

CALIFORNIA STATE UNIVERSITY, EAST BAY

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DATE SUBMITTED: October 18, 2012

TO: The Academic Senate

FROM: The Committee on Academic Planning and Review (CAPR)

SUBJECT: Five-Year Program Review for Math and Computer Science/Computer Networks

PURPOSE: For Action by the Academic Senate

ACTION REQUESTED:

Acceptance of the Five-Year Program Review of the Computer Science B.S. and M.S.; Computer Networks M.S.; and Mathematics B.S. and M.S. programs in the College of Science at California State University East Bay and the recommendation that they continue with specific modification. Specifically, each of these programs must submit evidence of direct and indirect assessment of *at least one* Program Learning Outcome (PLO) each year in its annual report (Spring 2013, 2014, and 2015). In addition, each program should note actions taken to use the assessment results for program improvement. The date of the next Five-Year review is 2016-2017.

Background

At its meeting on January 19, 2012, CAPR invited members of the Department of Mathematics, Computer Science (CS) and Computer Networks (CN) to orally present the outcome of their five-year review process completed in May, 2011 and submitted to CAPR for review in January 2012 as prescribed in the Academic Program Review Procedures (08-09 CAPR 23(revised)). Prior to the meeting in January, the CAPR liaisons to the Mathematics and CS/CN programs examined the five-year review documents closely, applying a review matrix derived from the Academic Program Review Procedures on suggested content for five-year review documentation. Julie Beck reviewed the Computer Science B.S. and M.S. and Computer Networks M.S. program documents and Sharon Green reviewed the Mathematics B.S. and M.S. program documents. Questions were developed by both reviewers to present to the Department Chair, Dr. Eddie Reiter. Dr. Reiter, Dr. Levent Ertaul (Computer Networks), and Dr. Kathy Hann (Mathematics) attended the meeting to present a summary of the Mathematics and CS/CN Five-Year Review and answer questions from members of CAPR. Following the January 19, 2012 meeting, Chair Reiter submitted an addendum to the 5-Year Review documents. The following report is the result of the combined input from Julie Beck and Sharon Green.

Overview description of the program

The Math and Computer Science program offers five degrees: Mathematics B.S. and M.S., Computer Science B.S. and M.S. and Computer Networks M.S. Data provided by Institutional Research provides combined statistics for the Mathematics and Computer Science Department as well as disaggregated data for the separate programs. According to Fall Quarter enrollment data for 2009, the combined Mathematics and CS/CN programs reported 351 undergraduate majors and 311 graduate students who were served by 28 instructional, tenure-track faculty; 3 part-time faculty; 3 full-time lecturers; and 20 part-time lecturers. For the Mathematics degrees, according to 2009 Fall Quarter enrollment figures, there were 70 undergraduate majors and 86 graduate majors, with an SFR (student faculty ratio) of 20.4 for tenure/tenure track faculty and 29.4 for lecturers. The average section size for math classes was 28. The overall SFR for Mathematics climbed from 22.8 in 2005 to 26.3 in 2009. The major in Mathematics consists of 72 units, with 28 lower division units and 44 upper division units.

For the CS/CN degrees, the Fall Quarter 2009 enrollment data indicated that there were 281 undergraduate CS majors, 202 graduate CS majors, and 23 CN graduate majors. For the CS/CN degrees the SFR was 26.7 for lower division undergraduates, 18 for upper division undergraduates, and 16.6 for graduate students. The SFR for tenured/tenure track faculty was 17.8 and 22.3 for lecturers. The overall SFR for Computer Science climbed from 12.5 in 2005 to 18.8 in 2009. The undergraduate major in CS consists of 84 units, with 36 lower division units and 48 upper division units. Both the Mathematics and CS/CN programs fall within the 180 units requirement of the CSU.

Beginning in 2006, the number of Mathematics undergraduate majors declined, from a high of 102 in 2005 to 70 in 2009. However, in 2011 the Department completed a Blackboard Student Count and counted file folders in the office and determined that there were between 94 and 121 Mathematics BS students, a significant increase from 2009. The Mathematics Department predicts that enrollment will increase slightly with the STEM initiative and with strong employment opportunities for high school math teachers.

CS/CN enrollments have steeply declined nationally since the start of 2007 to about 1/3 of the 2007 level; however, with recent improvements in the job market, enrollments are on the rise. In 2011 the Department completed a Blackboard Student Count and counted file folders in the office and concluded that there were between 237 (Blackboard) and 442 (Dept. files) CS MS students; between 40 (Blackboard) and 62 (Dept. files) Networks MS students; and between 247 (Dept. files) and 336 (Blackboard) CS BS students. These numbers bode well for the CS and CN programs' growth in coming years, especially given CSU East Bay's location relative to Silicon Valley.

Overview of the Documents Submitted to CAPR

Documents from the Department of Mathematics and Computer Science included a combined summary of all programs, followed by the Mathematics Self Study and Five-Year Plan, and the Mathematics Outside Reviewer's Report and Response to the Outside Reviewer's Report. Appendices provided information about Resources and Support from Campus Units, Support for

Training Math Teachers, Employment Outlook in Mathematics, Mathematics Faculty Publications and Award, Courses Offered to Other CSU Majors, Student Learning Outcomes, and the Dean's Letter in Response to the Outside Reviewer. Comparable documents for the CS Department were provided for its B.S. and M.S. degrees, with an additional appendix providing data on CS students and faculty nationwide (Taulbee Report).

The documents provide evidence of the critical role that the Department of Mathematics and Computer Sciences plays in meeting the needs of a diverse student body in a large public university, including growing demands for remediation, coverage of a significant number of GE courses, response to pressures to meet the increased need for well-prepared K-8 math teachers, and the transition of more courses to online delivery. The Department has experienced the significant impact from the loss of six of its last nine hires and a number of its long-time lecturers. Finally, the CSUEB Mathematics and Computer Science Department is the only one left in the CSU system that combines the two fields in one department, which presents benefits and challenges.

Program's Self-Study (2006/07-2010/11)

Summary of specific areas of the Self-Study:

The Mathematics program has responded reasonably well to a multitude of challenges including an on-going budget crisis, the loss of regular faculty and long-term lecturers, and the significant impact of the much larger freshman class sizes with concomitant increased remediation requirements. Because of increased demand for remediation for lower division students and evening courses for re-entry and graduate students, the program has had a difficult time staffing courses with regular faculty. However, the program has been successful in improving student flow through the remedial math program. The program has made strides in curriculum development, including courses to prepare future K-12 teachers and innovative and challenging courses for math majors at the undergraduate and graduate levels. The program has developed an innovative new Foundational Math certificate and has successfully acquired Noyce Fellowships that bring in outside support. Since 2005 the Mathematics program has set and met goals in the following areas: to bring in new faculty, which they did successfully with two new hires; to gain California state approval of a Single Subject Prep Program, which they accomplished; to strengthen ties with local community colleges, which they have begun and continue to develop; to address office, lab and meeting space needs for faculty and students, where they have experienced both gains and losses; to support new and current faculty, which they have met with only marginal success; to carry out efforts to assess students' needs, which have been accomplished only in minimal form; and to analyze and strengthen an applied math option, where no real progress has been made.

The CS/CN program has made progress in accomplishing a number of its stated goals with reduced faculty and scarce resources. Their stated goals and their accomplishments since the last five year review include the following: they have analyzed the new Association for Computer Machinery (ACM) curriculum and have substantially updated and revised their curriculum's major requirements to fit ACM criteria. The Department revised the introductory sequence of B.S. courses. New areas of CS have led to development (or modification) over 10 new courses,

including online and hybrid courses. Changes to the M.S. program include redesigning and re-launching the MS degree in Computer Networks and adding a new programming course, removing a course, and substantially revising the examination system. The CS/CN program has sought out and received feedback from the Computer Science Advisory Committee. In addition, the CS program now offers a BS in Computer Engineering in cooperation with the Department of Engineering. Time and budget constraints have kept the program from seeking American Board of Engineering and Technology (ABET) accreditation.

Graduate and Undergraduate Student Data/Demographics

Among Mathematics undergraduate majors, there are more men (58%) than women (42%), a majority of white students (36%) followed by Asian students (24%), Hispanic students (9%), and black students (7%). Available demographics in CS/CN indicate that 91% of the department's MS students in Computer Networks are foreign students without U.S. residency, and 37% of the CS department's BS students are foreign born and without U.S. residency. By comparison, only 9% of CSUEB students are foreign born without U.S. residency. The CS/CN students are primarily upper division and graduate students. The CS/CN program has an aging faculty, with 1/3 of faculty members over the age of 60 and 80% white. In addition, no CS/CN faculty members were hired in last five years, and most of the program's lecturers were lost.

External Reviewer's Comments & Department's Response

In the five-year review process, programs prepare their self-study and their five-year plan (draft) and submit these to their external reviewer prior to the reviewer's visit to campus. The program then has the opportunity to adjust their five-year plan based on feedback from the external reviewer and the response of their Dean to their document and the external review report. The Department received separate external reviews for Mathematics and CS/CN.

The external review of the CSUEB Mathematics program was conducted by Dr. Roger Alperin, Professor of Mathematics at San Jose State University. The visit took place on May 5, 2011 and consisted of document review, meetings with undergraduate and graduate faculty members, the Chair and Associate Chair, the Dean, and students, as well as a class visit. The external reviewer for Mathematics confirmed that, in general, Mathematics students appreciate the faculty, are engaged with their major, and benefit from research and job opportunities. Dr. Alperin reported that: students requested that more courses be made available, including in the summer; that they were dissatisfied with the inconsistency of course content provided by different professors as well as with the overreliance on PowerPoint-driven lectures; and that students were unhappy with the lack of accessibility of some faculty members outside of the classroom. Dr. Alperin recommended revitalization of the Math Club to support faculty/student connections, reduction in class sizes, and Math Labs staffed by senior undergraduates and graduate students. Dr. Alperin reported that the faculty members desire more cohesion, more meetings, and a place to gather (Mathematics faculty offices are distributed across campus); more support for new faculty who are frequently assigned new preps; and financial support for graders. The external reviewer recommended: more advising for students, including the proof's course prerequisite and use of a qualifying exam to appropriately direct students to classes; updated computer technology and increased travel funds for faculty; more scholarship activity among faculty; and regular meetings

among the faculty. Dr. Alperin also recommended expanding the course requirements in the major in the areas of genomics and quantitative finance.

The external review for the CSUEB Computer Science/Computer Networks program was conducted by Dr. Sigurd Meldal, Chair of Computer Engineering at San Jose State University. The visit took place on April 11, 2011, and consisted of document review, meetings with faculty and staff members, the Department Chair, the Dean, and students, including upper division and graduation students and officers of student clubs. The review included two class visits and a tour of facilities that support student learning. Dr. Meldal had many good things to say about the program. These included: innovative and quality instruction; well-qualified and enthusiastic CS faculty; faculty appreciation of students; and systematic assessment and updating of curricula. He noted that CS faculty members are engaged in a continuing process of self-assessment, reflection, improvement of their curriculum, which has been modified and revised to reflect Association of Computing Machinery (ACM) recommendations as well as keeping education current with Silicon Valley employer expectations. Dr. Meldal applauded the faculty for maintaining high standards despite an extreme lack of resources.

The external reviewer's report cited several significant program deficiencies that require prompt attention. These include: a serious lack of computer labs (there are no instructional labs). There is also insufficient technical support—only one person provides equipment support. Hardware infrastructure is managed by ITS, not the Mathematics and CS/CN Department or the College of Science. The report suggested that there is too little autonomy and discretion for faculty members regarding the hands-on (experimental-experiential) components of the program (for example, computer lab experience). The reviewer commented that there were too few faculty members and insufficient resources. Dr. Meldal suggested that the program is at risk and is in a precarious position, with over-extended faculty and resources: funding is critical to the program's future continued well-being, and the reviewer clearly stated that CS/CN should be a focus for funds when the economic situation improves. The external reviewer warned that reduced faculty size and increased workload is causing professional development to suffer, noting that, "In order to meet ABET accreditation standards, this situation must be systematically addressed." Finally, deficiencies with regard to institutional support include inadequate library resources, computer networks and other electronic information retrieval systems, as well as classrooms and offices, which were found to be only "minimally adequate."

The external review also identified several program weaknesses, which were rated as less pressing than the program deficiencies outlined above. These include the need for improved student advising as well as G.E. advising outside the department, and classes being taken out of order. Dr. Meldal stressed that "In order to meet accreditation standards, this situation must be systematically addressed!" Finally, the reviewer noted some program concerns, such as a lack of a systematic approach to learning assessment objectives (LAOs) (although he points out that the faculty are assessing the program content); the need for teacher-supported lab instruction to put ideas into practice; and inadequate support from the Career Center. He suggested that facilitation of informal interactions with students would be desirable, which could be achieved through closer office and classroom proximity. The review also mentioned that ABET (American Board of Engineering and Tech) accreditation is important (e.g., for international graduate students evaluating the program).

The Mathematics and CS/CN Program Responses to External Review

In response to the external reviewer's comments, the Mathematics program named the factors that have an impact on their ability to act on the recommendations: real demand for upper division and graduate courses, the number of faculty members available to teach courses, and the CSUEB budget. The Mathematics faculty members agreed that larger class sizes and the lack of graders has a detrimental impact on student learning. Offering more small classes would also provide more class offerings to students. Because Mathematics faculty members have been asked by the State and the Chancellor's Office to redirect energies to K-12 teacher preparation, STEM initiatives, and educational grant commitments, fewer faculty members are available to staff upper division and graduate level math courses. The CSUEB budget has also had a significant negative impact on the program's ability to offer a variety of upper division and graduate level courses, particularly during the summer quarter. One impact of budget cuts has been a significant reduction in the number of graders. The combined impact of larger class sizes and fewer graders has led faculty members to reduce the amount of homework required of students because they do not have the time and capacity to provide meaningful feedback. Faculty members have resorted to desperate measures, including paying for graders out of pocket and referring students to web-based tutoring to cope with these circumstances. The Mathematics faculty members also acknowledge that demands placed on newer faculty members are high as a result of senior faculty members being released from teaching to work on administrative responsibilities and CSU projects.

The Mathematics faculty members have been advised through memos that students desire more advising and access outside the classroom. The faculty members also agree that a Math Lab needs to be recreated for advising undergraduate and graduate math students. The program faculty members also acknowledge the negative consequences of the lack of cohesion among faculty members. This situation is exacerbated by the dispersion of faculty members' offices and the Department office across campus. Because there is not a natural, easily accessible place to gather, the Chair, faculty and staff members have not developed a sense of community, which has probably contributed to the loss of six of the last nine hires. The Mathematics faculty gather for a meeting only once a year on the first day of the fall quarter, and there was recognition that the culture of the program needs to change if many of the outside reviewer's recommendations are to be met.

The CS/CN program faculty members were in agreement with the external reviewer's observations and responded to several points raised in the report. With regard to accreditation by the American Board of Engineering and Technology (ABET), the faculty members agree that this would be desirable, but deem it too labor intensive and costly at present. The program will consider seeking ABET accreditation in the future. With regard to the lack of computer labs, the program states that it is relying on ITS to decentralize.

The program acknowledges that budget and resource deficiencies are problematic, and agrees that there is a severe faculty shortage, stating that "the Department is in need of new people with new views" to keep abreast of the CS and CN fields, including security studies and other new areas. They raised the possibility of looking for a new hire with ABET accreditation experience.

With regard to student advising, the program states it will seek to utilize staff in the Mathematics/CA Student Center.

There were several items that appeared in the external review that were not addressed in the program's reply, such as the lack of a systematic approach to learning assessment objectives, the lack of institutional support (e.g., library, computer networks, other information electronic retrieval systems, and classrooms and offices, which the external reviewer deemed only "minimally adequate"). In addition, the program's response did not mention faculty size and workload with reference compromised professional development.

The Department has an A2E2 proposal submitted to bring one small lab up to standards to be used to support student-faculty collaboration.

Program's Five-Year Strategic Plan 2011-2016

The Mathematics and CS/CN Department Five-Year Strategic Plan for 2011-2016 focuses on five critical elements: hiring new faculty to teach upper division and graduate courses; unifying the faculty and staff members in working together; improving student experience through interactions with faculty members, advising, and lab experiences; easing the burdens created by budget restrictions, including identifying funding for graders, professional development, and library support; and improving student preparedness through curriculum development and student support.

Curriculum: The Mathematics and CS/CN Department plans to increase its focus and energies on STEM-related initiatives supporting the campus community. This includes opening discussion with other departments on campus around the possibility of collaborating in the development of courses geared toward specific departmental needs. The Department will also continue working on developing hybrid and online course offerings to meet student needs. The CS/CN program plans to meet increasing enrollment by adding classes and updating curriculum to respond to emerging technologies. CS/CN has already updated an introductory course sequence that includes Mobile and Web Programming and they are planning for G.E. courses in CS. In addition, they plan to continue pursuing ABET accreditation. CS/CN plans on making curriculum changes in the MS-CS program including revising three areas, condensing curriculum, and removing category D.

Students and faculty: The Mathematics and CS/CN Department anticipates increasing the number of students enrolled to meet industry demands for qualified mathematicians and computer scientists, and to meet educational demands for qualified K-12 teachers. The Department plans to do more outreach at local community colleges, as well as growing outreach programs in China and India. Since STEM-related job growth is predicted in the coming decade and because CSUEB is strategically located in proximity to Silicon Valley, student enrollment in Mathematics and CS majors will also grow. This growth will necessitate that adequate space be made available to meet faculty and student needs, including advising and meeting spaces and computer labs. The Department plans to improve the student experience by offering labs, increasing advising, providing further support for the Math Club and welcome meetings for graduate students, and gaining student feedback (e.g., reinstating the survey of graduating

seniors). The Department plans to add new faculty with new areas of expertise and experience in emerging fields. They also plan to seek course release for advising graduate theses, as well as engaging in leadership development among faculty. The Department intends to address inadequate course release and workload issues to support assessment, recruitment, CTC coordination, and graduate programs (e.g., for the Graduate Coordinator). Finally, the Department plans to connect faculty to instructional practices and provide more guidance to faculty teaching courses for the first time.

Resources: The Mathematics and CS/CN Department plans to increase funding for graders and TAs, offering travel funds, improving library resources, and supporting up-to-date software (e.g., MATLAB). The Department hopes that plans for the new STEM building will include space for faculty and staff office and meeting spaces to support collaboration. The Department also plans to revisit the possibility of splitting Mathematics and CS/CN. The Department will pursue plans to institute a CS lab that is desperately needed.

CAPR Analysis of the Program's Five-Year Review

In the January 19, 2012 meeting with CAPR, the following issues were addressed with representatives from the Mathematics and CS/CN Department:

Particularly for the Mathematics program, well-organized specifics provided in the five-year plan for 2011-2016 are missing or weakly stated. Despite the severe budget constraints that the Department has experienced along with the rest of the University, the administration and faculty must collaboratively analyze current and future student, faculty and staff needs, articulate a set of desired outcomes, identify and prioritize specific resource and support needs, and develop plans for effectively reaching the desired outcomes within current budget projections. As is the case for other programs across the University, this will require creative responses to challenging circumstances. The plan should include specifics about what will be done, by whom, within a developed timeframe. Bring faculty members together to build this plan, with recognition that the desired outcomes can only be achieved through collective action. Attend to efforts to connect faculty instructional practices and increase articulation between courses. As noted in the Self Study, seek out opportunities to collaborate with the Science and Engineering programs to develop integrated offerings to prepare students for the expanding employment opportunities noted in the report. Continue to develop innovative methods for responding to the call for K-12 math teachers as well as the growing need for skilled CS/CN workers.

An important strategic issue that needs to be addressed is whether to maintain the current status of the Department with the combined Mathematics and Computer Science/Computer Networks programs. There are benefits and challenges to the current structure, and the external reviewers offered opinions about how the Department should move forward. CAPR recommends that faculty members from both programs spend time discussing how staying together or separating into independent programs might best support student and faculty needs. What would you like to say in your next 5-Year Report about how this issue was resolved?

Faculty: It was noted that effective functioning of the Department has been affected by the loss of faculty, including six of the last nine Mathematics tenure-track hires. The Chair and faculty

members stated that the Department is “in need of new people with new views” to meet student needs and to keep abreast of developments in both the Mathematics and CS/CN fields (e.g., CS/CN security studies). They raised an important point about possibly seeking new tenure track faculty members who have ABET-accreditation experience. The CAPR liaison recommended that the Department develop and brainstorm their overall vision in relation to new faculty hires, outlining criteria for new hires and desired areas of specialization over the next five years. It was also suggested that the Department make a case for better positioning themselves for new hires by strategizing how to increase enrollments (for example by offering more evening and online courses to draw students). CAPR liaisons also recommended that the Department develop a strategic plan for recruiting diverse faculty to better reflect their student population and student employment preparation needs. It was noted by the CS/CN faculty representative that most instructors in the program are older and white, and CAPR recommends that hiring considerations include criteria that attend to developing diversity among the faculty. This would help the program reach their aim to “change the composition of the faculty”, which has not happened because there have been no new hires in many years.

Students: CAPR strongly recommends that the Department attend to the needs of our diverse, multicultural student population. Plan for ways to retain students, including minority students, and support their success. One of the stated aims of the Department is to do more outreach with local community colleges, along with developing outreach programs in China and India. The CAPR liaison asked whether there are plans to increase the percentage of U.S. students in both BS and MS programs, and recommended that the Department outline specific strategies for outreach/recruitment at community colleges. CAPR supports the Departments’ aim to improve students’ experiences by offering labs, increasing advising, and gathering student feedback. The Department said that they will seek to increase advising staff in the Math/CA Student Center, and that they will be focusing efforts on improving student preparedness. CAPR recommends that the Department spend time with updating and developing their Program Learning Outcomes and Student Learning Outcomes at the course level. These outcomes will help students to focus their academic progress.

Resources: Because the budget/resource constraints are likely to continue, CAPR requested that the Department prioritize their most pressing needs and develop a list of the most feasible projects in order to show the University administration that they are planning ways to use potential funds and are working to make changes now. One external reviewer complimented the Department on its creativity in consolidating curriculum and making other changes, and CAPR suggests that they should continue to problem-solve and outline future developments despite the existing lack of funds. They have, in fact, suggested easing the burden of a reduced budget through finding course readers and TAs, and CAPR recommends considering enlisting graduate students as TAs and readers and offering a variety of incentives.

Computer labs: ITS decentralization has not taken place, and therefore the problem of the severe lack of computer labs has not been alleviated. The Department replied to CAPR inquiries that they are considering addressing this issue by asking students to bring private laptops on which to take their exams. Since computer use is of critical importance for CS students, and because technology access is a central concern for all CSUEB students, CAPR urges the Department to

continue to explore ways to offer laboratory instruction and maintain the crucial experiential elements of their program.

Assessment: CAPR notes that the assessment completed by the Department over the past five years has been weak to non-existent. It is critical in meeting student needs and for the health of the programs that an on-going, functional assessment process be developed. The CAPR liaison acknowledged that there has been minimal support on campus for carrying out successful assessment efforts in the past. At this time CAPR urges the Department to initiate planning meetings with the Coordinator of Learning and Assessment to institute on-going efforts to define learning outcomes, to directly and indirectly assess how well those learning outcomes are being achieved, to collaboratively review the evidence, and to take concrete steps to better achieve stated learning objectives.

CAPR Recommendations for Continuation of the Program

Acceptance of the Five-Year Program Review of the Computer Science B.S. and M.S.; Computer Networks M.S.; and Mathematics B.S. and M.S. programs in the College of Science at California State University East Bay and the recommendation that it continue with modification, to meet requirements in the CAPR Academic Program Review Procedures. Before CAPR will approve continuation without modification, the program must submit evidence of direct and indirect assessment of *at least one* Program Learning Outcome (PLO) each year, along with actions taken to close the loop, in their Annual Program Report for the next three years (Spring 2013, 2014 and 2015). The date of the next Five-Year review is 2016-2017.