Department of Mathematics

Monte Boisen, Dept. Chair (300 Carol Ryrie Brink Hall 83844-1103; phone 208/885-6742; math@uidaho.edu; www.uidaho.edu/Math). ***Faculty:*** **Zaid Abdo, Hirotachi Abo, Lyudmyla Barannyk, Arie Bialostocki, Dora Bialostocki, Monte Boisen, Rob Ely, Frank Gao, Jennifer Johnson-Leung, Paul Joyce, Stephen M. Krone, Mark J. Nielsen, Cynthia M. Piez, Brooks Roberts, Matthew Rudd, Hunter S. Snevily, Kirk C. Trigsted, Hong Wang.**

The Department of Mathematics offers a wide variety of majors and minors. In addition to the degree programs described below, many students pursue joint majors in mathematics and other disciplines that utilize mathematics. The most popular of these are mathematics/computer science and mathematics/physics. A joint major is obtained by completing the degree requirements for both majors. Minor programs are described below under "Undergraduate Curricular Requirements."

At the graduate level, the department offers the M.S., M.A.T., and Ph.D. degrees in mathematics. Graduate training in mathematics prepares students for careers in teaching or research and development. Employment opportunities include universities, colleges, industries, and government agencies. The Ph.D. is generally required for teaching and research at the university level. The M.S. qualifies students to teach at junior colleges, some four-year colleges, and for many positions in industry. The M.A.T. prepares students for secondary teaching and for some junior college positions. A baccalaureate degree in mathematics is generally required for admission to the graduate program; however, many students of science and technology can be admitted to the program with few undergraduate deficiencies.

The need for persons with quantitative skills is increasing dramatically as the world grows more complex. Mathematicians and statisticians have employment opportunities in business, industry, government, and teaching. Training in mathematics, with its emphasis on problem solving, analysis, and critical thinking, is excellent preparation for graduate programs in engineering, science, business, or law. In fact, persons planning careers in almost any field will find their opportunities enhanced by the study of mathematics and statistics. The programs are intended to provide students just such enhancement. It is generally the case that the person who develops his or her quantitative skills has increased ability to attack many of the complex problems of society. Advances in science, technology, the social sciences, business, industry, and government become more and more dependent on precise analysis and the extraction of information from large quantities of data. Environmental problems, for example, require careful analysis by persons (or teams of persons) with skills in mathematics, statistics, and computer science as well as in biology, geology, physics, and many other fields.

The demand for teachers of mathematics is greater now than ever before. Nearly every school district in the nation has a shortage of teachers trained in mathematics. UI offers a broadly based program leading to teacher certification, through enrollment either in the Department of Mathematics or in the College of Education and completion of a major or minor in mathematics.

Mathematics. The body of mathematical knowledge that has grown over the past 2,000 years is a magnificent human achievement, and it is growing more rapidly than ever before. The habits of systematic and creative thought developed in the study of mathematics are recognized as invaluable in most areas of human endeavor. University of Idaho's B.S. options in mathematics are designed to introduce the student to the excitement of mathematical ideas; they allow the maximum possible freedom to explore those areas of mathematics that the student finds most interesting.

The department has a sound program in mathematics with a proven record of preparing students for successful graduate study at the very best universities in the nation. There are sequences of courses in calculus, advanced calculus, linear algebra, differential equations, number theory, abstract algebra, topology, geometry, statistics, complex analysis, combinatorics and mathematical analysis. Students of mathematics who do not go to graduate school are well prepared for industrial, governmental, or teaching jobs if they have some additional exposure to computer science, education, or one of the natural, social, or applied sciences.

Applied Mathematics. Many of the greatest achievements in mathematics were inspired by problems in the natural sciences; today mathematics has wide application in both the natural and social sciences. Applied mathematics provides a broad arena for intellectual and creative impulses of people. The applied options in the mathematics B.S. degree allows a choice of the actuarial science and finance, computation, operations research, scientific modeling, or statistics options. Each of these is discussed briefly below. Many students interested in applications of mathematics pursue a joint major in some other department.

Applied--Actuarial Science and Finance Option. An actuary applies mathematics and statistics to forecasting problems. Actuaries are employed by financial institutions, government, insurance companies, and international corporations. They address problems as diverse as economic fluctuations, population demographics, resource consumption, medical insurance rates, and retirement needs. Actuaries are in great demand and have many interesting career opportunities leading often to high management positions. Admission to the actuarial profession is governed by a series of examinations administered by the actuarial societies. The first two examinations can be taken by undergraduates, and the rest are usually taken while working in the industry. The first two examinations are given locally. Our actuarial science and finance option, review seminars, and summer internship program with actuarial companies prepare students for these tests.

Applied--Computation Option. The advent of computers has changed nearly every aspect of society. As computation has become both more important and more feasible, it has inspired the development of several fields of study within mathematics. The computation option of the applied mathematics degree provides training in the mathematics applicable to computer science and technology. Many students pursue this option jointly with a computer science major.

Applied--Operations Research Option. This option is designed to prepare students for careers in business planning and management. The emphasis of study is on the mathematics used in modeling and analysis of real-world problems. This program is an excellent preparation for students planning to pursue an MBA degree.

Applied—Scientific Modeling Option. The role of modeling is essential in modern interdisciplinary research involving mathematics and the sciences. This option gives students an opportunity to learn about mathematical modeling with particular emphasis on the life sciences and the physical sciences. It provides an opportunity for students to create a very strong double major program and provides ideal preparation for future graduate training in the sciences.

Applied--Statistics Option. Statistics encompasses course work in designing and analyzing experiments, planning and interpreting surveys, and exploring relationships among variables observed on social, physical, and biological phenomena. The applied nature of the program allows the student to develop data analysis tools for such diverse areas as business and economics, crop and animal production, biological sciences, human behavior, education, engineering, and natural resource management.

Faculty members in the Department of Mathematics will be happy to answer questions about specific programs and courses. Such questions can also be addressed to the department chair (Brink 300; phone 208/885-6742).

Courses

See Part 6 for courses in Mathematics (Math).

Undergraduate Curricular Requirements

MATHEMATICS (B.S.)

Required course work includes the university requirements (see regulation J-3) and:

Basic courses:
Math 170 Analytic Geometry and Calculus I (4 cr)
Math 175 Analytic Geometry and Calculus II (4 cr)
Math 275 Analytic Geometry and Calculus III (3 cr)
Math 330 Linear Algebra (3cr)

And one of the following options:

A. General Option

This is the traditional curriculum in Mathematics. It is more mathematically rigorous than the other options. It is especially good for secondary education majors and students intending to go to graduate school in Mathematics or other sciences.

Math Courses:
Math 215 Introduction to Higher Mathematics (3 cr)
Math 461 Abstract Algebra (3 cr)
Math 462 Abstract Algebra or Math 472 Introduction to Analysis 2 (3 cr)
Math 471 Introduction to Analysis 1 (3 cr)
Math electives in courses numbered 303-499 or Stat 301 (6 cr)
Math electives in courses numbered 401-499 or Math 385 (6 cr)
Supporting Courses:

Physics 211, 212 Engr Physics I, II and either Physics 213 or an upper division physics course (except Phys 371) with a Math 170 prerequisite (to acquaint the students with an area in which math is systematically applied); upon approval of the department, substitution of other courses to meet this requirement may be allowed (9 cr)

B. Applied - Statistics Option

The emphasis is on the design and analysis of experiments. With a major or minor in another department this is an excellent preparation for work in industry or for graduate school in Statistics.

Math Courses:
Math 451 Probability Theory (3 cr)
Math 452 Mathematical Statistics (3 cr)
At least two courses from the following (6 cr):
Math 395 Analysis of Algorithms (3 cr)
Math 426 Discrete Optimization (3 cr)
Math 432 Numerical Linear Algebra (3 cr)
Math 433 Numerical Analysis (3 cr)

Math 471 Introduction to Analysis 1 (3 cr)
Math 472 Introduction to Analysis 2 (3 cr)

Supporting Courses:

CS 112 Introduction to Problem Solving and Programming or CS 120 Computer Science I (3-4 cr)
Stat 401 Statistical Analysis (3 cr)
Stat 423 Beginning SAS Programming (1 cr)
One course selected from the following (3-4 cr):
- Stat 251 Statistical Methods (3 cr)
- Stat 271 Statistical Inference and Decision Analysis (4 cr)
- Stat 301 Probability and Statistics (recommended) (3 cr)

At least two courses from the following (6 cr):
- Econ 353 Quantitative Economics and Forecasting (3 cr)
- Math 453 Stochastic Models (3 cr)
- Stat 422 Sample Survey Methods (3 cr)
- Stat 507 Experimental Design (3 cr)
- Stat 550 Regression (3 cr)
- Stat 514 Nonparametric Statistics (3 cr)
- Stat 519 Multivariate Analysis (3 cr)
- Stat 555 Statistical Ecology (3 cr)

Approved electives in fields where statistics is applied (not to be in Statistics (Stat) courses) (6 cr)

C. Applied - Computation Option

The emphasis is on the mathematics related to computer science and technology. With a major or minor in computer sciences this is a good preparation for work in the computer industry.

Math courses:

Math 176 Discrete Mathematics (3 cr)
Math 385 Theory of Computation (3 cr)
Math 395 Analysis of Algorithms (3 cr)
Math 432 Numerical Linear Algebra or 426 Discrete Optimization (3 cr)
Math 433 Numerical Analysis (3 cr)
Two additional math courses numbered 400-499 (6 cr)
At least two courses from the following, incl at least one course numbered 376 or above (6 cr):
- Math 326 Linear Optimization (3 cr)
- Math 376 Discrete Mathematics II (3 cr)
- Math 476 Combinatorics (3 cr)
- Stat 301 Probability and Statistics (3 cr)

Supporting courses:

CS 120 Computer Science I (4 cr)
CS 121 Computer Science II (4 cr)

D. Applied – Scientific Modeling Option

The emphasis is on the mathematics used to model phenomena in the sciences. With a second major in a science this provides ideal preparation for graduate school.

Math courses:

Math 310 Ordinary Differential Equations (3 cr)
Math 451 Probability Theory (3 cr)
Math 437 Mathematical Biology or WLF 552 Ecological Modeling (3 cr)

Five Additional courses from the following:

Math 326 Linear Optimization (3 cr)
Math 371 Mathematical Physics (3 cr)
Math 376 Discrete Mathematics II (3 cr)
Math 420 Complex Variables (3 cr)
Math 426 Discrete Optimization (3 cr)
Math 432 Numerical Linear Algebra (3 cr)
Math 433 Numerical Analysis (3 cr)
Math 435 Topics in Applied Mathematics (cr arr)
Math 452 Mathematical Statistics (3 cr)
Math 453 Stochastic Models (3 cr)
Math 471 Introduction to Analysis 1 (3 cr)
Math 472 Introduction to Analysis 2 (3 cr)
Math 476 Combinatorics (3 cr)
Math 480 Partial Differential Equations (3 cr)
Stat 301 Probability and Statistics (3 cr)

Supporting courses:

CS 112 Introduction to Problem Solving and Programming or CS 120 Computer Science I (3-4 cr)
Stat 301 Probability and Statistics or Math 452 Mathematical Statistics (3 cr)

Two courses at the 300 level or above in one area of science, engineering, or other quantitative area.

E. Applied - Actuarial Science and Finance Option

This curriculum provides the background to become an actuary and work in the insurance industry, or to work in finance.

Math courses:
- Math 310 Ordinary Differential Equations (3 cr)
- Math 451 Probability Theory (3 cr)
- Math 452 Mathematical Statistics (3 cr)
- In addition to the above courses, an additional three math courses numbered above 400, excluding Math 513-519 (9 cr)

Supporting courses:
- Acct 201 Introduction to Financial Accounting (3 cr)
- Acct 202 Introduction to Managerial Accounting (3 cr)
- Bus 301 Financial Management (3 cr)
- CS 112 Introduction to Problem Solving and Programming or CS 120 Computer Science I (3-4 cr)
- Econ 201 Principles of Economics (3 cr)
- Econ 202 Principles of Economics (3 cr)
- Stat 401 Statistical Analysis (3 cr)
- Stat 423 Beginning SAS Programming (1 cr)
- At least two course selected from the following (6 cr):
  - Bus 302 Intermediate Financial Management (3 cr)
  - Bus 463 Portfolio Management (3 cr)
  - Bus 481 International Finance (3 cr)
  - Econ 351 Intermediate Macroeconomic Analysis (3 cr)
  - Econ 352 Intermediate Microeconomic Analysis (3 cr)
  - Both of the following:
    - Bus 364 Insurance (3 cr)
    - Math 455 Applied Actuarial Science (1 cr)
- One course selected from the following (3-4 cr):
  - Stat 301 Probability and Statistics (recommended) (3 cr)
  - Stat 251 Statistical Methods (3 cr)
  - Stat 271 Statistical Inference and Decision Analysis (4 cr)
- One course selected from the following (3 cr):
  - Econ 353 Quantitative Economics and Forecasting (3 cr)
  - Stat 433 Econometrics (3 cr)
  - Stat 550 Regression (3 cr)

F. Applied - Operations Research Option

The emphasis is on the mathematics used in the modeling and analysis of problems from business and industry.

Math courses:
- Math 326 Linear Optimization (3 cr)
- Math 426 Discrete Optimization (3 cr)
- Math 451 Probability Theory (3 cr)
- Math 453 Stochastic Models (3 cr)
- Math 476 Combinatorics (3 cr)
- At least one course from the following (3 cr):
  - Math 310 Ordinary Differential Equations (3 cr)
  - Math 376 Discrete Mathematics II (3 cr)
  - Math 452 Mathematical Statistics (3 cr)
  - Stat 401 Statistical Analysis (3 cr)
  - Any other 400-level math course

Supporting courses:
- Acct 202 Introduction to Managerial Accounting (3 cr)
- Bus 370 Introduction to Operations Management (3 cr)
- CS 112 Introduction to Problem Solving and Programming or CS 120 Computer Science I (3-4 cr)
- Stat 271 Statistical Inference and Decision Analysis or 301 Probability and Statistics (3-4 cr)
- Four of the following courses (two must be above 400) (12 cr):
  - Bus 350 Management Information Systems (3 cr)
  - Bus 355 Systems Analysis and Design (3 cr)
  - Bus 378 Project Management (3 cr)
  - Bus 439 Systems and Simulation (3 cr)
  - Bus 456 Quality Management (3 cr)
  - Bus 472 Operations Planning and Scheduling (3 cr)
  - Econ 453/Stat 433 Econometrics (3 cr)

Academic Minor Requirements

MATHEMATICS MINOR

Math 170 Analytic Geometry and Calculus I (4 cr)
Math 175 Analytic Geometry and Calculus II (4 cr)
Six math courses chosen from Math 275, Stat 301, and math courses numbered 303-499 (18 cr)

Graduate Degree Programs

Candidates must fulfill the requirements of the College of Graduate Studies and of the Department of Mathematics. See the College of Graduate Studies section of Part 4 for the general university requirements applicable to each degree.

Master of Science in Mathematics. General M.S. requirements apply. An undergraduate major in mathematics or its equivalent is a prerequisite. Of the minimum of 30 credits required for this degree, at least 18 credits must be in mathematics at the 500 level (excluding Math 500, 510-519, 599,seminars, and directed study); the remaining 12 credits may include 400 and 500 level courses in mathematics, and 300 or 400 level courses in supporting areas. A thesis is not required, but a three-hour comprehensive written examination covering 6 mathematics courses chosen by the student (with at least 5 at the 500 level) is required.

Master of Arts in Teaching. General M.A.T. requirements apply. Under advisement of the major professor and committee, a broadly based study plan is designed taking into consideration the candidate's interests and teaching needs. The plan should include mathematics courses from several pure mathematics areas, for example, algebra, topology, analysis, geometry, and number theory. A three-hour written examination is given over the courses in the study plan. Students entering the M.A.T. program will be considered deficient if they have not completed a standard sequence in calculus (equivalent to Math 170-175-275).

The M.A.T. degree in mathematics may also be obtained via distance learning. This distance learning program is designed to meet the needs of in-service teachers. The requirements outlined above apply, but here the study plan is designed using courses that are available by video or in summer programs on-campus or at off-campus sites.

Doctor of Philosophy. In addition to the general university requirements for the Ph.D., the department requires that 36 credits of graduate-level mathematics (excluding Math 500, 510-519, 599, 600, seminars, and directed study) be completed or transferred (with at least 18 credits completed at UI). The department requires the ability to translate into English from mathematical work in one of the languages: Chinese, French, German, and Russian; a substitute language is sometimes allowed.

The preliminary examination must be passed no later than the end of the student’s fourth year of graduate study and before the dissertation is started. The preliminary examination is composed of three parts covering the areas algebra, analysis, and one of topology, combinatorics, or differential equations. These are given all in a one-week period and are graded by a departmental committee that may recommend additional testing in one or more of the specific areas if satisfactory results are not obtained. The committee may also recommend an oral examination in certain areas by the supervisory committee.

The dissertation must be of an original research nature and be in an area spanned by the research interests of the major professor. A final examination that amounts to a defense of the dissertation is required. Acceptability of the dissertation is to be determined by the student’s major professor and graduate committee.