Duluth Campus

Applied and Computational Mathematics M.S.

Mathematics & Statistics

Swenson College of Science and Engineering

Link to a list of faculty for this program.

Contact Information:
Department of Mathematics and Statistics, 140 Solon Campus Center, 1117 University Drive, Duluth, MN 55812 (218-726-8747; fax: 218-726-8399)
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Website: http://www.d.umn.edu/math/graduates

- Program Type: Master's
- Requirements for this program are current for Fall 2016
- Length of program in credits: 35
- This program does not require summer semesters for timely completion.
- Degree: Master of Science

Along with the program-specific requirements listed below, please read the General Information section of the catalog website for requirements that apply to all major fields.

This program is for those wishing to pursue careers that use applied mathematics and statistics in science, industry, business, and teaching, and for those wishing to go on for doctoral degrees in mathematics or statistics. It emphasizes the use of modern modeling techniques and computational methods with areas of concentration available in continuous modeling, probability/statistics, and discrete mathematics. The faculty is drawn largely from the Department of Mathematics and Statistics, but also includes members from other departments.

Program Delivery

This program is available:

- via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission

The preferred undergraduate GPA for admittance to the program is 3.00.

An undergraduate degree in mathematics or statistics is preferred. Students with degrees in any major and with a substantial background in mathematics or statistics are also encouraged to apply.

Applicants must submit their test score(s) from the following:

- GRE

International applicants must submit score(s) from one of the following tests:

- TOEFL
  - Internet Based - Total Score: 79
  - Internet Based - Writing Score: 21
  - Internet Based - Reading Score: 19
  - Paper Based - Total Score: 550
- IELTS
  - Total Score: 6.5
- MELAB
  - Final score: 80

Key to test abbreviations(GRE, TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements

Plan A: Plan A requires 15 to 19 major credits, 6 to 10 credits outside the major, and 10 thesis credits.The final exam is oral.

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Plan B: Plan B requires 25 to 29 major credits and 6 to 10 credits outside the major.The final exam is oral. A capstone project is required.
Capstone Project: The Plan B project must be presented to the department in a seminar or colloquium, and prepared for publication as a departmental technical report. A PDF file of the final version must be submitted to the department.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 3.00 is required for students to remain in good standing.

At least 1 semesters must be completed before filing a Degree Program Form.

The Master of Science degree is offered under both Plan A (with thesis) and Plan B (without thesis). At least 25 of these credits must be under MATH or STAT designator (including Thesis credits or Directed Research credits). At least 14 of these (not including Thesis credits or Directed Research credits) must be under the MATH designation. At least 6 credits must be from a minor or related field (statistics is a related field). The remaining 4 credits may be either major credits or from a related field. Every student must attend at least 16 Graduate Colloquium presentations.

Plan A requires 35 total credits; the final exam is oral.

Plan B requires 35 total credits; the final exam is oral.

Theoretical Core (10 - 11 cr)
Students not taking all four Theoretical Core courses must include in their program of study at least one course in the unrepresented area; i.e., Applied Analysis, Algebra and Discrete Math, or Probability and Statistics. The course selection must be approved by advisor and director of Graduate Studies.
MATH 5327 - Advanced Linear Algebra (3.0 cr)
Take 2 or more course(s) from the following:
- MATH 5201 - Real Variables (4.0 cr)
- MATH 5371 - Abstract Algebra I (3.0 cr)
- STAT 5571 - Probability (4.0 cr)

Graduate Seminar (1 cr)
Students must attend at least 16 Graduate Colloquium presentations.
MATH 8980 - Graduate Seminar (1.0 cr)

Computation (3 - 4 cr)
Take 1 or more course(s) from the following:
- MATH 5233 - Mathematical Foundations of Bioinformatics (3.0 cr)
- MATH 5830 - Numerical Analysis: Approximation and Quadrature (4.0 cr)
- MATH 5840 *{Inactive}*(4.0 cr)
- MATH 5850 - Numerical Differential Equations (4.0 cr)
- STAT 5411 - Analysis of Variance (3.0 cr)
- STAT 5511 - Regression Analysis (3.0 cr)
- STAT 5515 - Multivariate Statistics (3.0 cr)
- STAT 5521 - Applied Time Series Analysis (3.0 cr)

Related Field (6 cr)
At least 6 credits must be taken outside the major for both Plan A and Plan B programs. These credits outside the major may be taken from approved math related fields with designations other than MATH. STAT is an allowed related field except STAT 5571 Probability, which does not count towards the 6 credit requirement. Eligibility of courses other than STAT is determined by director of Graduate Studies.

Comprehensive Examination
All students must pass the comprehensive examination. The material tested is the courses from the Theoretical Core. There are 8 problems, 2 in each subject. The student must solve 4 problems; precisely 1 problem in advanced linear algebra and 3 problems in 2 or 3 of the remaining fields (abstract algebra; real variables; probability) according to the student's choice. This examination can be taken in an oral format at the mutual agreement of both the student and the graduate program.

Plan A or Plan B
Plan A
Thesis
Students must complete 10 thesis credits. The thesis must be presented to the department in a seminar or colloquium and defended before the candidate's Examining Committee. The candidate must submit required thesis copies to the graduate school and a PDF

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copy to the department. Starting the first semester after submission of their Graduate Degree Plan Form, Plan A students must register for at least 2 credits of MATH 8777 Thesis Credits in every semester until they defend their thesis.
MATH 8777 - Thesis Credits: Master's (1.0 - 18.0 cr)

Electives

From mathematics, statistics or approved related areas to reach a minimum of 35 credits. Your program must include a minimum of 14 credits with a MATH designator (not including MATH 8777 thesis credits).

or **Plan B**

Concentrations

Select at least two courses from one of the following areas of concentration (close to project topic).

Applied Analysis

Take 2 or more course(s) from the following:

- MATH 5260 - Dynamical Systems (3.0 cr)
- MATH 5270 - Modeling with Dynamical Systems (3.0 cr)
- MATH 5280 - Partial Differential Equations (3.0 cr)
- MATH 5810 - Linear Programming (3.0 cr)

or **Probability and Statistics**

Take 2 or more course(s) from the following:

- STAT 5411 - Analysis of Variance (3.0 cr)
- STAT 5511 - Regression Analysis (3.0 cr)
- STAT 5515 - Multivariate Statistics (3.0 cr)
- STAT 5531 - Probability Models (4.0 cr)
- STAT 5572 - Statistical Inference (4.0 cr)
- STAT 8611 - Linear Models (3.0 cr)

or **Algebra and Discrete Math**

Take 2 or more course(s) from the following:

- MATH 5330 - Theory of Numbers (3.0 cr)
- MATH 5365 - Graph Theory (3.0 cr)
- MATH 5366 - Enumerative Combinatorics (3.0 cr)
- MATH 5372 - Abstract Algebra II (3.0 cr)

or **Computation**

Take 2 or more course(s) from the following:

- MATH 5233 - Mathematical Foundations of Bioinformatics (3.0 cr)
- MATH 5830 - Numerical Analysis: Approximation and Quadrature (4.0 cr)
- MATH 5840 *{Inactive}*(4.0 cr)
- MATH 5850 - Numerical Differential Equations (4.0 cr)

Directed Research

Students must complete an approved project, present it to the dept in a seminar or colloquium, and prepare it for publication as a departmental technical report. A PDF file of the final version must be submitted to the department. A maximum of 4 cr can count towards the total number of credits required by the program. Starting the 1st semester after submission of their Graduate Degree Plan Form, Plan B students must register for 2 cr of MATH 8994 every semester until they defend their project.
MATH 8994 - Directed Research (1.0 - 4.0 cr)

Electives

From mathematics, statistics or approved related areas to reach a minimum of 35 credits. Your program must include a minimum of 14 credits with a MATH designator (not including MATH 8994 directed research credits).

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