

Math Educators, Computer Science Educators: Working Together

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Summary

Mathematics is one of the disciplines that helped give birth to computer science. Over the years, however, as computer science sought its own identity as an applied, professional discipline, it has occasionally lost contact with its roots. Also, the mathematics profession has had problems that are partly responsible for a decline in rigor in undergraduate computer science courses [1,2]. Both disciplines are coming to recognize that the bonds between them must be reestablished and strengthened. This is a healthy sign of maturity.

In 1999 the Mathematical Association of America's (MAA) *Committee on the Undergraduate Program in Mathematics* (CUPM) initiated the Curriculum Foundations Project, a series of disciplinary workshops, to determine the mathematical requirements - primarily in the first two undergraduate years - of the disciplines they serve. The first Curriculum Foundations Workshop was held at Bowdoin College in October 1999 and included both computer scientists and physicists. Since then a total of eleven workshops have been held with 19 different disciplines plus a final conference that gathered representatives from all previous workshops to discuss common needs. Draft reports from the workshops, including computer science, can be found at [3]. The reports were presented and discussed at panel sessions, open forums, and focus groups at the January 2000 to 2002 Joint Mathematics Associations meetings. Final versions are being prepared for publication by the MAA in early 2003.

CUPM is now engaged in developing a new set of curricular recommendations for mathematics departments,

tentatively entitled *Undergraduate Programs and Courses in the Mathematical Sciences: A CUPM Curriculum Guide*. These recommendations are being formed by the results of the Curriculum Foundation Workshops, by additional discussions within the mathematical community, and by further input from the partner disciplines. Thus as the process proceeds, it is important to encourage dialogue, at all levels: between mathematics and computer science colleagues through individual and departmental discussions, in university forums, at national and local conferences, and, perhaps most importantly, with national curriculum committees. As one part of the process, constituents from numerous disciplines, including computer science, are meeting at West Point in October 2002 to discuss ways of incorporating discrete mathematics in the mathematics curriculum.

The purpose of this panel/discussion is to broaden the opportunity to participate in influencing the final recommendations of CUPM to the entire computer science education community. Panelists will report on the draft CUPM recommendations and will solicit responses from those attending the session though discussion at the session and follow-up written communication with CUPM. Participation by members of the computer science community is extremely important because the CUPM recommendations will have a significant impact on mathematics instruction, and hence on our students. All the panelists are mathematics and computer science educators who have been closely involved with the CUPM Curriculum Foundations Project effort. Two of the panelists are members of the writing group for the CUPM recommendations.

Panelist Qualifications and Statements

William Barker, Bowdoin College

As a mathematician who has taught undergraduate students for twenty-eight years, I was heavily involved in the calculus reform movement in the early nineties as the PI for several NSF sponsored projects. This led to my becoming a member of the CUPM, the Chair of CRAFTY (the CUPM subcommittee now entitled *Curriculum Renewal across the First Two Years*), and the Chair of the Planning Committee for the Curriculum Foundations Project. In particular, I was Chair of the local Organizing Committee for the first Curriculum Foundations workshop at Bowdoin College in November, 1999, focused on physics and computer science, and I was a participant in six other Curriculum Foundations workshops. I am part of the writing group for the CUPM curriculum recommendations currently under development and am also attending the 2002 West Point Conference on Discrete Mathematics. I teach Bowdoin's "Introduction to Mathematical Reasoning," a required course for majors in computer science, and am currently involved in a major curriculum and textbook project for undergraduate geometry.

Susanna S. Epp, DePaul University

As I worked interactively with computer science students over several decades, I discovered that many of their problems resulted from a lack of understanding of basic principles of logical thought. Over time I developed materials to help them incorporate these principles into their own thinking while also teaching them the basic mathematical foundations of computer science. I have served on six major MAA committees since 1983, most recently CRAFTY and CUPM, where I am part of the writing group for the curriculum guidelines project. I also organized two sessions on discrete mathematics instruction at national MAA meetings, co-organized an international DIMACS symposium on teaching logical reasoning, participated in the final conference for the Curriculum Foundations Project, am attending the 2002 West Point Conference on Discrete Mathematics, and have written and spoken widely on instruction in discrete mathematics and analytical thinking. I look forward to the opportunity to receive input on the mathematics curriculum from a broad segment of the computer science education community.

I will describe the work of CUPM and look forward to the opportunity to receive input on the mathematics curriculum from a broad segment of the computer science education community.

Peter B. Henderson, Butler University

While a faculty member at SUNY Stony Brook I developed, and taught for 15 years, a mathematics-based first course for computer science majors that was, and still

is, a prerequisite for CS-I. The experience and knowledge I gained was beneficial in providing focus for the CUPM Computer Science Workshop Group, and that group's report[2]. I also participated in the final conference of the Curriculum Foundations Project and am attending the 2002 West Point Conference on Discrete Mathematics. I was principal or co-principal investigator of several NSF education grants, including the Long Island Consortium for Interconnected Learning in Quantitative Disciplines, a comprehensive, multi-faceted project to develop an environment for interconnected learning in mathematics courses and in mathematically based disciplines.

I will present concrete recommendations for ways in which the mathematics and computer science education communities can work together to improve education for all students.

William Marion, Valparaiso University

As a computer scientist and mathematician I have been intimately involved locally, regionally and nationally in the ongoing dialogue concerning the study of mathematics within the framework of computer science. I have been involved in national curricular efforts in both disciplines. I have been a member of ACM, SIGCSE and the MAA for the past 25 years. Since 1988 I have served on three committees of the MAA — CUPM, Classroom Resource Materials Board, and Mathematics Across the Disciplines. From 1999 to 2001 I was a member of the CC2001 Pedagogy Focus Group on Supporting Courses. One of our charges was to translate the knowledge units in the area of Discrete Structures into a cohesive set of courses. I also will be attending the West Point Conference. In addition, I currently have a proposal under consideration by the PREP Committee of the MAA to present a one-week Faculty Enhancement Workshop in June 2003 to prepare mathematics faculty to teach an "early" discrete math/structures course that meets the needs of computer science majors.

I will offer some suggestions as to how computer science faculty can address the issue of the mathematical preparation of computer science majors at their own institutions--to include working with the mathematics faculty.

References

- [1] Bruce, K., Kelemen, C., Tucker, A.B, Our curriculum has become Math-phobic, SIGCSE 2001 Technical Symposium on Computer Science Education, pages 243-247, Feb. 2001
- [2] Tucker, A., From rigor to rigor mortis: Avoiding the slippery slope. SIGCSE 2001 Technical Symposium on Computer Science Education, pages 21-25, Feb. 2001.
- [3] http://academic.bowdoin.edu/faculty/B/barker/dissemination/Curriculum_Foundations