MATHEMATICS B.A. - COMBINATORICS AND OPTIMIZATION

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

Bachelor of Arts - Mathematics; Combinatorics & Optimization Concentration

College of Humanities & Sciences

Degree Specific Credits: 67

Required Cumulative GPA: 2.0

Catalog Year: 2018-2019

Note on degree specific credits: The degree specific credits are much lower for double-majors and for students completing an additional minor (in another subject): 41 credits for students completing a second major, and 46 credits for students completing a minor.

Note on the GPA requirement:

1. A cumulative GPA of 2.0 is required for all courses used to fulfill major requirements.
2. 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.)

General Education Requirements

Summary

Code	Title	Hours
Mathematics Core Courses		23
Upper-Division Mathematics Requirement		23
Upper-Division Elective Courses		
Science Requirement		18
Foreign Language/Computer Science Requirement		3
Requirements for the Combinatorics & Optimization Concentration (usually fulfilled with courses that count towards the Upper-Division Mathematics Requirement)		
Total Hours		67

Mathematics Core Courses

Code	Title	Hours
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
Total Hours		23

Minimum Required Grade: C-

Upper-Division Mathematics Requirement

Rule: Complete 23 credits in this category.

Note:

1. Students completing a minor (in another subject) need take only 20 credits.
2. Students completing a second major need take only 18 credits.

Upper-Division Elective Courses

Note:

1. Students completing a minor in another subject or a second major need take only 6 courses (totaling 18 credits or more).
2. Residency Requirement: 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).
3. Note that STAT 451 does not count toward this requirement.
4. In addition to counting towards this requirement, M 429 (History of Mathematics) is also an advanced college writing course. Most Mathematics majors use M 429 to meet the advanced college writing general education requirement.

Code	Title	Hours
Complete 7 courses from the following list; at least 3 of them must be at the 400 level:		
M 301	Mathematics Technology for Teachers	
M 311	Ordinary Differential Equations and Systems	
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	
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 341	Introduction to Probability and Statistics
STAT 421	Probability Theory
STAT 422	Mathematical Statistics
STAT 452	Statistical Methods II

Minimum Required Grade: C-

Upper-Division Elective Computer Labs

Rule: Computer labs from the following list are optional; if taken (0-2 credits), they count toward the total number of credits required for the Upper-Division Mathematics Requirement.

Code	Title	Hours
M 317	Ordinary Differential Equations Computer Lab	1
M 363	Linear Optimization Laboratory	1
M 418	Partial Differential Equations Computer Lab	1
STAT 457	Computer Data Analysis I	1
STAT 458	Computer Data Analysis II	1

Minimum Required Grade: C-

Science Requirement

Rule: Take 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).

Note:

1. Students completing a minor (in another subject) or a second major are exempt from this requirement.
2. 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.

Minimum Required Grade: C-

Foreign Language/Computer Science Requirement

Rule: Either complete the General Education Requirement "Group III: Modern and Classical Language" (not the symbolic systems exception), or take one course from the following list.

Note: Students completing a second major are exempt from this requirement.

Code	Title	Hours
Complete one of the following:		3
CSCI 100	Intro to Programming	
CSCI 126	Computation in the Sciences with Calculus	
CSCI 135	Fund of Computer Science I	
CSCI 136	Fund of Computer Science II	
Total Hours		3

Minimum Required Grade: C-

Requirements for the Combinatorics & Optimization Concentration

Rule: Complete the following subcategories.12-13 total credits required.

Combinatorics & Optimization Option: Core Courses

Code	Title	Hours
Complete all of the following courses:		
M 361	Discrete Optimization	3
M 362	Linear Optimization	3
M 485	Graph Theory	3
Total Hours		9

Minimum Required Grade: C-

Combinatorics & Optimization Concentration: Elective Courses

Code	Title	Hours
Complete one of the following courses:		3-4
CSCI 332	Design/Analysis of Algorithms	
M 414	Deterministic Models	
M 440	Numerical Analysis	
STAT 341	Introduction to Probability and Statistics	
Total Hours		3-4

Minimum Required Grade: C-