Graduate Handbook for the Department of Mathematics and Statistics

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Foreword(s)

This handbook is the result of a great deal of work by previous members of the Graduate Committee in the Department of Mathematics and Statistics at Utah State University, particularly Jim Powell. The purpose of this handbook is to communicate in a single place the goals and vision of our graduate programs in Mathematics and Statistics, as well as a lot of nuts and bolts regarding how the graduate program is run. As policies and procedures (and opportunities and challenges) evolve over time, this handbook will be updated accordingly. It is our hope that this handbook will be a source of valuable information to prospective students, current students, and faculty members, and will lead to continued (and greater) success of our graduate program.

John R. Stevens, Professor
Assistant Head for Graduate Studies
June 6, 2019

It’s hard to see when you are in it, but graduate school is one of the really golden times in a person’s life. Grad school is the last time a student has freedom and time to master new skills, develop new talents and become a new person, while in the company of colleagues undergoing similar transformations and senior mentors committed to guiding them. As professionals with degrees you will no doubt keep learning, but developing new skills and learning new stuff are just two activities among many in a modern professional’s day, all of which must compete for time and energy. Amid all the challenges you face as a graduate student, I hope you find moments to appreciate and enjoy this unique opportunity.

I have enjoyed serving as the Asst. Head for Graduate Studies because I remember my own time as a graduate student and love the time I spend with my own graduate students. This handbook lays out the various requirements and procedures you face in your graduate program, but the point is to make all of this pedantic stuff transparent so that students and advisers can focus on the important things. Which is to say, making the most of your time as a graduate student.

The Graduate Committee of 2016-17 (Adele Cutler, Luis Gordillo, Brynja Kohler, Zhaohu Nie) was instrumental in helping construct and clarify the policies and procedures presented here. Our Graduate Program Coordinator, Gary Tanner, has been an indispensable partner and reliable professional who has assisted at every stage in developing these materials. John Stevens graciously edited this handbook and there is nobody better to take charge of our graduate program. Finally, I would like to thank our Department Head, Chris Corcoran, who always opened his door for me, was a reliable sounding board, provided constant encouragement and support, and has been a tireless advocate for our graduate program.

Jim Powell, Professor
Former Assistant Head for Graduate Studies
July 27, 2017
1 General Information

1.1 Cache Valley and the University Community

Utah State University, one of two state universities with a research mission in Utah, is located in Logan, about 80 miles north of Salt Lake City. The city of Logan is the regional center for Cache Valley, about 50 miles long and 20 miles wide at the northern end of the Wasatch Mountains. To the west, the valley is bordered by the Wellsville Mountains and to the east by the Bear River Range; two alpine wilderness areas are in sight of the center of campus. Logan is 20 minutes south of the Idaho border and is a four-hour drive from Jackson, Wyoming, just outside Teton National Park, with Yellowstone just an hour beyond. Five hours driving to the south is Utah’s Red Rock country, including Moab, Canyonlands, Arches, Capital Reef and Zion National Parks and Grand Staircase National Monument. City of Rocks National Reserve, a world climbing Mecca, is only 120 miles away.

Cache Valley has four well-defined seasons and affords quality outdoor experiences of many kinds. Hiking, camping, cross-country and downhill skiing, fishing, hunting, golf, rock climbing, biking and boating are all available within minutes of campus. The Logan River runs through Logan Canyon and empties into a large wetland area on the valley floor. The Bear River is nearby and offers many opportunities for outdoor recreation. The Beaver Mountain Ski Area is a short (30-45 minute) drive up Logan Canyon. In addition, there are many great places to cross-country ski, some only minutes from campus. Bear Lake, 40 miles through scenic Logan Canyon, offers boating and other related water activities. Smaller, local reservoirs (e.g., Hyrum and Newton) offer boating and water skiing as well.

The greater Cache Valley area population exceeds 110,000 distributed in Logan and several smaller neighboring communities. Logan’s cost of living is slightly below both state and national averages; housing is plentiful and in easy walking distance of campus. Cache Valley also has a free bus system. Rentals range from $500-800/month for a two-bedroom apartment near campus. The university offers graduate dorm housing with a meal plan and family student housing on bus routes and within walking distance of campus. The university is the largest employer in the area, and Logan feels like a university town, with cultural events occurring throughout the year, both on and off campus, including symphony, ballet, chamber music, theatre and opera.

The Logan cultural community is diverse and supports the Utah Festival Opera, Old Lyric Repertory Theater Co., Alliance for the Varied Arts, Cache Folk and Chamber Music Societies. USU’s School of the Arts attracts international jazz and classical musicians. Students receive discounts for all productions. As a Division 1 school, USU has athletic events every weekend, including football, men and women’s basketball, volleyball, soccer, softball and gymnastics. American, Thai, Mexican, Japanese, Chinese and Italian restaurants, several of which offer wine, beer and mixed drinks, offer students opportunities to socialize and relax. The White Owl, a downtown pub with a wonderful summertime deck on top, is the local melting pot and watering hole. Logan supports a diverse religious/lifestyle community; with Unitarian, Christian, LDS, Muslim, Buddhist and LGBTQ groups meeting weekly.

While the university is the largest organizational entity in the valley, the primary economic interests are of two kinds. Historically, Cache Valley was an agricultural region and much of that heritage remains. Agricultural concerns including a local dairy industry and grain and livestock production are still a major part of valley life. With the growth of USU into a major research institution, a variety of technology based industries have also been established. Many of these
endeavors came as spin-offs from the university and others have moved into the valley because of its location and professional resources.

While only an hour and a half from Salt Lake City International Airport and the industrial center of Salt Lake, Cache Valley has maintained a pristine environment entirely free of smokestack industry. The valley has low commute times, clean water and abundant space. The community is committed to maintaining these qualities. Some links to community information include:

- USU Community Info: http://www.usu.edu/community/
- Cache Valley Tourist Info: http://www.tourcachevalley.com/
- Beaver Mountain Ski Resort: http://www.skithebeav.com/
- Logan City’s official website: http://www.loganutah.org/
- Local religious/faith services: http://logan.areaconnect.com/churches.htm

1.2 About Utah State University

1.2.1 Facts and Figures

Since 1888 USU has evolved from a small, agricultural college to one that is nationally and internationally recognized for its intellectual and technological leadership in land, water, space and life enhancement. As Utah’s land-grant and space-grant institution, the university is led by President Noelle Cockett and has 850-faculty members who provide education for more than 28,000 undergraduate and graduate students, including 14,000 in its continuing education sites located throughout Utah. USU occupies 7,000 acres, 400 of which are on campus, with more than 200 buildings, 63 of which are devoted to academics. USU also has three branch campuses and Extension offices in all of Utah’s 29 counties.

With seven colleges, more than 200 majors and 130 research-related classes, USU can count 27 Goldwater Scholars, seven Rhodes Scholars and a Nobel Prize winner among its graduates in the past ten years. Student-centered, hands-on learning opportunities are plentiful as Utah State attracted more than $230 million in research revenue in 2017. These research dollars, along with stellar faculty mentors, have inspired more than 1,000 students to pursue their own research projects every year. Utah State is the number two public university in the West (top four in the nation) for lowest tuition on the Forbes list of “America’s Best College Buys” (2014).

1.2.2 Brief History

Founded in 1888, Utah’s land-grant institution, the Utah Agricultural College, opened for instruction in September 1890. More than 637,000 students have since enrolled at the institution, which officially became Utah State University in March 1957. The modest college that began in the unfurnished south wing of Old Main has grown to encompass all of College Hill, with the additional Innovation Campus, associated research facilities, Extension offices and Continuing Education sites throughout the state.
Research has distinguished the university since the Utah Agricultural Experiment Station began its work in 1890. From land, water and space to life enhancement, research permeates all of the university’s seven colleges and 42 academic departments. The university also supports a diverse number of specialized centers and laboratories in the sciences, education, business, arts, humanities, agriculture, natural resources and engineering. In 1914 the Utah Cooperative Extension Service was founded. Now University Extension disseminates information through county Extension offices and its Centers for Continuing Education. USU awarded its first advanced degree in 1916 and bestowed its first doctoral degrees in 1950. The Utah Water Research Laboratory has provided valuable research on water resources since its inception in 1963. The lab’s endeavors have not only impacted Utah, but have attained national and international reach and acclaim. Through outreach, USU and its faculty are preserving the historical land-grant tradition of providing service and expertise to the state, nation and world.

Utah State University’s expertise has had a major impact on the nation’s space program. The Space Dynamics Laboratory, associated with the Center for Atmospheric and Space Sciences, has worked closely with the National Aeronautics and Space Administration since the early 1960s. The university’s emphasis in space science and engineering research spans nearly five decades. Many students have participated in research at the Space Dynamics Laboratory.

Teaching remains imperative for the university in addition to research, extension and service. “This corps of loyal and devoted instructors,” wrote historian Joel E. Ricks on the eve of the institution’s semi-centennial, “sought ... to give the students the mental stimulus that ... would encourage them to face life unafraid.” Ricks’ declaration rings as true today as it did in 1938.

Classroom instruction is only part of a student’s experience at USU. Since 1890, students have participated in both academic and social organizations. They began publishing the student newspaper “Student Life” (forerunner to the current “USU Statesman”) in 1902 and a yearbook, the Buzzer, in 1910. In 1908, students drafted a constitution for student government, the predecessor of the Utah State University Student Association, through which the students control the allocation of student fees. The goal of the land-grant college, according to the institution’s first president Jeremiah W. Sanborn, is not just to provide training for students, but to provide for their “liberal education as ... citizen(s).” All 16 of the university’s presidents, from Sanborn through current President Noelle Cockett, have embraced that sentiment.

1.3 University Mission

Utah State University is a premier student-centered land-grant and space-grant university. The university fosters the principle that academics come first and cultivates diversity of thought and culture. USU is internationally recognized for its learning opportunities, world-class research and high level of excellence in learning, discovery and engagement. USU seeks to enhance the quality of life for individuals and communities, by promoting arts, cultural programming, working toward environmental sustainability and developing the technologies of tomorrow to drive economic development in Utah, as well as in the global marketplace.
1.4 The Department of Mathematics and Statistics

1.4.1 Mission and Goals of the Department

The mission of the Department of Mathematics and Statistics at USU is to increase fundamental knowledge in mathematics and statistics; explore the frontiers of the mathematical sciences with other disciplines; to train new generations of mathematically literate and quantitatively skilled graduates; to provide intellectual leadership in mathematics and statistics that is of direct benefit to the state of Utah and its citizens; and to earn national and international respect for the quality of its scholarship and educational programs. To achieve the mission of the Department of Mathematics and Statistics, the Department has identified goals impacting the University’s major functions of Teaching, Research and Engagement:

- Provide flexible, solid undergraduate and graduate programs emphasizing theoretical and applied skills which challenge the intellect and cater to the diverse interests of our majors.

- Build a first-rate, enthusiastic and vigorous faculty in a variety of overlapping fields across the broad spectrum of mathematical sciences with the aims that each individual is internationally recognized for the depth and originality of his or her contributions and that collaborations lead to an environment that enhances combined contributions.

- Be a resource in the mathematical sciences for other disciplines whose own activities have an ever-increasing need for the power of mathematics and statistics and to encourage and promote interdisciplinary partnerships, both on campus and in the larger research community including continued development of the industrial masters program.

- Advance our role in providing high quality training in mathematics teacher education to supply well-prepared, competent elementary and secondary school mathematics teachers and provide program access to in-service teachers wishing to upgrade their skills.

1.4.2 Overview of Graduate Programs

The Department of Mathematics and Statistics teaches advanced quantitative and analytic skills for professionals in education, industry and research. Financial aid in the form of research and teaching assistantships allows students to pursue their education without incurring debt while learning through interaction with experienced faculty. Graduates are employed as tenured faculty at universities and colleges as well as governmental and industrial research centers; the employment rate of Math & Stat grads is over 96%. Applicants for MS programs are expected to have undergraduate degrees in relevant topics with an overall GPA better than 3.0 and GPA of 3.5 in technical subjects.

The MS Statistics program prepares students for positions in industry or government, while providing them with the necessary applied and theoretical background to pursue PhD programs in statistics or biostatistics. Students may apply with an undergraduate degree in statistics, mathematics, or a wide variety of other disciplines, including the biological and social sciences. Statistics MS applicants are expected to have taken calculus through multivariate, linear algebra and differential equations, as well as some introductory statistics and preferably an intermediate or advanced course in regression or experimental design. Some coursework or experience with programming languages is strongly encouraged. The Statistics program provides many
opportunities for students to engage in a range of projects in health, medicine, business and analytics, genetics and biology, ecology, data science, and visualization and computing.

The **MS in Mathematics** prepares students for doctoral programs in mathematics and statistics as well as careers in industrial jobs. The program offers solid development of fundamentals required for admission into competitive PhD programs. Applicants are expected to have strong background in mathematics, including three semesters of calculus, linear algebra, differential equations, advanced calculus, and nontrivial experience in broader mathematical subjects (e.g. a selection of: modern algebra, topology, probability, discrete math or advanced DE).

The **Industrial/Interdisciplinary Mathematics Program** teaches students modeling, simulation, mathematical and statistical analysis for careers in industry and mathematical sciences. Students are prepared to work at a variety of government and industrial research jobs, teaching careers at community colleges as well as for entry to doctoral programs in applied mathematics or statistics. Thesis research topics are suggested by industrial and scientific internship partners. Applicants are welcomed from any undergraduate technical major, including computer science, chemistry, engineering, math, physics and statistics. Undergraduate linear algebra, multivariate calculus and differential equations is prerequisite, as is computer programming experience. Graduates are employed at places like Sandia National Labs, Los Alamos National Labs, NSA, Boeing, Chevron, ATK, Pacific Northwest National Labs, Micron, Lockheed Martin, the Alaska Fisheries Science Center, and as faculty members in a variety of applied math settings.

The **Master of Mathematics** (MMath) is a professional master’s degree designed to serve mathematics educators at the secondary and sometimes tertiary levels. The program offers students the opportunity to broaden and enhance their mathematics content background as suited for personal enrichment and the teaching profession. Advantages of the program include its flexibility and versatility for individual interest and professional needs. MMath students are expected to have taken calculus through multivariate, linear algebra and differential equations, as well as proof-based courses in mathematical analysis and/or algebra. Experience or strong interest in secondary/tertiary mathematics teaching is expected. Students may take courses from a broad array of topics in applied mathematics, pure mathematics, statistics, and education.

The **Master of Data Analytics** (MData) is a professional, cross-disciplinary program designed to equip students with tools for the management and analysis of data. MData students take coursework in Mathematics and Statistics, Economics and Finance, Computer Science and Management Information Systems.

The **Pure and Applied Mathematics PhD** specialization, a traditional doctoral program, provides training in the foundations of modern mathematics and specialized areas of mathematical research. Applicants are expected to be ‘research ready,’ with a broad background in mathematics and specific research interests. Students work closely with faculty on publishable research projects in areas as diverse as differential geometry and mathematical physics, mathematical ecology, topology, numerical analysis or graph theory.

The **Statistics PhD** specialization offers broad training in theoretical and applied statistics and data sciences for students seeking careers in academe, industry, or government. This is the only PhD program in the region allowing students to specialize in theoretical or applied statistics under the guidance of faculty dedicated to advancing statistical methodology for important and timely real-world problems. PhD applicants should also have more advanced training in probability and mathematical statistics, comparable to graduates of the MS program in Statistics.
The **Interdisciplinary Studies PhD** specialization combines training in mathematics and statistics, significant research interaction with another field using advanced math/stat methodology, and training in the application area. Research is often co-directed by faculty in math/statistics and external disciplines, e.g. physics, education, ecology, biology or computer science.

The **College Teaching PhD** specialization is in the process of being phased out. Students previously admitted to this option have been transferred to the Interdisciplinary Studies option.

### 1.5 Demographics

The Department has 29 full-time faculty at the USU campus, 16 in pure and applied mathematics, 10 in statistics, 3 in mathematics and statistics education. In Fall 2018 the Department counted 66 graduate students; 15 MS students in Math, 7 Master of Mathematics students, 1 MS student in Industrial Math, 14 MS students in Statistics, 5 Master of Data Analytics students, 7 PhD students in Pure and Applied Mathematics, 7 PhD students in Interdisciplinary Studies, and 10 PhD students in Statistics. Eighteen students (10 Masters, 8 PhD) received their graduate degrees in the 2017-18 academic year.
2 Admission to Graduate Programs

2.1 Overview and Departmental Priorities

Graduate education is one of the top departmental priorities. Graduate students advance departmental and faculty research programs, teach a large fraction of departmental courses, and represent the department as instructors, attendees and presenters at conferences, and eventually as graduates and colleagues. As research partners and participants in our most difficult and specialized classes, each student represents a huge investment in time and attention from the faculty. Since the impact of graduate students is so great we take pains in the admission process to admit and encourage the best applicants. Highly qualified applicants with a bachelor’s degree may be admitted directly to the PhD program if they have strong backgrounds and specific research interests.

Formal application is made on-line through the USU’s School of Graduate Studies Web site:

http://rgs.usu.edu/graduateschool/admissions/

The Graduate School will charge a $55 fee for application and require three letters of recommendation, GRE scores and official copies of transcripts from previous post-secondary academic institutions. International students who received degrees in non-English-speaking (that is, not US, UK, Canada, Australia or New Zealand) countries will be required to show proof of competency in English (TOEFL or IELTS exam); all international students will be required to file an I-20 form documenting sufficiency of financial resources. In addition to these materials applicants must complete and submit a Departmental Application directly to the Graduate Program Coordinator (gary.tanner@usu.edu). More detailed discussion of the required materials and the Department’s specific requirements appear below.

2.2 Materials to be Submitted to the School of Graduate Studies

2.2.1 Materials Required of All Applicants

An official transcript must be ordered from each previously attended college and/or university (except USU) and must be sent directly from those institutions to the USU School of Graduate Studies. Transcripts must be submitted for all courses above the high-school level and all prior degrees. Transcripts accumulated on one record are not acceptable. Transcripts submitted as application credentials become the property of the School of Graduate Studies and will not be copied for, or returned to, the applicant. A bachelor’s degree from an accredited college, with a minimum 3.0 GPA (on a 0-4 scale) for the last two years of study, is required. We will pay particular attention to performance in Mathematics/Statistics coursework, in which successful applicants normally have only A’s and B’s.

The Graduate School requires Graduate Record Examination (GRE) scores on the general exam; we do not accept the General Management Test (GMAT) or the Miller Analogy Test. THE GRADUATE SCHOOL WILL NOT ACCEPT PERSONAL COPIES OF YOUR SCORES. Performance on the quantitative portion of the exam are particularly important; successful candidates usually score above the 70th percentile on the GRE(Q). GRE subject exams are not required by the Department. Verbal and analytic writing scores are less relevant but still important; these abilities are crucial to the process of teaching and research communication. The
Department likes to see scores above the 40th percentile for GRE(V).

**Three letters of recommendation** are required; each must address the applicant’s potential for success in the proposed graduate degree program. In particular, we would like to hear about the candidate’s ability to pursue independent scholarly work, read and understand mathematical material on their own, persevere and overcome academic challenges, as well as communicate technical information in both oral and written formats. If you have been enrolled in school during the last five years, at least two of the letters must come from persons who are familiar with you, and can make an authoritative assessment of your recent academic progress and success. *Note:* Recommender names and e-mail addresses are required on the online application. Once you have completed the online application with the fee paid, the School of Graduate Studies will notify your recommenders to send their letters electronically. Applicants should be aware that sometimes the request for information gets lost in the haze of your recommenders’ email; check your application for completeness and be sure to remind your references so that your letters actually arrive!

**Departmental Application Form** To get specific information on student background, interests, and goals we have a departmental application form. This form may be requested from the Graduate Program Coordinator (GPC) or filled out on line at [http://math.usu.edu/forms/DeptForm](http://math.usu.edu/forms/DeptForm). The Graduate School online application requests that students enter a "Statement of Purpose;" this *does not* replace the more specific comments on the departmental application, which you will fill out on line or send directly to the GPC. In all these statements we are looking for evidence that you support the Department’s mission of research and teaching, are committed to and capable of meeting the challenges of graduate education, independent scholarly work, and research communication.

### 2.2.2 International Applicants

If you are an international applicant who has not obtained a university degree in an English-speaking country (e.g. US, UK or Canada), you should take either the Test of English as a Foreign Language (TOEFL) or International English Language Testing System (IELTS) and have the score sent directly to the School of Graduate Studies by the testing service. A combined TOEFL score of 79 or higher on the internet-based TOEFL or 6.0 on the IELTS is required by the School of Graduate Studies, however, the Department has a significantly higher standard for teaching assistants (≥ 100 TOEFL iBT or ≥ 6.5 IELTS are necessary, but not sufficient, conditions). If you lack a TOEFL/IELTS score or have a score below 79 (on the iBT TOEFL) or 6.0 (IELTS), you must take the English Proficiency Test administered by USU’s Intensive English Language Institute (IELI) the first day of each semester. The test will be evaluated to determine if you should be cleared for graduate study or be required to take IELI coursework to further develop your English proficiency. Students who wish to pursue intensive English studies can contact USU’s Intensive English Language Institute, [http://www.usu.edu/ieli/](http://www.usu.edu/ieli/).

In addition, international students must submit an I-20 application and guarantee of adequate financial support to be admitted to USU. While this material is not considered in the application process, students should be aware of the need to submit these and other materials related to US Immigration requirements. More details are available through USU’s Office of International Students and Scholars, [http://globalengagement.usu.edu](http://globalengagement.usu.edu).
2.3 Departmental Application

To solicit detailed information a little more specific to the requirements for academic success in Math and Stats graduate programs we have created a departmental application form. In addition to a summary of information which is also given to the graduate school (e.g. name and address, email) we ask questions about specific background and goals, including:

1. What are your career aspirations and motivations?
2. What are your research or scholarly plans and interests for your graduate career? Are there any particular faculty members with whom you might be interested in working?
3. What in your educational background would you like to highlight? Put your educational history in a context, reflecting on the strengths and weaknesses of your technical preparation and how this relates to your expectations for graduate school.
4. If you have applied for a teaching assistantship, please describe any relevant teaching/tutoring background and experience.
5. If you had any prior research or creative experiences that helped form your decision to apply to graduate school please share them with us. Undergraduate research experiences, exciting class projects, work or consulting experiences that you found particularly engaging would all be very interesting for us to know.
6. What factors influenced your decision to apply for graduate school at USU? Are you the first person in your family to go to graduate school? Do you have ethnic, work or personal experiences that bear on your decision to apply for graduate school?

The departmental form (see Appendix B) is available on line at [http://math.usu.edu/forms/DeptForm](http://math.usu.edu/forms/DeptForm) or by email from the GPC.

2.4 Application Timeline

Most students request admission in Fall semester and most programs are designed with an August start in mind. A rough time line for the application process is:

**December-January** Submit application files to Graduate School and Department before January 15.

**February** Departmental Graduate Committee reviews files.

**March** Decisions on admittance to graduate programs are made; assistantship offers are mailed to qualified, competitive candidates.

**April** Candidates indicate to Graduate School their intent to attend USU; candidates return signed assistantship contracts to the Department by April 15.

**May-July** General bacchanalia and sun-tanning.

**August** New students arrive in Logan; Departmental TA workshops and orientation.
The department will also accept students applying for Spring admission. Generally speaking, Spring starting students, if they receive financial support, receive an offer which is conditional on the candidate being competitive with the next class of Fall applicants. Applicants for Spring admission should submit their materials in September.

2.5 Review of Application Materials

Application materials are usually reviewed by the Department’s Graduate Committee, which is comprised of faculty representatives from the major research/scholarship areas in the department. MS applicant files are reviewed by at least two members of the committee, and PhD applicants are reviewed by at least two committee members as well as one or two faculty members in the applicant’s area(s) of interest (ideally researchers the applicant has indicated interest in working with on dissertation research). The committee is primarily concerned with determining whether applicants have the potential for success in the graduate program and timely progress through it, but secondary considerations include number of students in various program areas, balance of students in graduate courses, availability of research advisors, and program development needs.

It is almost impossible to determine whether a student will be successful from any single number (like GRE(Q) or GPA). During review of applicant files the committee tries to build a complete three dimensional picture of qualified students, reviewing all of their application materials. During this process applicants are scored along five major axes, addressing:

- **Strength and completeness of academic preparation.** Does the student have prerequisites to start graduate classes at USU? Is the background broad enough that they can learn independently and function as professionals? Is there evidence for required skills and capabilities?

- **Strength of recommendation letters.** Is there evidence that the student is particularly talented or hard-working? Do any of the letters address notable professional capabilities (writing, creative thinking, leadership)? Letters which say ‘Dimbert was a student in my Analytic Whatever class and managed to hunch out an A-’ are a dime-a-dozen.

- **Research experience and potential.** Does the student have any research/creative experience beyond normal classwork? Are there any research experiences for undergraduates, jobs, internships, project classes or similar that indicate research capabilities? Any professional writing, coding or presentations?

- **Teaching/tutoring experience and potential.** Is there any evidence of experience or talent in explaining math or stat to other audiences? Time spent as an undergrad teaching assistant or tutoring, either in a lab or privately?

- **The X-factor.** Good stuff doesn’t always fit into the previous four categories; here the reviewer records anything that got them particularly excited about the application materials. This can include things as prosaic as absence of spelling errors, excitement that we found somebody to work with a good faculty member, or acknowledgement of the quality of a previous program of study or reputation of a particular reference.

When applicants have been reviewed, the committee meets in discussion of the merits of individual cases and needs of various programs to construct a portfolio of students to admit and to receive offers of support. A sample graduate applicant review form appears in Appendix B.
3 Financial Aid

3.1 Teaching Assistantships

Most Math & Stat students are supported by Teaching Assistantships (TAs). Students receiving a TA work for the Department as the instructor of record for a class, assist a faculty member in teaching upper division or distance education courses, or assume responsibility for 3 recitation sections of a large lecture. TA duties should average no more than 20 hours/week; we expect that at least another 20 hours a week are spent on courses, research and professional development. A TA may not accept other employment on campus and should not work elsewhere if they expect to be successful. TA contracts are issued each spring for the subsequent academic year.

The department offers TA support to Masters students for a maximum of four semesters and a Ph.D. student for a maximum of eight semesters. Renewal of contracts from year to year is contingent on a student performing their teaching responsibilities, making appropriate progress through degree completion milestones, and continuing to satisfy TA requirements, below (see also Policies and Procedures).

3.1.1 Requirements

To receive a TA and/or a renewal a student must

- Discharge contractual teaching responsibilities in a timely and professional manner.
- Attend the Department’s TA workshop / conference in August and attend departmental teaching development activities (see below). The workshop is scheduled in the week preceding classes and generally takes two days to complete. Attendees receive training in teaching techniques, are video-recorded teaching, and participate in group discussion of lecturing/class management techniques.
- Complete the School of Graduate Studies on-line TA workshop (USU 7920) during the first semester. This course requires approximately 20 hours of time through the semester. Participants learn responsibilities and support opportunities for TAs at USU, as well as receive practical tips on instructional and management techniques. See: https://rgs.usu.edu/graduateschool/graduate-training-and-development/ta-training/
- Sign and return a contract to the Department by the stated deadline (generally before the end of classes in the previous semester).
- Maintain good standing as a graduate student, earning grades of a B or above in all classes on the program of study and completing program requirements (selecting a graduate advisor and committee, submitting a program of study, completing qualifying or comprehensive exams, etc.) in a timely fashion.
- Perform research duties leading toward a Plan A or B thesis (Masters students) or dissertation (Ph.D. students) under supervision of a faculty advisor.
- Register for 6-9 credits of coursework toward the degree in every semester (unless no classes are offered meeting requirements on the program of study, in which case students must
register for continuing graduate advisement, Math or Stat 6990). A TA may register for only three credits (of either 6970 or 6990) if all courses on the program of study have been completed.

These requirements are monitored on a semester-by-semester basis; failure to maintain adequate progress may result in mid-year termination of the assistantship.

3.1.2 Departmental TA Workshop/Teaching Development Activities

The TA Workshop is intended to be the beginning, or continuation in the case of veteran graduate students, of a professional development program the Math and Stat Department has designed not only to prepare TAs for the challenges of teaching effectively at a university that focuses on the educational experience of its undergraduates, but also to facilitate the further development of the skills necessary for success in a career with a focus on academics and, more generally, as a professional mathematician or statistician. The content of the two-day workshop will evolve over time and its evolution will be controlled by the veteran TAs and the outcomes of their experiences as TAs. A bit more specifically, a reflective approach will be fostered through semimonthly mini-workshops intended to enhance collaboration and the development of a portfolio cataloguing innovations and improvements in teaching practice.

The semimonthly mini-workshops will sometimes feature guest speakers who will speak about education-related issues and then foster a discussion or portfolio building working group.

Overall the workshop and continuing professional development opportunities are intended to alleviate the creative and psychological demands of teaching by increasing access to resources and fostering collaboration. When it comes to teaching, the more input, data, and ideas you have, the better.

3.1.3 Requirements for International TAs

In addition to the regular TA requirements, TAs who are not native English speakers must:

- Pass the Test of Spoken English (TSE) administered by the Intensive English Language Institute (IELI) at USU.
- Take the International TA Workshop (IELI 7920) offered by IELI. The course, for which students register through the Graduate School, will address understanding American undergraduates, classroom practices and environment, microteaching practicum, classroom language, cross-cultural awareness and classroom management.

For more details see: https://rgs.usu.edu/graduateschool/graduate-training-and-development/ta-training/

3.1.4 TA Compensation

Teaching assistants receive pay for the two semesters of the academic year, beginning in late August and ending in early May. TAs are also eligible for year-round TA insurance for a small
premium (approximately $250/semester in 2016). Additional compensation depends on the academic level of the student.

**Masters Students** receive a total stipend of **$15,000** for the nine-month academic year. Masters students working on a Plan A thesis also receive a **waiver** for their tuition. In the 2018-19 academic year this was worth $10,163 per semester for nonresidents and $2,904 for residents. Plan B students have received similar support in the past, but this is not guaranteed by the Graduate School and may have to be discontinued due to tuition costs.

**Ph.D. Students** receive an initial stipend of **$19,000** for the nine-month academic year. Doctoral students also receive a **full tuition waiver**, valued at $10,163 per semester for nonresidents and $2,904 for residents in 2018-19. Doctoral students receive a salary increment ($500) for each of the following milestones: selecting a supervisory committee in the first year, submitting a program of study in the third semester, defending a dissertation research proposal, and applying for PhD candidacy (passing comprehensive exams) in the third year.

Students in professional programs are not eligible to receive tuition waivers. Non-resident students with TAs and tuition waiver are expected to apply for Utah residency after their first year. Details may be found at [https://www.usu.edu/admissions/residency/](https://www.usu.edu/admissions/residency/)

### 3.1.5 Summer Teaching Support

Historically we have offered graduate TAs support to teach in the summer when possible. The summer stipend varies with the level, duration and number of credits taught. The university budget for summer classes is separate from the regular TA budget administered by the Department, and demand varies, so the exact number of classes taught by summer TAs is not predictable. Generally speaking, summer teaching is awarded preferentially to experienced TAs with a good teaching record according to a priority system:

1. Continuing PhD students (i.e. having at least one year left before graduation)
2. Continuing Masters students (i.e. between their first and second years)
3. Finishing PhD students (i.e. summer graduates)
4. Finishing Masters students (i.e. summer graduates)
5. Others (e.g. non-matriculated students, doctoral students who have used up their regular eight semesters of support but will not be defending in summer)

Summer teachers need not enroll for classes, and no tuition waiver is normally awarded.

### 3.2 Research Assistantships

Departmental faculty members engaged in research are often funded by regional, national and international agencies or companies. Many faculty members have, as part of their program of external support, research assistantships (RAs) for qualified students. RAs perform supervised research under faculty guidance, generally leading toward a thesis or dissertation. Pay and duration of RAs depend on the funding agency and the research; the term may be summer, all or part of the academic year, or the entire term of graduate study. The department is usually willing
to match part-time RA support with TA support to form a complete financial package for qualified students. RAs may receive insurance and tuition waiver; details are negotiated between the funded faculty member and the Asst. Head for Graduate Studies.

The graduate program does not administer or award RAs; funding and supervision are the responsibility of individual faculty researchers. Students interested in RAs should contact faculty with whom they are interested in working and discuss research funding opportunities. The faculty member can then approach the Assistant Head for Graduate Studies about developing a complete funding package for students under their supervision.

### 3.3 Fellowships and Scholarships

Fellowships are essentially funded positions for grad students to pursue their studies, awarded to students with extraordinary research potential, often with some degree of tuition support. By contrast a graduate scholarship usually covers only some or all of tuition and fees (which can be substantial!). There are some very nice national graduate fellowships which students must apply for before starting or at the beginning of a graduate program, including the National Science Foundation Graduate Fellowship and similar programs administered through the Departments of Homeland Security, Energy, and Defense. Interested students need to contact research faculty members early in the fall the year before their intended admission to USU to develop competitive proposals. Most national fellowships have application deadlines in October/November.

There are also a variety of USU graduate fellowships and scholarships offered through the School of Graduate Studies. These include:

**Martin Luther King Fellowship** for African-American graduate students, which gives full tuition support and a small stipend for 1 year. Students may apply but a letter of support from the Department is necessary.

**Alumni Legacy Scholarship** for non-resident students with USU ‘ties’ (generally relatives who earned USU degrees or served as faculty/staff), which offers non-resident tuition waiver.

**Seely-Hinckley Scholarship** for graduate students with financial needs, which covers full tuition and fees (Department must forward interested students’ files to the College, which may nominate one student per year).

**Dissertation Fellowship** for PhD students completing their dissertation, which provides full tuition and a small stipend which is intended to help the Department release the student from TA responsibilities to give them extra time for completing their dissertation on time. Student submits the application, but there is a required letter of support from the Department which details the strategy and cost matching for ‘release.’

Details are available at [http://rgs.usu.edu/graduateschool/finances](http://rgs.usu.edu/graduateschool/finances)

### 3.4 Tuition and Fees

A table of tuition and fees for graduate students can be found for the current semester on the USU Registrar’s web site ([http://www.usu.edu/registrar/tuition](http://www.usu.edu/registrar/tuition)). Nine graduate credits
per semester is viewed as a full-time student load for incoming students. In Fall 2019 the one-semester cost of nine graduate credits for various groups was:

<table>
<thead>
<tr>
<th></th>
<th>Utah Resident</th>
<th>US Non-Resident*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition</td>
<td>$2,998</td>
<td>$10,494</td>
</tr>
<tr>
<td>Fees</td>
<td>$504</td>
<td>$504</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$3,502</strong></td>
<td><strong>$10,998</strong></td>
</tr>
</tbody>
</table>

* International students pay an additional $125 International Student Fee each semester.
4 Masters Programs in Mathematics and Statistics

The Department of Mathematics and Statistics teaches advanced quantitative and analytic skills for professionals in education, industry and research. Financial aid in the form of research and teaching assistantships allows students to pursue their education without incurring debt while learning through interaction with experienced faculty. Masters programs follow three different major tracks (Plan A, B or C). All tracks require at least 30 credits, but with different balances of 5/6000 level courses and research (MATH/STAT 6970) credits. Research credits are counted as part of the 6000-level credit requirement. Both Plans A and B require a written and defended Master’s thesis; Plan C requires only coursework. The Department offers five separate degrees at the Masters level, tailored for students wishing to pursue careers in teaching, research, or industry.

4.1 Common Masters Requirements

All masters degree programs in the department share certain formal requirements, including:

**Supervisory Committee Form** Tells the SGS who your advisor and supervising committee are. Due in the second semester. Choose an advisor first, and select a committee appropriate to the research topic in consultation with your advisor, including an ‘outside’ committee member from USU who is not a researcher in the subject area of study.

**Program of Study** Outlines courses to be taken to complete degree, must be signed by committee and advisor. Due in the second semester, but after selecting a supervisory committee (who must all sign the form). Discuss proposed courses with advisor, ratify the list with committee either in a meeting or individually. Notification of changes to the program of study must be authorized by the major professor and submitted to GPC.

**Qualifying Requirements** All departmental masters programs require passing a qualifying requirement, either a test or above-threshold grade performance in specific classes.

Requirements for specific Masters programs are described below.

4.2 Mathematics

The MS program in Mathematics primarily prepares students for doctoral programs in pure and applied mathematics and statistics, and secondarily for careers in college teaching and industrial jobs. MS Math students conduct research in areas including differential geometry, computer-aided algebra and mathematical physics, mathematical ecology, dynamical systems and graph theory.

This degree requires 30 credits of approved coursework at or above the 5000 level. At least 18 of these credits must be at the 6000 level or above, excluding MATH 6990 and 7990 (Continuing Graduate Advisement) and MATH 7910 (College Teaching Internship). Generally, most of the coursework will be in mathematics, but the student’s supervisory committee may approve courses in statistics, physics, engineering, or any other discipline if it seems such coursework is appropriate for the student’s program of study.

MS Mathematics students must obtain a minimum grade of “B” or better in at least two topic tracks from the 5000-level or the 6000-level topic tracks listed in Appendix C. MS Mathematics
students may substitute one topic track if they can document they have had something equivalent in a previous degree program.

All students in the MS program in Mathematics must pass a written qualifying examination covering the introductory analysis and advanced calculus material presented in MATH 4200, 5210, and 5220. Students may take this exam before beginning formal coursework in the MS program but must take the exam by the end of the first full year of matriculation. The exam is typically given twice a year, in May and once during Fall semester. Matriculated students who fail on their first try must pass the exam at the next scheduled opportunity. A detailed exam syllabus is contained in this document.

4.3 Statistics

The MS Statistics program prepares students for positions in industry or government, while providing them with the necessary applied and theoretical background to pursue PhD programs in statistics or biostatistics. Students may apply with an undergraduate degree in statistics, mathematics, or a wide variety of other disciplines, including the biological and social sciences. An advanced undergraduate class in probability and mathematical statistics and some programming experience (particularly in R) is desirable; classes in linear algebra and multivariable calculus are necessary. MS Stat students conduct research in areas such as Big Data, time series, statistical genetics, bioinformatics, computational statistics, data visualization, experimental design and biostatistics. Nearly all MS Statistics projects involve collaboration with researchers in other fields, including ecology, agriculture, genetics, cancer, finance, public health, nutrition, education and engineering.

This degree requires 30 credits of coursework at or above the 5000 level. At least 18 credits must be at 6000 level or above, excluding STAT 6990 and STAT 7990 (Continuing Graduate Advisement). All students must take either MATH 5710/5720 (Introduction to Probability/Mathematical Statistics) or STAT 6710/6720 (Mathematical Statistics I/II). Generally, most coursework will be in Statistics, but the student’s supervisory committee may approve courses in mathematics, biology, economics, or any other discipline if appropriate for the student’s program of study. There is no examination required, however, the qualifying requirement for the MS Statistics degree is that students must earn a B or better in both semesters of either the MATH 5710/20 or the STAT 6710/20 sequence.

4.4 Industrial Mathematics

The Industrial Mathematics Program teaches students modeling, simulation, mathematical and statistical analysis for careers in industry and mathematical sciences. Students are prepared to work at a variety of government and industrial research jobs, teaching careers at community colleges as well as for entry to doctoral programs in applied mathematics or statistics. Research project topics are suggested by industrial and scientific internship partners; recent research has developed Bayesian optimization tools for use in quantitative Enzyme-Linked ImmunoSorbant Assay (ELISA) to detect bio-pathogens, used path planning algorithms to govern robotic devices in complicated environments, or developed mathematical models and dynamical systems approaches to optimize genetic amplification technology for industrial pathogen detection. Applicants are welcomed from any undergraduate technical major, including computer science, chemistry, engineering, math, physics and statistics. Undergraduate linear algebra, multivariate
calculus and differential equations is prerequisite, as is computer programming experience. This degree requires 36 credits at or above the 5000 level – 30 credits in coursework, 3 credits for research (MATH 6970), and 3 credits for internship (MATH 6250). At least 15 of the coursework credits must be completed in MATH/STAT courses at the 6000 level or above (including the 3 credits of required internship). The internship could be a formal paid or unpaid summer internship at a tech company, NGO or national lab, but could also be a less formal ‘imbedding’ experience in another discipline requiring the student to assist with field or lab experiments and data collection. The governing notion is to be completely out of Math & Stats for at least a month, seeing another discipline from the inside and figuring out how Math & Stats could be usefully applied.

Additionally, students must complete a total of 9 credits outside of the Department, complementing their internship and final project. A maximum of 3 of these credits may be taken at the 5000-level (i.e., one 3-credit course in another department). To build a foundation in applied mathematics, students are required to take four 5000-level classes in their first year (or receive approval from their Supervisory Committee for substitutes):

- STAT 5100, Linear Regression and Time Series analysis,
- one of MATH 5410, Methods of Applied Mathematics, or MATH 5420 Partial Differential Equations,
- one of MATH 5610, Computational Linear Algebra, or MATH 5620 Numerical Solution of Differential Equations, and
- one additional course from the five above or MATH 5760 (Stochastic Processes), 5460 (Nonlinear Dynamics), 5270 (Complex Variables) or an approved substitute.

The qualifying requirement is B or above performance in all four core classes. If students have had core classes (or clear equivalents) as part of an undergraduate degree and the supervising committee agrees, then they need not re-take the classes, but they must still meet the overall credit requirements for the degree.

Students are also required to complete a final project based on work done during an internship, either with a company or possibly with another department on campus. The project will include a technical write-up suitable to the industry/field, and presentation to the involved faculty and students in the program, following the Plan B option.

4.5 Master of Mathematics

The Master of Mathematics (MMath) degree is a professional masters degree (plan C) serving mathematics educators at the secondary (and sometimes tertiary) levels who want to broaden their background in Mathematics, Statistics, and pedagogy. The program offers students the opportunity to enhance their mathematics content background as suited for personal enrichment and the teaching profession. The program is flexible to serve the needs of professional teachers and provide a route to secondary mathematics licensure and endorsement in Utah.

The MMath program requires the completion of 36 credits approved by an advisory committee within the Department of Mathematics and Statistics. At least 21 of these credits must come
from Mathematics or Statistics classes numbered above 5000, while additional credits may be chosen from courses offered within the College of Education and Human Services. Students may conduct faculty supervised projects oriented around Mathematics and/or Statistics education. Past students have worked on various project types from curriculum design, to teaching experiments, to observational studies, to software/applet development.

All students in the MMath program must pass a written qualifying examination. They may take either the Advanced Calculus exam or the qualifying exam in Mathematics Teaching. Students may take these exams before beginning formal coursework in the program but must take them at or before the end of the first full year of matriculation.

4.6 Master of Data Analytics

The Master of Data Analytics (MData) degree is a professional masters degree (plan C) that integrates coursework in four departments (Mathematics and Statistics, Management Information Systems, Economics and Finance, and Computer Science) to give graduates a broad but focused collection of tools for the management and analysis of data, particularly Big Data.

The MData program requires at least 33 credits total, including 17 credits from the program core. The remaining 16 credits are determined by the emphasis or track a student chooses – Statistics, Management Information Systems, or Economics. In addition, students are expected to already have the equivalent of STAT 5100 Linear Regression and Time Series; if not, students will need to take STAT 5100, and their program of study will include 36 credits. A student’s committee may approve substitutions for elective courses from another track.

MData Program Core: CS 3430 Computational Science: Python and Perl Programming [3 cr]; STAT 5050 Introduction to R [1 cr]; STAT 5650 Statistical Learning and Data Mining I [2 cr]; STAT 5560 Statistical Visualization I [2 cr]; ECN 5330 Applied Econometrics [3 cr]; MIS 6230 Database Management [3 cr]; plus a 6000-level STAT/MIS/ECN Capstone Project and Internship in Data Analytics [3 cr].

MData Statistics emphasis: (in addition to the 17-credit program core) Each of STAT 5080 Data Technologies, STAT 5150 SAS Predictive Analytics, SAS 5680 Statistical Thinking for Big Data, STAT 6560 Statistical Visualization II, and STAT 6650 Statistical Learning and Data Mining II. Choose two elective courses from STAT 5120 Categorical Data Analysis, STAT 5410/6410 Applied Spatial Statistics, STAT 5570/6570 Statistical Bioinformatics, STAT 6100 Advanced Regression Analysis, CS 5665 Introduction to Data Science, CS 5810 Applied Data Science Incubator, CS 6665 Data Mining, or CS 6675 Advanced Data Science and Data Mining.

For the most current information on the MData program, visit www.usu.edu/mdata.

4.7 Plan A (Thesis)

The Plan A (or thesis option) requires taking 6 credits of MATH/STAT 6970 (Thesis and Research) and working with a faculty member on a research project requiring a substantial monograph-style write-up. The research must be presented in a thesis, which must be approved by the student’s supervisory committee and the Dean of the SGS. An oral defense of the thesis must be arranged through the SGS. Specific milestones include:
**Thesis Proposal** Candidate should make a (brief) written and oral presentation to supervising committee regarding proposed content and direction of research. A **Masters Proposal Approval Form** indicating committee acceptance is due at the SGS prior to scheduling a thesis defense.

**Defensible Thesis** This is a version of the thesis that is complete in content and believed to be correct in all technical details by both student and major advisor. The version submitted to the committee should require only relative minor editing. It is strongly recommended that this be submitted to committee at least four weeks prior to envisaged Defense to give committee two weeks to read and another two weeks to accommodate scheduling through the graduate school.

**Appointment for Examination** Signed by committee and due two weeks prior to defense. Signed form indicates that the thesis is defensible, and schedules a defense. *If the thesis is incomplete, incorrect in major details, or requires substantial editing the committee should not sign the Appointment for Examination.*

**Thesis Defense** Candidate prepares a public presentation of research, not to exceed 45 minutes. After public questions, candidate and audience are excused, committee discusses format for private questioning, and candidate then answers questions and concerns regarding the manuscript for as long as the committee desires (anywhere from 15 minutes to two hours). A **Record of Exam Completion** must be submitted to the SGS by the GPC.

**Signed Thesis** Most theses require editorial corrections after the defense. These corrections must be completed *before the committee will sign the title page.* The signature page can be signed via Docusign, and must be submitted to SGS with the final version of thesis.

**SGS Review** When the committee approves a copy can be submitted to to SGS Assistant Dean for style review. *This requires from one to two weeks.* After the Dean has signed the signature page final copies can be brought to the Merrill-Cazier Library for binding.

**Change Grades for Incomplete Research Credits** Students receive a grade of I on research credits until they have completed all departmental and research requirements. When all requirements are met the department must submit a change of grade form for the students so that the research credits appear with a passing grade.

**Library Receipt of Thesis** When the final version of the thesis has been electronically submitted, the Library notifies the SGS, which must occur before the degree will be posted to a student’s transcript.

**Departmental Thesis Copy** The student is responsible for requesting one copy of the printed thesis on behalf of the department.

Students should be careful with timing in the final semester. The Plan A thesis defense must occur at least two weeks before the end of the semester for everything to be completed and the degree to be posted in the semester, and the penultimate version must be submitted to the committee four weeks before that. Thus, a student’s research and writing must be substantially finished more than six weeks before the end of the semester! A variety of SGS minutae are sent to the candidate at the time of the defense, including a **Commencement Data Form, Electronic Thesis and Dissertation Approval Form, Graduation Fee Payment Form, Alumni File Form & Student Survey.** All of these forms must be signed and returned for the degree to be
posted. A student must *usually* be registered for three credits at USU during the semester of their defense; the exception is in the case when *all* Program of Study requirements have already been satisfied, in which case only one credit is required.

### 4.8 Plan B (Project)

The Plan B (or project option) requires taking 3 credits of MATH/STAT 6970 and working with a faculty member on a research project which can be conveyed in a technical report or journal-manuscript format. A written report of the research must be approved by the student’s supervisory committee but does not require the approval of SGS. An oral defense of the report must be scheduled through the School of Graduate Studies. Specific milestones include:

**Defensible Project Report** It is strongly recommended that this be submitted to committee at least four weeks prior to envisaged Defense (to allow two weeks of reading before committee signs the Appointment for Examination)

**Appointment for Examination** Signed by committee and scheduling the Defense, indicating that the report is defensible, which is to say complete in content, correct in major details, and requiring only small-scale editing. Due at SGS at least two weeks prior to Defense.

**Project Defense** Candidate prepares a public presentation of research, not to exceed 45 minutes. After public questions, candidate and audience are excused, committee discusses format for private questioning, and candidate then answers questions and concerns regarding the manuscript and research. A **Record of Exam Completion** must be submitted to the SGS by the committee.

**Signed Report** Most reports require editorial corrections after the defense. These corrections must be completed before the committee will sign the title page. The signature page can be signed via Docusign. When the report is signed a copy can be submitted to the Merrill-Cazier Library for binding. **No SGS review is required.**

**Change Grades for Incomplete Research Credits** Students receive a grade of I on research credits until they have completed all departmental and research requirements. When all requirements are met the department must submit a change of grade form for the students so that the research credits appear with a passing grade.

**Library Receipt of Report** When the final version of the report has been electronically submitted, the Library notifies the SGS, which must occur before the degree will be posted to a student’s transcript.

**Departmental Report Copy** The student is responsible for requesting one copy of the printed report on behalf of the department.

Students should be careful with timing in the final semester. The Plan B defense must occur before the end of the semester for everything to be completed and the degree to be posted in the semester, and the penultimate version must be submitted to the committee four weeks before that. Thus, a student’s research and writing must be substantially finished more than four weeks before the end of the semester! A variety of SGS minutiae are given to the candidate at the time of the defense, including a **Commencement Data Card**, **Graduation Fee Payment Form**, and others.
Alumni File Card & Student Survey. All of these forms must be signed and returned for the degree to be posted. A student must be registered for three credits at USU during the semester of their defense, unless their Program of Study is completed, in which case only one credit of registration is required.

4.9 Plan C (Coursework)

There is no Plan C (coursework-only) option for the MS degrees in the department. The MMath and MData degrees are professional degrees and are coursework-only (non-thesis, non-research) degrees.
5 Doctoral Programs in Mathematics and Statistics

The Department of Mathematics and Statistics teaches advanced quantitative and analytic skills for professionals in education, industry and research. At the Ph.D. level this mission is realized through four doctoral specializations within the Mathematical Sciences PhD. Common requirements are described after the specializations.

5.1 Pure and Applied Mathematics

The Pure and Applied Mathematics specialization, a traditional doctoral program, provides training in the foundations of modern mathematics and specialized areas of mathematical research. Graduates are employed as tenured faculty at universities and colleges as well as governmental and industrial research centers. Students work with faculty researchers in differential geometry, computer-algebra and mathematical physics, dynamical systems, mathematical ecology, graph theory and low-dimensional topology. The dissertation should be a publishable, significant contribution to research in an area of mathematics or its applications.

Students in this Pure and Applied Mathematics specialization must obtain a minimum grade of “B” or better in at least two of the 6000-level topic tracks listed in Appendix C.

5.2 Statistics

The Statistics PhD specialization offers training in theoretical and applied statistics for students seeking careers in academe, industry, or government. This is the only PhD program in the region allowing students to specialize in theoretical or applied statistics under the guidance of faculty dedicated to advancing statistical methodology for important and timely real-world problems. Students work with faculty mentors in areas such as Big Data, time series, statistical genetics, bioinformatics, computational statistics, data visualization, experimental design and biostatistics. Nearly all Statistics dissertations involve collaboration with researchers in other fields, including ecology, agriculture, genetics, cancer, finance, public health, nutrition, education and engineering. Dissertations constitute publishable, significant contributions to statistical research.

5.3 Interdisciplinary Studies

The Interdisciplinary Studies PhD specialization combines training in mathematics or statistics, significant interaction with other fields that use advanced methodology from mathematics or statistics, and training in an area of application outside math/statistics, with program direction by scholars in math/statistics and in an external discipline. The dissertation should constitute a body of work on significant application or relationship of mathematics or statistics to other disciplines, with the goal of publication in either mathematics, statistics or the field of impact.

The Interdisciplinary Studies Specialization requires at least 9 credits of coursework in the student’s chosen interdisciplinary area (outside both Mathematics and Statistics). Recent students have taken external courses in the College of Education, from the Departments of Biology and Physics, or as part of the Program in Climate Adaptation Science. The student’s PhD supervisory committee should include two persons in the student’s selected interdisciplinary...
area, and the comprehensive examination (see below) should have a significant interdisciplinary component.

Students in this Interdisciplinary Studies specialization must obtain a minimum grade of “B” or better in at least two of the 6000-level topic tracks listed in Appendix C.

5.4 College Teaching

The College Teaching PhD specialization is being phased out. Students already admitted to this specialization have been transferred to the more flexible (and likely more marketable) Interdisciplinary Studies specialization.

5.5 Common PhD Requirements

All doctoral programs of study (after a Masters) require 45 or more credits, at least 30 credits numbered 6000 or higher, including research credits but excluding MATH/STAT 6990 and 7990 (Continuing Graduate Advisement). No more than 15 credits numbered 5000-5999 may be taken toward a PhD. At least 12 credits must be 7970 (Dissertation Research) for PhD students starting with a Masters. For students entering the doctoral program directly from a bachelor’s degree 72 total credits are required, with at least 18 credits of Dissertation Research (and still only 15 credits of coursework allowed at 5000 level).

The core requirements for departmental doctoral degrees include the following:

1. Choose an advisor and a supervisory committee, with whom the student defines a program of study. The committee must have at least one ‘outside’ member, a USU faculty member from outside Mathematics and Statistics.

2. Pass a comprehensive examination that is constructed specifically for the student by his or her supervisory committee. The form of the examination may be written or oral, or may include a combination of written and oral components. The length and content of the exam are determined by the student’s supervisory committee, but is expected to take at least eight hours of direct effort from the student (e.g. three two-hour written exams followed by a two hour oral exam).

3. Write and successfully defend a dissertation research proposal.


5. Write and successfully defend a dissertation.

After completing items 1-3 and completing two thirds of the required coursework a PhD student may apply for candidacy. There are currently no language requirements for departmental Ph.D. students beyond competency in English (tested via comprehensive examinations, proposal and dissertation defenses).

A checklist and timeline for completion of a Ph.D. appears below, including several administrative milestones required by the SGS.
**Supervisory Committee Form**  Tells the SGS who your advisor and supervising committee are. Due in the second semester. Choose an advisor first, and select a committee appropriate to the research topic in consultation with advisor.

**Program of Study**  This defines the coursework to be completed in the doctoral program, and is signed by committee and advisor. Due third semester. Discuss proposed courses with advisor, ratify the list with committee either in a meeting or individually. Notification of changes to the program of study must be authorized by the major professor and emailed to the SGS by the GPC.

**Comprehensive Exams**  Subject areas and weighting set by committee; exams written, administered and graded by committee. Exams should last at least eight hours, and may include oral and presentational components. Candidate should discuss exam content with committee while organizing the Program of Study. Exams should be attempted in the second or third year of study. Major professor should write a letter to the Graduate Program Coordinator indicating when the exam has been passed.

**Dissertation Proposal**  Candidate should make a (brief) written and oral presentation to the supervising committee regarding proposed content and direction of research. A signed title page (same format as dissertation title page) should be submitted to the Graduate Program Coordinator when the proposal defense has been successfully completed. Must be completed at least three months before defense.

**Application for Candidacy**  Verifying that all exams have been passed, a dissertation proposal has been defended, and the majority of coursework completed. Due at SGS at least three months prior to Dissertation Defense.

**Defensible Dissertation**  Submitted to committee at least four weeks prior to envisaged Defense. This is a version of the dissertation that is complete in content and believed to be correct in all technical details by both student and major advisor. The version submitted to the committee should require only relative minor editing.

**Appointment for Examination**  Signed by committee, indicating that the dissertation is defensible, and scheduling Dissertation Defense. *If the dissertation is incomplete, incorrect in major details, or requires more than minor editing the committee should not sign the form.* Due at SGS at least two weeks prior to Defense.

**Dissertation Defense**  Candidate prepares a public presentation of research, not to exceed 45 minutes. After public questions, candidate and audience are excused, committee discusses format for private questioning, and candidate then answers questions and concerns regarding the manuscript and research. A **Record of Exam Completion** must be submitted to the SGS by the GPC.

**Signed Dissertation**  Most dissertations require some editorial corrections after the defense. These corrections must be completed before the entire committee signs the signature page.

**SGS Review**  When the committee agrees that recommended changes to the dissertation are completed, a copy can be submitted to to SGS Assistant Dean for style review. **This requires from one to two weeks.**  After corrections to formatting the Dean can sign the title page and final copies can be brought to the Merrill-Cazier Library for binding.
Change Grades for Incomplete Research Credits Students receive a grade of I on research credits until they have completed all departmental and research requirements. When all requirements are met the department must submit a change of grade form for the students so that the research credits appear with a passing grade.

Library Receipt of Dissertation When the final version of the dissertation has been electronically submitted, the Library notifies the SGS, which must occur before the degree will be posted to a student’s transcript.

Departmental Dissertation Copy Students are expected to provide one bound copy of their dissertation to the Department for archiving.

Students must be registered for three credits during the semester of their defense (if completing the program of study) or one credit (if all required classes on the program of study have been successfully completed). Students should be careful with timing in the final semester. The dissertation defense must occur at least two weeks before the end of the semester to allow for format review and corrections. The penultimate version must be submitted to the committee four weeks before that. Thus, a student’s research and writing must be substantially finished more than six weeks before the end of the semester to successfully graduate in that semester. Additionally, a variety of SGS minutae are given to the candidate at the time of the defense, including a Commencement Data Card, Electronic Thesis and Dissertation Approval Form, Graduation Fee Payment Form, Alumni File Card, Survey of Earned Doctorates Form, & Student Survey. All of these forms must be signed and returned for the degree to be posted.
6 Examinations

Two Qualifying Exams are offered in the department to serve the needs of the MS Math and MMath programs. Qualifying exams guarantee that students become proficient in core competencies. Qualifying exams must be taken within the first year of matriculation in the program; students receive only two attempts at the qualifiers (not counting a ‘free’ attempt which a student may make before matriculation).

At the doctoral level students are required to take comprehensive examinations in subjects determined by their supervisory committee. The examinations are used to probe the breadth and depth of the student’s knowledge in his/her area of specialization as well as foundational areas which the committee feels are requisite to the student’s professional goals. Guidelines and requirements for the comprehensive examinations appear below.

6.1 MS Qualifying Exam in Advanced Calculus

The Advanced Calculus Exam will be offered twice a year, once in May and once during the Fall semester. The student will be required to demonstrate knowledge of the theory supporting undergraduate calculus, including knowledge and application of definitions and theorems as well as proof and application of central theorems. Previous exams are available by request from the GPC. This material is covered in USU classes MATH 4200 Foundations of Analysis, 5210 & 5220 Introduction to Analysis I, II. A general syllabus of subjects includes:

**Calculus in One Dimension.** Topology of the real line, limits of sequences, series and functions, Cauchy sequences, power series, convergence and uniform convergence, continuity and uniform continuity of functions, theorems about differentiability including Mean Value Theorem, Taylor’s theorem, Riemann integration for bounded functions, Fundamental Theorem of Calculus.

**Calculus of \( \mathbb{R}^n \).** Topology of \( \mathbb{R}^n \), Heine-Borel Theorem, Bolzano-Weierstrass theorem, continuity and uniform continuity of functions, partial derivatives, differentiability, Implicit and Inverse Function Theorems, Riemann Integration for bounded functions in \( \mathbb{R}^n \), Fubini’s theorem, Change of Variables theorem, line and surface integrals, statement and application of Green’s, Stokes’ and Divergence Theorems.

References


6.2 MS Qualifying Exam in Mathematics Teaching

The Mathematics Teaching exam is given in take-home exam format followed by an oral component (face-to-face interview) by examinees to a jury of Mathematics and Statistics education faculty. The exam consists of 5 prompts intended to lead students to synthesize, explore, or apply mathematics or statistics topics that relate to teaching. Students will be instructed to work individually and list resources they use in their written report. Examinees will receive exam questions at least one week before the written responses are due, and the oral portion follows two or more days after the after turning in the written portion. The take-home exam requires 25 hours of total time to complete by a prepared examinee. The oral portion of the exam addresses details and extensions of questions the examinee responds to in writing, and will take 1.5 hours. Examinees will be notified by a letter if they have passed or failed the exam.

The jury (or exam committee) consists of at least three faculty members (two from the Department) and a highly-qualified, inservice teacher with MS degree qualifications. The jury is responsible for designing exam questions, reviewing written responses, participating in interviews on the exam day, and evaluating examinee performance (Pass/Fail).

Exam Syllabus

Math/Stat topics including: STAT 3000 Statistics for Scientists, MATH 1210/1220 Calculus I/II, MATH 2210 Multivariable Calculus, MATH 2250 Linear Algebra and Differential Equations, MATH 3110 Modern Geometry, MATH 3310 Discrete Mathematics, MATH 4200 Introduction to Analysis, MATH 4310 Introduction to Algebraic Structures, MATH 4500 Methods of Secondary School Mathematics Teaching, MATH 5010 Technology for Teaching Mathematics, MATH 5020 Mathematical Cognition and Assessment, STAT 4010 Statistics and Probability for Teachers (required for Math Ed undergraduate degrees.)

Precalculus Mathematics Analytic geometry, differential and integral calculus, transcendental functions, and applications.

College Calculus Integration, differentiation, arithmetic and geometric sequences and infinite series. Vector calculus, multiple integration, partial derivatives, line and surface integrals. The theorems of Green, Gauss, and Stokes.


Geometry Euclidean and non-Euclidean geometry, with emphasis on historical significance of the parallel postulate.

Foundations of Algebra Logic, axioms and proofs. Sets, functions, counting methods, recurrence relations, graph theory, Boolean algebra, combinatorial arguments. Group, ring, and field theory.

Foundations of Analysis The rational, real and complex number systems and proofs of major theorems in calculus.
**Probability and Statistics** Discrete and continuous probability, random variables, distribution and density functions, joint distributions, Bayes’ theorem, moments, moment generating functions, inequalities, convergence in probability and distribution, and central limit theorem. Basic statistical concepts, including sampling, graphical techniques, discrete and continuous distributions, parameter estimation, hypothesis testing, and chi-square tests.


**References**


WHATEVER BOOKS ARE REQUIRED/RECOMMENDED FOR STAT 3000, MATH 3110, MATH 3310, AND MATH 4310 (check with Graduate Program Coordinator)


**6.3 Guidelines and Requirements for Comprehensive Examinations**

Comprehensive examinations in the Department of Mathematics and Statistics are set by a student’s supervisory committee, and are intended to test the student’s depth of knowledge in areas related to their research specialization and career goals. There are no set syllabi for the exams, and the only guideline is that the entire examination process should take between 8 and 12 hours. The exams themselves may be comprised of individual exams written and graded by subsets of the supervisory committee, a single exam written and graded by the committee, oral examinations by the committee or a subset, or mixtures of these as the committee sees fit.

Comprehensive exams should be scheduled directly between the student and the supervisory committee, and the student should meet with the committee to discuss exam syllabus and format. The exams should be taken in or before the third year of matriculation in the doctoral program. Upon successful completion of the exams the major professor should write a letter to the Department’s Graduate Program Coordinator indicating results of the exams.
7 Policies and Procedures

General information regarding policies and procedures pertaining to all graduate students at USU is the Graduate Catalog, which is part of the USU General Catalog. The easiest way to find the Graduate Catalog is to start at the SGS web site, https://rgs.usu.edu/graduateschool/ and then click on ‘Graduate Catalog’ in the navigation column. It is also findable by starting at the USU General Catalog http://catalog.usu.edu/ and then click ‘School of Graduate Studies (Policy)’ in the navigation column. The Graduate Catalog provides a wealth of information on

- Graduate Admissions (procedures and requirements for admission, international admissions, ‘split-form’ policy for taking graduate courses as an undergraduate, concurrent degrees)
- Financial Assistance (assistantship rules, fellowships, scholarships, loans)
- Student Classifications (matriculated, non-matriculated, full-time, probationary)
- Graduate General Regulations (transfer and non-matriculated credits, acceptable courses, timing, leave of absence, withdrawal, academic progress and performance)
- Research and Intellectual Property (approval process for hazardous stuff, vertebrates, humans, research conduct, rights in inventions)
- Graduate Degree Requirements (for MS plans A, B and C, PhD programs, timing of progress, residency requirements)
- Degree Completion (composition of supervisor committee, preparation and approval of theses, project reports and dissertations, oral examination/defense)

Things that you read in the Graduate Catalog are DA RULZ, and departmental policies may not contradict DA RULZ. Approximately 75% of student and advisor questions can be answered directly by consulting DA RULZ. However, the Department has some specific policies and procedures which govern graduate students in Mathematics and Statistics.

7.1 Submission of Forms through GPC

All forms needing to be submitted to SGS must be uploaded by the Graduate Program Coordinator. Email completed forms to gary.tanner@usu.edu for proofing and submission. As the liaison between the Graduate Student and the Graduate School, the department’s GPC will also assist with questions regarding forms and deadlines throughout students’ degree programs.

7.2 Departmental Policy on Academic Progress

7.2.1 Progress through School of Graduate Studies Milestones

In the Graduate Catalog (‘DA RULZ’) under Graduate Degree Requirements SGS outlines the various milestones that they use to monitor a student’s progress through their graduate degree program, usually marked by submission of a form through the GPC. The bad news is that students usually only find out that they are not up-to-date at some late and painful stage (e.g.
when suddenly they can’t apply for candidacy, or are not allowed to schedule a defense). To make sure Math & Stat students are on track with respect to these milestones they are written into TA contracts, which will not be renewed in the absence of required progress (see below). Detailed Masters and PhD timeline/checklists appear in Appendix A.

7.2.2 Yearly Progress Reports

Annual (at the very least) meetings between supervisory committees and students are recommended by the Deans of the College of Science and the School of Graduate Studies. These should occur naturally as students move through their degree program (e.g., meeting with the committee to discuss a program of study in year 1, meeting to discuss the content and format of comprehensive exams in year 2, defending a thesis proposal in year 3). However, when students get off track it is often because they are not scheduling regular meetings with the committee and the committee therefore is unaware of the student’s progress (or lack thereof).

Additionally, to assess graduate program performance the Department needs to capture more data than the minimum required by SGS. For example, what conferences or workshops have students attended? Have students contributed talks, presented posters, earned awards, submitted papers? Where are they in completing their thesis or dissertation, how far through the program of study have they gotten, and when are comprehensives envisioned? To capture this information and to have a record of the suggested annual meetings the Department requires every student’s committee to submit a Yearly Progress Report to the GPC. The GPC will maintain a master form for each student, keeping track of all accomplishments, and provide a yearly update form (Progress Reports in Appendix A) to the supervisory committee at the beginning of Spring semester. Receipt of the form is a condition for contract renewal.

7.3 TA Support

7.3.1 Departmental Commitment

Teaching assistantships are given as financial aid to students to support the Department’s research and graduate education mission; TAs are not intended to be long-term jobs. As a means to cover the delivery of classes TAs are expensive, with TA stipends being from two to three times the market rate for covering classes with adjunct faculty or using undergrad SAs to handle recitations (and that is without even considering the cost of tuition waiver and insurance coverage!). Thus, to spread the financial aid over as many students as possible the Department limits the number of semesters of TA support offered to graduate students. In the normal course of events Masters students are capped at four semesters of TA support and PhD students (entering with MS) are capped at eight semesters of support. PhD students admitted directly from bachelors programs are granted ten semesters of support by default. A student’s advisor may petition for an extension of support for the student (see below), and may also extend their time via external funding (i.e. RA).

7.3.2 Conditions for Renewal

In addition to adequate academic progress (summarized in the following paragraphs), TA contract renewal requires satisfactory performance in the teaching assistantship duties. This assessment
will be made by the Assistant Head for Graduate Studies and the Associate Department Head.

For renewal of contracts at the MS level both the Supervisory Committee Form and the Program of Study must be submitted before the end of the second semester of study. It is also required that the supervisory committee submit a yearly progress report to the GPC (see above). Students should finish Masters degree requirements in the second year of study, so TA contracts are not normally renewed after the second year.

For doctoral students the situation is more complex; a detailed timeline and checklist is given in Appendix A. In the normal course of events a PhD student will need three contract renewals during their four years of study. In addition to a yearly progress report submitted to the GPC, the major conditions for each renewal are:

1. In the first year PhD students must choose an advisor and submit a Supervisory Committee Form.
2. In the second year PhD students must submit a Program of Study, may attempt comprehensive exams, and should write a dissertation proposal.
3. In the third year PhD students must have attempted comprehensive exams, written and defended a dissertation proposal, and applied for PhD candidacy.

The expectation is that PhD students will write and defend their dissertation in the fourth year, get a nice job, and not need contract renewal.

### 7.3.3 Applying for Extension of TA Support

In the event that a student has used up four semesters (MS) or eight semesters (PhD) of TA support, but still has not graduated, the student’s major professor may petition for an extension of departmental support. MS students may receive one extra semester of TA support, while PhD students may receive up to two semesters. In both cases, since the program of study should have been completed, TAs on extension are expected to teach either two courses, one course and two recitation sections, or five recitation sections. In effect, students on TA extension are being funded from the ‘adjunct’ teaching budget, with reduced tuition/insurance support from the TA budget, since they have used up their fare share of TA support.

To request extension, the advisor should write a letter to the Asst. Dept. Head for Graduate Studies (and c.c. the GPC). The letter should include:

- Rationale for the request.
- Summary of current state of the student’s research and plan for addressing missing results (if any).
- Proposed timeline for completion of graduation requirements, including tentative schedule for providing manuscript(s) to the supervisory committee and defending.

To be eligible for an extension the student must be up-to-date on required SGS forms and have completed all coursework on the program of study. MS students requesting extension should also have passed their qualifying requirements and defended a research proposal (for Plan A); PhD students must have applied for candidacy (i.e. passed comprehensives and successfully defended a dissertation proposal).
7.4 Departmental Tuition Waiver Limits

Costs for the non-resident portion of student tuition waivers are charged against the Department’s graduate TA budget. In the case of MS Plan B students the department also is required to pay the non-resident portion of tuition, if a waiver is granted. As a consequence, the more credits that the Department covers with a tuition waiver the fewer students who can be supported on TAs and RAs. There are therefore a number of policies in the department restricting the number of credits for which a student may receive waivers:

**Cap on Credits/Semester** No student may take more than 9 credits/semester without specific approval from the Asst. Dept. Head for Graduate Studies.

**Cap on Lifetime Credits toward MS Degrees** Students in MS Plan A and Plan B programs may not receive tuition waiver for more than 33 credits toward a Masters degree (which allows the 30 credits required for an MS program of study plus three ‘grace’ credits).

**Cap on Lifetime Credits toward Doctoral Degrees** Students in PhD programs (starting with Masters) may not receive tuition waiver for more than 48 credits toward a PhD (45 credits on the program of study plus three ‘grace’ credits). In the case of students admitted directly to the PhD from a bachelor’s program only 75 credits are allowed.

7.5 Advancement to PhD Program

When a student currently in one of USU’s Masters programs applies to enter a PhD program at USU they must submit a **Degree Advancement Form** to SGS through the GPC (see https://rgs.usu.edu/graduateschool/forms/). This allows them to apply for a new graduate program without having to submit new application materials; i.e. their application materials from their original MS application are ‘rolled over’ to the new program.

Many students with long-term goals to get a doctorate are initially admitted to the MS program to see how they will perform at the graduate level before the Department makes a long-term investment. Many other students start a Masters degree in the Department and discover a talent and interest in academic research. Either way, several MS students each year apply to be considered for advancement to one of the PhD specializations in Mathematics and Statistics. The graduate committee considers these as new applications to the PhD program, although in the case of students applying for advancement the committee has a much better opportunity to gauge student potential. In almost all cases the Department gives PhD admission preference to students who have proven themselves at the Masters level. In rare cases a particularly talented student may apply for advancement to the PhD program **without** being required to complete MS requirements, but the more usual case is that the student must complete the MS before starting their new PhD specialization.

To aid in assessing a student’s request to advance to the PhD program, the following materials must be submitted to the GPC along with the Degree Advancement Form:

1. One copy of the student’s current, unofficial USU transcript.
2. Three (new) letters of recommendation (which may be submitted by direct email to the GPC). These letters must include
• One letter from MS advisor detailing plan for completing MS requirements (if necessary) and suitability of candidate for requested PhD specialization.

• One letter from a faculty member who attests to their willingness to supervise the student in the PhD program. This letter may or may not be from the MS supervisor.

• One letter must address student performance as a TA or RA (depending on student’s MS support) in addition to suitability for the doctoral program.

All three requirements may be covered by only one or two letters, in which case the remaining letters may simply address the student’s strengths as a potential PhD candidate.

When all these documents have been submitted to the GPC the graduate committee will review the updated file in the context of other applicants to the program, before advising the GPC to forward the Degree Advancement Form to the Department Head for signing.

7.6 Two-Year Rotation of Classes

To aid in Program of Study planning the Department has organized core courses in two year rotations. Many of the courses are being offered as Readings or Special Topics courses as of 2018-19 while we wait for changes to be approved and placed in the University Catalog. To avoid diluting the pool of graduate students taking graduate Math classes the Department will offer only four credits of Special Topics coursework per year outside the two-year rotation.

7.6.1 Applied Mathematics/Mathematical Biology/Differential Equations

The rotation of advanced applied math courses have been organized to give maximum exposure to many different subject areas supporting Departmental research in Applied and Computational Math, Mathematical Biology, Dynamical Systems and Differential Equations, following student exposure to a relatively short list of core classes (usually at the 5000 level). Where possible advanced courses are offered as 1-2 credit blocks with only foundational prerequisites to allow for maximum flexibility and exposure.

Computational Math The foundational class is MATH 4610, Fundamentals of Numerical Analysis (Fall semester, 3 credits). This course supports more advanced, two credit courses:

• MATH 5610 Computational Linear Algebra (alternate Spring semesters, 2 credits)
• MATH 5620 Numerical Algorithms for Approximate Solution of DE (alternate Spring semesters, 2 credits)
• MATH 6610 Advanced Computational Linear Algebra and Solutions of Nonlinear Systems of Equations (alternate Fall semesters, 2 credits)
• MATH 6620 Finite Difference Approximations for Solutions to PDE (alternate Fall semesters, 2 credits)

Differential Equations There are two foundational classes in the DE concentration, MATH 5420 Partial Differential Equations (Spring semester, 3 credits) and Math 5470 Advanced Differential Equations (alternate Fall semesters, 3 credits). These courses support the more advanced courses in differential equations and dynamics:
• MATH 5460 Nonlinear Dynamics (alternate Spring semesters, 3 credits)
• MATH 6410 Existence and Uniqueness of Solutions to ODE (alternate Fall semesters, 1 credit)
• MATH 6420 Classical Methods in PDE (first half, alternate Fall semesters, 2 credits)
• MATH 6440 ODE and Dynamics (alternate Fall semesters, 2 credits)
• MATH 6450 Analysis of PDE (second half, alternate Fall semesters, 2 credits)

**Applied Math and Mathematical Biology** The foundational class in the Applied concentration is MATH 5410 Method of Applied Mathematics (Fall semester, 3 credits). Classes in related advanced topics include:

• MATH 5760 Applied Stochastic Processes (alternate Fall semesters, 2 credits)
• MATH 6470 Advanced Asymptotic Methods (alternate Fall semesters, 2 credits)
• MATH 6820.1, .2, .3, .4 Applied Math in Biology Quad Shot (alternate Spring semesters, 1 credit each to a max of three)

A visual lay-out of the applied rotation (with usual class times) appears in Appendix C.

### 7.6.2 Mathematics

Mathematics courses outside of applied subjects are organized around core tracks which give MS students fundamentals with which to complete research topics within two years and provide core fundamentals to PhD students working with research faculty. The core tracks are

**Combinatorics and Graph Theory**

**Analysis** The introductory analysis courses, MATH 5210/20, run on a yearly basis. Follow-on analysis courses in Complex Variables (MATH 5270) are offered yearly, and MATH 6210/20 (Measure Theory, Lebesgue Integration/Functional Analysis) offered semi-annually.

**Differential Geometry (with some Algebra)**

**Algebra (with some Differential Geometry)**

**Topology** Starting in alternate Fall semesters students may take a year-long sequence of Topology, MATH 5510/6510.

A visual lay-out of the two-year math rotation, including pure and applied, appears in Appendix C.

### 7.6.3 Statistics

Upper level Statistics courses are a mixture of regularly-offered staples and current (hot-off-the-presses) topics courses. While the graduate Statistics curriculum’s two-year rotation is currently in revision (due to new programs in Data Analytics and Public Health), a snapshot (subject to change) appears in Appendix C.
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A Appendix: Student Progress Forms

A.1 Masters Degrees Timeline and Checklist
# Masters Degree Timeline and Checklist

**USU Department of Mathematics & Statistics**

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<th>Required Item</th>
<th>Who</th>
<th>On or Before</th>
<th>Submit to</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of Graduate Studies TA Workshop</td>
<td>Teachers and recitation leaders</td>
<td>First semester of teaching</td>
<td>(on-line class, Banner)</td>
</tr>
<tr>
<td>Supervisory Committee Approval Form</td>
<td>All students</td>
<td>Second semester</td>
<td>→GPC→RGS</td>
</tr>
<tr>
<td>Program of Study</td>
<td>All students</td>
<td>Second semester</td>
<td>→GPC→RGS</td>
</tr>
<tr>
<td>1st Committee Meeting (min) (Departmental Form)</td>
<td>All students</td>
<td>Second semester</td>
<td>→GPC</td>
</tr>
<tr>
<td>Qualifying Requirements</td>
<td>All students</td>
<td>Fourth semester</td>
<td>various</td>
</tr>
<tr>
<td>Master’s Proposal Approval Form</td>
<td>Plan A students</td>
<td>Fourth semester</td>
<td>→GPC→RGS</td>
</tr>
<tr>
<td>2nd Committee Meeting (min) (Departmental Form)</td>
<td>All students</td>
<td>Fourth semester</td>
<td>→GPC</td>
</tr>
<tr>
<td>Informal completion plan and written request from Advisor</td>
<td>All students</td>
<td>Fourth semester</td>
<td>Advisor→Asst. Head for Grad Studies</td>
</tr>
<tr>
<td>Penultimate’ draft of manuscript</td>
<td>Plan A &amp; B students</td>
<td>4 weeks before thesis defense</td>
<td>→supervising committee</td>
</tr>
<tr>
<td>Appointment for Examination Form</td>
<td>Plan A &amp; B students</td>
<td>2 weeks before thesis defense</td>
<td>→GPC→RGS</td>
</tr>
<tr>
<td>Thesis Defense</td>
<td>Plan A &amp; B students</td>
<td>Week before commencement</td>
<td>→supervising committee</td>
</tr>
<tr>
<td>Record of Examination</td>
<td>Plan A &amp; B students</td>
<td>at defense</td>
<td>committee →GPC→RGS</td>
</tr>
<tr>
<td>Signed Copy of Title Page</td>
<td>Plan A &amp; B students</td>
<td>End of ‘grace’ semester</td>
<td>→GPC→RGS</td>
</tr>
<tr>
<td>Letter of Completion</td>
<td>All students</td>
<td>End of ‘grace’ semester</td>
<td>GPC→Dept. Head→RGS</td>
</tr>
</tbody>
</table>

**Required for departmental support after second semester**

**Required for extra semester of graduate support**

**Graduation**
A.2 MS Yearly Progress Report
Graduate Student Progress Report (Masters)

This form helps students and advisors track progress through the graduate program. Fill out this form accurately and completely as possible in a yearly meeting. Return the completed form to the Graduate Program Coordinator, Gary.Tanner@usu.edu by April 1.

**Student Information**

Student Name: __________________________________________ A# ________________

Advisor Name: ___________________________________________________________________________

Degree Program (Math/Stat/Industrial/MMath): ________________  Thesis Plan (A, B or C): __________

Start Date of Current Program (Semester/Year): ________________________________________________

Current Teaching Assistantship? _______ Total Semesters TA Support (not counting summer): __________

Classes/Recitations Taught (this year): POSSIBLY REPLACE WITH TABLE OF CLASSES/DEA SCORES ON BACK

Other Support (this year):

**Milestones of Progress**

Supervisory Committee Approval Form (due 2nd semester) Date of Completion: __________________________________

Committee Members: _____________________________________________________________ (outside)

Program of Study (due 2nd semester) Date of Completion: __________________________________________

MS Qualifying Requirement: ____________________________________________________________

  Anticipated Date of Completion: __________________________ Date of Completion: ________________

Proposal Defense (Plan A only)

  Anticipated Date of Completion: __________________ Date of Completion: ____________________

  Master’s Proposal Approval Form Submitted to SGS (due <4th semester): ____________________

Thesis Defense (Plan A & B; student must submit Appointment for Examination form to RGS two weeks prior to defense)

  Anticipated Date of Completion: __________________________ Date of Completion: ________________

**Other Information**

Notable Accomplishments and Service (internships, awards, special training, funding, abstracts/proceedings/papers submitted or published, posters or talks contributed or invited, workshops and conferences attended):

Comments or Concerns:

Student is approximately _____% done with their thesis (if applicable).

Student has completed _____ of _____ required credits. Current GPA is ____________

Student progress is (check one): Satisfactory □/ Unsatisfactory □

(SPACE FOR COMMITTEE AND ADVISOR SIGNATURES – DOCUSIGN)

The statements and information noted above are accurate to the best of my knowledge ________________________________________ (student signature - DocuSign)
A.3 PhD Degrees Timeline and Checklist
<table>
<thead>
<tr>
<th>Required Item</th>
<th>On or Before</th>
<th>Submit to</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of Graduate Studies TA Workshop</td>
<td>First semester of teaching</td>
<td>(on-line class, Banner)</td>
</tr>
<tr>
<td>Supervisory Committee Approval Form</td>
<td>Second semester</td>
<td>→GPC→RGS</td>
</tr>
<tr>
<td>1(^{st}) Committee Meeting (min) (Departmental Form)</td>
<td>Second semester</td>
<td>→GPC</td>
</tr>
<tr>
<td>Program of Study</td>
<td>Third semester</td>
<td>→GPC→RGS</td>
</tr>
<tr>
<td>2(^{nd}) Committee Meeting (min) (Departmental Form)</td>
<td>Fourth semester</td>
<td>→GPC</td>
</tr>
<tr>
<td>Comprehensive Examination set by Supervising Committee</td>
<td>Sixth semester</td>
<td>Advisor→GPC</td>
</tr>
<tr>
<td>Dissertation Proposal Defense</td>
<td>Sixth semester</td>
<td>Advisor→GPC</td>
</tr>
<tr>
<td>3(^{rd}) Committee Meeting (min) (Departmental Form)</td>
<td>Sixth semester</td>
<td>→GPC</td>
</tr>
<tr>
<td>Application for Candidacy (requires completion of comps and proposal defense)</td>
<td>Three months prior to dissertation defense</td>
<td>→GPC→RGS</td>
</tr>
<tr>
<td>4(^{th}) Committee Meeting (min) (Departmental Form)</td>
<td>Eighth semester</td>
<td>→GPC</td>
</tr>
<tr>
<td>Informal completion plan and written request from Advisor</td>
<td>Eighth semester</td>
<td>Advisor→Asst. Head for Grad Studies</td>
</tr>
<tr>
<td>`Penultimate’ draft of dissertation</td>
<td>4 weeks before dissertation defense</td>
<td>→supervising committee</td>
</tr>
<tr>
<td>Appointment for Examination Form</td>
<td>2 weeks before dissertation defense</td>
<td>→GPC→RGS</td>
</tr>
<tr>
<td>Dissertation Defense (must be registered for 3 credits)</td>
<td>Week before commencement</td>
<td>→supervising committee</td>
</tr>
<tr>
<td>Record of Examination</td>
<td>at Dissertation Defense</td>
<td>committee →GPC→RGS</td>
</tr>
<tr>
<td>Signed Copy of Dissertation title page</td>
<td>End of `grace' semester</td>
<td>→GPC→RGS</td>
</tr>
<tr>
<td>Letter of Completion</td>
<td>End of `grace' semester</td>
<td>GPC→Dept. Head→RGS</td>
</tr>
</tbody>
</table>
A.4 PhD Yearly Progress Report
Graduate Student Progress Report (PhD)

This form helps students and advisors track progress through the graduate program. Fill out this form accurately and completely as possible in a yearly meeting. Return the completed form to the Graduate Program Coordinator, Gary.Tanner@usu.edu by April 1.

Student Information

Student Name: ___________________________________________ A# __________

Advisor Name: ___________________________________________________________________

Specialization (Math/Stat/Interdisciplinary/College Teaching): ________________________________

Start Date of Current Program (Semester/Year): ___________________________________________

Current Teaching Assistantship? _______ Total Semesters TA Support (not counting summer): _________

Classes/Recitations Taught (this year): POSSIBLY REPLACE WITH TABLE OF CLASSES/IDEA SCORES ON BACK

Other Support (this year):

Milestones of Progress

Supervisory Committee Approval Form (due 2nd semester) Date of Completion: _________________

Committee Members: ____________________________ (outside)

Program of Study (due 3rd semester) Date of Completion: ___________________________________________________________________

PhD Comprehensive Examination (organized by supervisory committee, complete <4th year)

Anticipated Date of Completion: ___________________ Date of Completion: ___________________

Proposal Defense (due in 3rd year)

Anticipated Date of Completion: ___________________ Date of Completion: ___________________

Application for Candidacy Form Submitted to SGS (due at least three months before defense): ___________________

Dissertation Defense (student must submit Appointment for Examination form to RGS two weeks prior to defense)

Anticipated Date of Completion: ___________________ Date of Completion: ___________________

Other Information

Notable Accomplishments and Service (internships, awards, special training, funding, abstracts/proceedings/papers submitted or published, posters or talks contributed or invited, workshops and conferences attended):

Comments or Concerns:

Student is approximately ____% done with their thesis (if applicable).
Student has completed ____ of ____ required credits. Current GPA is ______________
Student progress is (check one): Satisfactory / Unsatisfactory

(SPACE FOR COMMITTEE AND ADVISOR SIGNATURES – DOCUSIGN)

The statements and information noted above are accurate to the best of my knowledge ____________________________

(student signature - DocuSign)
B Appendix: Application Forms

B.1 Departmental Application
Department of Mathematics & Statistics
Information Form for
Graduate Program Applicants

Fill out this form accurately and completely; your responses will be considered as part of the application process for both admittance and teaching/research assistantships. Return the completed form as a PDF to the Graduate Program Coordinator, Gary.Tanner@usu.edu

Name: ___________________________________________ Date: ________________

Family or Surname First Middle MM/DD/YYYY

Email Address:_____________________________________________________________________

Degree Program (indicate one): MS Mathematics_____, MS Statistics_____, MS Industrial Math_____, Master of Mathematics_____, PhD _____

Please indicate PhD specialization, if applicable:
Specialization: Mathematics_____, Statistics_____, Interdisciplinary_____, College Teaching_____

Subject Area (s) of Particular Interest: ____________________________________________________________________

_______________________________________________________________________________________

Applying for a Teaching Assistantship? _______ Starting Semester (Fall/Spring/Summer): __________ Year: ______

Test Scores: GRE: Quantitative: _______ Verbal: _________ Analytic Writing: _________

% below: _______ % below: _______

International Students Only: Circle one: TOEFL or IELTS

Overall Score: _________ Test (Paper, Computer, Ibt): ___________

Written Personal Statements
This is your opportunity to tell us some important things about yourself in your own words. Please take time to give complete and considered answers to the questions below. Feel free to take as much space as you need and be as detailed as you would like. Your responses will be an important consideration regarding your admission to graduate school and whether or not an assistantship can be awarded.

1. What are your career aspirations and motivations?
2. What are your research or scholarly plans and interests for your graduate career? Are there any particular faculty members with whom you might be interested in working? Explain why, if applicable.

3. What in your educational background would you like to highlight? Put your educational history in a context, reflecting on the strengths and weaknesses of your technical preparation and how this relates to your expectations for graduate school.

4. If you have applied for a teaching assistantship, please describe any relevant teaching/tutoring background and experience.

5. If you had any prior research or creative experiences that helped form your decision to apply to graduate school please share them with us. Undergraduate research experiences, exciting class projects, work or consulting experiences that you found particularly engaging would all be very interesting for us to know.

6. What factors influenced your decision to apply for graduate school at USU? Are you the first person in your family to go to graduate school? Do you have ethnic, work or personal experiences that bear on your decision to apply for graduate school?
B.2 Application Review Form
Graduate Applicant Review Form  
Department of Mathematics and Statistics, Utah State University

| Applicant Name: |
| Program Applying For: |
| Degrees/Institutions/GPAs: |

<table>
<thead>
<tr>
<th>GRE (Percentiles):</th>
<th>Verbal</th>
<th>Quantitative</th>
<th>Analytic Writing</th>
</tr>
</thead>
</table>

| TOEFL iBT (sum, required for international w/o English-speaking degrees, 100 min for TAs): |  |
| or IELTS (average, 6.5 min for TAs): |  |

| Strength of Academic Preparation (0-5): |  |
| Notes: |  |

| Strength of Recommendations (0-5): |  |
| Notes: |  |

| Research Experience/Potential (0-5): |  |
| Notes: |  |

| Teaching/Tutoring Experience/Potential (0-5): |  |
| Notes: |  |

| STARS! (indicate overall excitement, or lack thereof): |  |

| Admittance Recommendation Category (A-B-C): |  |
| (A-encourage applicant/offer support, B-acceptable, C-unacceptable) |  |
| Notes: |  |

Reviewer:
C Appendix: Two-Year Class Rotations and Math Topic Tracks

C.1 General Math Rotation and Topic Tracks
Mathematics Topic Tracks

- PhD students in the “Pure and Applied Mathematics” and “Interdisciplinary Studies” options must obtain a minimum grade of “B” or better in at least two of the 6000-level topic tracks listed below.

- MS Mathematics students must obtain a minimum grade of “B” or better in at least two topic tracks from the 5000-level or the 6000-level topic tracks listed below. MS Mathematics students may substitute one topic track if they can document they have had something equivalent in a previous degree program.

### 6000-level Topic Track

<table>
<thead>
<tr>
<th>Courses</th>
<th>Pure</th>
<th>Applied</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real Analysis</td>
<td>6210/6220</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Algebra &amp; Linear Algebra</td>
<td>6310/6340</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Geometry &amp; Topology</td>
<td>6110/6510</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Differential Equations</td>
<td>6410/6440/6420/6450</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Applied Mathematics</td>
<td>6470 / 6810</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Numerical Methods</td>
<td>6610/6620</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

### 5000-level Topic Track

<table>
<thead>
<tr>
<th>Courses</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Calculus</td>
<td>5210/5220</td>
</tr>
<tr>
<td>Algebra &amp; Linear Algebra</td>
<td>5310/5340</td>
</tr>
<tr>
<td>Geometry and Topology</td>
<td>5110/5510</td>
</tr>
<tr>
<td>Differential Equations</td>
<td>5420/5470</td>
</tr>
<tr>
<td>Applied Mathematics</td>
<td>5410/5420</td>
</tr>
<tr>
<td>Probability and Stochastic Processes</td>
<td>5710/5760</td>
</tr>
<tr>
<td>Computational Mathematics</td>
<td>5610/5620</td>
</tr>
</tbody>
</table>
### Mathematics Two-Year Anticipated Class Rotation (6000-level)

[* = course requires first taking another course in track; all others have at most 5000-level prerequisites unless otherwise noted]

<table>
<thead>
<tr>
<th>Topic Track</th>
<th>Even Fall</th>
<th>Odd Spring</th>
<th>Odd Fall</th>
<th>Even Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Real Analysis</strong></td>
<td><strong>MATH 6220</strong>* Functional Analysis?</td>
<td><strong>MATH 6210</strong> Real Analysis (Lebesgue + Measure Theory)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Algebra &amp; Linear Algebra</strong></td>
<td><strong>MATH 6310</strong> Modern Algebra I</td>
<td><strong>MATH 6340</strong> Multilinear Algebra I</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Geometry &amp; Topology</strong></td>
<td><strong>MATH 6110</strong> Differential Geometry</td>
<td></td>
<td><strong>MATH 6510</strong> Topology</td>
<td></td>
</tr>
<tr>
<td><strong>Differential Equations</strong></td>
<td><strong>MATH 6410</strong> ODE $\exists!$ (1 cr)</td>
<td><strong>MATH 6420</strong>* Classical PDE (2cr)</td>
<td><strong>MATH 6450</strong>* Analysis of PDE (2cr)</td>
<td><strong>MATH 6440</strong>* ODE &amp; Dynamics (2cr)</td>
</tr>
<tr>
<td><strong>Applied Mathematics</strong></td>
<td><strong>MATH 6620</strong>* Finite Diff Meth for PDE (2cr)</td>
<td><strong>MATH 6470</strong> Adv. Asymptotic Methods (2cr)</td>
<td><strong>MATH 6810x3cr</strong> MathBio Quad Shot</td>
<td><strong>MATH 6610</strong> Adv. Compu Linear Alg (2cr)</td>
</tr>
<tr>
<td><strong>Numerical Methods</strong></td>
<td><strong>MATH 6320</strong> Modern Algebra II (prereq 6310)</td>
<td></td>
<td><strong>MATH 6350</strong> Multilinear II (Lie algebra &amp; Reps; prereq 6340)</td>
<td><strong>MATH 6810</strong> SPEC. TOPICS:</td>
</tr>
<tr>
<td><strong>[Electives]</strong></td>
<td><strong>MATH 6120</strong> DG II (Special Topics in DE; prereq 6110)</td>
<td></td>
<td><strong>MATH 5/6yyy</strong> Graph Theory I &amp; II (2+2 cr)?</td>
<td><strong>MATH 6810</strong> SPEC. TOPICS:</td>
</tr>
<tr>
<td><strong>[Electives]</strong></td>
<td><strong>MATH 5/6xxx Combinatorics I &amp; II (2+2 cr)?</strong></td>
<td><strong>MATH 6810</strong> SPEC. TOPICS:</td>
<td><strong>MATH 5/6yy</strong> SPEC. TOPICS:</td>
<td><strong>MATH 6810</strong> SPEC. TOPICS:</td>
</tr>
<tr>
<td>Topic Track</td>
<td>Even Fall</td>
<td>Odd Spring</td>
<td>Odd Fall</td>
<td>Even Spring</td>
</tr>
<tr>
<td>------------------------</td>
<td>----------------------------------------</td>
<td>----------------------------------------</td>
<td>-----------------------------------------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>Advanced Calculus</td>
<td>MATH 5210 Intro to Analysis I</td>
<td>MATH 5220* Intro to Analysis II</td>
<td>MATH 5210 Intro to Analysis I</td>
<td>MATH 5220* Intro to Analysis II</td>
</tr>
<tr>
<td>Algebra &amp; Linear Algebra</td>
<td>MATH 5340 Theory of Linear Algebra</td>
<td>MATH 5310 Intro Modern Algebra</td>
<td>MATH 5340 Theory of Linear Algebra</td>
<td>MATH 5310 Intro Modern Algebra</td>
</tr>
<tr>
<td>Geometry &amp; Topology</td>
<td></td>
<td>MATH 5110 Differential Geometry</td>
<td>MATH 5510 Intro Topology</td>
<td>MATH 5110 Differential Geometry</td>
</tr>
<tr>
<td>Differential Equations</td>
<td>MATH 5470 Advanced ODE</td>
<td>MATH 5420 PDE</td>
<td>MATH 5410 Methods Applied Math</td>
<td>MATH 5420 PDE</td>
</tr>
<tr>
<td>Applied Mathematics</td>
<td>MATH 5410 Methods Applied Math</td>
<td>MATH 5420 PDE</td>
<td>MATH 5410 Methods Applied Math</td>
<td>MATH 5420 PDE</td>
</tr>
<tr>
<td>Probability &amp; Stochastic Processes</td>
<td>MATH 5710 Intro to Prob</td>
<td>MATH 5710 Intro to Prob</td>
<td>MATH 5710 Intro to Prob</td>
<td>MATH 5710 Intro to Prob</td>
</tr>
<tr>
<td>Computational Mathematics</td>
<td>MATH 5610 Computational Linear Algebra (2cr)</td>
<td>MATH 5620 Numerical Soln of DE (2cr)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Electives]</td>
<td>MATH 5270 Complex Variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Electives]</td>
<td>MATH 5/6xxx Combinatorics I &amp; II (2+2 cr)?</td>
<td>MATH 5460 Nonlinear Dynamics</td>
<td>MATH 5/6yyy Graph Theory I &amp; II (2+2 cr)?</td>
<td></td>
</tr>
<tr>
<td>[Electives]</td>
<td></td>
<td></td>
<td></td>
<td>MATH 6810 SPEC. TOPICS:</td>
</tr>
</tbody>
</table>
C.2 Statistics Rotation, Tentative
### Statistics Two-Year Class Rotation (tentative)

<table>
<thead>
<tr>
<th>Odd Fall</th>
<th>Even Spring</th>
<th>Even Fall</th>
<th>Odd Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 5570 Actuarial Science I</td>
<td>MATH 5580 Actuarial Science II</td>
<td>MATH 5570 Introduction to Probability</td>
<td>MATH 5560 Financial Mathematics</td>
</tr>
<tr>
<td>MATH 5710 Introduction to Probability</td>
<td>MATH 5710 Introduction to Probability</td>
<td>MATH 5710 Introduction to Probability</td>
<td>MATH 5710 Introduction to Probability</td>
</tr>
<tr>
<td>MATH 5720 Intro to Mathematical Statistics</td>
<td>MATH 5720 Intro to Mathematical Statistics</td>
<td>MATH 5720 Intro to Mathematical Statistics</td>
<td>MATH 5720 Intro to Mathematical Statistics</td>
</tr>
<tr>
<td>STAT 5100 Linear Regression</td>
<td>STAT 5100 Linear Regression</td>
<td>STAT 5100 Linear Regression</td>
<td>STAT 5100 Linear Regression</td>
</tr>
<tr>
<td>STAT 5200 Design of Experiments</td>
<td>STAT 5200 Design of Experiments</td>
<td>STAT 5200 Design of Experiments</td>
<td>STAT 5200 Design of Experiments</td>
</tr>
<tr>
<td>STAT 5xxx (1 cr) Intro to R</td>
<td>STAT 5xxx (1 cr) Intro to R</td>
<td>STAT 5xxx (1 cr) Intro to R</td>
<td>STAT 5xxx (1 cr) Intro to R</td>
</tr>
<tr>
<td>STAT 5xxx (2 cr) SAS Certification</td>
<td>STAT 5xxx (2 cr) SAS Certification</td>
<td>STAT 6xxx (2 cr) SAS Predictive Analytics</td>
<td>STAT 5xxx (2 cr) SAS Certification</td>
</tr>
<tr>
<td>STAT 5xxx (2 cr) Rates and Proportions</td>
<td>STAT 5410/6410 (2 cr) Spatial Statistics</td>
<td>STAT 5xxx (2 cr) Rates and Proportions</td>
<td>STAT 6110 (1 cr) Theory of Linear Models</td>
</tr>
<tr>
<td>STAT 5560 (2 cr) Stat Visualization I</td>
<td>STAT 6560 Stat Visualization II</td>
<td>STAT 5560 (2 cr) Stat Visualization I</td>
<td>STAT 5xxx/6xxx (2 cr) Stat Thinking for Big Data</td>
</tr>
<tr>
<td>STAT 6xxx (2 cr) Statistical Genetics</td>
<td>STAT 5650 (2 cr) Stat Learning / Data Mining I</td>
<td>STAT 6180 (2 cr) Time Series</td>
<td>STAT 5650 (2 cr) Stat Learning / Data Mining I</td>
</tr>
<tr>
<td>STAT 5xxx (2 cr) Data Technologies</td>
<td>STAT 6xxx (2 cr) Advanced R (was Stat Computing)</td>
<td>STAT 6xxx (2 cr) Longitudinal Data Analysis</td>
<td>STAT 6650 (2 cr) Stat Learning / Data Mining II</td>
</tr>
<tr>
<td>STAT 5570/6570 (2 cr) Stat Bioinformatics</td>
<td>STAT 5500/6500 Biostatistics Methods</td>
<td>STAT 5500/6500 Biostatistics Methods</td>
<td>STAT 5500/6500 Biostatistics Methods</td>
</tr>
<tr>
<td>STAT 6200 (2 cr) Messy Data PROC GLIMMIX</td>
<td>STAT 6100 (2 cr) Advanced Regression</td>
<td>STAT 6710 Mathematical Statistics I</td>
<td>STAT 6720 Mathematical Statistics II</td>
</tr>
</tbody>
</table>

Depending on the semester, course numbers may differ, and may in fact appear as Topics (5810, 5820, 6810) or Seminar (6910) in the course catalog.
D  Appendix: Research Faculty in Mathematics and Statistics

The following pages include summaries of research-active faculty in the Department of Mathematics and Statistics at Utah State University. These pages are intended to give current and prospective students some perspective on the breadth of research expertise in the department as they are considering possible graduate programs and advisors. The information given here is not exhaustive, and students can also find many of our faculty (including publication histories) on www.researchgate.net. Many faculty also maintain personal pages on the department website, www.math.usu.edu.
Adele Cutler, Professor, Statistics and Machine Learning

BioSketch Dr. Cutler earned a B.Sc.(Hons) degree in mathematics at the University of Auckland in 1982 and a Ph.D. in Statistics at UC Berkeley in 1988. She has been on the faculty at USU since 1988. Dr Cutler was tenured and promoted to Associate Professor in 1994 and promoted to Professor in 2006. Dr Cutler works in the general area of Statistical Learning.

Her most significant work was with the renowned statistician Leo Breiman (1928-2005), who was her Ph.D. advisor, collaborator, and friend. After Breiman introduced Random Forests in 2000, Breiman and and Cutler worked together to develop code and methodology until Breiman’s death in 2005. With the help of Andy Liaw, their code formed the basis of the popular R package randomForest. Random Forests is now a standard technique in data mining, in part because it can handle datasets with thousands, or even hundreds of thousands of predictor variables. Dr Cutler continues to work on Random Forests. Recently she has been investigating specialized versions for Big Data.
Andreas Malmendier
Assistant Professor, Core Mathematics

BioSketch  Andreas Malmendier received his Vordiplom in Mathematics and in Physics, as well as a Diplom in Physics from the University of Bonn, and his Ph.D. in Mathematics from MIT in 2007, studying partition functions of string and gauge theories. He was a visiting assistant professor at the University of California at Santa Barbara from 2007 to 2010, and an assistant professor of mathematics at Colby College from 2010 to 2014. He also held visiting appointments at the University of California at Berkeley and the University of Alberta in Edmonton.

Dr. Malmendier’s awards include a scholarship of the Kavli Institute for Theoretical Physics (KITP), the MIT Akamai Presidential Fellowship, a dissertation fellowship of the German Academic Exchange Service (DAAD), and a fellowship of the Studienstiftung des Deutschen Volkes. Andreas Malmendier also received several teaching awards, including the Mochizuki Award for Outstanding Achievement in Teaching and the Housman Award for Skill and Dedication in Undergraduate Teaching, and presented a TEDx talk in 2013.

Current Research Interests  Malmendier’s research lies in the intersection of mathematical physics and algebraic geometry. In particular, he is interested in the mathematical aspects of gauge and string theory dualities. Recent interdisciplinary work with colleagues in mathematics and physics showed that intuition gained from gauge and string theory provides novel constructions of Calabi-Yau manifolds and their Picard-Fuchs operators. Closely related is his research studying properties of projective algebraic surfaces with Kodaira number zero, in particular abelian surfaces and K3 surfaces using birational geometry, modular forms, and period mappings.

Recent Publications


† student co-author

Current Students PhD: Michael Schultz MS: Shantel Spatig Undergrad: Thomas Hill (UTF)

Former Students PhD: Lubjana Beshaj (external co-advisor) MS: 

Undergrad: Elise Griffin; Allie Gardiner, Michael Park (UTFs)
Undergrad (at Colby College): Arjumand Masood, Anika Lindemann, Katherine Smith, Irina Cazan
Brynja Kohler, Associate Professor, Mathematics Education and Mathematical Biology

BioSketch Brynja Kohler joined the Mathematics and Statistics Department faculty at USU in 2004, with a background as a high school teacher in New York and Los Angeles, an MS in mathematics from NYU, and a PhD in mathematics from the University of Utah. She works closely with departmental programs relating to secondary mathematics teacher development and public school outreach, and collaborates on undergraduate teaching and learning projects related to mathematical biology and mathematical modeling.

Current Research Interests include instructional materials design and assessment of learning in undergraduate mathematics, mathematical knowledge for secondary mathematics teaching, and developing and assessing competencies in mathematical modeling. She is currently also investigating bumble bee foraging and nesting dynamics in agricultural applications. Past work includes creating stochastic and differential equations models of immune response and viral dynamics, and models of neuromuscular phenomena.

Recent Publications


Former Students MMath: Kyle Hodson, Emma Bullock, Jameson Hardy, Jill Ashby, David Cowan, Brandee Merkley, Danika Foley, Helene Poppleton, Kimberly Ammons, Debra Alcox, Eric Thorson, Ashley Salisbury, Jeff Long, Shawn Fowers, Lynette Checketts, Janice Bodily, Abibat Lasisi, Funmilayo Obieleno, Carrie Bala, Jessica Munns Davis, Rebecca Atkins Swank

Undergrad: Julia Gillespie, Katherine Richardson, Samantha Rupp, Ethan Williams, Elise Griffin, Sarah Mousley, Morgan Summers, Stephanie Swainston, April Lockwood, Carina Eggleston, Shane Hansen
Chris Corcoran, Professor, Statistics

BioSketch  Professor Corcoran joined USU’s Department of Mathematics and Statistics in 1999, after receiving his doctorate in Biostatistics from Harvard University. He collaborates frequently on interdisciplinary projects in biomedicine and public health - funded primarily through the National Institutes of Health - including studies of cancer, autism, hip fracture among the elderly, birth defects, aging and age-related cognitive change, and Alzheimer’s disease. He also has strong research interests in algorithms and methods for computationally challenging problems in permutation tests and large-scale genetic association tests.

Professor Corcoran has mentored over 20 graduate students, including six doctoral candidates, and has served on committees advising dozens of other students from departments across USU, including Psychology, Family Consumer and Human Development, Dietetics and Food Science, Animal Science, Wildlife Science, and others. He primarily teaches courses covering introductory statistics for scientists and engineers, categorical data analysis, linear regression, statistical computing, and the analysis of longitudinal and time-to-event data. Chris was promoted from Assistant to Associate Professor in 2006, and to the rank of Professor in 2011. He was named Teacher of the Year in the Department of Mathematics and Statistics in 2006, and Researcher of the Year in 2005, 2011, and 2012. He was recognized also as the Researcher of the Year in USU’s College of Science in 2012. He is currently serving as Department Head. In his spare time, Chris enjoys hiking and biking in the mountains around Cache Valley, golfing, and spending time with his wife Barbara and their kids (even though none of them seem to like math very much).
BioSketch  Dr. Coster earned his BA in Mathematics with 1st Class Honors from Cambridge University, England, in 1980 and obtained his Ph.D. in Statistics at UC Berkeley in 1986. Following four years with the Purdue University Statistics Department, Dr. Coster joined the Department of Mathematics and Statistics at Utah State University in 1990. His research began in the field of optimal experimental design and analysis and broadened into interdisciplinary research involving statistical methodology in a variety of areas, including public health and health education, biostatistics, medicine, wildlife, and science education. He was co-PI on a 5-year NSF funded research project, with Dr. T. Campbell (University of Connecticut) and S-K Wang (New York Institute of Technology) et. al., involving the impact on student outcomes in 8th grade science classes of a professional teacher development course on cyber-enabled instruction. One of the multiple publications from this project, involving the idea of “digital natives” and ideal technology integration in K-12 classrooms, was discussed on an NBC program in late 2014. Dr. Coster has advised four doctoral students and numerous Masters students. His teaching is at all levels of statistical theory and methods, with particular emphasis on graduate courses in statistical methodology. Beginning in 2008, Dr. Coster became Director of the Actuarial Program and has since regularly taught all four of the senior undergraduate courses required in this program that prepare students for the first three professional examinations offered by the Society of Actuaries. Dr. Coster has also served the Department and USU in a variety of administrative roles, including Associate Department Head from 2000-2008, and served as Director of Undergraduate Studies from 2010 until 2015. Dr. Coster had the good fortune to meet his now wife, Sherri, at USU in 1996, and together they enjoy living in Cache Valley.
Dariusz Wilczynski, Associate Professor, Geometric and Algebraic Topology, Noncommutative Algebra

**BioSketch**  Dariusz Wilczynski received his Ph.D. from Indiana University in 1987 for a dissertation on topological symmetry groups of homology complex projective planes. After several postdoctoral appointments, including positions at Yale University and the University of Notre Dame, he joined the USU Department of Mathematics and Statistics in 1997.

**Current Research Interests** include transformation groups of manifolds, topological embeddings of surfaces in 4-dimensional manifolds, toric manifolds, fixed point theory, formal polynomial algebras, composition algebras.

**Recent Publications**


**Former Students** PhD: Piotr Runge  MS: Serge Ballif, Daniel Murphree  Undergrad: Reed Solomon
David Brown, Associate Professor, Discrete Mathematics

BioSketch Dr. Brown has been the Discrete Math Hub for USU’s Department of Mathematics and Statistics since 2004. He earned his doctorate from the University of Colorado Denver studying the combinatorial aspects of part of the Human Genome Project, and a few of its connections to graph theory. His main research interests are divided primarily into the following four categories: Graph Theory, in particular representations of graphs; Matrix Theory, in particular its connections to Graph Theory and its development over atypical number systems such as the Boolean antinegative semiring (where \(1 + 1 = 1\)); Poset Theory, i.e., the theory of partially ordered sets, with a focus on characterizing their structure via Graph Theory; university-level Mathematics Education with a focus on the improvement of teaching performance. But these categories do not indicate the limits of his advising history or desire.

To wit, he has advised a Ph.D. student in the cycle structure of graphs, a Masters student in Number Theory, and a Masters student in applying network analysis to a problem in social science, to name a few examples of his desire to work outside of his specialization. He has advised, to the completion of their degrees, four Masters students and one Ph.D. student. He is currently advising one Ph.D. student, two Masters students, and several undergraduate students in projects ranging from Voting Theory to Artificial Intelligence.

Dr. Brown primarily teaches Discrete Mathematics and graduate courses in Combinatorics and Graph Theory. Dr. Brown is a TEDxUSU fellow, was the College of Science Teacher of the Year in 2014, and the USU Teacher of the Year in 2014. Dr. Brown is an avid cyclist who enjoys both mountain and road biking, was a competitive bodybuilder in his late teens and early twenties who still adheres to a weightlifting regimen, and flirts with rock climbing.
Ian Anderson, Professor, Mathematics

BioSketch Ian M. Anderson joined the Department of Mathematics at Utah State University in 1979. Since then he has held visiting positions at the Univ. of Minnesota, Univ. of Utah, Univ. of Washington, Univ. of North Carolina and the Univ. of Montreal.

His field of research is differential geometry and its applications to mathematical physics and differential equations. Specific areas of expertise include the inverse problem of the calculus of variations, variational bicomplexes, symmetric methods in general relativity, symmetry reduction of differential equations and variational principles, exterior differential systems theory and solution generating techniques for differential equations. He is the author or co-author of more than 40 journal articles and conference proceedings and author of the DifferentialGeometry software package, part of the Maple distributed library. This research has been supported regularly by grants from the National Science Foundation. Professor Anderson is frequently an invited speaker at international differential geometry conferences and workshops.

Students PhD: Martin Juras, Matt Biesecker, Francesco Strazzullo, Spencer Sitton, Jesse Hicks, Brandon Ashley* Masters: Hiroshi Nagao, Cinnamon Hillyard, Charles Miller, Adam Bower, Alan Perry, Tom Apedaile, Jordan Rozum, Hannah Lewis, Mychelle Parker*, Jacob Kullberg* Undergrad: Jeff Humphries, Adam Bower, Jeff Leek, John Stevens, Jamie Jorgensen, Robert Berry, Sydney Chamberlain, Dillon Morse, Broc Wursten, Thomas Hill*, Phillip Linson*
* = current
James Powell, Professor, Applied Math and Mathematical Biology

BioSketch  Jim Powell earned his Ph.D. at the University of Arizona in 1990, studying nonlinear waves and front propagation in fluids and nonlinear optics. After working as a postdoc at the Arizona Center for Mathematical Sciences he was hired by USU in 1991, tenured in 1998 and promoted to full professor in 2003. In 2008 he was appointed as a professor in Biology and an Associate of USU’s Ecology Center. He has twice served as Graduate Director in the Department of Math & Stats and is currently on leave of absence for a rotation as Mathematical Biology Program Officer, DMS, National Science Foundation.

Current Research Interests include application of nonlinear modeling techniques to understand biological systems, emphasizing effects of temperature and climate change on insect development and species interactions, invasion and dispersal dynamics, model competition and selection in ecological systems. He maintains active interests in mathematical pedagogy and professional development of students. Dr. Powell is supported by the National Science Foundation, USDA Forest Service, and private companies.

Recent Publications


Current Students PhD: Ian McGahan (Math) MS: Anne McManis (Biology)

Former Students PhD: Audrey Addison (Interdisciplinary), Jacob Duncan (Math), Marti Garlick (Interdisciplinary), Justin Heavilin (Interdisciplinary), Matt Lewis (Interdisciplinary), Ram Neupane (Math), Brian Yurk (Interdisciplinary)

MS: Daniel Balls (Math), Zy Biesinger (Biology), Bradley Bush (Industrial), Alicia Caldwell (Math), Alia Criddle (Industrial), Estella Gilbert (Industrial), AnnMarie Harris (Math), Kun Huang (Industrial), Jan Jenkins (Math), Matt Lewis (Math), Tyler McMillen (Math), Sarah Reehl (Industrial), Chris Retford (Industrial), Michael Rigley (Industrial), Audrey Smith (Math), Heidi Tangermann (Wildlife Ecology)

Undergrad: Zy Biesinger (Biology), Dawance Chea (Biological Engineering), Joe Eason (Math/Physics), Estella Gilbert (Math), Ephraim Hanks (Math), Sujit John (Math/CS), Shannon Kay (Wildlife), Bruce Kennedy (Math), Michael Larkin (Math/Education), Jeff Leek (Math), Rachel Nydegger (Physics), Andrew Pound (Math/Physics), Chris Retford (Math), Jason Rose (Math/Physics), Lizzie Spencer (Math), David Stowell (Computational Math), Jessica Tams (Math/Physics), Ethan Williams (Math)
Jia Zhao
Assistant Professor, Mathematical Biology and Computational Mathematics

BioSketch Jia Zhao got his B.S. in Applied Mathematics in 2010 from Nankai University in China. Then he earned his Ph.D. in Applied and Computational Mathematics at University of South Carolina (USC) in 2015. After he worked as a post-doc at University of North Carolina at Chapel Hill (UNC-CH) for two years, he joined the USU faculty in 2017.

Current Research Interests Dr. Zhao is trained as an applied and computational mathematician, aiming to strike a balance between mathematical modeling, numerical analysis, and high-performance simulations, while his application domains are multiphase complex fluids and mathematical biology. His research is highly interdisciplinary, sitting at the interface between applied mathematics, scientific computing, soft matter physics, and mathematical biology. Dr. Zhao’s research has been supported by Dean’s Dissertation Fellowship, SPARC Research Grant, ASPIRE-II Research Grant at USC, and AMS-Simons Grant from AMS Simons Foundation.

Recent Publications
DOI:10.1142/S0218202517500373.

Former Students PhD: NONE

Currently, there is a Research Assistant position opening in Dr. Zhao’s research group.
Jim Cangelosi, Professor, Mathematics Education

**BioSketch** Dr. Cangelosi has served more than 25 years on faculty at Utah State University. Recognized for his dedication to students and contributions to the field of math education, Jim Cangelosi was named a 2011 Carnegie Professor of the Year. Administered by the Carnegie Foundation for the Advancement of Teaching and the Council for Advancement and Support of Education, the award recognizes outstanding professors for their influence on teaching and their extraordinary commitment to undergraduate education. Cangelosi, working with the Utah State Office of Education, initiated the Utah Mathematics Endorsement Project in 2007, to deliver advanced distance education courses to public secondary school mathematics teachers throughout the state. Among all his endeavors, Cangelosi sees his highest calling as the education of future teachers of mathematics and statistics.
Joe Koebbe, Associate Professor, Computational and Applied Mathematics

BioSketch Joe Koebbe earned his Ph.D. in Mathematics from the University of Wyoming in 1988. His dissertation combined mixed finite element methods and a polynomial framework for the approximate solution of partial differential equations that model petroleum reservoirs and aquifers. In addition, he has 30 graduate credit hours in a Mechanical Engineering program and a Master of Science in Mathematics earned in 1982 at Washington State University. He has taught a wide variety of courses in mathematics, computational mathematics, and numerical analysis. He has worked with researchers in France and Norway where he received funding through visiting researcher appointments (more than 10).

Current Research Interests include computational homogenization methods, multiscale analysis, and combining wavelet analysis and homogenization theory to develop multiscale analysis techniques conditioned on the differential models used to describe porous media, microscale structure in nanomaterials, and other real world problems. Dr. Koebbe has obtained both research and infrastructure funding (computers) from the NSF, Sun Microsystems, the Department of Education, the Utah System of Higher Education, ATK Thiokol, Boeing, the Alaska Fishery Science Center (AFSC), USTAR, along with a number of other sources.

Recent Publications


Current Students PhD: Marcus Scott, Jonathan Tyler, Abibat Lasisi, Eden Furtak-Cole
   MS: None right now
   Undergrad: Jeremy Vanderdoes, Abigail Butikofer

Former Students PhD: Cinnamon Hillyard, Laura Watkins, Mike Rigley, Ju Yi
**MS:** Joan Oana, Helen Alkes, Laura Watkins, Andrea Van Sickle, Landen Jensen, Anna Furniss, J.J. Clark, Marcus Scott, Tyson Dye, Ryan Thomas

**Undergrad:** Shafiq Ahmed, Taren McKenna (Goldwater Fellowship Winner)
John R. Stevens, Professor, Applied Statistics

**BioSketch** John R. Stevens earned his Ph.D. in Statistics at Purdue University in 2005, studying statistical methods for meta-analysis of gene expression studies. He joined the USU faculty in 2005, and was tenured in 2011. He has received departmental Teacher of the Year (2009) and Researcher of the Year (2016) awards, and was awarded 2009 College of Science Teacher of the Year. He spent the 2016-2017 academic year on sabbatical as a Visiting Professor in the Division of Epidemiology of the Department of Internal Medicine at the University of Utah.

**Current Research Interests** include statistical bioinformatics and genomics, meta-analysis, and applied statistics in the biological and agricultural sciences. Dr. Stevens has received support from the Utah Agricultural Experiment Station, the National Cancer Institute (part of the National Institutes of Health), and the United States Department of Agriculture. He has also worked as a statistical consultant for several biotechnology and pharmaceutical companies.

**Recent Publications**


**Former Students**

**PhD:** Garrett Saunders, Darl Flake, Anvar Suyundikov

**MS:** Gabriel Nicholas, Matthew Maw, Jason Bell, Jeremiah Rounds, Abdullah Masud, Lysnie Daley, Todd Jones, Dennis Mecham, Russell Banks, Sun Young Jeon, Rachael Stone, Michael Bishop

**Undergrad:** Shelley Taylor Moss, Dallas Bateman, Mark Nielsen, Cortnie Broadus, Benjamin Johnson, Nicole Rupp Tindall, Lauren J. Preece
Jürgen Symanzik, Professor, Applied Statistics

BioSketch  Jürgen Symanzik earned MS (Diplom) degrees in Statistics (1991) and in Computer Science (1992) from the University of Dortmund, Germany, and a PhD with a co-major in Statistics and Computer Science (1996) from Iowa State University, Ames, Iowa. He was hired by USU in 1999, tenured in 2005, and promoted to full professor in 2014. He is an Elected Member of the International Statistical Institute (ISI) since 2007 and he became a Fellow of the American Statistical Association (ASA) in 2015. He was the Regional Editor for North America/Co-Editor (2005–2015) for the journal Computational Statistics and took over as Editor-in-Chief in 2015. He is the President-Elect of the International Association for Statistical Computing (IASC) since 2017.

Current Research Interests  include dynamic statistical graphics, micromaps, visual data mining & exploratory (spatial) data analysis, applications of statistical computing and statistical graphics to natural resources, education/teaching, medical research, and eye-tracking research.

Recent Publications


(http://www.amstat.org/publications/jse/v21n1/schneiter.pdf)

Current Students  PhD: Chunyang Li, Eric McKinney.

Kady Schneiter  
Associate Professor, Statistics Education

BioSketch Kady Schneiter earned her Ph.D. from USU in Mathematical Sciences in 2004. Her research focused on developing algorithms for exact statistical tests for identifying genetic risk factors of complex human diseases. She continued this work at the Harvard School of Public Health where she was a post-doctoral research fellow from 2004-2006. She joined the faculty at USU in 2006 and was tenured in 2012.

Current Research Interests include statistics education, the development and use of technology resources in math and statistics education, and pre and in-service professional development for secondary math teachers.

Selected Publications

Selected Statistics Applets
Schneiter, K. “Errors in Hypothesis Testing.”
Schneiter, K. “Analysis of Variance.”
Schneiter, K. “Simpson's Paradox.”

Former Students PhD: Jennifer Loveland
MS: Kim Thatcher, Melissa Jackson, Brittany Allred, Chelsa Tuddenham.
Kevin R. Moon, Assistant Professor, Machine Learning and Data Science

**BioSketch:** Kevin R. Moon earned a B.S. degree in 2011 and an M.S. degree in 2012 in Electrical Engineering at Brigham Young University, focusing on signal processing. He then obtained an M.S. degree in Mathematics and a Ph.D. in Electrical Engineering at the University of Michigan in 2016 where his research focused on nonparametric estimation of distributional functionals. Prior to joining Utah State University in 2018, he was a postdoctoral scholar in the Genetics Department and the Applied Math Program at Yale University where he developed methods for exploratory data analysis with a focus in biomedical applications.

**Current Research Interests** are in the development of theory and applications in machine learning, big data, information theory, manifold learning, deep learning, statistical learning theory, estimation, graphical models, and random matrix theory. Dr. Moon’s projects have recently focused on data visualization, learning dynamics via neural networks, data denoising, estimating bounds on the Bayes error for classification problems, and nonparametric estimation of information theoretic measures such as entropy, mutual information, and information divergence. Current applications he is involved in include analyzing biomedical data as well as sunspot images. He is interested in advising students in either theoretical or application-focused research projects at the advanced undergraduate, masters, and PhD levels.

**Recent Publications**


*=these authors contributed equally to this work
*=these authors contributed equally to this work
Luis Gordillo, Associate Professor, Mathematical Biology

BioSketch Dr. Gordillo obtained his Ph.D. degree in Mathematics from Arizona State University in 2004, and joined Utah State University as Assistant Professor in the Fall of 2012, after spending some years in teaching and research at Universidad de Puerto Rico and Universidad San Francisco de Quito in Ecuador. His current research interests lie at the interface between natural sciences and mathematical modeling, particularly the construction and analysis of models for invasive pest populations.

Recent publications focus on the impact that control measures have on the dispersal of agricultural pests, and the role of stochasticity and spatial/environmental structures in the spread of diseases. Luis’ interests in education come from his long-term relationship with mathematics programs directed toward minority students in the United States. He enjoys spending his free time with Maru, his beloved wife, exploring together the beautiful scenery of Cache Valley in Northern Utah.

Recent Publications


Students Scott Jordan (PhD, Applied Mathematics, USU, expected May 2018); Shannon Dixon (MSc, Applied Mathematics, USU, May 2017); Katherine Snyder (MSc, Applied Mathematics, USU, May 2016); Scott Jordan (MSc, Applied Mathematics, USU, May 2015); Sergio Ramirez (MSc, Applied Mathematics, USU, May 2014); Katherine Snyder (BSc, Mathematics, USU, May 2014).
Mark Fels, Professor, Mathematics


Current Research Interests  Differential Geometry, Geometric Methods in Differential Equations, General Relativity,

Recent Publications


Former Students MS: Russel Saddler, Robert Reem, Brian Gleason, Andrew Renner, Kimberli Cole-Tripp
Michael Cortez, Assistant Professor, Mathematical Biology

BioSketch Michael Cortez earned his Ph.D. at Cornell University in 2011, studying the ecological and evolutionary dynamics of predator-prey systems using fast-slow dynamical systems theory. After a postdoc funded by the National Science Foundation in the School of Biology at Georgia Institute of Technology, he was hired by USU in 2014. Michael has been an Associate of USU’s Ecology Center since 2014.

Current Research Interests include the development of mathematical theory to explain ecological and evolutionary patterns. Specific areas of interest are eco-evolutionary theory, the population dynamics of predator-prey communities, and the epidemiological dynamics of disease systems. Dr. Cortez has received support from the National Science Foundation.

Recent Publications

Current Students PhD: Guen Grosklos
Nathan Geer, Associate Professor, Mathematics

BioSketch Nathan Geer earned his Ph.D. at the University of Oregon in 2004, studying low dimensional topology and abstract algebra. Before being hired at USU in 2009, he was a postdoc at Georgia Institute of Technology in Atlanta and member of the Max-Planck Institute of Mathematics in Germany. In 2013, he was awarded the College of Science Researcher of the Year. Dr. Geer has travelled extensively both nationally and internationally, holding several research appointments, including a French CNRS Directeur de Recherches position and a Japan Society for the Promotion of Science Research Fellowship. He has been continuously funded by the National Science Foundation, first with a VIGRE postdoctoral fellowship, then subsequently with three full multi-year research grants from the Division of Mathematical Sciences and concurrently with a CAREER grant and FRG grant.

Current Research Interests include 3-manifolds, knot theory, representation theory, quantum groups, Lie (super)algebras.

Recent Publications


Current Students PhD: Clinton Reece
Nghiem Nguyen, Associate Professor, Mathematics

**BioSketch** Dr. Nguyen received his Ph.D. from the University of Illinois at Chicago in 2004. After spending a few years at Purdue University as a National Science Foundation postdoctoral researcher, he joined USU’s Department of Mathematics and Statistics in 2008 and was promoted to the rank of Associate Professor in 2014.

Dr. Nguyen’s main area of research interest lies in Partial Differential Equations, particularly Nonlinear Evolution Equations, Fluid Mechanics and Nonlinear Waves. He is interested in applying mathematics to everyday physical problems, especially nonlinear wave phenomena. He has studied problems related to water waves, fluid mechanics, Bose-Einstein condensates and plasma physics, using a variety of mathematical techniques from such different fields as variational methods for nonlinear partial differential equations, dynamical systems, integrable systems and solutions, to topological approaches such as degree theory, positive operators.

**Recent Publications**


Richard Cutler, Applied Statistics

**BioSketch** Dr. Cutler’s academic career began at the University of Auckland, New Zealand, where he earned a B.Sc.(Hons) degree with first class honors in mathematics and, more importantly, met his wife, Dr. Adele Cutler. After obtaining his M.A. and Ph.D. in Statistics at the University of California, Berkeley, Dr. Cutler joined the Department of Mathematics and Statistics at Utah State University in 1988, and has been here ever since. He has broad research interests in applied and interdisciplinary statistics, including some projects in nutritional epidemiology and several projects in ecological and environmental statistics. One of those projects involved sampling for rare species as part of the Northwest Forest Conservation Plan for the northern spotted owl; another involved predicting occurrences of invasive plant species in national parks in northern California and southern Oregon. Dr. Cutler has worked with his wife, Dr. Adele Cutler, on ecological applications of the Random Forests statistical program. Throughout his career, Dr. Cutler has been involved in administrative work, serving as Assistant Department Head from 1996-1999 and Director of the Statistical Consulting Center in the Department of Mathematics and Statistics in 1995-1996 and 1999-2001. He was Head of the Department of Mathematics and Statistics from 2008-2016. Adele and Richard Cutler enjoy traveling with their three children to a wide range of places. Richard is particularly fond of snorkeling on coral reefs, spending time with his family in the happiest place on earth, and he is a certified English soccer fanatic.
Yan Sun, Associate Professor, Statistics

BioSketch Yan Sun earned her Ph.D in Mathematical Sciences (with a concentration in Statistics) at University of Cincinnati in 2010, studying high-dimensional time series. In the same year, she joined the faculty of Statistics in the Department of Mathematics & Statistics at USU.

Current Research Interests include time series with applications in financial econometrics and climatology, random sets, set-valued data and high-dimensional data analysis.

Recent Publications

Bean, B., Maguire, M. and Sun, Y. “Predicting Utah ground snow loads with PRISM”, ASCE’s Journal of Structural Engineering, in press.


Current Students PhD: Brennan Bean

Former Students MS: Isaac Blackhurst, Eric McKinney, Chihching Yeh

Undergrad: Zhiying Cui
Zhaohu Nie, Associate Professor, Pure Mathematics

BioSketch Zhaohu Nie obtained his Ph.D. in mathematics from Stony Brook University, NY in 2005. He joined the USU faculty in 2011 and was tenured in 2017. He had previously worked at Texas A&M University and Penn State University. He has received the departmental Researcher of the Year (2017) award.

Current Research Interests include integrable systems and differential geometry. Dr. Nie is particularly interested in combining the theory of integrals systems, especially Toda systems, with nonlinear analysis to study differential equations arising from differential geometry and mathematical physics. He has received support from the Simons Foundation.

Recent Publications


Former Students MS: Patrick Seegmiller
Zhi-Qiang Wang, Professor, Pure and Applied Mathematics

**BioSketch**  Zhi-Qiang Wang received his Ph.D. in mathematics at Chinese Academy of Sciences in 1986. After working as a postdoc and visiting member at Peking University, Courant Institute of New York University, University of Utah and University of Wisconsin he was hired by USU in 1991, tenured in 1994 and promoted to full professor in 1998. He served from 1994-1997 as Director of Graduate Studies in Mathematics and Statistics at Utah State University. In 1998 he was awarded Researcher of The Year in the College of Sciences at Utah State University. He was elected a Fellow of American Mathematical Society in 2014.

**Current Research Interests** include developing new methods and techniques in nonlinear analysis, in particular, in variational and topological methods, for solving classical and emerging problems in nonlinear differential equations such as nonlinear elliptic partial differential equations, Hamiltonian systems, nonlinear Schrödinger equations and other nonlinear model problems in geometric analysis and mathematical physics.

**Former Students PhD:** Kazuya Hata (Interdisciplinary), Rushun Tian (Pure and Applied Mathematics), Charles Miller (Pure and Applied Mathematics), Francois van Heerden (Pure and Applied Mathematics), Florin Catrina (Pure and Applied Mathematics)

**MS:** 8-10 students