

MATHEMATICS B.A. - COMBINATORICS AND OPTIMIZATION

This degree concentration differs from the BA in Mathematics without a concentration only in the Concentration Requirements.

General Degree Requirements

To earn a baccalaureate degree, all students must complete successfully, in addition to any other requirements, the University of Montana General Education Requirements. Please refer to the General Education Requirements page (<https://catalog.umat.edu/academics/general-education-requirements/>) for more information.

Additional requirements for graduation can be found on the Degree/Certificate Requirements for Graduation page (<https://catalog.umat.edu/academics/graduation-requirements/>).

Unless otherwise noted in individual program requirements, a minimum grade point average of 2.00 in all work attempted at the University of Montana-Missoula is required for graduation. Please see the Academic Policies and Procedures page (<https://catalog.umat.edu/academics/policies-procedures/>) for information on how your GPA is calculated.

Courses taken to satisfy the requirements of a major, minor, or certificate program must be completed with a grade of C- or better unless a higher grade is noted in the program requirements.

Bachelor of Arts - Mathematics; Combinatorics and Optimization Concentration

Credit Requirements

The major specific credits are much lower for double-majors and for students completing a minor in another subject:

- 41 credits for students completing a second major, and
- 46 credits for students completing a minor.

GPA Requirement

- A cumulative GPA of 2.0 is required for all courses used to fulfill major requirements.
- In addition, a cumulative GPA of 2.0 is required for all mathematical sciences courses used to fulfill major requirements. (Mathematical sciences courses are those with a prefix of M or STAT.)

Course Requirements

Code	Title	Hours
Core Courses		
Complete all of the following courses:		
M 171	Calculus I	4
or M 181	Honors Calculus I	
M 172	Calculus II	4
or M 182	Honors Calculus II	
M 210	Introduction to Mathematical Software	3
M 221	Introduction to Linear Algebra	4

M 273	Multivariable Calculus	4
M 300	Undergraduate Mathematics Seminar	1
M 307	Introduction to Abstract Mathematics	3

Electives ¹

Complete 18-23 credits (6-7 courses) of the following courses. 18-23
At least three courses must be at the 400 level. See note below about the elective credit requirement.

M 274	Introduction to Differential Equations
M 301	Teaching Mathematics with Technology
M 325	Discrete Mathematics
M 326	Number Theory
M 361	Discrete Optimization
M 362	Linear Optimization
M 381	Advanced Calculus I
M 412	Partial Differential Equations
M 414	Deterministic Models
M 429	History of Mathematics ²
M 431	Abstract Algebra I
M 432	Abstract Algebra II
M 439	Euclidean and NonEuclidean Geometry
M 440	Numerical Analysis
M 445	Statistical, Dynamical, and Computational Modeling
M 461	Data Science Analytics
M 462	Theoretical Basics of Big Data Analytics and Real Time Computation Algorithms
M 472	Introduction to Complex Analysis
M 473	Introduction to Real Analysis
M 485	Graph Theory
STAT 342	Probability and Simulation
STAT 421	Probability Theory
STAT 422	Mathematical Statistics
STAT 452	Statistical Methods II

Science Requirement ³

Complete 18 credits in at most 3 areas selected from astronomy (ASTR), biology (BIO*), chemistry (CHMY), computer science (CSCI, except CSCI TR*), economics (ECNS), forestry (FORS, WILD), geosciences (GEO), management information systems (BMIS), and physics (PHSX). 18

Language/Computer Science Requirement ⁴

Complete either the General Education Language Requirement or complete one of the following courses: 3

CSCI 150	Introduction to Computer Science
CSCI 151	Interdisciplinary Computer Science I
CSCI 152	Interdisciplinary Computer Science II

Combinatorics & Optimization Concentration

These courses count toward the mathematics electives requirement

Combinatorics & Optimization Concentration Core Courses

Complete all of the following courses:

M 361	Discrete Optimization
M 362	Linear Optimization
M 485	Graph Theory

Combinatorics & Optimization Concentration Elective Courses

Complete one of the following courses:

CSCI 332	Advanced Data Structures and Algorithms
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M 414	Deterministic Models
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M 440	Numerical Analysis
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STAT 342	Probability and Simulation
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Total Hours**62-67**

¹ Students completing a second major need take only 18 credits. Students completing a minor in another subject need take only 20 credits. All other students must complete 23 credits and 7 courses. At least 4 of the courses in this category must be taken at UM-Missoula (only 3 if M 307 is taken at UM-Missoula).

² M 429 is also an advanced college writing course. Most Mathematics majors use M 429 to meet the advanced college writing general education requirement.

³ Students completing a minor in another subject or a second major are exempt from this requirement. Transfer courses listed on the transcript as CSCI TR* may include course work in other areas such as Computer Applications (CAPP) and therefore do not count towards this requirement unless a student successfully petitions the Department of Mathematical Sciences.

⁴ Students completing a second major are exempt from this requirement.

Code	Title	Hours
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Elective Computer Labs and Independent Study Courses

Computer labs and independent study courses from the following list are optional; if taken (0-2 credits), they count toward the total number of credits required for the Mathematics Elective requirement.

M 363	Linear Optimization Laboratory
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M 392	Independent Study
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M 492	Independent Study
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STAT 457	Computer Data Analysis I
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STAT 458	Computer Data Analysis II
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