

# Mathematics Major, B.S.

Department of Mathematics and Statistics

The mathematics major is offered in five options. The **Applied Mathematics** option is designed for students interested in pursuing careers in business, industry, and government. The **Computational Mathematics** option has a significant computer science component and is designed for students interested in pursuing careers in business and industry. The **Statistics** option trains students in theoretical, applied, and computational statistics used in a wide variety of disciplines, and serves as a stepping stone to the actuarial profession, graduate school, and jobs in data analysis. The **Traditional Mathematics** option offers a more theoretical program for students interested in teaching or graduate work. Finally, the **Mathematics as a Double Major** option allows for individualized programs for students who have already completed a degree or who are working on another major outside the Department of Mathematics and Statistics.

## Typical Program of Study:

### Applied Mathematics Option\*

#### First Year

Math 1296 Calculus I <sup>a</sup>	5 cr
CS 1511 Computer Science I	5 cr
Comp 1120 College Writing	3 cr
Math 1297 Calculus II	5 cr
Liberal education courses	10-13 cr

#### Second Year

Math 3280 Diff Equations/Linear Algebra	4 cr
Math 3298 Calculus III	4 cr
Stat 3611 Probability & Statistics	4 cr
CS programming elective <sup>b</sup>	3-5 cr

#### Third Year

Math 3299 Intermediate Analysis	3 cr
Math 4326 Linear Algebra	3 cr
Approved mathematics electives <sup>b</sup>	6 cr
Comp 3130 or 3150 Advanced Writing	3 cr

#### Fourth Year

Math 3941 Undergraduate Colloquium	1 cr
Math research component	2-3 cr
Approved mathematics electives <sup>b</sup>	4 cr

### Computational Mathematics Option\*

#### First Year

Math 1296 Calculus I <sup>a</sup>	5 cr
Comp 1120 College Writing	3 cr
Math 1297 Calculus II	5 cr
CS 1511 Computer Science I	5 cr
CS 1521 Computer Science II	5 cr
Liberal education courses	3-7 cr

#### Second Year

Math 3280 Diff Equations/Linear Algebra	4 cr
Math 3298 Calculus III <b>OR</b>	
Math 3355 Discrete Mathematics	4 cr
CS 2511 Software Analysis and Design	4 cr
Approved computer science elective <sup>b</sup>	3 cr

#### Third Year

Math 4326 Linear Algebra	3 cr
Stat 3611 Probability & Statistics	4 cr
Approved computer science elective <sup>b</sup>	4 cr
Approved mathematics elective <sup>b</sup>	3-4 cr
Comp 3130 or 3150 Advanced Writing	3 cr

#### Fourth Year

Math 3941 Undergraduate Colloquium	1 cr
Approved computer science elective <sup>b</sup>	4 cr
Approved mathematics elective <sup>b</sup>	3-4 cr

\*Liberal education and minor field courses are required in addition to the above major requirements.

<sup>a</sup>First math course is determined by math placement exam. This schedule presupposes placement into Math 1296.

<sup>b</sup>See the Department of Mathematics & Statistics home page ([www.d.umn.edu/math](http://www.d.umn.edu/math)) for a listing of approved electives.

**Statistics and Actuarial Science Option\****First Year*

Math 1296 Calculus I <sup>a</sup>	5 cr
Comp 1120 College Writing	3 cr
Math 1297 Calculus II	5 cr
CS 1511 Computer Science I	5 cr
Liberal education course	8-14 cr

*Second Year*

Math 3280 Diff Equations/Linear Algebra	4 cr
Math 3298 Calculus III	4 cr
Stat 3611 Probability & Statistics	4 cr

*Third Year*

Stat 5511 Regression Analysis	3 cr
Stat 5531 Probability Models	4 cr
Approved mathematics elective <sup>b</sup>	3-4 cr

*Fourth Year*

Math 3941 Undergraduate Colloquium	1 cr
Comp 31xx Advanced Writing	3 cr
Stat 5571 Probability	4 cr
Stat 5572 Statistical Inference	4 cr
Approved mathematics elective <sup>b</sup>	3-4 cr

**Traditional Mathematics Option\****First Year*

Math 1296 Calculus I <sup>a</sup>	5 cr
Comp 1120 College Writing	3 cr
Math 1297 Calculus II	5 cr
CS 1511 Computer Science I	5 cr
Liberal education course	8-14 cr

*Second Year*

Math 3280 Diff Equations/Linear Algebra	4 cr
Math 3298 Calculus III	4 cr
Math 3355 Discrete Mathematics	4 cr
Stat 3611 Probability & Statistics	4 cr

*Third Year*

Math 3299 Intermediate Analysis	3 cr
Math 4326 Linear Algebra	3 cr
Comp 3130 or 3150 Advanced Writing	3 cr

*Fourth Year*

Math 3941 Undergraduate Colloquium	1 cr
Math 5371 Abstract Algebra I	3 cr
Approved mathematics electives <sup>b</sup>	7-12 cr

**Double Major Option\***

Consult with the Director of Undergraduate Studies as the requirements for this option are individually designed.

\*Liberal education and minor field courses are required in addition to the above major requirements.

<sup>a</sup>First math course is determined by math placement exam. This schedule presupposes placement into Math 1296.

<sup>b</sup>See the Department of Mathematics & Statistics home page ([www.d.umn.edu/math](http://www.d.umn.edu/math)) for a listing of approved electives.

For further information:

Department of Mathematics and Statistics  
 140 Campus Center  
 1117 University Drive  
 Duluth, MN 55812-2496  
 218-726-8747  
[math@d.umn.edu](mailto:math@d.umn.edu)  
<http://www.d.umn.edu/math>

Major Course Requirements	Credits	Prerequisites	Semester To Be Completed	Grade When Completed
<b>Year 1</b>				
Math 1296 Calculus I	5	Math placement test		
Math 1297 Calculus II	5	Math 1296		
CS 1511 Computer Science I	5	3.5 years high school math		
<b>One of the following:</b>				
CS 1121 Intro to Visual BASIC	3	1 year high school algebra		
CS 1131 Intro to Programming in FORTRAN	3	3.5 years high school math		
CS 1211 Intro to Programming in C	3	3 yrs hs math; 1 sem college programming		
CS 1521 Computer Science II	5	CS 1511		
CS 2111 Intro to Programming in C++	3	1 yr programming in C or CS 1211 or 1521		
CS 2121 Intro to Programming in JAVA	3	3 years hs math; programming course		
Comp 1120 College Writing	3			
<b>Year 2</b>				
Math 3280 Diff Equations w/ Linear Algebra	4	Math 1297		
Math 3298 Calculus III	4	Math 1297		
Stat 3611 Intro to Probability and Statistics	4	Math 1296		
<b>Year 3</b>				
Math 3299 Intermediate Analysis	3	Math 1297		
Math 4326 Linear Algebra	3	6 Math/Stat credits above 3120		
Math Electives *	6			
<b>Year 4</b>				
Math 3941 Undergraduate Colloquium	1			
Math Electives *	4-8			
Comp 3130 or 3150 Advanced Writing	3	Comp 1120; 60 credits		
<b>One of the following:</b>				
Math 3097 Internship	2	department consent		
Math 5270 Modeling w/Dynamical Systems	3	Math 3280		
Math 5900 Team Modeling Project	3	90 credits		
Math 5991 Independent Study	2	department consent		
Math or Stat 3xxx or above for UROP participants	2			
<b>*Math Electives: Select at least one course from each group. Students who take CS 1521 select 3 courses, others select 4 courses.</b>				
<b>Group 1</b>				
Math 4230 Applied Math: Complex Variables	3	Math 3280		
Math 4240 Applied Math: Operational Methods	3	Math 3280		
Math 4820 Applied Math: Numerical Methods	3	Math 3280		
<b>Group 2</b>				
Math 5220 Optimization and Control	3	Math 3280		
Math 5260 Dynamical Systems	3	Math 3280		
Math 5280 Partial Differential Equations	3	Math 3280		
Math 5810 Linear Programming	3	Math 3280		
<b>Group 3</b>				
Math 5830 Num. Analysis: Approx. & Quadrature	4	Math 3280		
Math 5840 Num. Analysis: Systems & Optimiz.	4	Math 3280		
Math 5850 Numerical Differential Equations	4	Math 5280		

NOTE: In addition to the above, students must complete the liberal education program and a minor to earn the B.S. degree

**MATHEMATICS - COMPUTATIONAL MATHEMATICS MAJOR, B. S.**

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Major Course Requirements	Credits	Prerequisites	Semester to be Completed	Grade When Completed
<b>Year 1</b>				
Math 1296 Calculus I	5	Math placement test		
Math 1297 Calculus II	5	Math 1296		
CS 1511 Computer Science I	5	3.5 years high school math		
CS 1521 Computer Science II	5	CS 1511		
Comp 1120 College Writing	3			
<b>Year 2</b>				
Math 3280 Diff Equations w/ Linear Algebra	4	Math 1297		
Math 3298 Calculus III OR	4	Math 1297		
Math 3355 Discrete Mathematics	4	Math 1296; CS 1511; Math 1297 or CS 1521		
CS 2511 Software Development	4	CS 1521		
Computer Science Elective*	3			
<b>Year 3</b>				
Math 4326 Linear Algebra	3	6 Math/Stat credits above 3120		
Stat 3611 Intro to Probability and Statistics	4	Math 1296		
Mathematics Elective**	3-4			
Computer Science Elective*	4			
<b>Year 4</b>				
Math 3941 Undergraduate Colloquium	1	must register during semester of 16th point		
Mathematics Elective**	3-4			
Computer Science Elective*	4			
Comp 3130 or 3150 Advanced Writing	3	Comp 1120; 60 credits		
<b>* CS Electives: Select three courses, with at least two from Group 2.</b>				
<b>Group 1</b>				
CS 1121 Intro to Programming in Visual BASIC	3	high school algebra		
CS 1131 Intro to Programming in FORTRAN	3	3.5 years high school algebra or Math 1250		
CS 2121 Intro to Programming in Java	3	3 years hs math; programming course		
<b>Group 2</b>				
CS 4511 Automata, Comput & Formal Language	4	CS 1521; Math 3355		
CS 4521 Advanced Data Structures & Algorithms	4	CS 2511; Math 3355		
CS 4531 Software Engineering	4	CS 2511; Math 3355		
CS 4611 Database Management Systems	4	CS 2511, CS 2521		
CS 4811 Systems Software	4	CS 2511, CS 2521		
CS 4821 Computer Security	4	CS 2511; CS 2521 or CS 3011; Math 3355		
CS 5541 Artificial Intelligence	4	CS 2511; Math 3355		
CS 5551 User Interface Design	4	CS 2511; Math 1297		
CS 5621 Computer Architecture	4	CS 2511, CS 2521		
CS 5631 Operating Systems	4	CS 2511, CS 2521		
CS 5641 Compiler Design	4	CS 2511, CS 2521; Math 3355		
CS 5651 Computer Networks	4	CS 2511, CS 2521		
CS 5721 Computer Graphics	4	CS 2511; Math 1297		
CS 5731 Information and Text Processing	4	CS 2511; Math 3355		
CS 5741 Object-Oriented Design	4	CS 2511; Math 3355		
CS 5751 Machine Learning	4	CS 2511; Stat 3611		
<b>**Mathematics Electives - select two of the following courses:</b>				
Math 4820 Applied Math: Numerical Methods	3	Math 3280 or 4326; FORTRAN or C or C++		
Math 5810 Linear Programming	3	Math 3280 or 4326; FORTRAN or C or C++		
Math 5830 Num Analysis: Approx and Quadrature	4	Math 3280 or 4326; FORTRAN or C or C++		
Math 5840 Num Analysis: Systems & Optimization	4	Math 3280 or 4326; FORTRAN or C or C++		
Math 5850 Numerical Differential Equations	4	Math 3280; FORTRAN or C or C++		

NOTE: In addition to the above, students must complete the liberal education program and a minor to earn the B.S. degree.

# MATHEMATICS - STATISTICS AND ACTUARIAL SCIENCE MAJOR, B. S.

2001-2003 Catalog

Major Course Requirements	Credits	Prerequisites	Semester To Be Completed	Grade When Completed
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<b>Year 1</b>				
Math 1296 Calculus I	5	Math placement test		
Math 1297 Calculus II	5	Math 1296		
CS 1121 Visual Basic <b>OR</b> other CS 11xx course (if no programming experience)*	3	1 year high school algebra		
Comp 1120 College Writing	3			

<b>Year 2</b>				
CS 1511 Computer Science I*	5	3.5 years high school math		
Math 3280 Diff Equations w/ Lin Algebra	4	Math 1297		
Math 3298 Calculus III	4	Math 1297		
Stat 3611 Intro to Probability and Statistics	4	Math 1296		

\*Students with prior programming experience may take CS 1511 their first year and need not take CS 11xx.

<b>Year 3</b>				
Stat 5511 Regression Analysis	3	Stat 3611; Math 3280 or Math 4326		
Stat 5531 Probability Models	4	Stat 3611; Math 1297		
Mathematics Elective**	3-4			

<b>Year 4</b>				
Math 3941 Undergraduate Colloquium	1	must register during semester of 16th point		
Stat 5571 Probability	4	Stat 3611; Math 3298		
Stat 5572 Statistical Inference	4	Stat 5571		
Comp 31xx Advanced Writing	3	Comp 1120; 60 credits		
Mathematics Elective**	3-4			

**\*\* Mathematics Electives**

Select two of the following:

Math 3299 Intermediate Analysis	3	Math 1297		
Math 3355 Discrete Mathematics	4	Math 1296; CS 1511; Math 1297 or CS 1521		
Math 4326 Linear Algebra	3	Math 3280; 3 Math/Stat cr above 3120		

NOTE: In addition to the above, students must complete the liberal education program and a minor to earn the B.S. degree.

**MATHEMATICS - TRADITIONAL MATHEMATICS MAJOR, B. S.**

2001-2003 Catalog

Major Course Requirements	Credits	Prerequisites	Semester To Be Completed	Grade When Completed
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<b>Year 1</b>				
Math 1296 Calculus I	5	Math placement test		
Math 1297 Calculus II	5	Math 1296		
CS 1511 Computer Science I OR CS Elective above 1010	5 3	3.5 years high school math		
Comp 1120 College Writing	3			

<b>Year 2</b>				
Math 3280 Diff Equations w/ Lin Algebra	4	Math 1297		
Math 3298 Calculus III	4	Math 1297		
Math 3355 Discrete Mathematics	4	Math 1296; CS 1511; Math 1297 or CS 1521		
Stat 3611 Intro to Probability and Statistics	4	Math 1296		

<b>Year 3</b>				
Math 3299 Intermediate Analysis	3	Math 1297		
Math 4326 Linear Algebra	3	6 Math/Stat credits above 3120		
Math 5371 Abstract Algebra I	3	Math 3280 or 3320		

<b>Year 4</b>				
Math 3941 Undergraduate Colloquium Mathematics Electives *	1 7-12	must register during semester of 16th point		
Comp 3130 or 3150 Advanced Writing	3	Comp 1120; 60 credits		

**\*Mathematics Electives:**

Select one of the following three options:

<b>Option 1</b>				
Math 5201 Real Variables and Math 5372 Abstract Algebra II	4 3	Math 3299 Math 5371		

<b>Option 2</b>				
Math 5201 Real Variables and two 5xxx courses approved by Dept	4 6-8	Math 3299 see Dept web site: <a href="http://www.d.umn.edu/math">www.d.umn.edu/math</a>		

<b>Option 3</b>				
Math 5372 Abstract Algebra II and two 5xxx courses approved by Dept	3 6-8	Math 5371 see Dept web site: <a href="http://www.d.umn.edu/math">www.d.umn.edu/math</a>		

NOTE: In addition to the above, students must complete the liberal education program and a minor to earn the B.S. degree