Master of Science in Statistics

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The graduate program in statistics is designed to provide the student with a broad knowledge of the concepts and practice of statistics and related fields. Students are prepared to assume positions of responsibility and expertise. Graduates may find employment involving diverse statistics-related activities in business, industry, government regulatory agencies, insurance companies, biotechnology firms, and marketing research firms. Graduates possess a good foundation to pursue further advanced studies in statistical sciences and allied disciplines.

Program Description

The graduate program is offered in a flexible 4+1 format where currently enrolled undergraduate students in mathematics and other disciplines at USM may earn both an undergraduate degree and the M.S. degree in statistics in five years. Candidates planning to earn both the undergraduate and the graduate degrees in five years are advised to take MAT 281 Probability and MAT 282 Statistical Inference in the sophomore year, take upper-level undergraduate courses in relevant concentrations in the junior year, and take graduate-level courses in the senior year. The student will receive graduate standing after satisfactory completion of all requirements for the undergraduate degree. Candidates holding baccalaureate degrees from accredited institutions may join the program directly at the master's level. The student may earn up to two credits by way of internship with local industry. The program will provide guidance in locating internship opportunities.

Program Concentrations

The graduate program is truly interdisciplinary, providing the student with the opportunity to tailor programs specifically to individual interests. Students may customize their program of study. A list of possible concentrations and relevant courses is given below:

1. Applied Statistics
   Relevant courses: STA 574 and any course from STA 580 though STA 589, OPR 562, OPR 563, and OPR 564.

2. Operations Research/Applied Mathematics
   Relevant courses: OPR 561, OPR 562, OPR 563, OPR 564, MAT 571, and COS 562. (COS 562 is offered by the Computer Science Department)

3. Biostatistics
   Relevant courses: STA 574, STA 585, STA 588, STA 589, AMS 535, AMS 638, and AMS 677 (AMS courses are offered by the Department of Applied Medical Sciences).

Admission Requirements

Applications from students with undergraduate degrees in business, computer science, education, mathematics, statistics, engineering, or one of the behavioral or social sciences are encouraged. It is required that the applicant have completed the following USM courses: MAT 153 Calculus B, MAT 281 Probability, and MAT 282 Statistics or their equivalents. Conditional admission status may be granted to students who do not fully meet these requirements, but have a good working knowledge of statistical methods. Upon successful completion of preparatory coursework, the student will be granted regular admission status.

Currently enrolled students at USM may apply for admission anytime after attaining junior standing by writing to the director of the graduate program. Additional requirements include copies of all transcripts, current vitae, a personal statement, a GPA of 2.75 or better, and two letters of recommendation.

A student already holding a baccalaureate degree from an accredited institution may apply directly to the Office of Graduate Admissions. Additional requirements include copies of all transcripts, current vitae, a personal statement, a GPA of 3.0 or better, GRE scores, and three letters of recommendation. Applicants whose first language is not English are required to submit TOEFL scores.

Application Deadlines

The program has a rolling admission policy. However, deadlines for candidates seeking financial support are March 15 for the fall semester and October 15 for the spring semester. Students applying to the graduate program by January 15 are eligible to apply for a tuition waiver for the next academic year.

Degree Requirements

The requirements for the M.S. degree in statistics consist of a minimum of 30 credit hours. At least 18 credit hours must be graduate courses offered by the graduate program, excluding graduate internship credits, independent study credits, or thesis/project credits. STA 574 Statistical Computing and STA 580 Statistical Inference are required courses for all degree candidates. A student meeting the above requirements has the flexibility of taking additional courses subject to the following policies:

1. At most six of the required credits may be earned by taking pre-approved relevant upper level undergraduate courses.
2. For students within the 4+1 format, at most two pre-approved relevant graduate courses may be used for both the undergraduate and graduate degrees. At least 18 credit hours should be taken by students after full matriculation.
3. All courses applied toward the graduate degree must be completed within six years of enrollment in the graduate program with a cumulative GPA of 3.0 or better. Otherwise, additional coursework must be taken to fulfill program requirements.
4. Our program policies allow a student to earn up to two credit hours as an intern, and up to three graduate independent-study credits under the supervision of a faculty member associated with our graduate program. With the approval of the graduate committee, a student may transfer a maximum of six credit hours for graduate work completed at other institutions or in other graduate programs at USM, including those listed in concentrations.
5. Students (STA/OPR/MAT) can earn up to 6 credits through doing a master's thesis/project.
6. A student must register for at least one course every semester to maintain continuous enrollment. Students who do not maintain continuous enrollment will be dropped from the program and will have to reapply for admission to continue. Students who anticipate being unable to take classes may apply in writing for a fixed-term leave of absence.
7. A student whose grade point average (GPA) falls below 3.0 will be placed on academic probation. In this case a student will be allowed 12 semester hours to raise their GPA to, or above, the 3.0 minimum by taking only graduate-level courses. Students unsuccessful in raising their GPA during a probationary period may be dismissed from the program.
8. If a student chooses to do a master's thesis/project, he/she must select one of the following:

   Option I: Master's Thesis. The student must write a Master's Thesis (STA/OPR/MAT 590).

   Option II: Master's Project. The student must complete a Master's Project (STA/OPR/MAT 590).

   Once an option has been selected, the student with his/her advisor must submit a proposal to the Graduate Committee for approval. The thesis/project must be approved by the Graduate Committee in advance.

Master's Thesis Project Procedure

Once the thesis/project topic has been approved by the Graduate Committee, the student must select a Thesis/Project Committee in consultation with his/her advisor. The Thesis/Project Committee will consist of at least three members, including the advisor. At most, one member of the Thesis/Project Committee may be from outside the Department of Mathematics and Statistics. The Graduate Committee will approve the Thesis/Project Committee.

Although the thesis/project work will be done under the direct supervision of the advisor, the student is expected to keep all committee members apprised of its progress. Once the thesis/project is completed, the student will produce a document describing his/her work. This document must adhere to the format specified by the Graduate Committee. Each Thesis/Project Committee member must be supplied with a copy of this document for review and approval at least two weeks before the intended date of defense.

The defense of the thesis/project should occur no less than 60 days after the approval of the Thesis/Project Committee and will consist of an oral presentation of its content to the University community. The Master's Thesis/Project requirement will be considered fulfilled when the thesis/project has been defended and the final document has been approved by all members of the Thesis/Project Committee.

The entire procedure for the fulfillment of the Master's Project requirement is the same as in the Master's Thesis, except that the project may be in the form of an expository paper in an area of mathematics/statistics/operations research, or it may be a solution of a practical problem in one of these areas, possibly related to the student's employment.

Financial Aid

A limited number of teaching assistantships and tuition waivers is available to students receiving regular graduate admission. Requests for an assistantship and/or a tuition waiver should accompany the application.

Graduate Certificate in Statistics

The Department also offers a graduate certificate in statistics for those candidates who are interested in attaining a working knowledge of statistical methodologies. Interested candidates should apply to the Graduate Admissions Office (*see page 9*) and submit current vitae, copies of all undergraduate/graduate transcripts, and at least one letter of recommendation. Applicants must hold a baccalaureate degree from an accredited institution with a cumulative GPA of at least 2.75, and must have completed MAT 153, MAT 281, MAT 282 or their equivalents. To earn the graduate certificate, a candidate must earn a minimum of 15 credits in statistics, at least 12 of which are at the graduate level. A cumulative GPA of 3.0 or better is required in these courses, and they must be completed within six years of enrollment (which is defined as the date when the application for admission to the graduate certificate is accepted by the Graduate Committee). Courses taken for the certificate may also be used toward the master's degree in statistics, as long as they are completed within six years of enrollment in the graduate program (Master of Science in Statistics).

Note: Academic matters not addressed by the *Program Description* should be referred to the Graduate Committee in writing (official letter) for prompt resolution.

MAT 501 Teaching Seminar
A seminar intended to expose students to the teaching of introductory college mathematics courses. Students will be expected to participate in discussions concerning issues of pedagogy and classroom management. Some classes will be student-led. Credit earned for this course will not count toward the master's degree. Cr 1.

OPR/MAT 561 Deterministic Models in Operations Research
Formulation and analysis of deterministic models in operations research, linear programming, integer programming, project management, network flows, dynamic programming, non-linear programming, game theory, and group projects on practical problems from business and industry. Prerequisite: MAT 152 or MAT 295 or permission of instructor. Cr 3.

OPR/STA 562 Stochastic Modeling in Operations Research
Formulation and analysis of stochastic models in operations research, Markov chains, birth-death models, Markov decision models, reliability models, inventory models, applications to real world problems, and group projects on practical problems from business and industry. Prerequisite: MAT 281 or MAT 380 or permission of instructor. Cr 3.

OPR/STA/MAT 563 System Modeling and Simulation
Basic simulation methodology, general principles of model building, model validation and verification, random number generation, input and output analysis, simulation languages, applications to computer and communication networks, manufacturing, business, and engineering will be considered, and group projects on practical problems from business and industry. Prerequisite: MAT 281 or MAT 380 or permission of instructor. Cr 3.

OPR/STA 564 Queuing Networks
Queuing and stochastic service systems, birth-death processes, Markovian queues, open and closed Jackson networks, priority queues, imbedded Markov chain models, optimal control and design, stochastic scheduling, applications to computer and communication networks, manufacturing, business, and engineering will be considered, and projects on practical problems from business and industry. Prerequisite: MAT 281 or MAT 380 or permission of instructor. Cr 3.

MAT/OPR 571 Graph Theory
This course considers various properties of graphs and diagraphs and includes applications to optimization questions and networks. Prerequisite: MAT 290 or permission of instructor. Cr 3.

STA 574 Statistical Computing
The course will introduce two commonly used statistical packages, SAS and MINITAB, with an emphasis on SAS programming and data management. Prerequisite: MAT 212 or MAT 282 or permission of instructor. Cr 3.

STA/OPR/MAT 575 Graduate Internship
The course is ideal for students who have had no work experience with statistical data analysis or mathematical modeling. Such students can try to locate paid or unpaid internship opportunities that might be available on-campus or off-campus. The students will submit to the graduate committee a formal written report on the internship experience. Prerequisite: graduate standing. Cr var.

STA 580 Statistical Inference
Sampling distributions such as Chi-square, t and F, order statistics, parametric point estimation covering methods of moments, maximum likelihood, and Bayesian techniques, concept of sufficiency and completeness, parametric interval estimation covering pivotal quantity method, parametric hypothesis testing covering GLR and UMP tests, and analysis of real and simulated data. Prerequisites: MAT 153 and MAT 282. Cr 3.

STA 581 Statistical Quality Control
Methods and philosophy of statistical process control, control charts for variables, control charts for attributes, CUSUM and EWMA control charts, some other statistical process control techniques, process capability analysis, and certain process design and improvements with experimental design. Prerequisite: MAT 282. Cr 3.

STA 582 Time Series Modeling
Overview of the basic concepts of trend and seasonality, ARMA and ARIMA models, parameter estimation with asymptotic properties, forecasting techniques, spectral analysis, bivariate time series, and some special topics. Prerequisite: MAT 282. Cr 3.

STA 583 Sampling Methods
Simple random, stratified, systematic, cluster, and multi-stage sampling, PPS sampling, optimum sample size, use of auxiliary variables in sample surveys, ratio and regression estimates, double sampling, sources of error in surveys and ways of removing them, and methods of collecting data. Prerequisite: MAT 282. Cr 3.

STA 584 Advanced Design and Analysis of Experiments
Factorial experiments, fractional replications in factorial experiments, BIB and PBIB designs, and response surface methodology. Prerequisite: MAT 484 or equivalent. Cr 3.

STA 585 Regression Analysis
Certain concepts of data reduction, simple linear regression using matrices, residual analysis, certain techniques to select a best regression equation, multiple regression, analysis of variance and covariance, and data analysis and computation using statistical package programs. Prerequisite: MAT 282. Cr 3.

STA 586 Nonparametric Methods
Empirical distribution functions and their properties, certain goodness-of-fit techniques, inference concerning quantiles, comparison of two and more treatments, rank tests in randomized complete designs, and some special topics. Prerequisite: MAT 282. Cr 3.

STA 587 Categorical Data Analysis
Topics to be examined include: two-way tables, generalized linear models, logistic and conditional logistic models, loglinear models, fitting strategies, model selection, and residual analysis. Prerequisite: MAT 282. Cr 3.

STA 588 Introduction to Biostatistics
Basic concepts of estimation and hypothesis testing, standardization of rates, life tables, analysis of categorical data, multiple regression including binary response regression models. Prerequisite: MAT 282. Cr 3.

STA 589 Survival Analysis
Survival and reliability concepts, mathematics of survival models, parametric and non-parametric estimates from complete and censored data, Kaplan-Meier estimators, regression models including Poisson regression and Cox's proportional hazards model, time-dependent covariates, and analysis of rates. Prerequisite: MAT 282. Cr 3.

STA/OPR/MAT 590 Master's Project/Thesis
The project must be approved by the graduate program committee in advance. Offered only as a pass/fail course. Prerequisites: full graduate standing and faculty approval. Cr 6.

STA/OPR/MAT 599 Independent Study
An opportunity for graduate students to pursue areas not currently offered in the graduate curriculum. Cr 3.

Graduate Certificate in the Acting Techniques of Michael Chekhov

The graduate certificate, offered by the Department of Theatre, in the acting techniques of Michael Chekhov is designed to appeal to theatre and drama instructors, professional actors/directors, experienced community actors/directors, and advanced students. The courses provide an intensive overview of the acting techniques attributed to Michael Chekhov and the application of those techniques to performing, directing, auditioning, and teaching. Areas of focus will include image and body, preparing the part, characterization, and improvisation. The graduate certificate program introduces methods of teaching these techniques and provides opportunities for graduate students to teach back to the peer group and faculty, receiving feedback and guidance on their presentations. Candidates for the certificate must attend two summer institutes at USM, including an additional one and a half days in residence for the certificate program, and complete a significant one-credit independent project approved by the instructors.