**CHANGE to the Mathematics Major and the Mathematics Minors**

**Summary:** We propose to add one new course to the Mathematics Major and change the required Computer Science courses for Mathematics Majors and Mathematics Minors. We propose the new course and the changes to the major and minors as one package.

**Change to Catalog Language for the Major**

|  |  |  |
| --- | --- | --- |
|  | **Current Catalog Requirements** | **New Catalog Requirements** |
| **Required Mathematics Classes** | MTH 1120 Calculus I (4cr) | MTH 1120 Calculus I (4cr) |
|  | MTH 1220 Calculus II (4cr) | MTH 1220 Calculus II (4cr) |
|  | MTH 1240 Discr. Structures (4cr) | MTH 1240 Disc. Structures (4cr) |
|  | MTH 2040 Linear Algebra (4cr) | MTH 2040 Linear Algebra (4cr) |
|  |  | **MTH 2090 Mathematical Computing (4cr)** |
|  | MTH 3040 Abst. Algebra (4cr) | MTH 3040 Abst. Algebra (4cr) |
|  | MTH 3120 Real Analysis (4cr) | MTH 3120 Real Analysis (4cr) |
|  | Three Elective Classes (12 cr) | Three Elective Classes (12 cr) |
|  | MTH 4300 Senior Research (4cr) | MTH 4300 Senior Research (4cr) |
|  | MTH 4990 Senior Thesis Completion (0cr) | MTH 4990 Senior Thesis Completion (0cr) |
| **Required Courses Outside of Mathematics** | ~~CSC 1110 Principles of Computer Science I (4 cr)~~ | **CSC 2030 Data Science (4cr)** |
| **Total:** | **36 credits in Mathematics + 4 credits in CS + Senior Research** | **40 credits in Mathematics + 4 credits in CS + Senior Research** |

**Additional Catalog Changes**

Due to the changes in the Computer Science course offerings, other catalog changes need to be made.

**Changes to the Mathematics Minor:** The current Mathematics Minor requirements state that

“A minor consists of four mathematics courses beyond MTH 1220 and ~~CSC 1110~~. PHY 2200 or PHY 2470 may be used as one of ~~these~~ courses.”

We propose to change the CSC 1110 requirement to a choice of MTH 2090 (4 cr) or CSC 2030 Introduction to Data Science (4 cr), or CSC 1810 Principles of Computer Science I (4 cr) or CSC 1100 Introduction to Computing (4 cr), so the requirements will read,

*“A minor consists of four mathematics courses beyond MTH 1220, and* ***one computing course which may be any one of CSC 2030 Introduction to Data Science (4 cr), or CSC 1810 Principles of Computer Science I (4 cr) or CSC 1100 Introduction to Computing (4 cr) or MTH 2090 Mathematical Computing (4 cr).*** *PHY 2200 or PHY 2470 may be used as one of* ***the mathematics*** *courses.”*

**The Additional Information Section of the Catalog**

Changes are also required in a section of the catalog called “Additional Information.” In all cases, the CSC 1110 requirement will be replaced with a choice of CSC 2030 Introduction to Data Science (4 cr), or CSC 1810 Principles of Computer Science I (4 cr) or CSC 1100 Introduction to Computing (4 cr), or MTH 2090 Mathematical Computing (4 cr).

|  |  |
| --- | --- |
| **Current Catalog Language** | **New Catalog Requirements** |
| **Additional Information:**  The mathematics minor for secondary  education should include:  MTH 1120 Calculus I (4 cr.)  MTH 1220 Calculus II (4 cr.)  MTH 2040 Linear Algebra (4 cr.)  MTH 2080 Modern Geometry (4 cr.)  MTH 3040 Abstract Algebra I (4 cr.)  MTH 3050 Theory of Statistics (4 cr.)  ~~CSC 1110 Principles of Computer~~  ~~Science I~~  ~~(4 cr.)~~  The elementary education major desiring  licensure for teaching mathematics should  include:  MTH 1030 Applied Contemporary  Mathematics  (4 cr.)  MTH 1040 Principles of Modern  Mathematics  (4 cr.)  MTH 1050 Elementary Statistics (4 cr.)  MTH 1120 Calculus I (4 cr.)  MTH 1240 Discrete Structures (4 cr.)  MTH 2080 Modern Geometry (4 cr.)  And  CSC 1100 Introduction to Computing (4 cr.)  OR  ~~CSC 1110 Principles of Computer~~  ~~Science I~~ | **Additional Information:**  The mathematics minor for secondary  education should include:  MTH 1120 Calculus I (4 cr.)  MTH 1220 Calculus II (4 cr.)  MTH 2040 Linear Algebra (4 cr.)  MTH 2080 Modern Geometry (4 cr.)  MTH 3040 Abstract Algebra I (4 cr.)  MTH 3050 Theory of Statistics (4 cr.)  **CSC 2030 Introduction to Data Science (4 cr), or CSC 1810 Principles of Computer Science I (4 cr) or CSC 1100 Introduction to Computing (4 cr), or MTH 2090 Mathematical Computing (4 cr).**  The elementary education major desiring  licensure for teaching mathematics should  include:  MTH 1030 Applied Contemporary  Mathematics  (4 cr.)  MTH 1040 Principles of Modern  Mathematics  (4 cr.)  MTH 1050 Elementary Statistics (4 cr.)  MTH 1120 Calculus I (4 cr.)  MTH 1240 Discrete Structures (4 cr.)  MTH 2080 Modern Geometry (4 cr.)  And  **CSC 2030 Introduction to Data Science (4 cr),** or CSC 1100 Introduction to Computing (4 cr)**, or MTH 2090 Mathematical Computing (4 cr).** |

**Rationale for the Changes**

**Minors:** The need for the changes to the Mathematics Minors is clear. The Computer Science Department is phasing out CSC 1110, and for Mathematics Minors, any of the courses listed will expose the students to computer-based problem solving.

**Major:** Using a computer to solve mathematical problems is an essential skill for mathematics majors today. While computer skills are taught throughout the courses in the major, the department’s recent program review and assessment activities indicate that even more attention is needed in this area. The Computer Science Department plans to change the content of some of their course offerings, and we believe that the new courses provide exciting and valuable opportunities for mathematics majors.

In response to assessment data collected, the program review, and the changes to the Computer Science courses, **we propose to add one course in mathematical problem solving to our major, and change the Computer Science course required of all mathematics majors to the one we believe will serve our majors best.**

**Transition Plan**

The transition to the new requirements should be smooth. The first section of MTH 2090 will be offered in the spring of 2019, with one section offered each spring thereafter. Students under current catalogs will be able to use MTH 2090 as a math elective. While the computer science department transitions to its new course offerings, any of CSC 1100, 1810, or 2030 will be allowed to take the place of CSC 1110 if necessary.

**Impact on Other Departments**

The impact on the Computer Science Department should be minimal. We are still requirement one CSC course, so the impact on demand for CSC courses should be unchanged. Students from other departments may find MTH 2090 to be an attractive course, and we anticipate enough seats in the one section we offer to be sufficient to meet their needs.

**Staffing/Budget Statement**

We expect to be able to offer one section of MTH 2090 per year with our current staff. As mentioned in the course proposal, we expect one section of MTH 2090 to run per year, and have multiple qualified faculty members interested in teaching the course.

**Supporting Documentation**

**Request for Approval of New Catalog Course**

# Basic Course Information

Title: Mathematical Computing

Department/Program: MTH

Course Number(s) [*see below*]: 2090  
Credits: 4 credits

Crosslistings: None anticipated.

Year and term next offered:

Spring 2019, although this course would be suitable for Fall or J-term.

Anticipated frequency of offering: One section per academic year.

Anticipated enrollment cap: 24

## Course Category

|  |  |
| --- | --- |
| Catalog Course [*Should have unique course number*] | X |
| Topics Course [200T/400T *even if offered in J-term*] |  |
| J-Term Only Course [675 - *exclusively for J-term*] |  |

Distribution credit: [*indicate*: **bold**] **None**.

(FAR, HUM, SOC, LABSCI, NLAB, 2ndREL, EXSS, MTH)

Record of Approval: Verified/Date \_ \_

Other approvals from appropriate sub-committees [*indicate*: **bold**]: (GH/C-SYM/HON):

Record of Approval: Verified/Date \_ \_

*Please append a brief explanation of request for distribution and/or other curricular credit.*

In what major(s) (and how?) will this course be used? Specify whether core/elective/category/etc… [*This is catalog language, so clarity is important!*]

This course will be a required course for all mathematics majors beginning in 2018-2019, and can be used as a math elective by students under previous catalogs. We also believe that students outside of mathematics may be interested in taking this course.

Course Description and Goals [*\* Catalog language; # Syllabus language – do* ***not*** *include reading lists…*]

\*Catalog Description:

This course focuses on three classes of computational tools: structured programming languages, computer algebra systems, and spreadsheets. Students will learn Python, Mathematica, and Excel by solving a wide range of mathematical problems from discrete mathematics, number theory, and applied mathematics; and as importantly, students will learn which tools are appropriate for various problems.

\*Prerequisites: (*Specify course name & number*) MTH 1240 Discrete Structures **or** MTH 1220 Calculus II

#Full Course Description:

This course focuses on three classes of computational tools: structured programming languages, computer algebra systems, and spreadsheets. Students will learn Python, Mathematica, and Excel by solving a wide range of mathematical problems from discrete mathematics, number theory, and applied mathematics; and as importantly, will learn which tools are appropriate for various problems.

The course will be project-based. Students will use structured programming languages, computer algebra systems, and spreadsheets to solve mathematical problems, present their solutions to the class, and evaluate the appropriateness of their choice of technology.

## #Major Student Learning Outcomes and Methods to Measure Success:

1. Student Learning Outcome:

Students will be able to solve mathematical problems using a spreadsheet (currently Excel) and assess whether or not a spreadsheet is an appropriate tool for solving a mathematical problem.

Anticipated Methods of Assessment:

Students will complete multiple projects involving solving mathematical problems using a spreadsheet, and assess whether using a spreadsheet was the best choice of technology for such a problem.

1. Student Learning Outcome:

Students will be able to solve mathematical problems using a computer algebra system (currently Mathematica) and assess whether or not a computer algebra system is an appropriate tool for solving a mathematical problem.

Anticipated Methods of Assessment:

Students will complete multiple projects involving solving mathematical problems using a computer algebra system, and assess whether using a computer algebra system was the best choice of technology for such a problem.

1. Student Learning Outcome:

Students will be able to solve mathematical problems using a structured computer programming language (currently Python) and assess whether or not a structured computer programming language is an appropriate tool for solving a mathematical problem.

Anticipated Methods of Assessment:

Students will complete multiple projects involving solving mathematical problems using a structured programming language, and assess whether using a structured computer programming language was the best choice of technology for such a problem.

# Rationale, staffing, and budgetary impact

Please address the rationale for the course. Examples include the following: how does this course fit in with the department/program student learning outcomes? How does it fit in with the strategic plan of the department and strategic plan and the mission of the college? Is this course the result of assessment, and if so, how?

In the past, the only way to solve a mathematical problem using a computer was to write a computer program. Although writing a computer program is still a very good solution in many situations, as technology has evolved, powerful alternates have taken the place of writing computer code, including spreadsheets and computer algebra systems. Because all of these options are available at little or no cost to nearly everyone, a mathematics major entering the job market today needs to have experience with a variety of computer-based mathematical problem-solving tools.

In addition, this course will develop skill in deciding which technology is the best choice for a given problem, rather than focusing exclusively on the techniques themselves.

How does the department intend to staff the course? [*If this is a conversion of topics to catalog, here’s where to mention that…*]

We expect a department member (probably Wheeler, S. Jensen, Yaple, or Snavely) will be able to teach this course as part of their regular load. We expect one section per year to be sufficient to meet student demand, and the department’s current staffing level is sufficient to cover this course. If necessary, this course will take the place of optional elective mathematics courses that have been taught on an occasional basis.

Please note any budgetary considerations, including materials, student fees, infrastructure requirements, etc…

No budgetary implications are anticipated. All appropriate software is already available to students, or is available free to download.

## Approval record:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Date approved | Verified by |  |
| Dept/Prog: Mathematics | 11/8/17 | Mark Snavely | Chair/Director |
| Divisional Sub-Committee (*for new catalog courses*) |  |  | Sub-Committee Chair |
| Division: |  |  | Dean |
| Curriculum Committee- Approval |  |  | CC-A Chair |
| Academic Senate |  |  | Secretary |