

Date: February 28, 2008
Subject: Proposed Revision to the Math Minor
From: Mike Vasey, Chair, Subcommittee C

Subcommittee C first considered the proposal for revisions to the Math Minor on 10/30/07. There are two major aspects of the proposed revision to the Mathematics Minor. The first is the addition of a separate honors version of the minor. Whereas the current Mathematics Minor includes embedded statements regarding additional requirements for students pursuing an honors contract, the revised minor includes a fully articulated honors version. As discussed below, this honors minor was the focus of questions raised by the subcommittee. The second major aspect involves increasing the flexibility of the minor to permit greater fit with the varying needs of students depending on the nature of their major programs.

With regard to the current minor (henceforth to be labeled the non-honors minor), the following changes are proposed:

1. Clarification of requirements for the minor. These changes do not appear to be substantive but rather are largely stylistic/formatting changes that clarify the presentation of these requirements. For example, in the current minor, the requirement of a minimum 2.0 GPA in the courses that constitute the minor is described in a confusing manner. The revised wording and placement of this requirement is considerably clearer.
2. Reduction of the required course domains from five to three. Previously the minor required courses in: 1) Calculus, 2) Differential Equations; 3) Foundations of Higher Mathematics, 4) Linear Algebra, and 5) Analysis. The proposed minor would require only domains 1, 3, and 4. Courses from the omitted domains appear instead among the elective courses for the minor. It should also be noted that in addition to dropping two domains, the proposed minor also has modified the lists of courses fulfilling the remaining domains. For example, the courses listed as fulfilling the algebra requirement have been reduced from six to three possibilities.
3. Addition of a range of additional 400-600-level courses to the list of acceptable elective courses for a minor program in mathematics.

The changes to the non-honors minor were regarded by the subcommittee as valuable clarifications and additions to the program. No significant concerns or questions were raised and the non-honors minor was thus unanimously approved.

In contrast, the subcommittee raised a number of significant questions regarding the proposed honors version of the minor and thus sent that proposal back for clarification. That proposal was reviewed again on 1/16/08.

As described in the proposal and the requested clarifications, the honors version of the minor is meant to be required of all honors students wishing to minor in mathematics. The rationale behind this proposal "is that Honors students should be required to do a minor which is more rigorous than the Non-Honors Minor..." Three routes are proposed in order to increase flexibility of the honors minor. Additionally, the GPA minimum for the courses comprising the

minor is higher for the honors version, thus increasing rigor over the non-honors minor. The three options vary in number of credit hours of math courses at the 200 level or higher, in the minimum number of honors math courses, and in the minimum GPA. Options range from 20 credits with at least two honors courses and a GPA minimum of 3.0 to 22 credits with at least one honors course and a GPA minimum of 3.2, and finally 25 credits with no requirement for honors courses and a GPA minimum of 3.3.

The idea of a special honors minor was discussed at considerable length by the subcommittee. Ultimately, we asked for clarification of the legitimacy of such a minor and asked the Mathematics Department to obtain a supporting statement from the director of the honors program. The director, Professor van der Heijden, has provided a letter attesting to her support for the honors minor. The subcommittee additionally asked for clarification as to whether an honors student could complete the non-honors minor. For example, could an honors student in Spanish choose the non-honors minor. The Mathematics Department has indicated that the answer to this question is no. However, the subcommittee regards this decision as being the purview of the Honors Program and not of the Mathematics Department. Thus, although the subcommittee ultimately voted to approve the proposal, we did so with the stipulation that our approval assumes that the decision as to whether a given student must take the honors or non-honors version of the minor is up to the staff of the Honors Program.

Transmittal History for Proposal to Math Non-Honors and Honors Minor

MAPS CCC

5/07

- a. I.B. is it 345 or H190
- b. 366 used in place of 345 or H190?
- c. What constitutes a minor course?
 - i. Do the required courses count in CPHR (GPA)?
- d. Are 151, 152, 153 required or pre-req?
- e. Clarify language on non-Honors grade point requirements

CCI Sub-Committee C – Sent Back

10-30-08

- 1. Math minor— Non-honor- approved; Honors- sent back.
 - i. overview of the proposal
 - ii. Honors Minor—sent back
 - a. Clarification/definition of “Honors Minor” – committee is unaware of other examples
 - b. the Math Department should contact the Honors for supporting statement for “the Honors Minor”
 - c. Clarification needed: could honors students take the non-honors minor?
 - iii. Non-honor Minor—approved.

CCI Sub-Committee C – Approved

1-16-08

3. Math Honors minor- Approved

- i. review of the proposal and response
- ii. Question about can honors students take the non-honors option- what if a Spanish major wants to take a Math non-honor minor? It should not be mandated but the Honors’ decision about students’ option.
- iii. Sub C approved the Math Minor’s curriculum with the stipulation that we do not override Honor’s decision for students’ honor status. Our approval does not mean that honors students are bound to take the Honors option. It’s the Honor’s decision.

Motion to approve with stipulation: Breitenberger

2nd: Berman

Yes: all No: none.

RATIONALE FOR CHANGES TO THE REQUIREMENTS FOR A MATHEMATICS MINOR

The principal changes to the Requirements for a Mathematics Minor for the Department of Mathematics are the following:

- 1) Specification of a set of additional requirements, involving minimum grade point and the enrollment in honors courses, for students with an honors contract pursuing a minor in mathematics.
- 2) Elimination of two courses from the list of courses required for a minor program in mathematics.
- 3) Addition of certain 500 and 600-level courses to the list of acceptable elective courses for a minor program in mathematics.

Item #1 is simply a codification of existing practice, not hitherto specified in writing. It represents the sense of the Department that there should be additional academic expectations of honors students. The three alternative criteria are an attempt to be as flexible as possible as regards these additional expectations.

Items #2 and #3 reflect the Department's recognition that many students pursuing different major disciplines can add considerable value to their degree program by including a minor in mathematics. However, it is desirable to allow considerable flexibility so that the minor program can be designed to best suit the needs of the student's major discipline. For this reason, we have pared down the list of required courses to the absolute fundamentals of any mathematical training, and we have enlarged the list of possible electives to accommodate the maximum number of different career paths. [We are currently compiling a set of suggested electives matched to a variety of major programs to give guidance to students in these disciplines.]

**The Ohio State University
Colleges of the Arts and Sciences
College of Mathematical and Physical Sciences**

Mathematics Minor (Math, 265)

Department of Mathematics
105 Mathematics Building, 231 West 18th Avenue
Columbus, OH 43210-1174
614-292-6994; <http://www.math.ohio-state.edu>

Mathematical methods are used today in the social sciences as well as the physical and biological sciences. A minor program in mathematics is a useful supplement to a major program in many widely differing areas. The minor must include at least 20 hours of mathematics at the 200 level or above, beyond that which is required for the student's major. A maximum of three hours of 593 or 693 may be used on a minor. Mathematics 487 may not be used on a minor. Courses used to fulfill your major requirements may not be used toward the 20-hour minimum; however, such courses may be used to fulfill the requirements in part 1 (required courses) below.

If you complete the minor following these guidelines, you then need the approval of the coordinating adviser in the Department of Mathematics, 105 Mathematics Building.

1. Required courses

- Calculus sequence—Mathematics 151, 152, 153, 254 (or the accelerated or the honors sequence)
- Differential equations—Mathematics 255 or 415 or H521
- Foundations of higher mathematics—Mathematics 345
- Algebra—Mathematics 568 or 571 or 580 or 566 or H520 or H590
- Analysis—Mathematics 547 or H190 or 651

2. Elective courses (as necessary to reach 20 credit hours)

- History of mathematics—504
- Complex variables—514, 552 or H522, 654
- Differential equations—512
- Geometry—507
- Combinatorial mathematics—575, 674
- Probability—530
- Linear algebra—572
- Vector analysis—513 or 551
- Number theory—573, H576, or H577
- Discrete mathematical models—578
- Calculus on manifolds—H540, H541
- Abstract algebra—580, 581, 582
- Real analysis—548, 549

Mathematics minor program guidelines

The following guidelines govern this minor.

Required for graduation No

Credit hours required A minimum of 20

Transfer credit hours allowed A maximum of 10

Overlap with the GEC Permitted

Overlap with the major Not allowed and

- The minor must be in a different subject than the major.
- The same courses cannot count on the minor and on the major.

Overlap between minors Each minor completed must contain 20 unique hours.

Grades required

- Minimum C- for a course to be listed on the minor.
- Minimum 2.00 cumulative point-hour ratio required for the minor.
- Course work graded Pass/Non-Pass cannot count on the minor.

Approval required The minor program description sheet indicates if the minor course work must be approved by:

- The academic unit offering the minor

Filing the minor program form The minor program form must be filed at least by the time the graduation application is submitted to a college/school counselor.

Changing the minor Once the minor program is filed in the college office, any changes must be approved by:

- The academic unit offering the minor

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If you complete the minor following these guidelines, you then need the approval of the coordinating adviser in the Department of Mathematics, 105 Mathematics Building.

1. Required courses

- A. Calculus: 254 (or the accelerated or honors courses)
- B. Foundations of Higher Mathematics: 345 or H190.
Math 366 can fulfill this requirement **only** if it is required for the student's major.
- C. Linear Algebra: 568 or 571 or H520

Honors students are expected to complete the Honors Mathematics Minor and are required to fulfill one of the following additional requirements.

Option #1:

- Complete at least 20 hours of math at the 200 level or above to include the REQUIRED COURSES
- At least TWO of the courses **MUST BE** Honors math courses
- Must have at least a 3.0 CPHR in the courses that constitute the minor (see bullets in Option 1).

Option #2:

- Complete at least 22 hours of math at the 200 level or above to include the REQUIRED COURSES
- At least ONE of the courses **MUST BE** an Honors math course
- Must have at least a 3.2 CPHR in the courses that constitute the minor (see bullets in Option 2).

Option #3:

- Complete at least 25 hours of math at the 200 level or above to include the REQUIRED COURSES
- Must have at least a 3.3 CPHR in the courses that constitute the minor (see bullets in Option 3).

2. Elective courses (as necessary to reach 20 credit hours)

To reach the 20 hour minimum (at least 15 hours must be in math), students may select courses from the following:

- Differential Equations: 255 or 415 or H521
- Any 500 level course excluding Math 532 or 588
- Math 601, 602, 603.02, 606, 607, 618, 647, 648, 649, 665, 666, 701
- Statistics 420, 421, or 610

3. Restrictions

-- All minor courses must have a grade of C- or better, and must have the cumulative GPA referenced in Option 1, 2 or 3 respectively.

--Courses used to fulfill a student's major requirements **may not** be used towards the 20 hour minimum; such courses may be used to fulfill the requirements in part I.

--Math H487, 593, or 693 may not be used on a minor.

--No more than 10 hours of transfer credit may be used on a minor.

Mathematics minor program guidelines

The following guidelines govern this minor.

Required for graduation No

Credit hours required A minimum of 20

Transfer credit hours allowed A maximum of 10

Overlap with the GEC Permitted

Overlap with the major Not allowed and

- The minor must be in a different subject than the major.
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Grades required

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Arts and Sciences Curriculum Office
<http://artsandsciences.osu.edu>
The Ohio State University
4132 Smith Lab, 174 W. 18th Ave.
STL 02/28/08

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- Any 500 level course excluding Math 532 or 588
- Math 601, 602, 603.02, 606, 607, 618, 647, 648, 649, 665, 666, 701
- Statistics 420, 421, or 610

3. Restrictions

-- *The minor must include at least 20 hours of mathematics at the 200 level or above with grades of C- or better and a minimum of a 2.0 cumulative GPA in the courses that constitute the minor.*

--*Courses used to fulfill a student's major requirements may not be used towards the 20 hour minimum; such courses may be used to fulfill the requirements in part I.*

--Math H487, 593, or 693 may not be used on a minor.

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REQUIREMENTS FOR AN HONORS MATHEMATICS MINOR -GEC REQUIREMENTS-

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I. REQUIRED COURSES

- A. Calculus: 254 (or the accelerated or honors courses)
- B. Foundations of Higher Mathematics: 345 or H190. Math 366 can fulfill this requirement **only** if it is required for the student's major.
- C. Linear Algebra: 568 or 571 or H520

Honors students are expected to complete the Honors Mathematics Minor and are required to fulfill one of the following additional requirements.

Option #1:

- Complete at least 20 hours of math at the 200 level or above to include the **REQUIRED COURSES**
- At least **TWO** of the courses **MUST BE** Honors math courses
- Must have at least a 3.0 CPHR in the courses that constitute the minor (see bullets in Option 1).

Option #2:

- Complete at least 22 hours of math at the 200 level or above to include the **REQUIRED COURSES**
- At least **ONE** of the courses **MUST BE** an Honors math course
- Must have at least a 3.2 CPHR in the courses that constitute the minor (see bullets in Option 2).

Option #3:

- Complete at least 25 hours of math at the 200 level or above to include the **REQUIRED COURSES**
- Must have at least a 3.3 CPHR in the courses that constitute the minor (see bullets in Option 3).

II. ELECTIVE COURSES

To reach the 20 hour minimum (at least 15 hours must be in math), students may select courses from the following:

- Differential Equations: 255 or 415 or H521
- Any 500 level course excluding Math 532 or 588
- Math 601, 602, 603.02, 606, 607, 618, 647, 648, 649, 665, 666, 701
- Statistics 420, 421, or 610

III. RESTRICTIONS

--All minor courses must have a grade of C- or better, and must have the cumulative GPA referenced in Option 1, 2 or 3 respectively.

--Courses used to fulfill a student's major requirements may not be used towards the 20 hour minimum; such courses may be used to fulfill the requirements in part I.

--Math H487, 593, or 693 may not be used on a minor.

--No more than 10 hours of transfer credit may be used on a minor.

REQUIREMENTS FOR A NON-HONORS MATHEMATICS MINOR -GEC REQUIREMENTS-

Mathematical methods are used today in the social sciences as well as the physical and biological sciences. A minor program in mathematics is a useful supplement to a major program in many widely differing areas. The Mathematics Department has a list of suggested electives to complement various major programs.

I. REQUIRED COURSES

- A. Calculus: 254 (or the accelerated or honors courses)
- B. Foundations of Higher Mathematics: 345 or H190. Math 366 can fulfill this requirement **only** if it is required for the student's major.
- C. Linear Algebra: 568 or 571 or H520

II. ELECTIVE COURSES

To reach the 20 hour minimum (at least 15 hours must be in math), students may select courses from the following:

- Differential Equations: 255 or 415 or H521
- Any 500 level course excluding Math 532 or 588
- Math 601, 602, 603.02, 606, 607, 618, 647, 648, 649, 665, 666, 701
- Statistics 420, 421, or 610

III. RESTRICTIONS

- *The minor must include at least 20 hours of mathematics at the 200 level or above with grades of C- or better and a minimum of a 2.0 cumulative GPA in the courses that constitute the minor.*
- *Courses used to fulfill a student's major requirements **may not** be used towards the 20 hour minimum; such courses may be used to fulfill the requirements in part I.*
- Math H487, 593, or 693 may not be used on a minor.
- No more than 10 hours of transfer credit may be used on a minor.

Wed 11/28/2007 3:55 PM
Judie Monson [jumonson@math.ohio-state.edu]

Sophia, Below please find responses requested by Subcommittee C. I hope that this information will resolve their concerns. I look forward to a positive feedback. Judith Monson

> 1. **Clarification/definition of "Honors Minor"**

The Honors Minor in Mathematics is designed for student designated as Honors students, pursuing a major in some other discipline and a minor in mathematics. The Honors Minor in Mathematics is somewhat more demanding than the Non-Honors Minor in Mathematics, which has recently been approved. The rationale behind this proposal is that students designated as Honors students should be required to do a minor which is more rigorous than the Non-Honors Minor (which is the minimum 20 hours with certain core courses). In order to incorporate both flexibility and rigor into the Honors Minors in Mathematics, we are proposing three different routes. Moreover, the minimum grade point required for the Honors Minor in Mathematics is also higher than for the Non-Honors Minor, in Mathematics, adding extra rigor.

> 2.the Math Department should contact the Honors for **supporting statement** for "the Honors Minor"

I am emailing to you under separate cover a support letter from ASC Honors, Merijn van der Heijden.

> 3. Clarification needed: **could honors students take the non-honors minor?**

No. The honors students can choose from the options within the Honors minor to stay on the honor's contract, but they cannot choose the non-honors minor.

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Judith Monson
Assistant Director, Academic Studies
Department of Mathematics
The Ohio State University
250 Mathematics Building
231 W. 18th Avenue
Columbus, OH 43210
(614) 292-6994
jumonson@math.ohio-state.edu

November 28, 2007

Ron Solomon
Department of Mathematics
606 Math Tower
231 West 18th Ave
CAMPUS

Dear Professor Solomon:

I write to inform you that the Curriculum Subcommittee of the Colleges of the Arts and Sciences Honors Committee supports your proposal for a new honors minor in Mathematics.

In extending their support, the members of the subcommittee believe the minor will constitute a welcome addition to the honors curriculum, and they wish you the very best with what they are certain will be a rewarding experience for you and your students.

Sincerely,

Merijn van der Heijden
Assistant Dean and Director
Arts and Sciences Honors program