PROPOSAL TO THE SENATE COMMITTEE ON EDUCATIONAL POLICY

TITLE OF THE PROPOSAL:

Modifications to the Mathematics and Computer Science curriculum in the College of Liberal Arts and Sciences

SPONSOR:

Samuel Kamin, Director of Undergraduate Programs in Computer Science
Phone: 333-7505
Email: kamin@uiuc.edu

BRIEF DESCRIPTION:

We are proposing to add two required courses at the 200 level to the graduation requirements for this major: CS 241 (Systems Programming) and CS 242 (Programming Studio). The six hours added in this way are to be taken from free electives. In addition, MATH 415 (Linear Algebra) is to be required instead of being grouped as an option with MATH 418 (was Advanced Linear Algebra; now Intro to Abstract Algebra II).

JUSTIFICATION:

The major degree program for students in Computer Science is the Computer Science degree in the College of Engineering; about 80% of undergraduates advised by CS are in that program. The remaining 20% are in two LAS majors: Math/CS and Stats/CS, of which Math/CS is by far the larger.

As the name implies, the Math/CS degree is a mixed program, with a large number of upper-level Math courses. By contrast, the Computer Science degree requires many more upper-level CS courses. The CS department is concerned that the strength of the Math/CS curriculum, in its Computer Science component, not be too much lower than that of the Computer Science degree. One way we have maintained that is to keep the 100- and 200-level requirements identical for the two programs. However, a recent change in the Computer Science curriculum added the two above-named courses – CS 241 and 242 – as requirements. We are proposing to restore the traditional parity between the two majors in lower-level courses.

We believe these two courses are important for several reasons. The first is that they will build students skills in programming at an early stage in their careers. The Programming Studio (CS 242) is a unique course with very small classes in which students can work intensively on their programming skills. This is important to the students because it can enable them to more fully participate in projects in the department and also gives them a greater ability to find internships. More important, though, is its impact on the higher-level courses in CS: having the strong foundation provided by the entire set of 100- and 200-level courses both allows the student to learn more conceptual material in the higher-level courses, and allows the instructor to assign deeper homeworks. Needless to say, we do not wish to have these benefits confined to CS students. Hence, this proposal.

The proposal to make MATH 415 a requirement reflects the lack of a suitable alternative; formerly students chose between MATH 415 and MATH 418 Advanced Linear Algebra to satisfy Group III of the 400-level Math and CS electives. As Intro to Advanced Algebra II, however, MATH 418 is no longer related in content or equivalent in prerequisites.

BUDGETARY AND STAFF IMPLICATIONS:

Because the two courses are already required of the CS students, who constitute roughly 80% of our undergraduate population, we believe we can accommodate the additional 20% with modest additional resources. We anticipate needing to assign an additional 50% of a TA to each of the courses each semester; this is an expense we can easily absorb.

This change should have no effect on enrollment in any other department's courses, nor any impact on resources, such as computer labs, outside of the CS Department itself.

We have discussed the changes with the Math department, and they have approved them.
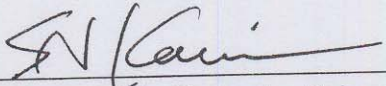
GUIDELINES FOR UNDERGRADUATE EDUCATION:

The revised curriculum better meets the guidelines for undergraduate education than the current curriculum, in several ways:
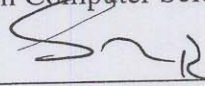
- The new required courses will help students build basic skills in speaking, listening, and creatively engaging problems in computation. In particular, the second of these courses (CS 242, Programming Studio) includes a large component of oral presentation and group interaction currently lacking in the Math/CS curriculum.
- The new courses will crucially improve our student's professional education, making them much better programmers. At the same time, these are not narrowly focused courses. CS 241 (Systems Programming) covers material that has been in our curriculum, at a higher level, for many years. (We join most of our peer institutions in requiring this earlier in the curriculum.) CS 242 (Programming Studio) will help students to build programming skills by emphasizing the need to *reflect on*, and *explain*, their own practice in programming.
- By building students' skills in programming, these courses will enable our upper-level courses to proceed at a higher, more abstract, level, freed from the need to teach our students low-level skills. (Indeed, the initial impetus for developing these courses was the common complaint from instructors that, in higher-level, conceptually-oriented courses, our students' weak programming skills became a barrier to their learning high-level concepts.)
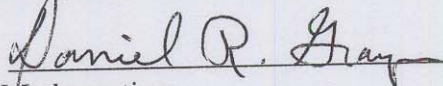
CLEARANCES: *(Clearances should include signatures [sponsor, department head, dean] and dates of approval)*

Samuel N. Kamin   Date _3/31/06_
Director of Undergraduate Programs in Computer Science
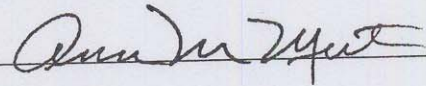
Marc Snir   Date _3/17/06_
Head, Department of Computer Science

Daniel R. Grayson   Date _3/6/2006_
Chair, Department of Mathematics

                                                 Date _11/27/06_
, LAS

STATEMENT FOR PROGRAMS OF STUDY CATALOG: *see attached*

EFFECTIVE DATE: Fall, 2007

Mathematics and Computer Science

www.math.uiuc.edu or www.cs.uiuc.edu

This major is sponsored jointly by the Departments of Mathematics and Computer Science. Also see Computer Science, Mathematics, and Statistics and Computer Science. The Mathematics and Computer Science major is designed to prepare students for professional or graduate work in mathematics and computer science.

Major in Sciences and Letters Curriculum

E-mail: academic@cs.uiuc.edu or office@math.uiuc.edu

Degree title: Bachelor of Science in Liberal Arts and Sciences

Minimum required major and supporting course work normally equates to 67-69 hours.

General education: The LAS General Education requirements are set up so students automatically complete the Campus General Education requirements.

Minimum hours required for graduation: 120 hours

Departmental distinction: To graduate with distinction requires a specified minimum grade point average in all Computer Science and Mathematics courses listed below. A GPA of 3.25 is required for Distinction, 3.5 for High Distinction, and 3.75 for Highest Distinction. In addition, students must complete at least three semester hours of additional Computer Science or Mathematics courses selected from the following: CS 196, 296, 397, 492, 493, 499; any CS course numbered 411 or higher; MATH 412, 414, 417, 418, 423, 432, 448, 482, 484, 496.

Hours	Requirements
11-12	Calculus through MATH 241 – Calculus III
3	MATH 347–Fundamental Mathematics or MATH 348- Fundamental Mathematics-ACP
4	CS 125 – Intro to Computer Science
3	CS 173 – Discrete Structures
4	CS 225 – Data Structure & Softw Prin
3	CS 241 – System Programming
3	CS 242 – Programming Studio
3	CS/MATH 257– Numerical Methods
3	CS 273– Intro to Theory of Computation
3	CS 231– Computer Architecture, I

3	CS 232– Computer Architecture, II
3	MATH 415–Linear Algebra
21-22	400-level mathematics and computer science requirements:
	Students must select at least seven 400-level mathematics and computer science courses, including one from each of the following groups:
	GROUP I:
	MATH 461/STAT 451–Probability Theory I
	STAT 400/MATH 463–Statistics and Probability I
	GROUP II:
	MATH 412–Graph Theory
	MATH 417–Intro to Abstract Algebra
	GROUP III:
	MATH 441–Differential Equations
	MATH 446–Applied Complex Variables
	MATH 484–Nonlinear Programming
	GROUP IV:
	MATH 444–Elementary Real Analysis
	MATH 447–Real Variables
	GROUP V:
	MATH 414–Mathematical Logic
	CS/MATH 473–Algorithms
	CS/MATH 475–Formal Models of Computation
	GROUP VI:
	CS 421–Programming Lang and Compilers
	CS 423– Operating Systems Design
	GROUP VII:
	CS/MATH 450– Intro to Numerical Analysis
	CS/MATH 458– Numerical Linear Algebra
	CS/MATH 459– Numerical Approx and ODEs

NOTE: A student taking a cross-listed course in this major may designate it as either mathematics or computer science.

Twelve hours of 300- and 400-level courses in the major must be taken on this campus.

All foreign language requirements must be satisfied.

Typical Schedule for Mathematics & Computer Science

The following is an example of a schedule taken by students in the mathematics and computer science program in the College of Liberal Arts and Sciences.

Hours	Requirements
16	**First Year - First Semester**
1	CS 100 Freshman Orientation
3	CS 173 Discrete Structures
4	MATH 221 Calculus I
4	Foreign language I
4	Composition I
14	**First Year - Second Semester**
3	MATH 231 Calculus II
4	CS 125 Intro to Computer Science
4	Foreign language II
3	General education elective
16	**Second Year - First Semester**
4	MATH 241 Calculus of Several Variables
4	CS 225 Data Structure and Softw Prin
3	CS 231 Computer Architecture I
4	Foreign language III
1	Elective
14	**Second Year - Second Semester**
3	MATH 347 Fundamental Mathematics
3	CS 232 Computer Architecture II
3	CS 241 System Programming
4	Foreign language IV
1	Elective
15	**Third Year - First Semester**
3	CS 242 Programming Studio
3	MATH 415 Linear Algebra
3	Group I elective
6	General education electives

15	**Third Year - Second Semester**	
3		CS 257 Numerical Methods
3		CS 273 Intro to Theory of Computation
3		Group VI elective
3		General education elective
3		Elective
15	**Fourth Year - First Semester**	
6		Group II and III electives
3		Group V elective
6		General education electives
15	**Fourth Year - Second Semester**	
3		Group IV elective
3		Group VII elective
9		General education electives
120		Total