May 2013).

Invited Manuscript Reviewer or Referee, "Journal of the Royal Statistical Society Series B." (February 2013 - May 2013).

Invited Manuscript Reviewer or Referee, "The Annals of Statistics." (April 2013).

Invited Manuscript Reviewer or Referee, "Journal of Nonparametric Statistics." (January 2013 - April 2013).

Invited Manuscript Reviewer or Referee, "The Annals of Statistics." (January 2013 - March 2013).

Invited Manuscript Reviewer or Referee, "Statistica Sinica." (November 2012 - February 2013).

Invited Manuscript Reviewer or Referee, "Annals of Applied Statistics." (October 2012 - December 2012).

Invited Manuscript Reviewer or Referee, "Communications in Statistics - Simulation and Computation." (August 2012 - November 2012).

Invited Manuscript Reviewer or Referee, "Journal of the American Statistical Association." (August 2012 - September 2012).

Invited Manuscript Reviewer or Referee, "Journal of the Korean Statistical Society." (July 2012 - September 2012).

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

Invited Manuscript Reviewer or Referee, "Journal of the American Statistical Association." (May 2012 - June 2012).

Invited Manuscript Reviewer or Referee, "Pakistan Journal of Statistics." (May 2012 - June 2012).

Invited Manuscript Reviewer or Referee, "Journal of Nonparametric Statistics." (April 2012 - June 2012).

Invited Manuscript Reviewer or Referee, "Communications in Statistics - Theory and Methods." (March 2012 - June 2012).

Invited Manuscript Reviewer or Referee, "Statistics and Probability Letters." (March 2012 - May 2012).

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

Invited Manuscript Reviewer or Referee, "Journal of the American Statistical Association." (March 2012 - April 2012).

Invited Manuscript Reviewer or Referee, "Communications in Statistics - Theory and Methods." (January 2012 - April 2012).

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

Invited Manuscript Reviewer or Referee, "Journal of Nonparametric Statistics." (January 2012 - March 2012).

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

Invited Manuscript Reviewer or Referee, "Biometrika." (December 2011 - January 2012).

Invited Manuscript Reviewer or Referee, "Statistics and Its Interface." (December 2011 - January 2012).

Invited Manuscript Reviewer or Referee, "Journal of Statistical Planning and Inference." (October 2011 - January 2012).

Invited Manuscript Reviewer or Referee, "Statistics and Probability Letters." (November 2011 - December 2011).

Invited Manuscript Reviewer or Referee, "Journal of Nonparametric Statistics." (October 2011 - December 2011).

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

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

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

Invited Manuscript Reviewer or Referee, "Journal of Multivariate Analysis." (May 2011 - November 2011).

Invited Manuscript Reviewer or Referee, "Journal of the Korean Statistical Society." (February 2011 - October 2011).

Invited Manuscript Reviewer or Referee, "Statistica Sinica." (June 2011 - August 2011).

Invited Manuscript Reviewer or Referee, "Journal of Statistical Planning and Inference." (May 2011 - August 2011).

Invited Manuscript Reviewer or Referee, "Journal of Multivariate Analysis." (June 2011 - July 2011).

Kasman, Alex

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

Invited Manuscript Reviewer or Referee, "Journal of Nonlinear Science." (July 2015).

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).

Invited Manuscript Reviewer or Referee, "Journal of Physics A." (December 2011 - January 2012).

Kumar, Mukesh

Math review, "Applications of Mathematics." (June 2016 - December 2016).

AMS reviewer, "Computers and Mathematics with Applications," American Mathematical Society. (January 2016 - April 2016).

Invited Manuscript Reviewer or Referee, "Computers and mathematics with applications," Elsevier. (January 2016 - March 2016).

Mathematical Reviews AMS, "Applied Numerical Mathematics," American Mathematical Society. (November 2015 - December 2015).

Invited Manuscript Reviewer or Referee, "BIT numerical mathematics," Springer. (July 2015 - November 2015).

Invited Manuscript Reviewer or Referee, "Applied Mathematics and Computations," Elsevier. (July 2015 - October 2015).

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.

Invited Manuscript Reviewer or Referee, "Computer Aided Geometric Design," Elsevier. (February 2015 - September 2015).

Invited Manuscript Reviewer or Referee, "Applied Numerical Mathematics," Elsevier. (February 2013 - March 2013).

Lafortune, Stephane

Invited Manuscript Reviewer or Referee, "Exact Solutions of the Hirota Equation and Vortex Filaments Motion," Physica D. (April 2015 - May 2015).

Invited Manuscript Reviewer or Referee, "Multi-Soliton Solutions with Symmetrical Structures of A Variable-Coefficient mKdV Hierarchy," Symmetry. (March 2015 - April 2015).

Invited Manuscript Reviewer or Referee, "Real (complex) coupled dispersionless equations and real (complex) short pulse equations," Studies in Applied Mathematics. (March 2015 - April 2015).

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, "Exact Solutions of the Hirota Equation and Vortex Filaments Motion," Physica D. (September 2014 - October 2014).

Invited Manuscript Reviewer or Referee, "Irreducibility and co-primeness as an integrability criterion for discrete equations," Journal of Physics A. (July 2014 - August 2014).

Invited Manuscript Reviewer or Referee, "Exact periodic cross-kink wave solutions and breather type of two-solitary wave solutions for the (3+1)-dimensional generalized shallow water equation," IMA Journal of Applied Mathematics. (April 2014 - May 2014).

Invited Manuscript Reviewer or Referee, "Stability of Traveling Wave Solutions to the Whitham Equation," Physics Letters A. (March 2014 - April 2014).

Invited Manuscript Reviewer or Referee, "A synthetical integrable two-component model with peakon solutions," Proceedings A of the Royal Society. (February 2014 - March 2014).

Invited Manuscript Reviewer or Referee, "Singularities of the discrete KdV equation and the Laurent property," Journal of Physics A. (January 2014).

Invited Manuscript Reviewer or Referee, "Gasless combustion fronts with heat loss," SIAM Journal on Applied Mathematics. (December 2012).

Invited Manuscript Reviewer or Referee, "Linearisable ultradiscrete systems with sign variables and the confinement of singularities," Journal of Mathematical Physics. (August 2012).

Invited Manuscript Reviewer or Referee, "Algebraic entropy for semi-discrete equations," Journal of Physics A. (July 2012).

Invited Manuscript Reviewer or Referee, "Spectral behavior of combustion fronts with high exothermicity," SIAM Journal on Applied Mathematics. (February 2012).

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

Invited Manuscript Reviewer or Referee, "A generalized class of new integrable coupled nonlinear ordinary differential equations through nonlocal transformations," Journal of Physics A. (November 2011).

Invited Manuscript Reviewer or Referee, "Linearisable QRT mappings," Journal of Physics A. (August 2011).

Langville, Amy N.

Invited Manuscript Reviewer or Referee, "Complex Networks." (October 2013 - December 2013).

Invited Manuscript Reviewer or Referee, "IEEE Control Systems." (October 2013 - November 2013).

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

Invited Manuscript Reviewer or Referee, "World Wide Web Conference Proceedings." (December 2012).

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

Invited Manuscript Reviewer or Referee, "Applied Mathematics and Computation." (August 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, "Columbian Journal of Statistics." (February 2012).

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

Invited Manuscript Reviewer or Referee, "IEEE Transactions on Signal Processing." (August 2011).

Li, Jiexiang

"LearningCurve Activities" StatsPortal Reviewer, "Introductory Statistics," W. H. Freeman/Macmillan. (September 2014 - October 2014).

Mitchener, W.

Invited Manuscript Reviewer or Referee, "Analysing the first case of the International Criminal Court from a network-science perspective," Journal of Complex Networks. (August 2015 - October 2015).

Invited Manuscript Reviewer or Referee, "Stochastic Optimal Control for Online Seller under Reputational Mechanisms," Risks (Journal published by MDPI, Basel, Switzerland). (August 2015 - September 2015).

Invited Manuscript Reviewer or Referee, "Agent-based model of dialect evolution in killer whales," Journal of Theoretical Biology. (January 2015).

Invited Manuscript Reviewer or Referee, "When learners surpass their models: mathematical modeling of learning from an inconsistent source," Bulletin of Mathematical Biology. (March 2014 - June 2014).

Invited Manuscript Reviewer or Referee, "Analytic solution of a model of language competition with bilingualism and interlinguistic similarity," Physica D: Nonlinear Phenomena. (May 2013).

Invited Manuscript Reviewer or Referee, "A simple computational model of the evolution of a communicative trait and its phenotypic plasticity," Journal of Theoretical Biology. (December 2012 - March 2013).

"Hopf Bifurcations and Limit Cycles in Evolutionary Network Dynamics," SIAM Journal of Applied Dynamical Systems. (June 2012).

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

Invited Manuscript Reviewer or Referee, "A Nearest integer solution to the longest run of randomly generated words," American Mathematical Monthly. (May 2011 - August 2011).

Invited Manuscript Reviewer or Referee, "Stability of strategies in payoff-driven evolutionary games on networks," Chaos, American Institute of Physics. (March 2011 - July 2011).

Park, Jin-Hong

Invited Manuscript Reviewer or Referee, "Journal of Korean Statistical Society." (January 2016 - March 2016).

Invited Manuscript Reviewer or Referee, "Journal of Applied Probability and Statistics." (July 2015 - September 2015).

Invited Manuscript Reviewer or Referee, "Statistica Sinica." (January 2015 - March 2015).

Invited Manuscript Reviewer or Referee, "Statistics: A Journal of Theoretical and Applied Statistics." (January 2015 - March 2015).

Invited Manuscript Reviewer or Referee, "Technometrics." (January 2015 - March 2015).

Invited Manuscript Reviewer or Referee, "Journal of the Iranian Statistical Society." (January 2014 - November 2014).

Invited Manuscript Reviewer or Referee, "Statistica Neerlandica." (March 2014 - June 2014).

Invited Manuscript Reviewer or Referee, "Journal of Korean Statistical Society." (July 2013 - December 2013).

Invited Manuscript Reviewer or Referee, "Journal of Applied Statistics." (March 2013 - June 2013).

Invited Manuscript Reviewer or Referee, "Journal of Applied Statistics." (November 2012 - January 2013).

Ph.D. Thesis reviewer, "A statistical study of the risk factors for urinary bladder cancer in Pakistan," Statistics, GC University. (June 2010 - August 2011).

Przeworski, Andrew

Invited Manuscript Reviewer or Referee, "Geometry & Toplology," Mathematical Sciences Publishers. (October 2013 - January 2014).

Invited Manuscript Reviewer or Referee, "Monatshefte für Mathematik." (December 2011 - January 2012).

Invited Manuscript Reviewer or Referee, "Journal of Geometry." (September 2011 - November 2011).

Sarvate, Dinesh G.

Invited Manuscript Reviewer or Referee, "Journal of Algebra Combinatorics Discrete Structures and Applications." (November 2015 - January 2016).

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

Invited Manuscript Reviewer or Referee, "Discrete Applied Mathematics," Elsevier. (July 2015 - August 2015).

Invited Manuscript Reviewer or Referee, "Journal of Design Theory." (June 2015 - July 2015).

Invited Manuscript Reviewer or Referee, "Discrete Mathematics." (May 2015 - July 2015).

Invited Manuscript Reviewer or Referee, "AKCE International Journal of Graphs and Combinatorics." (May 2014 - June 2014).

Invited Manuscript Reviewer or Referee, "Journal of Combinatorial Designs." (March 2014 - May 2014).

Invited Manuscript Reviewer or Referee, "Designs, Codes and Cryptography," Springer. (December 2013 - January 2014).

Invited Manuscript Reviewer or Referee, "Australasian Journal of Combinatorics." (March 2013 - October 2013).

Invited Manuscript Reviewer or Referee, "Math Reviews." (January 2013 - February 2013).

Invited Manuscript Reviewer or Referee, "Bulletin of the Institute of Combinatorics and its Applications." (September 2012 - November 2012).

Invited Manuscript Reviewer or Referee, "Discrete Mathematics." (August 2012 - November 2012).

Invited Manuscript Reviewer or Referee, "Journal of Combinatorial Designs." (May 2012 - August 2012).

Invited Manuscript Reviewer or Referee, "Discovering Statistics, Larose Ch 3,10 and 11." (April 2012 - May 2012).

Invited Manuscript Reviewer or Referee, "Australasian Journal of Combinatorics." (February 2012 - May 2012).

Invited Manuscript Reviewer or Referee, "Central European Journal of Mathematics." (January 2012 - February 2012).

Invited Manuscript Reviewer or Referee, "Discrete Mathematics." (May 2011 - August 2011).

Invited Manuscript Reviewer or Referee, "Aequationes Mathematicae," Springer. (June 2011 - July 2011).

Invited Manuscript Reviewer or Referee, "Australasian Journal of Combinatorics." (March 2011 - July 2011).

Smirnov, Oleg N.

Invited Manuscript Reviewer or Referee, "Israel Journal of Mathematics." (September 2014 - December 2014).

Invited Manuscript Reviewer or Referee, "Journal of Algebra and its Applications." (August 2014).

Invited Manuscript Reviewer or Referee, "Journal of Algebra." (September 2012 - December 2012).

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, "Applicable Analysis." (November 2015 - January 2016).

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

"Mathematical Reviews," American Mathematical Society. (January 2010 - January 2016).

Invited Manuscript Reviewer or Referee, "Applied Mathematics and Computation." (October 2014 - January 2015).

Invited Manuscript Reviewer or Referee, "Applicable Analysis." (October 2014 - November 2014).

Young, Paul T.

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

Invited Manuscript Reviewer or Referee, "Advances in Difference Equations." (January 2015 - December 2015).

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

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

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

Invited Manuscript Reviewer or Referee, "Journal of Combinatorial Mathematics and Combinatorial Computing." (January 2015 - December 2015).

Invited Manuscript Reviewer or Referee, "Journal of Number Theory - 6 papers." (January 2015 - December 2015).

Invited Manuscript Reviewer or Referee, "Springer Plus - 2 papers." (January 2015 - December 2015).

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

Invited Manuscript Reviewer or Referee, "Journal of Integer Sequences." (January 2014 - December 2014).

Invited Manuscript Reviewer or Referee, "Journal of Number Theory." (January 2014 - December 2014).

Invited Manuscript Reviewer or Referee, "Research and Communications in Mathematics and Mathematical Sciences." (January 2014 - December 2014).

Invited Manuscript Reviewer or Referee, "Rocky Mountain Journal of Mathematics." (January 2014 - December 2014).

Invited Manuscript Reviewer or Referee, "The Fibonacci Association International Conference Proceedings." (January 2014 - December 2014).

Invited Manuscript Reviewer or Referee, "The Fibonacci Quarterly." (January 2014 - December 2014).

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

Invited Manuscript Reviewer or Referee, "Far East Journal of Mathematical Sciences." (January 2013 - December 2013).

Invited Manuscript Reviewer or Referee, "Fibonacci Quarterly," two papers. (January 2013 - December 2013).

Invited Manuscript Reviewer or Referee, "Hacettepe Journal of Mathematics and Statistics." (January 2013 - December 2013).

Invited Manuscript Reviewer or Referee, "Journal of Number Theory," four papers. (January 2013 - December 2013).

Invited Manuscript Reviewer or Referee, "Mathematics of Computation." (January 2013 - December 2013).

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

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

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

	Core Requirements			Selected Electives		
	Math 530	**Math 531**	**Math 550**	**Math 540**	**Math 541**	**Math 555**
SLO1 Core theoretical knowledge and skills	I/R	I/R	I/R	I/R	R	I/R
SLO2 Core modeling knowledge and skills	I/R	R	R/E	R/E	R/E	R/E
SLO3 Model construction and analysis			R/E	R/E	R/E	R/E
SLO4 Communicating Statistics	R	R	R	R	R	R/E

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

Graduate Certificate Program in Operations Research 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 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.

Graduate Certificate Program in Operations Research Assessment Map

		SLO1 Core theoretical knowledge and skills	SLO2 Core modeling knowledge and skills	SLO3 Constructing and analyzing models	SLO4 Communicating modeling outcomes
Core Requirements	Math 502	I	I		I/R
	Math 551	I/R	I/R	R/E	I/R
	Math 552	I/R	I/R	R/E	I/R
Selected Elective	Math 550	I/R	R/E	R/E	R

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

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