

**APPROVED BY SENATE**  
**12/06/2021**

# 10KV3894BSLA: MATHEMATICS: DATA OPTIMIZATION, BSLAS

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## In Workflow

1. U Program Review (dforgacs@illinois.edu; eastuby@illinois.edu; aledward@illinois.edu; mhazen@illinois.edu)
2. 1257 Head (verahur@illinois.edu)
3. KV Dean (las-catalog@illinois.edu)
4. University Librarian (jpwilkin@illinois.edu)
5. Provost (kmartens@illinois.edu; mhazen@illinois.edu)
6. Senate EPC (bjlehman@illinois.edu; moorhouz@illinois.edu; kmartens@illinois.edu)
7. Senate (jtempel@illinois.edu)
8. U Senate Conf (none)
9. Board of Trustees (none)
10. IBHE (none)
11. HLC (kmartens@illinois.edu)
12. DMI (eastuby@illinois.edu; aledward@illinois.edu; dforgacs@illinois.edu)

## Approval Path

1. Thu, 04 Nov 2021 21:45:57 GMT  
Deb Forgacs (dforgacs): Approved for U Program Review
2. Thu, 04 Nov 2021 22:28:37 GMT  
Vera Hur (verahur): Approved for 1257 Head
3. Fri, 05 Nov 2021 14:38:24 GMT  
Andrea Ray (aray): Approved for KV Dean
4. Fri, 05 Nov 2021 14:44:54 GMT  
John Wilkin (jpwilkin): Approved for University Librarian
5. Mon, 08 Nov 2021 17:25:30 GMT  
Kathy Martensen (kmartens): Approved for Provost

## History

1. Jun 10, 2019 by Deb Forgacs (dforgacs)

Date Submitted: Thu, 04 Nov 2021 20:52:57 GMT

## Viewing: 10KV3894BSLA : Mathematics: Data Optimization, BSLAS

Changes proposed by: Andrea Ray

### Proposal Type:

Concentration (ex. Dietetics)

### This proposal is for a:

Revision

## Administration Details

### Official Program Name

Mathematics: Data Optimization, BSLAS

### Sponsor College

Liberal Arts & Sciences

**Sponsor Department**

Mathematics

**Sponsor Name**

Randy McCarthy, Professor and Director of Undergraduate Studies

**Sponsor Email**

rmccrthy@illinois.edu

**College Contact**

Stephen R. Downie

**College Contact Email**

sdownie@illinois.edu

**List the role for rollbacks (which role will edit the proposal on questions from EPC, e.g., Dept Head or Initiator) and/or any additional stakeholders. Purpose: List here who will do the editing work if proposal needs rolled back. And any other stakeholders.**

Alison Champion, abc@illinois.edu

**Does this program have inter-departmental administration?**

No

**Proposal Title****Effective Catalog Term**

Fall 2022

**Provide a brief, concise description (not justification) of your proposal.**

Revision to the BSLAS, Major in Mathematics, College of Liberal Arts & Sciences. Includes revisions to five concentrations: General Mathematics (no concentration selected), Applied Mathematics, Operations Research, Graduate Preparation, and Mathematics Teaching.

**List here any related proposals/revisions and their keys. Example: This BS proposal (key 567) is related to the Concentration A proposal (key 145) and the Concentration B proposal (key 203).**

This Mathematics BSLAS proposal (key 230) is related to the Applied Mathematics Concentration (key 731) and the Mathematics Data Optimization Concentration (key 730) and the Mathematics Teaching Option Concentration (key 729) and the Mathematics Doctoral Preparation Concentration (key 728)

## Program Justification

### Why are these changes necessary?

The Operations Research concentration will be renamed to Data Optimization. The new name gives a more meaningful and modern description of the coursework.

We propose that the 12 advanced on-campus hours required for this major should not be S/U-graded courses. This should apply also to the free-choice advanced MATH courses. This helps maintain the quality of a major which did not have S/U-graded courses available to fill requirements when created but now does.

Computer Science is in the process of discontinuing CS 125 with replacement CS 124. We add the new course while leaving CS 125 for cases of students with transfer credit.

The current supporting coursework requirement mentions lists "any minor" as a possibility, but several campus minors may be completed almost entirely with coursework that is part of the major or offered through the Department of Mathematics, without meeting LAS requirements for supporting coursework. The restrictions on supporting coursework are stated more clearly in the revision.

This program provides a solid foundation in mathematics. Objectives include giving students technical proficiency in calculus and linear algebra; ability to construct proofs and recognize when proofs are complete; ability to use theorems in order to solve problems, and ability to translate real-world problems into mathematical problems and solve them. Careers range from programming to teaching to data analysis. Students pursue graduate studies in a variety of fields, including mathematics, statistics, computer science, and many fields in which mathematics is applied.

## Instructional Resources

**Will there be any reduction in other course offerings, programs or concentrations by your department as a result of this new program/proposed change?**

No

**Does the program include other courses/subjects impacted by the creation/revision of this program?**

No

## Program Regulation and Assessment

**Briefly describe the plan to assess and improve student learning, including the program's learning objectives; when, how, and where these learning objectives will be assessed; what metrics will be used to signify student's achievement of the stated learning objectives; and the process to ensure assessment results are used to improve student learning. (Describe how the program is aligned with or meets licensure, certification, and/or entitlement requirements, if applicable).**

Learning objectives:

Students should be able to construct proofs and recognize when a proof is complete. Students should be able to use theorems in order to solve problems without going back to first principles. Students should have technical proficiency in calculus and linear algebra. Students should be able to translate real-world problems into mathematics to solve them.

These learning objectives are measured through annual surveys of students (senior survey for all graduating seniors in late spring; general math major surveys at approximately the same time for all others); annual reviews by the Math Undergraduate Office of performance of math majors in key classes; feedback from the Math Department Advisory Board (MDAB); and reviews of special initiatives.

Performance in specific courses demonstrates the first three objectives so long as our syllabus coverage and grading standards are upheld, with reviews both of specific grades and performance compared with non-majors enrolled in the same courses. Feedback from student surveys and the MDAB assists the review of the fourth. The student surveys and course reviews also help us to identify areas of special concern for specific subgroups of students or specific courses.

Results and recommendations are shared by the Math Undergraduate Office with the department's Undergraduate Affairs Committee, which is tasked with overseeing and revising the undergraduate curriculum. Results are also shared with the full department faculty meeting once per semester.

Is the career/profession for graduates of this program regulated by the State of Illinois?

No

## Program of Study

"Baccalaureate degree requires at least 120 semester credit hours or 180 quarter credit hours and at least 40 semester credit hours (60 quarter credit hours) in upper division courses" (source: <https://www.ibhe.org/assets/files/PrivateAdminRules2017.pdf>). For proposals for new bachelor's degrees, if this minimum is not explicitly met by specifically-required 300- and/or 400-level courses, please provide information on how the upper-division hours requirement will be satisfied.

All proposals must attach the new or revised version of the Academic Catalog program of study entry. Contact your college office if you have questions.

### Revised programs

Data Optimization Comparative Table.docx  
Data Optimization Academic Catalog.docx  
Math Major Senate Curriculum Revision for LAS.docx

Attach a side-by-side comparison with the existing program AND, if the revision references or adds "chose-from" lists of courses students can select from to fulfill requirements, a listing of these courses, including the course rubric, number, title, and number of credit hours.

Catalog Page Text - Overview Tab

### Statement for Programs of Study Catalog

**General education: Students must complete the Campus General Education (<https://courses.illinois.edu/gened/DEFAULT/DEFAULT/>) requirements including the campus general education language requirement.**  
**Minimum required major and supporting course work: Normally equates to 46-49 hours including 27-35 hours of mathematics beyond calculus, 3-4 hours of computer science, and 12 hours of supporting coursework.**  
**Twelve hours of 300- and 400-level non-S/U-graded courses in the major must be taken on this campus.**  
**Minimum hours required for graduation: 120 hours.**

Code	Title	Hours
<b>Required Core Courses</b>		
MATH 241	Calculus III (Students should have credit for MATH 220/MATH 221 and MATH 231 before enrolling in MATH 241.)	4
MATH 347 or MATH 348	Fundamental Mathematics Fundamental Mathematics-ACP	3-4
MATH 416	Abstract Linear Algebra (Students may not receive credit for both MATH 416 and either ASRM 406 or MATH 415.)	3
MATH 417 or MATH 427	Intro to Abstract Algebra Honors Abstract Algebra	3
MATH 424 or MATH 444 or MATH 447	Honors Real Analysis (If MATH 424 or MATH 447 is completed, a requirement for the Math Doctoral Preparation concentration has been satisfied.) Elementary Real Analysis Real Variables	3
STAT 400	Statistics and Probability I	4
MATH 461 or STAT 400	Probability Theory (If STAT 400 is completed, a requirement for the Data Optimization concentration has been satisfied.) Statistics and Probability I	3 or 4

CS 101 or CS 124 or CS 125	Intro Computing: Engrg & Sci Introduction to Computer Science I Introduction to Computer Science	3-4
Approved supporting coursework outside Mathematics. (Supporting coursework may be completed with 12 advisor-approved hours of a single math-related area outside of MATH/ASRM not used for a major requirement and must include at least one advanced course; ANY minor which is fulfilled with at least 12 hours of courses, including one advanced course, not used for the major nor cross-listed with MATH/ASRM; or any double major or dual degree.)		12
<b>Data Optimization Courses</b>		
CS 357	Numerical Methods I	3
MATH 412 or MATH 484	Graph Theory Nonlinear Programming	3
STAT 410 or STAT 420	Statistics and Probability II Methods of Applied Statistics	3
MATH 482	Linear Programming	3
Total Hours		46-49

## Program Relationships

Corresponding Program(s):

**Corresponding Program(s)**

Mathematics, BSLAS

## Program Features

**Academic Level**

Undergraduate

**Is This a Teacher Certification Program?**

No

**Will specialized accreditation be sought for this program?**

No

**Additional concentration notes (e.g., estimated enrollment, advising plans, etc.)**

No change to current admission requirements: Freshmen must meet LAS Admissions requirements. On-campus transfer students must complete Math 241 and Math 347 and have an on-campus major GPA of at least 2.50. Off-campus transfer students must meet LAS transfer requirements and complete at least Calculus II (sophomore transfer) or Calculus III and computer programming (junior transfer) with grades of B or higher in each math course taken. Admission to the Teaching concentration is via the application used for all LAS Secondary Education minor applicants. Admissions is handled by the Office of Undergraduate Admissions for freshmen and off-campus transfers. On-campus transfers are managed through the LAS Student Academic Affairs Office with approval from the Math Undergraduate Director. Admission to the Secondary Education minor and Teaching concentration is handled by the College of Education in cooperation with Mathematics. Academic advising is provided by the Math Undergraduate Office with assistance from faculty on the Undergraduate Advising Committee. Supplemental academic advising for the Secondary Education minor is provided by the College of Education, but primary advising for Teaching concentration students is provided by Mathematics.

## **Delivery Method**

**This program is available:**

On Campus - Students are required to be on campus, they may take some online courses.

## **Enrollment**

**Describe how this revision will impact enrollment and degrees awarded.**

No change anticipated.

## **Budget**

**Are there budgetary implications for this revision?**

No

**Will the program or revision require staffing (faculty, advisors, etc.) beyond what is currently available?**

No

## **Financial Resources**

**How does the unit intend to financially support this proposal?**

We anticipate the same resources will be devoted to the revised program as are devoted to the program in its current form.

**Will the unit need to seek campus or other external resources?**

No

## **Resource Implications**

### **Facilities**

**Will the program require new or additional facilities or significant improvements to already existing facilities?**

No

### **Technology**

**Will the program need additional technology beyond what is currently available for the unit?**

No

## Non-Technical Resources

Will the program require additional supplies, services or equipment (non-technical)?

No

## Resources

For each of these items, be sure to include in the response if the proposed new program or change will result in replacement of another program(s). If so, which program(s), what is the anticipated impact on faculty, students, and instructional resources? Please attach any letters of support/acknowledgement from faculty, students, and/or other impacted units as appropriate.

## Faculty Resources

Please address the impact on faculty resources including any changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc. Describe how the unit will support student advising, including job placement and/or admission to advanced studies.

No change anticipated.

## Library Resources

Describe your proposal's impact on the University Library's resources, collections, and services. If necessary please consult with the appropriate disciplinary specialist within the University Library.

Current collections and services are adequate for the proposed program.

## EP Documentation

EP Control Number

EP:22.047

This proposal requires HLC inquiry

No

## DMI Documentation

Banner/Codebook Name

BSLAS:Math:Operations Res-UIUC

Program Code:

10KV3894BSLA

**Conc Code**

3894

**Degree Code**

BSLAS

**Major Code**

0439

**Program Reviewer Comments**

**Deb Forgacs (dforgacs) (Thu, 04 Nov 2021 20:05:53 GMT):**Rollback: requested

**Kathy Martensen (kmartens) (Mon, 08 Nov 2021 14:54:42 GMT):**Administrative approval: Does not change total hours required; does not restrict student choice.

**Kathy Martensen (kmartens) (Mon, 08 Nov 2021 17:25:19 GMT):**Retract previous comment about admin approval - will be packaged with other Math proposals, two of which involve concentration name changes and therefore cannot be admin approvals.

Key: 730





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## Proposal for revised curricula (degree, major, concentration, minor)

Submit completed proposals via email to Associate Dean Stephen R. Downie (sdownie@illinois.edu). Please obtain Executive Officer and School Director (if applicable) approval via email and forward with the proposal to LAS.

**Proposal Title:**

Revision to the Bachelor of Science in Liberal Arts & Sciences, Major in Mathematics, College of Liberal Arts & Sciences. Includes revisions to five concentrations: General Mathematics (no concentration selected), Applied Mathematics, Operations Research, Graduate Preparation, and Mathematics Teaching.

**For proposals with concentrations-** will you admit to the concentration(s) directly? Is a concentration required for graduation?

No; no

**Proposed effective date:** *(Proposals may not be implemented until they go through all necessary levels of approval. Proposed changes may not be publicized as final on any web sites, printed documents, etc. until written confirmation of final approval is issued. For LAS units, a fall semester effective term for all curricula will be requested, please indicate the proposed year).*

Fall 2022

**Sponsor(s):** Randy McCarthy, Professor and Director of Undergraduate Studies, Department of Mathematics, rmccrthy@illinois.edu

**College contact:** Stephen Downie, Associate Dean for Curricula and Academic Policy, College of Liberal Arts and Sciences, sdownie@illinois.edu

### PROGRAM DESCRIPTION and JUSTIFICATION

1) **Provide a brief description but concise description of your proposal.** For example, if proposing revisions to a curriculum, state specifically what is changing. Where applicable, note whether stated program changes include additional requirements in the form of prerequisite courses. Requests for curriculum revisions must be accompanied by a table which clearly outlines the current requirements and the proposed revisions. This information may be submitted as an appendix. See Appendix A for an example. Please provide pertinent information only.

We propose that the 12 advanced on-campus hours required for this major should not be S/U-graded courses. This should apply also to the free-choice advanced MATH courses. This helps maintain the

quality of a major which did not have S/U-graded courses available to fill requirements when created but now does.

Computer Science is in the process of discontinuing CS 125 with replacement CS 124. We add the new course while leaving CS 125 for cases of students with transfer credit.

The Operations Research concentration will be renamed to Data Optimization. The new name gives a more meaningful and modern description of the coursework.

The Graduate Preparation concentration will be renamed to Math Doctoral Preparation. The new name better describes the purpose of this concentration and should reduce student confusion regarding the fact that all concentrations are suitable as preparation for Mathematics master's programs or graduate work in other fields of study.

We reduce by one the number of required MATH courses in the Mathematics Teaching concentration. This concentration is typically completed in 7 terms instead of 8, due to student teaching. Removing one elective course significantly decreases the likelihood that a student will drop out of the concentration or need more than 4 years to graduate, while still providing a strong mathematical background that will prepare for teaching and for passing state tests. With the steep drop in enrollment in this program, often due to students dropping out of it or removing it from consideration after giving it serious thought, we anticipate that this change will make the program more attractive to students.

The current supporting coursework requirement mentions lists "any minor" as a possibility, but several campus minors may be completed almost entirely with coursework that is part of the major or offered through the Department of Mathematics, without meeting LAS requirements for supporting coursework. The restrictions on supporting coursework are stated more clearly in the revision.

In addition, there will be minor changes to accepted courses within concentrations.

2) **Provide a justification of the program**, including how your unit decided to create this program, highlights of the program objectives, and the careers, occupations, or further educational opportunities for which the program will prepare graduates, when appropriate.

This program provides a solid foundation in mathematics. Objectives include giving students technical proficiency in calculus and linear algebra; ability to construct proofs and recognize when proofs are complete; ability to use theorems in order to solve problems, and ability to translate real-world problems into mathematical problems and solve them. Careers range from programming to teaching to data analysis. Students pursue graduate studies in a variety of fields, including mathematics, statistics, computer science, and many fields in which mathematics is applied.

3) In addition, please provide an answer as to how your undergraduate degree (120 hours of coursework) will satisfy this requirement: IBHE requires that all degree programs contain at least 40 credit hours in upper division courses. Upper division courses have been described as 300- and 400-level coursework and some 200-level courses in which multiple prerequisites are required.

Major requirements include a minimum of 9-11 300-level and 400-level courses for a total of 27-34 credits. Math 241, 4 credits, is a requirement with multiple prerequisites. Supporting coursework

includes at least 1-2 advanced courses for 3-8 credits. A student's Advanced Composition course adds another 3-4 credits, and between language other than English, electives, supporting coursework, and additional major courses, we expect a student to have at least 3 more hours of upper division coursework, for a minimum of 40 upper division hours.

**Is this program interdisciplinary?** No

**If a proposal for a concentration-**

**will you admit to the concentration directly?** No

**is a concentration required for graduation?** No

**Will specialized accreditation be sought for this program?** No

## **ADMISSION REQUIREMENTS**

**1) Desired admissions term:** *For LAS units, a fall semester effective term for all curricula will be requested, please indicate the proposed year*

Fall, 2022

**Is this revision a change to the admission status of the program?** No.

**2) Provide a brief narrative description of the admission requirements for this program. Where relevant, include information about licensure requirements, student background checks, GRE and TOEFL scores, and admission requirements for transfer students. (degrees, majors, concentrations ONLY)**

No change to current admission requirements: Freshmen must meet LAS Admissions requirements. On-campus transfer students must complete Math 241 and Math 347 and have an on-campus major GPA of at least 2.50. Off-campus transfer students must meet LAS transfer requirements and complete at least Calculus II (sophomore transfer) or Calculus III and computer programming (junior transfer) with grades of B or higher in each math course taken. Admission to the Teaching concentration is via the application used for all LAS Secondary Education minor applicants.

**3) Describe how critical academic functions such as admissions and student advising are managed.**

Admissions is handled by the Office of Undergraduate Admissions for freshmen and off-campus transfers. On-campus transfers are managed through the LAS Student Academic Affairs Office with approval from the Math Undergraduate Director. Admission to the Secondary Education minor and Teaching concentration is handled by the College of Education in cooperation with Mathematics. Academic advising is provided by the Math Undergraduate Office with assistance from faculty on the Undergraduate Advising Committee. Supplemental academic advising for the Secondary Education minor is provided by the College of Education, but primary advising for Teaching concentration students is provided by Mathematics.

## **ENROLLMENT**

**1) Describe how this revision will impact enrollment and degrees awarded.**

For the Teaching concentration, it is hoped that this revision will revitalize this shrinking program. Otherwise, no changes are expected.

**2) Estimated Annual Number of Degrees Awarded (degrees, majors, concentrations ONLY)**

**Year 1: 150**

**Year 5 (or when fully implemented): 150**

**3) What is the matriculation term for this program? Fall**

**4) What is the typical time to completion of this program?**

4 years

**5) What are the minimum Total Credit Hours required for this program?**

120

**6) Delivery Method, what is the program's primary delivery method?**

Face to Face

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**5) MINORS ONLY:**

**Will the department limit enrollment in the minor?**

**Describe how the department will monitor admission to/enrollment in the minor.**

**Are there any prerequisites for the proposed minor? If yes, please list the courses and whether or not these course count in the total hours for the minor.**

**Other than certification via the students' degree audits, is there any additional planned mechanism to award/honor successful completion of the minor? If yes, please describe.**

N/A; not a minor

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## **BUDGET**

**1) Please describe any budgetary implications for this revision- addressing applicable personnel, facilities, technology and supply costs.**

None

**2) Will the revision require staffing (faculty, advisors, etc.) beyond what is currently available? If yes, please describe.**

No

**3) Please provide any additional budget information needed to effectively evaluate the proposal.**

N/A

## **RESOURCE IMPLICATIONS**

**1) Facilities- Will the program require new or additional facilities or significant improvements to already existing facilities? If yes, please outline the specific need and Year 1 and Year 5 cost.**

No

**2) Technology- Will the program need additional technology beyond what is currently available for the unit? If yes, please outline the specific need and Year 1 and Year 5 cost.**

No

**3) Non-Technical Resources- Will the program require additional supplies, services or equipment (non-technical)? If yes, please outline the specific need and Year 1 and Year 5 cost.**

No

## **RESOURCES**

**1) Faculty Resources: Please address the impact on faculty resources including any changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc. Describe how the unit will support student advising, including job placement and/or admission to advanced studies.**

Mathematics Teaching Concentration: This will have minimal impact on faculty, as a small decrease in required courses is offset by a small increase in students staying with this program.

Otherwise, no impact.

**2) Library Resources: Describe your proposal's impact on the University Library's resources, collections, and services. If necessary please consult with the appropriate disciplinary specialist within the University Library.**

Current collections and services are adequate for the proposed program.

**3) Instructional Resources: Will there be any reduction in other course offerings, programs or concentrations by your department as a result of this new program/proposed change? If yes, please describe.**

No

**4) Does this new program/proposed change result in the replacement of another program? If yes, please specify the program.**

No

**5) Does the program include any required or recommended subjects that are offered by other departments? If yes, please list the courses. Explain how these additional courses will be used by the program and provide letters of support from the departments.**

No

## FINANCIAL RESOURCES

### 1) How does the unit intend to financially support this proposal?

We anticipate the same resources will be devoted to the revised program as are devoted to the program in its current form.

### 2) Will the unit need to seek campus or other external resources? If yes, please provide a summary of the sources and an indication of the approved support.

No

**3) Are you seeking a change in the tuition rate or differential for this program?** (degrees, majors, concentrations ONLY) *If this program requires a tuition or differential change, initiate a discussion with the LAS curricula contact, LAS budget officer, and LAS Associate Dean.*

No

**4) Is this program requesting self-supporting status? (degrees, majors and concentrations ONLY)? If yes, please explain.**

No

## PROGRAM REGULATION & ASSESSMENT

**1) Briefly describe the plan to assess and improve student learning, including the program's learning objectives; when, how, and where these learning objectives will be assessed; what metrics will be used to signify student's achievement of the stated learning objectives; and the process to ensure assessment results are used to improve student learning.** Describe how the program is aligned with or meets licensure, certification, and/or entitlement requirements, if applicable.

Learning objectives:

Students should be able to construct proofs and recognize when a proof is complete. Students should be able to use theorems in order to solve problems without going back to first principles. Students should have technical proficiency in calculus and linear algebra. Students should be able to translate real-world problems into mathematics to solve them.

These learning objectives are measured through annual surveys of students (senior survey for all graduating seniors in late spring; general math major surveys at approximately the same time for all others); annual reviews by the Math Undergraduate Office of performance of math majors in key classes; feedback from the Math Department Advisory Board (MDAB); and reviews of special initiatives.

Performance in specific courses demonstrates the first three objectives so long as our syllabus coverage and grading standards are upheld, with reviews both of specific grades and performance compared with non-majors enrolled in the same courses. Feedback from student surveys and the MDAB assists the

review of the fourth. The student surveys and course reviews also help us to identify areas of special concern for specific subgroups of students or specific courses.

Results and recommendations are shared by the Math Undergraduate Office with the department's Undergraduate Affairs Committee, which is tasked with overseeing and revising the undergraduate curriculum. Results are also shared with the full department faculty meeting once per semester.

**2) Is the career/profession for graduates of this program regulated by the State of Illinois?** If yes, please describe.

Yes, only for the Mathematics Teaching concentration. This is a teacher licensure program with oversight from Council on Teacher Education for the Illinois State Board of Education.

## ACADEMIC CATALOG ENTRY

**1) All proposals must submit the major requirements (courses, hours) for the proposed curricula. Please see the University of Illinois Academic Catalog- <http://catalog.illinois.edu/> for your unit for an example of the entry.**

### General Mathematics

General education: Students must complete the Campus General Education requirements including the campus general education language requirement.

Minimum required major and supporting course work: Normally equates to 46-57 hours including 27-35 hours of mathematics beyond calculus, 3-4 hours of computer science, and 12 hours of supporting coursework. Twelve hours of 300- and 400-level non-S/U-graded courses in the major must be taken on this campus.

Minimum hours required for graduation: 120 hours.

Required Core Courses		
<a href="#">MATH 241</a>	Calculus III <sup>1</sup>	4
<a href="#">MATH 347</a>	Fundamental Mathematics	3-4
<a href="#">or MATH 348</a>	Fundamental Mathematics-ACP	
<a href="#">MATH 416</a>	Abstract Linear Algebra <sup>2</sup>	3
<a href="#">MATH 417</a>	Intro to Abstract Algebra	3
<a href="#">or MATH 427</a>	Honors Abstract Algebra	
<a href="#">MATH 424</a>	Honors Real Analysis <sup>3</sup>	3
<a href="#">or MATH 444</a>	Elementary Real Analysis	

<a href="#">or MATH 447</a>	Real Variables	
<a href="#">MATH 461</a>	Probability Theory <sup>4</sup>	3-4
<a href="#">or STAT 400</a>	Statistics and Probability I	
<a href="#">CS 101</a>	Intro Computing: Engrg & Sci	3-4
<a href="#">or CS 124</a>	Intro to Computer Science I	
<a href="#">or CS 125</a>	Intro to Computer Science	
Approved supporting coursework outside Mathematics <sup>5</sup>		12
<b>Mathematics Courses</b>		
Select a total of two courses from two of the following three lists:		6
<b>Geometry</b>		
<a href="#">MATH 402</a>	Non Euclidean Geometry	
<a href="#">MATH 403</a>	Euclidean Geometry	
<a href="#">MATH 423</a>	Differential Geometry	
<a href="#">MATH 481</a>	Vector and Tensor Analysis	
<b>Differential Equations and Complex Analysis</b>		
<a href="#">MATH 441</a>	Differential Equations	
<a href="#">MATH 446</a>	Applied Complex Variables	
<a href="#">MATH 448</a>	Complex Variables	
<b>Number Theory</b>		
<a href="#">MATH 453</a>	Elementary Theory of Numbers	
Two additional 400-level or approved 500-level mathematics courses <sup>6</sup>		6
<b>Total Hours</b>		<b>46-49</b>

1. *Students should have credit for MATH 220/MATH 221 and MATH 231 before enrolling in MATH 241.*
2. *Students may not receive credit for both MATH 416 and either ASRM 406 or MATH 415.*
3. *If MATH 424 or MATH 447 is completed, a requirement for the Math Doctoral Preparation concentration has been satisfied.*
4. *If STAT 400 is completed, a requirement for the Data Optimization concentration has been satisfied.*
5. *Supporting coursework may be completed with 12 advisor-approved hours of a single math-related area*



*outside of MATH/ASRM not used for a major requirement and must include at least one advanced course; ANY minor which is fulfilled with at least 12 hours of courses, including one advanced course, not used for the major nor cross-listed with MATH/ASRM; or any double major or dual degree.*

6. *Courses awarded S/U grades may not be used to fill this requirement.*

### Mathematics Teaching Concentration

**General education:** Students must complete the Campus General Education requirements including the campus general education language requirement.

**Minimum required major and supporting course work:** Normally equates to 80-84 hours including 27-29 hours of mathematics beyond calculus, 3-4 hours of computer science, and 39 hours for the Teacher Education Minor in Secondary School Teaching. Twelve hours of 300- and 400-level non-S/U graded coursework in the major must be taken on this campus.

**Minimum hours required for graduation: 120 hours.**

Students in this concentration must complete the Teacher Education Minor in Secondary School Teaching (39 hours).

Code	Title	Hours
<b>Foundation Courses</b>		
The following courses must be completed or in progress when students apply to the Secondary Education minor.		
<a href="#">MATH 220</a> or <a href="#">MATH 221</a>	Calculus Calculus I	4-5
<a href="#">MATH 231</a>	Calculus II	3
<a href="#">MATH 241</a>	Calculus III	4
Three advanced mathematics courses, including		
<a href="#">MATH 347</a> or <a href="#">MATH 348</a>	Fundamental Mathematics Fundamental Mathematics-ACP	3-4
<b>Required Core Courses</b>		
<a href="#">MATH 416</a>	Abstract Linear Algebra <sup>1</sup>	3
<a href="#">MATH 417</a>	Intro to Abstract Algebra	3

<a href="#">or MATH 427</a>	Honors Abstract Algebra	
<a href="#">MATH 424</a>	Honors Real Analysis <sup>2</sup>	3
<a href="#">or MATH 444</a> <a href="#">or MATH 447</a>	Elementary Real Analysis Real Variables	
<a href="#">MATH 461</a> <a href="#">or STAT 400</a>	Probability Theory <sup>3</sup> Statistics and Probability I	3-4
<a href="#">CS 101</a>	Intro Computing: Engrg & Sci	3-4
<a href="#">or CS 124</a> <a href="#">or CS 125</a>	Intro to Computer Science I Intro to Computer Science	
<a href="#">Teacher Education Minor in Secondary School Teaching</a>		39
<b>Mathematics Teaching Courses</b>		
<a href="#">MATH 402</a>	Non Euclidean Geometry	3
<a href="#">or MATH 403</a>	Euclidean Geometry	
<a href="#">MATH 453</a>	Elementary Theory of Numbers	3
One additional 400-level or approved 500-level mathematics course <sup>4</sup>		3
<b>Total Hours</b>		<b>77-81</b>

1. Students may not receive credit for both MATH 416 and either ASRM 406 or MATH 415..
- 2.If MATH 424 or MATH 447 is completed, a requirement for the Math Doctoral Preparation concentration has been satisfied.
- 3..If STAT 400 is completed, a requirement for the Data Optimization concentration has been satisfied.
4. Courses awarded S/U grades may not be used to fill this requirement.

### Applied Mathematics Concentration

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#### Required Core Courses

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General education: Students must complete the Campus General Education requirements including the campus general education language requirement.

Minimum required major and supporting course work: Normally equates to 46-57 hours including 27-35 hours of mathematics beyond calculus, 3-4 hours of computer science, and 12 hours of supporting coursework. Twelve hours of 300- and 400-level non-S/U-graded courses in the major must be taken on this campus.

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Minimum hours required for graduation: 120 hours.

<a href="#">MATH 241</a>	Calculus III <sup>1</sup>	4
<a href="#">MATH 347</a>	Fundamental Mathematics	3-4
<a href="#">or MATH 348</a>	Fundamental Mathematics-ACP	
<a href="#">MATH 416</a>	Abstract Linear Algebra <sup>2</sup>	3
<a href="#">MATH 417</a>	Intro to Abstract Algebra	3
<a href="#">or MATH 427</a>	Honors Abstract Algebra	
<a href="#">MATH 424</a>	Honors Real Analysis <sup>3</sup>	3
<a href="#">or MATH 444</a>	Elementary Real Analysis	
<a href="#">or MATH 447</a>	Real Variables	
<a href="#">MATH 461</a>	Probability Theory <sup>4</sup>	3-4
<a href="#">or STAT 400</a>	Statistics and Probability I	
<a href="#">CS 101</a>	Intro Computing: Engrg & Sci	3-4
<a href="#">or CS 124</a>	Intro to Computer Science I	
<a href="#">or CS 125</a>	Intro to Computer Science	
Approved supporting coursework outside Mathematics <sup>5</sup>		12
<b>Applied Mathematics Courses</b>		
<a href="#">MATH 441</a>	Differential Equations	3
<a href="#">MATH 446</a>	Applied Complex Variables	3
<a href="#">or MATH 448</a>	Complex Variables	
<a href="#">CS 357</a>	Numerical Methods I	3
<a href="#">or MATH 442</a>	Intro Partial Diff Equations	
<a href="#">or MATH 489</a>	Dynamics & Differential Eqns	
<a href="#">MATH 412</a>	Graph Theory	3
<a href="#">or MATH 413</a>	Intro to Combinatorics	
<a href="#">or MATH 482</a>	Linear Programming	
One additional 400-level or approved 500-level mathematics course <sup>6</sup>		3
<b>Total Hours</b>		<b>49-52</b>

1. Students should have credit for MATH 220/MATH 221 and MATH 231 before enrolling in MATH 241.
2. Students may not receive credit for both MATH 416 and either ASRM 406 or MATH 415.
3. If MATH 424 or MATH 447 is completed, a requirement for the Math Doctoral Preparation concentration has been satisfied.
4. If STAT 400 is completed, a requirement for the Data Optimization concentration has been satisfied.

5. Supporting coursework may be completed with 12 advisor-approved hours of a single math-related area outside of MATH/ASRM not used for a major requirement and must include at least one advanced course; ANY minor which is fulfilled with at least 12 hours of courses, including one advanced course, not used for the major nor cross-listed with MATH/ASRM; or any double major or dual degree.
6. Courses awarded S/U grades may not be used to fill this requirement.

## Data Optimization Concentration

### Required Core Courses

General education: Students must complete the Campus General Education requirements including the campus general education language requirement.

Minimum required major and supporting course work: Normally equates to 46-57 hours including 27-35 hours of mathematics beyond calculus, 3-4 hours of computer science, and 12 hours of supporting coursework. Twelve hours of 300- and 400-level non-S/U-graded courses in the major must be taken on this campus.

Minimum hours required for graduation: 120 hours.

<a href="#">MATH 241</a>	Calculus III <sup>1</sup>	4
<a href="#">MATH 347</a>	Fundamental Mathematics	3-4
<a href="#">or MATH 348</a>	Fundamental Mathematics-ACP	
<a href="#">MATH 416</a>	Abstract Linear Algebra <sup>2</sup>	3
<a href="#">MATH 417</a>	Intro to Abstract Algebra	3
<a href="#">or MATH 427</a>	Honors Abstract Algebra	
<a href="#">MATH 424</a>	Honors Real Analysis <sup>3</sup>	3
<a href="#">or MATH 444</a>	Elementary Real Analysis	
<a href="#">or MATH 447</a>	Real Variables	
<a href="#">MATH 461</a>	Probability Theory <sup>4</sup>	3-4
<a href="#">or STAT 400</a>	Statistics and Probability I	
<a href="#">CS 101</a>	Intro Computing: Engrg & Sci	3-4
<a href="#">or CS 124</a>	Intro to Computer Science I	
<a href="#">or CS 125</a>	Intro to Computer Science	
Approved supporting coursework outside Mathematics <sup>5</sup>		12

### Data Optimization Courses

<a href="#">CS 357</a>	Numerical Methods I	3
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<a href="#">MATH 412</a> or <a href="#">MATH 484</a>	Graph Theory Nonlinear Programming	3
<a href="#">STAT 410</a> or <a href="#">STAT 420</a>	Statistics and Probability II Methods of Applied Statistics	3
<a href="#">MATH 482</a>	Linear Programming	3
<b>Total Hours</b>		<b>47-49</b>

1. Students should have credit for MATH 220/MATH 221 and MATH 231 before enrolling in MATH 241.

2. Students may not receive credit for both MATH 416 and either ASRM 406 or MATH 415.

3. If MATH 424 or MATH 447 is completed, a requirement for the Math Doctoral Preparation concentration has been satisfied.

4. If STAT 400 is completed, a requirement for the Data Optimization concentration has been satisfied.

5. Supporting coursework may be completed with 12 advisor-approved hours of a single math-related area outside of MATH/ASRM not used for a major requirement and must include at least one advanced course; ANY minor which is fulfilled with at least 12 hours of courses, including one advanced course, not used for the major nor cross-listed with MATH/ASRM; or any double major or dual degree.

### Math Doctoral Preparation Concentration

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#### Required Core Courses

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General education: Students must complete the Campus General Education requirements including the campus general education language requirement.

Minimum required major and supporting course work: Normally equates to 46-57 hours including 27-35 hours of mathematics beyond calculus, 3-4 hours of computer science, and 12 hours of supporting coursework. Twelve hours of 300- and 400-level non-S/U-graded courses in the major must be taken on this campus.

Minimum hours required for graduation: 120 hours.

<a href="#">MATH 241</a>	Calculus III <sup>1</sup>	4
<a href="#">MATH 347</a> or <a href="#">MATH 348</a>	Fundamental Mathematics Fundamental Mathematics-ACP	3-4
<a href="#">MATH 416</a>	Abstract Linear Algebra <sup>2</sup>	3
<a href="#">MATH 417</a> or <a href="#">MATH 427</a>	Intro to Abstract Algebra Honors Abstract Algebra	3

<a href="#">MATH 424</a> <a href="#">or MATH 444</a> <a href="#">or MATH 447</a>	Honors Real Analysis <sup>2</sup> Elementary Real Analysis Real Variables	3
<a href="#">MATH 461</a> <a href="#">or STAT 400</a>	Probability Theory <sup>4</sup> Statistics and Probability I	3-4
<a href="#">CS 101</a>  <a href="#">or CS 124</a> <a href="#">or CS 125</a>	Intro Computing: Engrg & Sci  Intro to Computer Science I Intro to Computer Science	3-4
Approved supporting coursework outside Mathematics <sup>5</sup>		12
<b>Math Doctoral Preparation Courses</b>		
The courses chosen from the core and the Math Doctoral Preparation concentration must include at least two of honors MATH 416, MATH 424, MATH 425, MATH 427, MATH 428.		
<a href="#">MATH 418</a>  <a href="#">or MATH 428</a>	Intro to Abstract Algebra II  Honors Topics in Mathematics	
<a href="#">MATH 448</a> <a href="#">MATH 423</a> <a href="#">or MATH 425</a>	Complex Variables Differential Geometry Honors Advanced Analysis	
<a href="#">or MATH 432</a> <a href="#">or MATH 481</a> <a href="#">MATH 441</a>	Set Theory and Topology Vector and Tensor Analysis Differential Equations	
Two additional 400-level or approved 500-level mathematics courses <sup>6</sup>		6
<b>Total Hours</b>		<b>52-56</b>

1. Students should have credit for MATH 220/MATH 221 and MATH 231 before enrolling in MATH 241.
2. Students may not receive credit for both MATH 416 and either ASRM 406 or MATH 415.
3. If MATH 424 or MATH 447 is completed, a requirement for the Math Doctoral Preparation concentration has been satisfied.
4. If STAT 400 is completed, a requirement for the Data Optimization concentration has been satisfied.
5. Supporting coursework may be completed with 12 advisor-approved hours of a single math-related area outside of MATH/ASRM not used for a major requirement and must include at least one advanced course; ANY minor which is fulfilled with at least 12 hours of courses, including one advanced course, not used for the major nor cross-listed with MATH/ASRM; or any double major or dual degree.
6. Courses awarded S/U grades may not be used to fill this requirement.

**2) Include a comparative table of the current and proposed requirements.**

**General Mathematics:**

Mathematics Major revisions, 10KV0439BSLA  
Current requirements

Proposed revisions

General education: Students must complete the Campus General Education requirements including the campus general education language requirement.

General education: Students must complete the Campus General Education requirements including the campus general education language requirement.

Minimum required major and supporting course work: Normally equates to 46-57 hours including 27-35 hours of mathematics beyond calculus, 3-4 hours of computer science, and 12 hours of supporting coursework. Twelve hours of 300- and 400-level courses in the major must be taken on this campus.

Minimum required major and supporting course work: Normally equates to 46-57 hours including 27-35 hours of mathematics beyond calculus, 3-4 hours of computer science, and 12 hours of supporting coursework. **Twelve hours of 300- and 400-level non-S/U-graded courses in the major must be taken on this campus.**

Minimum hours required for graduation: 120 hours.

Minimum hours required for graduation: 120 hours.

Required Core Courses			Required Core Courses		
<a href="#">MATH 241</a>	Calculus III <sup>1</sup>	4	<a href="#">MATH 241</a>	Calculus III <sup>1</sup>	4
<a href="#">MATH 347</a>	Fundamental Mathematics	3-4	<a href="#">MATH 347</a>	Fundamental Mathematics	3-4
<a href="#">8</a> <a href="#">or MATH 34</a>	Fundamental Mathematics-ACP		<a href="#">8</a> <a href="#">or MATH 34</a>	Fundamental Mathematics-ACP	
<a href="#">MATH 416</a>	Abstract Linear Algebra <sup>2</sup>	3	<a href="#">MATH 416</a>	Abstract Linear Algebra <sup>2</sup>	3
<a href="#">MATH 417</a>	Intro to Abstract Algebra	3	<a href="#">MATH 417</a>	Intro to Abstract Algebra	3
<a href="#">7</a> <a href="#">or MATH 42</a>	Honors Abstract Algebra		<a href="#">7</a> <a href="#">or MATH 42</a>	Honors Abstract Algebra	
<a href="#">MATH 424</a>	Honors Real Analysis <sup>3</sup>	3	<a href="#">MATH 424</a>	Honors Real Analysis <sup>3</sup>	3
<a href="#">4</a> <a href="#">or MATH 44</a>	Elementary Real Analysis		<a href="#">4</a> <a href="#">or MATH 44</a>	Elementary Real Analysis	
<a href="#">7</a> <a href="#">or MATH 44</a>	Real Variables		<a href="#">7</a> <a href="#">or MATH 44</a>	Real Variables	
<a href="#">MATH 461</a>	Probability Theory <sup>4</sup>	3-4	<a href="#">MATH 461</a>	Probability Theory <sup>4</sup>	3-4
<a href="#">or STAT 400</a>	Statistics and Probability I		<a href="#">or STAT 400</a>	Statistics and Probability I	
<a href="#">CS 101</a>	Intro Computing: Engrg & Sci	3-4	<a href="#">CS 101</a>	Intro Computing: Engrg & Sci	3-4
-			<a href="#">or CS 124</a>	Intro to Computer Science I	

<a href="#">or CS 125</a> Intro to Computer Science		<a href="#">or CS 125</a> Intro to Computer Science	
Approved supporting coursework or any minor	12	Approved supporting coursework outside Mathematics <sup>5</sup>	12
<b>Mathematics Courses</b>		<b>Mathematics Courses</b>	
Select a total of two courses from two of the following three lists:	6	Select a total of two courses from two of the following three lists:	6
<b>Geometry</b>		<b>Geometry</b>	
<a href="#">MATH 402</a> Non Euclidean Geometry		<a href="#">MATH 402</a> Non Euclidean Geometry	
<a href="#">MATH 403</a> Euclidean Geometry		<a href="#">MATH 403</a> Euclidean Geometry	
<a href="#">MATH 423</a> Differential Geometry		<a href="#">MATH 423</a> Differential Geometry	
<a href="#">MATH 481</a> Vector and Tensor Analysis		<a href="#">MATH 481</a> Vector and Tensor Analysis	
<b>Differential Equations and Complex Analysis</b>		<b>Differential Equations and Complex Analysis</b>	
<a href="#">MATH 441</a> Differential Equations		<a href="#">MATH 441</a> Differential Equations	
<a href="#">MATH 446</a> Applied Complex Variables		<a href="#">MATH 446</a> Applied Complex Variables	
<a href="#">MATH 448</a> Complex Variables		<a href="#">MATH 448</a> Complex Variables	
<b>Number Theory</b>		<b>Number Theory</b>	
<a href="#">MATH 453</a> Elementary Theory of Numbers		<a href="#">MATH 453</a> Elementary Theory of Numbers	
Two additional 400- or 500-level Math courses	6	Two additional 400-level or approved 500-level mathematics courses. <sup>6</sup>	6
<b>Total Hours</b>	<b>46-49</b>	<b>Total Hours</b>	<b>46-49</b>

<sup>1</sup> Students should have credit for MATH 220/MATH 221 and MATH 23 1 before enrolling in MATH 241.

<sup>1</sup> Students should have credit for MATH 220/MATH 221 and MATH 23 1 before enrolling in MATH 241.

<sup>2</sup>

<sup>2</sup>

Beginning in Fall 2012, students may not receive credit for both MATH 416 and either ASRM 406 (formerly MATH 410) or MATH 415. However, if one course is taken prior to Fall 2012, credit may be earned for both MATH 416 and either of ASRM 406 (formerly MATH 410) or MATH 415.

Students may not receive credit for both MATH 416 and either ASRM 406 or MATH 415.



3

*If MATH 424 or MATH 447 is completed, a requirement for the Graduate Preparatory concentration has been satisfied.*

3

*If MATH 424 or MATH 447 is completed, a requirement for the Math Doctoral Preparation concentration has been satisfied.*

4

If STAT 400 is completed, a requirement for the Operations Research concentration has been satisfied.

4

If STAT 400 is completed, a requirement for the Data Optimization concentration has been satisfied.

5

*Supporting coursework may be completed with 12 advisor-approved hours of a single math-related area outside of MATH/ASRM not used for a major requirement and must include at least one advanced course; ANY minor which is fulfilled with at least 12 hours of courses, including one advanced course, not used for the major nor cross-listed with MATH/ASRM; or any double major or dual degree.*

6

*Coursework awarded S/U grades may not be used to fill this requirement.*

**Mathematics Teaching:**

**Mathematics Teaching Concentration**

Current requirements			Proposed Revisions		
Code	Title	Hou rs	Code	Title	Hou rs
<b>Foundation Courses</b>			<b>Foundation Courses</b>		
The following courses must be completed or in progress when students apply to the Secondary Education minor.			The following courses must be completed or in progress when students apply to the Secondary Education minor.		
<a href="#">MATH 220</a> <a href="#">or MATH 221</a>	Calculus Calculus I	4-5	<a href="#">MATH 220</a> <a href="#">or MATH 221</a>	Calculus Calculus I	4-5

<a href="#">MATH 231</a>	Calculus II	3	<a href="#">MATH 231</a>	Calculus II	3
<a href="#">MATH 241</a>	Calculus III <sup>1</sup>	4	<a href="#">MATH 241</a>	Calculus III <sup>1</sup>	4
Three advanced mathematics courses, including			Three advanced mathematics courses, including		
<a href="#">MATH 347</a> or <a href="#">MATH 348</a>	Fundamental Mathematics Fundamental Mathematics-ACP	3-4	<a href="#">MATH 347</a> or <a href="#">MATH 348</a>	Fundamental Mathematics Fundamental Mathematics-ACP	3-4
<b>Required Core Courses</b>			<b>Required Core Courses</b>		
<a href="#">MATH 416</a>	Abstract Linear Algebra <sup>2</sup>	3	<a href="#">MATH 416</a>	Abstract Linear Algebra <sup>2</sup>	3
<a href="#">MATH 417</a> or <a href="#">MATH 427</a>	Intro to Abstract Algebra Honors Abstract Algebra	3	<a href="#">MATH 417</a> or <a href="#">MATH 427</a>	Intro to Abstract Algebra Honors Abstract Algebra	3
<a href="#">MATH 424</a> or <a href="#">MATH 444</a> or <a href="#">MATH 447</a>	Honors Real Analysis <sup>3</sup> Elementary Real Analysis Real Variables	3	<a href="#">MATH 424</a> or <a href="#">MATH 444</a> or <a href="#">MATH 447</a>	Honors Real Analysis <sup>3</sup> Elementary Real Analysis Real Variables	3
<a href="#">MATH 461</a> or <a href="#">STAT 400</a>	Probability Theory <sup>4</sup> Statistics and Probability I	3-4	<a href="#">MATH 461</a> or <a href="#">STAT 400</a>	Probability Theory <sup>4</sup> Statistics and Probability I	3-4
<a href="#">CS 101</a> or <a href="#">CS 125</a>	Intro Computing: Engrg & Sci Intro to Computer Science	3-4	<a href="#">CS 101</a> or <a href="#">CS 124</a> or <a href="#">CS 125</a>	Intro Computing: Engrg & Sci Intro to Computer Science I Intro to Computer Science	3-4
<a href="#">Teacher Education Minor in Secondary School Teaching</a>			<a href="#">Teacher Education Minor in Secondary School Teaching</a>		
<b>Mathematics Teaching Courses</b>			<b>Mathematics Teaching Courses</b>		
<a href="#">MATH 402</a> or <a href="#">MATH 403</a>	Non Euclidean Geometry Euclidean Geometry	3	<a href="#">MATH 402</a> or <a href="#">MATH 403</a>	Non Euclidean Geometry Euclidean Geometry	3
<a href="#">MATH 453</a>	Elementary Theory of Numbers	3	<a href="#">MATH 453</a>	Elementary Theory of Numbers	3
Two additional 400- or 500-level mathematics courses			One additional 400-level or approved 500-level mathematics course. <sup>5</sup>		
<b>Total Hours</b>		<b>80-84</b>	<b>Total Hours</b>		<b>77-81</b>

<sup>1</sup> *Students should have credit for MATH 220/MATH 221 and MATH 231 before enrolling in MATH 241.*

<sup>2</sup> *Students may not receive credit for both MATH 416 and either ASRM 406 (formerly MATH 410) or MATH 415.*

<sup>3</sup> *If MATH 424 or MATH 447 is completed, a requirement for the Graduate Preparatory concentration has been satisfied.*

<sup>4</sup> [If STAT 400 is completed, a group requirement for the Operations Research concentration has been satisfied.](#)

<sup>1</sup> *Students may not receive credit for both MATH 416 and either ASRM 406 or MATH 415.*

<sup>2</sup> *If MATH 424 or MATH 447 is completed, a requirement for the Math Doctoral Preparation concentration has been satisfied.*

<sup>3</sup> [If STAT 400 is completed, a group requirement for the Data Optimization concentration has been satisfied.](#)

<sup>4</sup> *Coursework awarded S/U grades may not be used to fill this requirement.*

**Applied Math**

**Applied Math Concentration**

Current requirements			Proposed revisions	
Core courses: see Mathematics major			Core courses: see Mathematics major	
Applied Mathematics Courses			Applied Mathematics Courses	
<u><a href="#">MATH 441</a></u>	Differential Equations	3	<u><a href="#">MATH 441</a></u>	Differential Equations
<u><a href="#">MATH 446</a></u>	Applied Complex Variables	3	<u><a href="#">MATH 446</a></u>	Applied Complex Variables
<u><a href="#">or MATH 448</a></u>	Complex Variables		<u><a href="#">or MATH 448</a></u>	Complex Variables
<u><a href="#">CS 357</a></u>	Numerical Methods I	3	<u><a href="#">CS 357</a></u>	Numerical Methods I
<u><a href="#">or MATH 442</a></u>	Intro Partial Diff Equations		<u><a href="#">or MATH 442</a></u>	Intro Partial Diff Equations
<u><a href="#">or MATH 489</a></u>	Dynamics & Differential Eqns		<u><a href="#">or MATH 489</a></u>	Dynamics & Differential Eqns
<u><a href="#">MATH 412</a></u>	Graph Theory	3	<u><a href="#">MATH 412</a></u>	Graph Theory

<a href="#">or MATH 413</a> Intro to Combinatorics <a href="#">or MATH 482</a> Linear Programming		<a href="#">or MATH 413</a> Intro to Combinatorics <a href="#">or MATH 482</a> Linear Programming	
One additional 400- or 500-level Math course	3	One additional 400-level or approved 500-level mathematics course not graded with S/U grading	
<b>Total Hours</b>	<b>49</b>	<b>Total Hours</b>	<b>52</b>

### Data Optimization

Current name: Operations Research

Proposed name: Data Optimization

Current requirements

Proposed revisions

Core courses: see Mathematics major			Core courses: see Mathematics major		
<b>Operations Research Courses</b>			<b>Data Optimization Courses</b>		
<a href="#">CS 357</a>	Numerical Methods I	3	<a href="#">CS 357</a>	Numerical Methods I	3
<a href="#">MATH 412</a>	Graph Theory	3	<a href="#">MATH 412</a>	Graph Theory	3
<a href="#">or MATH 484</a>	Nonlinear Programming		<a href="#">or MATH 484</a>	Nonlinear Programming	
<a href="#">STAT 410</a>	Statistics and Probability II	3	<a href="#">STAT 410</a>	Statistics and Probability II	3
<a href="#">or STAT 420</a>	Methods of Applied Statistics		<a href="#">or STAT 420</a>	Methods of Applied Statistics	
<a href="#">MATH 482</a>	Linear Programming	3	<a href="#">MATH 482</a>	Linear Programming	3
<b>Total Hours</b>		<b>47-49</b>	<b>Total Hours</b>		<b>47-49</b>

### Math Doctoral Preparation

Name: Graduate Preparation

Proposed name: Math Doctoral Preparation

Current requirements

Proposed revisions

Core courses: see Mathematics major			Core courses: see Mathematics major		
<b>Graduate Preparation Courses</b>			<b>Math Doctoral Preparation Courses</b>		
The courses chosen from the core and the Graduate Preparation concentration must include at least two of MATH 424, MATH 425, MATH 427, MATH 428.			The courses chosen from the core and the Math Doctoral Preparation concentration must include at least two of honors MATH 416, MATH 424, MATH 425, MATH 427, MATH 428.		
<a href="#">MATH 418</a>	Intro to Abstract Algebra II	3	<a href="#">MATH 418</a>	Intro to Abstract Algebra II	3

<a href="#">or MATH 428</a>	Honors Topics in Mathematics		<a href="#">or MATH 428</a>	Honors Topics in Mathematics	
<a href="#">MATH 448</a>	Complex Variables	3	<a href="#">MATH 448</a>	Complex Variables	3
<a href="#">MATH 423</a>	Differential Geometry	3	<a href="#">MATH 423</a>	Differential Geometry	3
<a href="#">or MATH 425</a>	Honors Advanced Analysis		<a href="#">or MATH 425</a>	Honors Advanced Analysis	
<a href="#">or MATH 432</a>	Set Theory and Topology		<a href="#">or MATH 432</a>	Set Theory and Topology	
-			<a href="#">or MATH 481</a>	Vector and Tensor Analysis	
<a href="#">MATH 441</a>	Differential Equations	3 or 4	<a href="#">MATH 441</a>	Differential Equations	3 or 4
Two additional 400- or 500-level Math courses		6	Two additional 400-level or approved 500-level mathematics courses not graded with S/U grading		6
<b>Total Hours</b>		<b>52-56</b>	<b>Total Hours</b>		<b>52-56</b>

## Academic Catalog

### Data Optimization Concentration

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#### Required Core Courses

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General education: Students must complete the Campus General Education requirements including the campus general education language requirement.

Minimum required major and supporting course work: Normally equates to 46-57 hours including 27-35 hours of mathematics beyond calculus, 3-4 hours of computer science, and 12 hours of supporting coursework. Twelve hours of 300- and 400-level non-S/U-graded courses in the major must be taken on this campus.

Minimum hours required for graduation: 120 hours.

<a href="#">MATH 241</a>	Calculus III <sup>1</sup>	4
<a href="#">MATH 347</a>	Fundamental Mathematics	3-4
<a href="#">or MATH 348</a>	Fundamental Mathematics-ACP	
<a href="#">MATH 416</a>	Abstract Linear Algebra <sup>2</sup>	3
<a href="#">MATH 417</a>	Intro to Abstract Algebra	3
<a href="#">or MATH 427</a>	Honors Abstract Algebra	
<a href="#">MATH 424</a>	Honors Real Analysis <sup>3</sup>	3
<a href="#">or MATH 444</a>	Elementary Real Analysis	
<a href="#">or MATH 447</a>	Real Variables	
<a href="#">MATH 461</a>	Probability Theory <sup>4</sup>	3-4
<a href="#">or STAT 400</a>	Statistics and Probability I	
<a href="#">CS 101</a>	Intro Computing: Engrg & Sci	3-4
<a href="#">or CS 124</a>	Intro to Computer Science I	
<a href="#">or CS 125</a>	Intro to Computer Science	
Approved supporting coursework outside Mathematics <sup>5</sup>		12

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#### Data Optimization Courses

<a href="#">CS 357</a>	Numerical Methods I	3
<a href="#">MATH 412</a>	Graph Theory	3
<a href="#">or MATH 484</a>	Nonlinear Programming	
<a href="#">STAT 410</a>	Statistics and Probability II	3
<a href="#">or STAT 420</a>	Methods of Applied Statistics	
<a href="#">MATH 482</a>	Linear Programming	3

1. *Students should have credit for MATH 220/MATH 221 and MATH 231 before enrolling in MATH 241.*
2. *Students may not receive credit for both MATH 416 and either ASRM 406 or MATH 415.*
3. *If MATH 424 or MATH 447 is completed, a requirement for the Math Doctoral Preparation concentration has been satisfied.*
4. *If STAT 400 is completed, a requirement for the Data Optimization concentration has been satisfied.*
5. *Supporting coursework may be completed with 12 advisor-approved hours of a single math-related area outside of MATH/ASRM not used for a major requirement and must include at least one advanced course; ANY minor which is fulfilled with at least 12 hours of courses, including one advanced course, not used for the major nor cross-listed with MATH/ASRM; or any double major or dual degree.*

## Comparative Table

### Data Optimization Concentration

Current name: Operations Research

Proposed name: Data Optimization

Current requirements

Proposed revisions

Core courses: see Mathematics major			Core courses: see Mathematics major		
<b>Operations Research Courses</b>			<b>Data Optimization Courses</b>		
<a href="#">CS 357</a>	Numerical Methods I	3	<a href="#">CS 357</a>	Numerical Methods I	3
<a href="#">MATH 412</a>	Graph Theory	3	<a href="#">MATH 412</a>	Graph Theory	3
<a href="#">or MATH 484</a>	Nonlinear Programming		<a href="#">or MATH 484</a>	Nonlinear Programming	
<a href="#">STAT 410</a>	Statistics and Probability II	3	<a href="#">STAT 410</a>	Statistics and Probability II	3
<a href="#">or STAT 420</a>	Methods of Applied Statistics		<a href="#">or STAT 420</a>	Methods of Applied Statistics	
<a href="#">MATH 482</a>	Linear Programming	3	<a href="#">MATH 482</a>	Linear Programming	3
<b>Total Hours</b>		47-49	<b>Total Hours</b>		47-49