MATHEMATICS, MS

Department of Mathematics, College of Arts & Sciences

Vision Statement
The Master of Science in mathematics is designed to achieve two objectives:

- Provide a strong program of course work in mathematics beyond the undergraduate level and
- Be flexible enough to accommodate a wide variety of student interests and backgrounds. There are no required courses in the program, but students are strongly encouraged to develop an emphasis in the courses which make up their individual plan of study; such an emphasis provides both focus and depth in the graduate experience.

Whatever their objectives in their graduate programs, students should form a close working relationship with a faculty member having similar mathematical interests as soon as possible. This will ensure good advice in planning a coherent plan of study. In addition, an advisor may be able to suggest special topics courses, independent study, or the thesis option which could all be used to pursue one's interests in greater depth. Finally, students who plan to pursue a doctoral degree in mathematics should include a sequence in analysis and a sequence in algebra in their plans of study.

Program Contact Information
Dr. Andrew Swift, DSc, Graduate Program Chair (GPC)
237 Durham Science Center (DSC)
402.554.3637
aswift@unomaha.edu

Program Website (http://www.unomaha.edu/math/)

Other Program Related Information

Graduate Assistantships
The Department of Mathematics annually awards graduate assistantships for work within the department. There are also several joint UNO/MCC positions where the teaching assignments are at Metropolitan Community College. All of these positions pay an annual stipend plus a waiver of tuition. For the details of the nature of the work, please visit the assistantships page of the Department of Mathematics website.

Admissions
General Application Requirements and Admission Criteria (http://catalog.unomaha.edu/graduate/admission/)

Program-Specific Requirements
Application Deadlines (Spring 2022, Summer 2022, and Fall 2022)
- Fall: July 31
- Spring: November 30
- Summer: April 15

Other Requirements
For unconditional admission, an applicant should:
- Have completed a bachelor’s degree with a grade point average of at least 3.0 in mathematics courses taken.
- Have completed 15 credit hours of mathematics courses beyond calculus, including MATH 3230/MATH 8235 or equivalent.
- Applicants lacking the 15 credit hours beyond calculus may be eligible for admission in a provisional or unclassified status with a deficiency to be made up in addition to the degree requirements listed.
- Applicants who satisfy the admission requirements above except for the GPA requirement may be granted provisional admission to the graduate program. They will be granted unconditional admission upon completion of 12 graduate hours with a grade of “B” or better in each course.
- English Language Proficiency: Applicants are required to have a command of oral and written English. Those who do not hold a baccalaureate or other advanced degree from the United States, OR a baccalaureate or other advanced degree from a predetermined country on the waiver list, must meet the minimum language proficiency score requirement in order to be considered for admission.

Degree Requirements

Required Courses
There are no required courses. Choose mathematics courses with a MATH or STAT prefix numbered 8000 or above and ending in the digit zero or six, excluding MATH 8880. At least 18 of these hours must be in courses with a number ending in a zero digit. These 18 may include three hours of independent study, MATH 8970. Courses numbered 8x5 will not count towards the MS degree in Mathematics.

If the project option is chosen, the six required hours of MATH 8960 or STAT 8960 will count towards the overall credit hour total, and the required 18 hours of courses ending in a zero digit.

If a student chooses to add a concentration to their degree program (see below) then there will be specific courses that will be needed to be completed to fulfill the concentration requirements.

Electives
Since there are no required courses, all courses are electives which must satisfy the requirements given above for the 36 credit hours. Up to 12 hours of graduate work electives may be taken in areas related to mathematics, physics, computer science, and economics, if permission is obtained from the Graduate Program Committee.

Exit Requirements
Select One:
- Comprehensive Examination
  - The comprehensive examination is based on three related courses (one of which must have a number ending in a zero digit) consisting of two parts. The first part is a one-week take-home examination. The second part is a three hour examination which may be open book, at the discretion of the instructor(s). The examination is normally taken in the student’s final semester and should be scheduled well in advance of the graduate college deadlines.
- Project
  - A mathematical or statistical project undertaken under the supervision of both a faculty advisor and an external (industry) advisory. The purpose of the project is for the student to work on a 'real-world' problem. The student will produce a written report and give an oral presentation of their work. Students are required to register for six hours of MATH 8960 or STAT 8960.
### Concentrations

Students may choose (although there is no requirement to do so) to add a concentration to their Mathematics MS degree. There are currently four available concentrations:

- Mathematics, MS with Computational Mathematics Concentration
- Mathematics, MS with Data Science Concentration
- Mathematics, MS with Operations Research Concentration
- Mathematics, MS with Statistics Concentration

### Total Credit Hours: 36

#### Concentrations

Courses numbered 8-5 will not count towards the MS degree in Mathematics.

#### Computational Mathematics Concentration

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 8336</td>
<td>INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS ¹</td>
<td>15</td>
</tr>
<tr>
<td>MATH 8250</td>
<td>PARTIAL DIFFERENTIAL EQUATIONS</td>
<td></td>
</tr>
<tr>
<td>MATH/CSCI 8500</td>
<td>NUMERICAL LINEAR ALGEBRA</td>
<td></td>
</tr>
<tr>
<td>MATH/CSCI 8510</td>
<td>NUMERICAL DIFFERENTIAL EQUATIONS</td>
<td></td>
</tr>
<tr>
<td>MATH 8406</td>
<td>THE FINITE ELEMENT METHOD ¹</td>
<td></td>
</tr>
<tr>
<td>MATH 8970</td>
<td>INDEPENDENT GRADUATE STUDIES</td>
<td></td>
</tr>
</tbody>
</table>

**Core Courses**

Select at least 5 of the following:

- MATH 8336
- MATH 8250
- MATH/CSCI 8500
- MATH/CSCI 8510
- MATH 8406
- MATH 8970

**Electives**

Select at least 21 credit hours of courses related to computational mathematics (see below).

**Total Credits:** 36

¹ Students who were undergraduates at UNO and took MATH 4330 or MATH 4400 may not take MATH 8336 or MATH 8406 at the graduate level. Students can replace these requirements with additional elective courses.

#### Data Science Concentration

**Prerequisites**

Some statistics and computer programming are highly recommended.

**Required Courses**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 8746</td>
<td>INTRODUCTION TO PROBABILITY AND STATISTICS I ¹</td>
<td>3</td>
</tr>
<tr>
<td>MATH 8756</td>
<td>INTRODUCTION TO PROBABILITY AND STATISTICS II ¹</td>
<td>3</td>
</tr>
</tbody>
</table>

**Introductory Courses**

**Core Courses**

- MATH 8416
- STAT 8426
- MATH/CSCI 8306

**Approved Electives**

Select at least 15 credit hours from the following:

- MATH/CSCI 8316
- STAT 8436
- STAT 8446
- MATH 8456
- STAT 8700
- STAT 8710
- MATH 8970
- STAT/MATH 8960

**Total Credits:** 36

¹ Students who were undergraduates at UNO and took MATH 4330 or MATH 4400 may not take MATH 8336 or MATH 8406 at the graduate level. Students can replace these requirements with additional elective courses.

### Exit Requirements

#### Comprehensive Examination

The comprehensive examination is based on three related courses (one of which must have a number ending in a zero digit) consisting of two parts. The first part is a one-week take-home examination. The second part is a 3-hour examination which may be open book, at the discretion of the instructor(s). The examination is normally taken in the student's final semester and should be scheduled well in advance of the graduate college deadlines.

(Note: The project exit requirement is not available for those students wishing to complete the Computational Mathematics concentration, only the comprehensive exam exit requirement is allowed.)

### Total Credits

36

¹ Students who were undergraduates at UNO and took MATH 4740 or MATH 4750 may not take MATH 8746 or MATH 8756. For those students who can demonstrate previous statistical exposure can appeal to the graduate program chair to waive the MATH 8746/MATH 8756 requirements. Students can replace these requirements with additional elective courses.
2 Students who were undergraduates at UNO and took STAT 4410, STAT 4420, or MATH 4300 may not take STAT 8416, STAT 8426, or MATH 8306 at the graduate level. Students can replace these requirements with additional elective courses.

3 If any of the introductory or core course requirements were waived, then additional electives should be taken in their place. Other elective courses may be possible with the prior permission of the graduate program chair.

4 Students who were undergraduates at UNO and took MATH 4310, STAT 4430, or STAT 4440 may not take MATH 8316, STAT 8436, or STAT 8446 at the graduate level.

**Exit Requirement**
Each student is required to complete a project involving working with real-world data. The student will be advised by both a faculty and external advisor, and a completed written and oral report is required.

Students are required to sign up for 6 hours of MATH 8960 or STAT 8960.

(Notes: The comprehensive exam exit requirement is not available for those students wishing to complete the Data Science concentration, only the project exit requirement is allowed).

**Operations Research Concentration**

<table>
<thead>
<tr>
<th>Code</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Core Courses</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>MATH/CSCI 8306</td>
<td>DETERMINISTIC OPERATIONS RESEARCH MODELS 1</td>
<td></td>
</tr>
<tr>
<td>MATH/CSCI 8316</td>
<td>PROBABILISTIC OPERATIONS RESEARCH MODELS 1</td>
<td></td>
</tr>
<tr>
<td>MATH 8326</td>
<td>COMPUTATIONAL OPERATIONS RESEARCH</td>
<td></td>
</tr>
<tr>
<td>MATH 8430</td>
<td>LINEAR PROGRAMMING</td>
<td></td>
</tr>
<tr>
<td>MATH 8440</td>
<td>NETWORK PROGRAMMING</td>
<td></td>
</tr>
<tr>
<td>MATH 8460</td>
<td>INTEGER PROGRAMMING</td>
<td></td>
</tr>
</tbody>
</table>

**Electives**
Select one of the following (see below):

- For students choosing the comprehensive exam option, at least 21 credit hours of courses related to operations research
- For students choosing the project option, at least 15 credit hours of courses related to operations research and 6 credit hours of MATH 8960

**Total Credits**
36

1 Students who were undergraduates at UNO and took MATH 4300, MATH 4310, or MATH 4320 may not take MATH 8306, MATH 8316, or MATH 8326 at the graduate level. Students can replace these requirements with additional elective courses.

**Statistics Concentration**

<table>
<thead>
<tr>
<th>Code</th>
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<tr>
<td>Core Courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH 8746</td>
<td>INTRODUCTION TO PROBABILITY AND STATISTICS 1</td>
<td>3</td>
</tr>
<tr>
<td>MATH 8756</td>
<td>INTRODUCTION TO PROBABILITY AND STATISTICS II</td>
<td>3</td>
</tr>
<tr>
<td>STAT 8436</td>
<td>LINEAR MODELS 1</td>
<td>3</td>
</tr>
<tr>
<td>STAT 8710</td>
<td>DESIGN AND ANALYSIS OF EXPERIMENTS</td>
<td>3</td>
</tr>
</tbody>
</table>

**Electives**
Select one of the following (see below):

- For students choosing the comprehensive exam option, at least 24 credit hours of courses with a statistical nature, with at least 15 hours of courses ending in 0

If any of the core course requirements were waived, then additional electives should be taken in their place.

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For students choosing the project option, at least 18 credit hours of courses with a statistical nature, with at least 9 hours of courses ending in 0. Six hours of MATH 8960 are required.

**Total Credits**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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<tbody>
<tr>
<td>STAT 8700</td>
<td>BAYESIAN STATISTICS</td>
<td>3</td>
</tr>
<tr>
<td>STAT 8720</td>
<td>RELIABILITY THEORY</td>
<td>3</td>
</tr>
<tr>
<td>STAT 8446</td>
<td>TIME SERIES ANALYSIS</td>
<td>3</td>
</tr>
<tr>
<td>MATH 8650</td>
<td>INTRODUCTION TO PROBABILITY MODELS</td>
<td>3</td>
</tr>
<tr>
<td>MATH 8670</td>
<td>TOPICS IN PROBABILITY AND STATISTICS</td>
<td>3</td>
</tr>
<tr>
<td>MATH/CSCI 8316</td>
<td>PROBABILISTIC OPERATIONS RESEARCH MODELS</td>
<td>3</td>
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<td>STAT 8416</td>
<td>INTRODUCTION TO DATA SCIENCE</td>
<td>3</td>
</tr>
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<td>STAT 8426</td>
<td>EXPLORATORY DATA VISUALIZATION AND QUANTIFICATION</td>
<td>3</td>
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<td>ADVANCED STATISTICAL MACHINE LEARNING</td>
<td>3</td>
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<td>MATH 8970</td>
<td>INDEPENDENT GRADUATE STUDIES</td>
<td>1-3</td>
</tr>
</tbody>
</table>

1 Students who were undergraduates at UNO and took MATH 4740, MATH 4750, or STAT 4430 may not take MATH 8746, MATH 8756, or STAT 8436 at the graduate level. Students can replace these requirements with additional elective courses.

**Electives**

For students choosing the comprehensive exam option, at least 24 credit hours of courses with a statistical nature, with at least 15 hours of courses ending in 0.

For students choosing the project option, at least 18 credit hours of courses with a statistical nature, with at least 9 hours of courses ending in 0.

Some suggested courses are provided below. Other elective courses may be possible with the prior permission of the graduate program chair.

If any of the core course requirements were waived, then additional electives should be taken in their place.

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<td>INDEPENDENT GRADUATE STUDIES</td>
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</tbody>
</table>

1 Students who were undergraduates at UNO and took MATH 4310, STAT 4410, STAT 4420, or STAT 4440 may not take MATH 8316, STAT 8416, STAT 8426, or STAT 8446 at the graduate level.

**Exit Requirements**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT/MATH 8960</td>
<td>MASTER'S PROJECT</td>
<td>6</td>
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</tbody>
</table>

The comprehensive examination is based on three related courses (one of which must have a number ending in a zero digit) consisting of two parts. The first part is a one-week take-home examination. The second part is a 3-hour examination which may be open book, at the discretion of the instructor(s). The examination is normally taken in the student's final semester and should be scheduled well in advance of the graduate college deadlines.

A statistical project undertaken under the supervision of both a faculty advisor and an external (industry) advisory. The purpose of the project is for the student to work on a 'real-world' problem. The student will produce a written report and give an oral presentation of their work.

Students are required to register for 6 hours of STAT 8960.