NORTHWEST
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MATHEMATICS AND STATISTICS
College of Arts and Sciences

MATHEMATICS AND STATISTICS

MAJORS
- Mathematics
- Mathematics Education
- Statistics:
  - Applied Mathematical Statistics Emphasis
  - Actuarial Science Emphasis

MINORS
- Mathematical Sciences
- Statistics
- Mathematics Education

THE DEPARTMENT

Why study mathematics at Northwest? Dedicated teachers, small class sizes, student-run organizations, creative student life leaders, widely accessible technology and a friendly, close-knit community are just some of the benefits of life at Northwest Missouri State University. The Department of Mathematics and Statistics offers a wide variety of courses, a student-run math club (After Math), a colloquium series and opportunities for undergraduate research in order to provide an enriching academic environment.

The mission of the Department of Mathematics and Statistics is to provide a program where students learn to interpret, solve and explain mathematical problems. The department also offers general education and service courses to the University that provide students with mathematical knowledge to assist them in their lifelong learning experiences.

Classes in the Department of Mathematics and Statistics offer a mix of traditional teaching and dynamic group work in problem solving. Assignments can include complex problems such as “Buried Treasure,” “Describing Aircraft Landings,” “Those New Quarters” and “Spider and Fly.” Typically, these assignments require the group to write a paper containing their solution and present it to the class. Appropriate use of technology, including dynamic presentation software, is encouraged.

Unlike faculty at larger institutions, the primary focus of Northwest faculty is teaching. Many of our professors are actively involved in research, which keeps them current in their subject, but the success of our students is the No. 1 priority.

Project PRISM (Promoting Reasoning and Inquiry in Science and Math) is a professional development project currently under way at Northwest and underwritten by a grant from the National Science Foundation.

DEGREE PROGRAMS

The Department of Mathematics and Statistics offers programs leading to the Bachelor of Arts, Bachelor of Science and Bachelor of Science in Education degrees. The department’s programs include undergraduate majors and minors in mathematics, mathematics education and statistics. Each program requires a balanced selection of coursework from both pure and applied areas in the mathematical sciences while staying flexible enough for students to explore areas outside the department and shape their education to meet their personal interests and career objectives. Majors can thus prepare for immediate employment in the mathematical sciences or for additional study after graduation.

PUB 09

NORTHWEST
MISSOURI STATE UNIVERSITY

MATHEMATICS

This program is designed to give students an understanding of the basic structures and concepts of Mathematics. Compared to the Statistics program, coursework is more theoretical.

A degree in Mathematics can lead to jobs besides those traditionally considered "mathematical." This is because mathematical techniques are used in an increasing number of fields. Many employers and graduate schools recognize that knowledge of mathematics is crucial for success in many areas.

Many mathematics majors choose to continue their studies beyond the undergraduate level. This gives them preparation for teaching and research and advanced technical positions in industry. Most graduate students can obtain teaching positions that pay graduate school expenses.

MATHEMATICS EDUCATION

This program prepares students to teach high school mathematics. This comprehensive major combines instruction in mathematical content with courses that explore strategies for teaching mathematics. Since advanced degrees are often expected of a teacher, the program not only provides the strong content knowledge needed to teach mathematics, but it also prepares students to enter a graduate program in mathematics education. This program leads to Missouri teaching certification and can be augmented to meet the requirements in most other states.

STATISTICS

This program is designed to give students background in Statistics as well as Computer Science and Mathematics. Statisticians are needed in many areas, including the federal government, which employs statisticians in areas like the Departments of Commerce, Defense, Interior, Health and Human Services, Labor and Justice. Statistics graduates can also work as actuaries, people who calculate risks and assess premiums for insurance companies.

TEST-OUT POLICY

Undergraduate students may test out of certain lower division courses in mathematics. Examinations are available each trimester during the first week of class. See the department chair for courses that are available for test-out.

MAJORS

MATHEMATICS CORE REQUIREMENTS:

To achieve the common objectives, all majors in the Department of Mathematics and Statistics are required to complete a common list of courses and participate in senior assessment.

- Calculus I
- Calculus II
- Discrete Mathematics
- Probability and Statistics
- Elementary Linear Algebra
- Multivariate Calculus
- Senior Paper
- Scientific Computing

MATHEMATICS

B.A., B.S. — no minor required

Required Courses

- Mathematics Core Requirements
- General Statistics II
- Logic of the Exact Sciences
- Introduction to Abstract Algebra
- Intermediate Analysis
- Seminar in Readings in Mathematics Literature
- Approved departmental electives
- Approved electives in a quantitative field (physics, chemistry, economics, computer science)

MATHEMATICS EDUCATION

B.S. Ed. — no minor required (certifies grades 9-12)

Required Courses

- Mathematics Core Requirements
- Methods in Teaching with Technology
- College Geometry
- Logic of the Exact Sciences
- Introduction to Abstract Algebra
- Intermediate Analysis
- Seminar in History of Mathematics
- Approved departmental electives
- Methods in Secondary School Mathematics is the required subject field methods course.

STATISTICS

B.A., B.S. — no minor required

Applied Mathematical Statistics Emphasis

Required Courses

- Mathematics Core Requirements
- Computationally Intensive Statistical Methods
- General Statistics II
- Logic of the Exact Sciences
- Intermediate Analysis
- Seminar in Readings in Mathematics Literature
- Nonparametric Statistics
- Probability Theory
- Statistical Inference
- Statistical Projects
- Approved electives

Directed General Education course

- General Economics I

Actuarial Science Emphasis

Required Courses

- Mathematics Core Requirements
- Computationally Intensive Statistical Methods
- General Statistics II
- Seminar in Readings in Mathematics Literature
- Applied Time Series
- Probability Theory
- Statistical Inference
- Statistical Projects
- General Economics II

Choose 11 hours of electives from the following:

Differential Equations, Intermediate Analysis, Sampling, Nonparametric Statistics, Design of Experiments, Applied Linear Algebra, Complex Analysis, Applied Mathematics, Numerical Analysis, Macroeconomic Theory, Microeconomic Theory, Econometrics, Fundamentals of Business Finance, Investment Principles, Intermediate Financial Management

Directed General Education Course

General Economics I

MINORS

MATHEMATICAL SCIENCES

Required Courses

Calculus I
Calculus II
Discrete Mathematics
Probability and Statistics
Scientific Computing
Electives from both mathematics and statistics

STATISTICS

Required Courses

General Statistics I OR Probability and Statistics
General Statistics II
Nonparametric Statistics
Scientific Computing
Electives from mathematics or statistics

MATHEMATICS EDUCATION

B.S. Ed., (certifies grades 5-9)

Required Courses

Fundamentals of Mathematics
General Statistics I
Precalculus
Calculus I
Methods in Teaching with Technology
Algebra & Geometry for Elementary & Middle School Teachers
Advanced Topics for Middle School Teachers

Methods for Middle School Teachers is the required subject field methods course.

MATHEMATICS EDUCATION

B.S. Ed. Secondary program (certifies grades 9-12)

Required Courses

Calculus I
Calculus II
Discrete Mathematics
Methods in Teaching with Technology
College Geometry OR Non-Euclidean Geometry
Scientific Computing
Methods in Secondary School Mathematics

Electives

General Statistics I OR Probability and Statistics
Multivariate Calculus
Elementary Linear Algebra
Introduction to Abstract Algebra
Intermediate Analysis
Number Theory

COURSE DESCRIPTIONS

MATHEMATICS

Mathematics Skills I

A basic developmental course. Topics include fundamentals of arithmetic, algebra and numerical geometry.

Mathematics Skills II

An intermediate-level developmental course to prepare students for Finite Mathematics, General Statistics I, Concepts of Mathematics, College Algebra, Trigonometry and Fundamentals of Mathematics. Topics include graphs, systems of equations and intermediate algebra. This course does not satisfy the General Education requirement in mathematics or any graduation requirement.

Finite Mathematics

Topics include set algebra, matrices, functions, analytics of the straight line, linear programming and probability spaces, with emphasis on applications from business and economics.

Concepts of Mathematics

An explanation of ways in which mathematics is used to understand the contemporary world. Will satisfy the General Education requirement in mathematics.

Precalculus

A course to prepare students to take calculus. Topics include functions and graphs, equations and inequalities, and analytic geometry and trigonometry.

College Algebra

Topics include functions and graphs, systems of equations and inequalities and analytic geometry. Designed for students who plan continued study in college mathematics.

Trigonometry

Trigonometric functions and analytic trigonometry.

Calculus I

An introduction to single-variable calculus. Topics include intuitive treatment of limits and continuity, differentiation of elementary functions, curve sketching, extreme values, areas, rates of change, definite integral and fundamental theorem of calculus.

Calculus II

Topics include sequences and series, approximations, techniques and applications of integration and plane curves.

Fundamentals of Mathematics

An analytic exploration of elementary mathematics concepts, including set theory, operations in numeration systems and bases, number theory, operations and applications with rational and real numbers, probability and statistics, logic, relations and modular arithmetic.

Discrete Mathematics

An introduction to discrete models; topics include sets, symbolic logic, relations, combinatorics, mathematical induction, probability, vectors and matrices and graph theory.

Elementary Linear Algebra
An elementary introduction to finite-dimensional vector spaces and matrices. Topics include linear independence, bases, matrix operations, canonical forms, similarity, invertibility, geometric applications and determinants.

Multivariate Calculus
Topics include functions of several variables, partial differentiation and multiple integration.

College Geometry
A survey of geometry with an emphasis on the theorems and proofs of Euclidean and neutral geometry.

Differential Equations
A study of solutions of elementary differential equations. Topics include standard first-order forms, special higher-order linear equations, Laplace transform techniques, power series solutions and applications.

Logic of the Exact Sciences
Topics include the propositional and predicate calculus and methods of mathematical proof.

Introduction to Abstract Algebra
An introduction to standard abstract algebraic systems.

Intermediate Analysis
A careful examination of the main theorems of elementary calculus. Topics include completeness of R, limits of sequences and functions, continuity, mean-value theorem, Riemann integration and representation of functions.

Seminar in History of Mathematics
This course is an in-depth study of great historical innovations, thoughts and theories in mathematics.

Seminar in Readings in Mathematical Literature
This course is an in-depth study of timely topics for senior students of mathematics.

Senior Paper
A supervised paper required of all majors in the department.

Applied Linear Algebra
A second course in linear algebra with emphasis on applications. Topics may include linear programming, graph theory, game theory, Markov chains, computer graphics, equilibrium temperature distributions, electrical networks and least squares models.

Number Theory
A standard course in classical number theory. Topics include divisibility, congruences, theory of quadratic residues and Diophantine analysis.

Advanced Calculus
An advanced course in analysis; may include vector analysis, differentials and integration theory.

Complex Analysis
Topics may include the algebra and geometry of complex numbers, elementary and analytic functions of a complex variable, contour integration, residues, Taylor and Laurent series and basic fundamental theorems.

Non-Euclidean Geometry
An introduction to plane hyperbolic, elliptic and projective geometries and geometric transformation groups.

Introduction to Point Set Topology
Topics include metric spaces and axiomatic topology including the separation axioms, product spaces, derived sets, limit points and convergence.

Applied Mathematics
Topics may include construction and use of mathematical models, probability theory, Markov chains, network analysis, linear programming, differentiation and integration.

Numerical Analysis
Topics may include finite differences, numerical differentiation and integration and eigenvalue problems.

STATISTICS

General Statistics I
Basic concepts of decision making, central values, variability, probability and statistical inference, elementary concepts of correlation, parametric tests of significance, and regression analysis. Will satisfy the General Education requirement in mathematics.

Probability and Statistics
Fundamental principles and techniques of statistical investigations including probability, discrete and continuous random variables, estimation and hypothesis testing.

Computationally Intense Statistical Methods
This course will develop some statistical procedures that are difficult to implement without the help of the computer software.

General Statistics II
Applied course in statistics, including analysis of variance, multiple regression and the use of SAS, a statistical package.

Sampling
This course contains discussion and applications of the methods of good sampling. Comparisons of techniques are made when more than one method of sampling is possible.

Applied Time Series
A course in forecasting and some of the statistical techniques that can be used to produce forecasts.

Nonparametric Statistics
This course emphasizes methods for dealing with populations of unknown distribution and methods to use for ranked data or categorical data.

Probability Theory
A mathematical development of probability with emphasis on continuous random variables.

Statistical Inference
A mathematical development of statistics with emphasis on continuous random variables.

Design of Experiments
A course covering many of the statistical designs and techniques widely used in research and applications.

Introduction to Operations Research
An introduction to some of the basic models and analytical techniques of operations research.

Statistical Projects
Formulation and execution of statistical projects with faculty supervision.

MATHEMATICS EDUCATION

Methods in Teaching with Technology
Introduces technological tools and appropriate methods for using them to teach mathematics and science. Topics include dynamic software packages, web explorations, programming of graphing calculators, data collection with probes and analysis, and appropriate methods for teaching with these technologies.

Algebra and Geometry for Elementary and Middle School Teachers
Topics include plane and space figures, congruence, similarity, mensuration and transformation geometry. For elementary and middle school education majors only.

Mathematical Methods for Elementary Teachers
A study of current techniques, this course is designed to acquaint prospective teachers with both the content of elementary school mathematics and the materials available to aid in the teaching of this content. Activities are incorporated to provide experience with the various methods of teaching mathematics to elementary students.

Advanced Topics for Middle School Teachers
A course designed to provide more fundamental treatment of mathematical topics from the middle school. Topics include algebraic systems, trigonometry, number theory, problem-solving techniques, graphing, logic, probability and its applications to statistics.

Seminar in Teaching Elementary School Mathematics
Supervised practice in teaching mathematics in the elementary school with weekly seminar on teaching issues.

Methods in Secondary School Mathematics
A study of teaching procedures and current literature useful in teaching secondary school mathematics. Includes a two-week practicum experience.

Mathematical Methods for Middle School Teachers
This course is a study of current techniques for teaching middle school mathematics, including a two-week practicum experience in the school.

UNDERGRADUATE RESEARCH

Northwest is proud of its Undergraduate Research program because at many colleges and universities, research opportunities are reserved for graduate students.

Getting involved is fairly simple. To do so, one must discuss his or her topic with a faculty member. Then, it must be approved by a committee.

CAREER OPPORTUNITIES

MATHEMATICS

Mathematics is one of the oldest and most fundamental sciences and is therefore an integral part of what is becoming an increasingly technological world. Mathematical theory and the computational techniques developed through studying mathematics are combined with algorithms and the latest computer technology (each with roots in mathematics) to solve economic, scientific, engineering, physics and business problems each day.

Graduates from the Department of Mathematics and Statistics are prepared to enter a variety of job markets, including many in the teaching profession — both at the elementary/middle/secondary level and the post-secondary level.

The following are some places Northwest graduates are employed:
- Butler Manufacturing (pricer)
- Computer Software (Japan)
- Guaranteed Life Insurance
- Principal Financial Group
- St. Paul Insurance Company (as an actuary)
- U.S. Bureau of the Census
- Woodman of the World Insurance

An undergraduate degree in Mathematics or Statistics also prepares students for graduate school.

STUDENT ORGANIZATIONS

Pi Mu Epsilon

This is the mathematics honorary society. Membership is based upon academic excellence.

Mathematical Association of America

This group is open to anyone interested in mathematics. The group sponsors seminars about careers in math and related topics. They also present problem-solving sessions and papers at conventions.

OTHER ACTIVITIES

Students participate in the annual Collegiate Mathematics Competition, sponsored by the Missouri Section of the Mathematical Association of America.

Students and faculty attend the annual meeting of the Missouri section of the MAA, delivering mathematical papers and hearing other speakers.

WORK-STUDY OPPORTUNITIES

The department hires several students each year from various majors to serve as tutors in the Mathematics Lab or to assist faculty members. It also hires juniors and seniors as group study leaders for the two developmental mathematics courses.

SCHOLARSHIPS

Mathematics Olympiad Scholarships

Two $375 scholarships are awarded each year to high school seniors who have high scores on exams given at the department's spring Mathematics Olympiad. To find out how to participate in the Mathematics Olympiad, contact the department.

C.L. Butler Scholarship

Preference is given to those pursuing mathematics education, with special preference to those planning a mathematics major and English (or other area of the humanities) minor or second major. All applications pursuing secondary education will be considered. Recipients will show outstanding potential in their area of study as evidenced by excellent ACT scores and will demonstrate a need for financial assistance. The award, $1,500 for the academic year, may be renewed for up to four years.

Pi Mu Epsilon Scholarship

A $350 award each year goes to a junior or senior mathematics major on the basis of academic performance in mathematics and statistics courses.

Thomas Webb Harvey Scholarship

Two $525 awards are made each year to two mathematics majors on the basis of academic performance.

Marvin Gutzmer Scholarship

A $100 award toward tuition and fees is made each year to a qualifying junior or senior math major on the basis of academic performance and financial need.

C.F. Gray Physical Science Scholarship

Scholarships are given to juniors and seniors on the basis of a competition in mathematics, chemistry and physics.

Forrest G. and Joan B. Lowe Scholarship

A one-time $500 award, granted at the beginning of the student's freshman year. Recipient shall have elected a major in either mathematics or physics with a minimum 3.00 cumulative grade point average.

Department of Mathematics and Statistics Sophomore Scholarship

The Department of Mathematics and Statistics Sophomore Scholarship is awarded to an outstanding mathematics or statistics major who has at least a 3.0 cumulative GPA, earned at least a B in Calculus I and has completed one semester at Northwest. These scholarships are for $200, subject to availability of funds.

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