May 23, 2006

MEMORANDUM

TO: Stephen Halperin  
   Dean, College of Computer, Mathematical, and Physical Sciences

FROM: Phyllis Peres  
   Associate Provost for Academic Planning and Programs

SUBJECT: Proposal to Add a Minor in Mathematics (PCC Log No. 05085)

At its meeting on May 19, 2005, the Senate Committee on Programs, Curricula, and Courses approved your proposal to add a Minor in Mathematics. A copy of the approved proposal is enclosed.

The changes are effective in Fall 2006. All advisors should be notified and the College should ensure that the approved guidelines are followed.

enclosure

cc: James Baeder, Chair, Senate PCC  
    Sarah Bauder, Office of Student Financial Aid  
    Mary Giles, University Senate  
    Barbara Hope, Data Administration  
    Kathy McAdams, Undergraduate Studies  
    Anne Turkos, Archives  
    Linda Yokoi, Office of the Registrar  
    Deborah Reid Bryant, College of Computer, Mathematical, and Physical Sciences  
    Denny Gulick, Mathematics
DIRECTIONS:
- Provide one form with original approval signatures in lines 1 - 4 for each proposed action. Keep this form to one page in length.
- Early consultation with the Office of the Associate Provost for Academic Planning & Programs is strongly recommended if there are questions or concerns, particularly with new programs.
- Please submit the signed form to Claudia Rector, Office of the Associate Provost for Academic Planning and Programs, 1119 Main Administration Building, Campus.
- Please email the rest of the proposal as an MSWord attachment to pcc-submissions@umd.edu.

DATE SUBMITTED 4-17-06

PCC LOG NO. 05085

COLLEGE/SCHOOL_ CMPS_

DEPARTMENT/PROGRAM_ Mathematics_

PROPOSED ACTION (A separate form for each) ADD x ___ DELETE _____ CHANGE ___

DESCRIPTION (Provide a succinct account of the proposed action. Details should be provided in an attachment. Provide old and new sample programs for curriculum changes.)

This is a proposal for a new Minor in Mathematics.

JUSTIFICATION/REASONS/RESOURCES (Briefly explain the reason for the proposed action. Identify the source of new resources that may be required. Details should be provided in an attachment.)

The Department of Mathematics had two citations, but they could not readily be converted to minors when citations were required either to convert to minors or to be dropped.

Quite a number of students, especially students with Life Science majors, have asked that there be a Minor in Mathematics. The Department of Mathematics is responding to those requests. The Department expects that there would be no resource issues.

APPROVAL SIGNATURES

<table>
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<tr>
<th>SIGNATURE</th>
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<tbody>
<tr>
<td>Department Committee Chair</td>
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<td>College/School PCC Chair</td>
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<td>Dean of the Graduate School (if required)</td>
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<td>Chair, Senate PCC</td>
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<td>Chair of Senate</td>
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<td>Vice President for Academic Affairs &amp; Provost</td>
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Proposal for a Minor in Mathematics

Until 2004 the Department of Mathematics had 4 citations:

Citation in Discrete Mathematics
Citation in Applied Mathematical Modeling
Citation in Statistics
Citation in Actuarial Mathematics

The latter two citations were converted to Minor in Statistics and Minor in Actuarial Mathematics, respectively, and are administered within the Statistics Program in the Department of Mathematics. By contrast, there were substantive reasons why the Citations in Discrete Mathematics and Applied Mathematical Modeling were not initially converted to Minors.

However, recently a number of students, especially Chemical and Life Science majors, have asked that there be a Minor in Mathematics. The Department of Mathematics is responding to those requests with this proposal for a Minor in Mathematics:

MINOR IN MATHEMATICS

The Department of Mathematics offers a Minor in Mathematics for students majoring in other disciplines. The goal of the Minor in Mathematics is to provide the student with significant mathematical skills and a perspective on the discipline.

The requirements for the Minor in Mathematics include at least 19 credits beyond first-year calculus, and include the following:

I. MATH 241; and either MATH 240 or MATH 461 -- or – MATH 340-341

The remaining credits for the Minor in Mathematics must be at the 400-level in mathematics, and include:

II. At least one of the following core theoretical courses: MATH 403, 405, 410.

III. At least one of the following algebra courses: MATH 401, 402, 403, 405, 406.

IV. At least one of the following analysis courses: MATH 410, 414, 462, 463, 464.

V. At least one of the following probability courses: STAT 400 or STAT 410.

If additional credits are needed in order to fulfill the 19-credit minimum, any 400-level MATH-STAT-AMSC courses except MATH 400, MATH 477-478, 480-484, 489, 498, and STAT 464 are acceptable.
Other issues related to the Minor in Mathematics:

(a) The Minor in Mathematics is NOT open to Mathematics majors.

(b) The student will need to achieve at least a C (2.0) in each course to be applied to the Minor in Mathematics.

(c) The student may use a maximum of 2 courses to satisfy the requirements of both a major and the Minor in Mathematics.

(d) Normally no more than 1 of the courses for the Minor in Mathematics may be taken at an institution other than the University of Maryland, College Park.

There is more information about the Minor in Mathematics from the department’s webpage: www.math.umd.edu/undergraduate/opportunities/minors.shtml

Formally, the departmental advisor for this program is the Associate Chair for Undergraduate Studies in the Department of Mathematics.

Comments (with references to the numbered paragraphs in the Provost’s Section IV: Academic Minors in parentheses):

1. (9) Since the prerequisites for MATH 241 are the high-enrollment courses MATH 140-141, it may be asserted that there are 8 credits of “hidden prerequisites” for the Minor in Mathematics. If that is true, then we would like to apply for an exception to the 24-academic credit maximum and ask for the maximum to be 27 credits, including MATH 140-141.

2. (11) The Minor in Mathematics will be overseen by the Associate Chair for Undergraduate Studies in the Department of Mathematics, with consultation by the Math-Majors Committee. One of the 16 faculty advisors will be assigned to be advisor for students who are pursuing the Minor in Mathematics.

3. (11) The Minor in Mathematics will be assessed 3 years after inception. The assessment will involve: (a) number of students in the program; (b) completion rate of those who enter the program; (c) questionnaire filled out by students who complete the program and a selection of those in the pipeline.

4. (3) The course structure for the Minor in Mathematics has been devised not only to represent a truncated version of the Major in Mathematics but also to yield a coherent survey of the field of mathematics.

5. (5) Resource issues: Our best guess is that the total number of courses to be offered at the undergraduate level would be approximately the same as it is now, so there would be no resource issues. (On the one hand, it is expected that there might be a modest shrinkage from the present number (around 400) of Majors in Mathematics. On the other hand, the Minor in Mathematics is expected to draw a significant number of students with other majors.)
Name of Student ________________________________________________________

University ID Number __________________  Major ___________________________

Telephone ________________________  Email Address ________________________

Estimated Date of Graduation ______________________________________________

Required courses and credits completed toward Mathematics Minor:

<table>
<thead>
<tr>
<th>Course</th>
<th>Date</th>
<th>Grade</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MATH 241 or MATH 340-341</td>
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<tr>
<td>MATH 240 or MATH 461 or MATH 340-341</td>
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<td>MATH 403 or 405 or 410</td>
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<td>MATH 401 or 402 or 403 or 405 or 406</td>
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<td>MATH 410 or 414 or 462 or 463 or 464</td>
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<td>STAT 400 or STAT 410</td>
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<tr>
<td>Other 400-level MATH-STAT-AMSC Courses needed to fulfill 19-credit minimum</td>
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(except MATH 400, MATH 477-478, 480-484, 489, 498, and STAT 464)

The student has completed the requirements for a Minor in Mathematics.

(Signature of Minor Advisor)     (Date)
Goals and Assessments for the Minor in Mathematics

MAIN GOAL: The goal of the Minor in Mathematics is to provide the student with significant mathematical skills and a perspective on the discipline. To achieve this goal, a student obtaining a Minor in Mathematics will take the 3-semester calculus course sequence (MATH 140, 141, 241), then a course in each of several basic areas (linear algebra, abstract algebra, analysis, probability, and a core theoretical course). The collection of courses is a truncated version of the Major in Mathematics, but is designed to yield a coherent survey of the field of mathematics at the undergraduate level.

With regard to Outcomes and Assessments, there are Outcomes and Assessments already set forth for the Major in Mathematics, and they are robust. It is essential that the Outcomes and Assessments for the Minor in Mathematics be coordinated with those of the Major in Mathematics.

OUTCOMES AND ASSESSMENTS for the Minor in Mathematics:

1. **Outcome:** The student pursuing a Minor in Mathematics will gain an understanding of what constitutes mathematical thinking, including the ability to produce and judge the validity of rigorous mathematical arguments.

   **Assessment Measure:** Each student pursuing a Minor in Mathematics will be required to take at least one of the following core theoretical courses: MATH 403, 405, 410. There is already an assessment program for the mathematics major which involves these courses, and the Mathematics Department will use that assessment program for the minor as well:

   With regard to MATH 410, in consultation with the faculty members teaching MATH 410, the Mathematics Department Assessment Committee (MDAC) will select an appropriate problem from each MATH 410 final examination and analyze the solutions of a random sample of students from the class. In addition, the MDAC will consult with the faculty members in that course to ascertain strengths and weaknesses of Math 410 and the level of preparation of the students. The same will occur with respect to MATH 403, 405. If there are students pursuing a Minor in Mathematics, the selection will include one or more of such students (so the selection would not be quite random).

   **Criteria:** The final exam question chosen will involve the proof of a significant result drawn from the concepts in the course under question. The proof will be judged using the following criteria:

   1. **Correctness:** Is the result rigorously proved?
   2. **Clarity:** Is the proof presented in a readable manner?
   3. **Conciseness:** Are all of the steps relevant to the proof and are they presented in a concise manner?
We will expect a 75% success rate for the MDAC evaluation based upon the above criteria.

**Assessment Schedule:** The Assessment Schedule for the Major in Mathematics lists the assessment of MATH 410 as beginning in Fall 2006, and occurring each year thereafter. As for MATH 403 and 405, these courses are to be assessed in rotation annually with 4 other significant 400-level courses with the same criteria as for the assessment for MATH 410. This identifies the assessment schedule to be followed for the Minor in Mathematics.

2. **Outcome:** The Minor in Mathematics program is designed to offer students outside of mathematics significant mathematical skills and a perspective on the discipline. It is expected that the Minor in Mathematics Program will be successful in promoting mathematics for such students.

**Assessment measure:** The Minor in Mathematics Program will be assessed in order to:

(a) identify the number of students in the Program, and trends in the number and majors of students in the Program;

(b) observe the completion rate of those who enter the Program;

(c) give a questionnaire to those students who have already completed the Program and to a selection of those pursuing the Program.

**Criteria:** The questionnaire will be designed to learn the student assessment of the Program. If there are significant questions about, or suggestions for, the Program, the Department will take appropriate steps to modify the Program.

**Timetable:** 3 years after inception of the Program.