BOARD OF HIGHER EDUCATION

REQUEST FOR COMMITTEE AND BOARD ACTION

COMMITTEE: Assessment and Accountability **NO.**: AAC 10-12

COMMITTEE DATE: April 27, 2010

BOARD DATE: May 4, 2010

APPLICATION OF THE UNIVERSITY OF MASSACHUSETTS AMHERST TO AWARD THE BACHELOR OF ARTS IN COMPUTER SCIENCE

MOVED: The Board of Higher Education hereby approves the application of the **University of Massachusetts Amherst** to award the **Bachelor of Arts in Computer Science**.

Upon graduating the first class for this program, the University of Massachusetts Amherst shall submit to the Board a status report addressing its success in reaching program goals as stated in the application and in the areas of enrollment, curriculum, faculty resources and program effectiveness.

Authority: Massachusetts General Laws Chapter 15A, Section 9(b)

Contact: Dr. Francesca B. Purcell, Associate Commissioner for Academic and P-16 Policy

BOARD OF HIGHER EDUCATION

University of Massachusetts Amherst

Bachelor of Arts in Computer Science

INTENT AND MISSION
The University of Massachusetts Amherst submitted an expedited proposal requesting approval to offer a Bachelor of Arts in Computer Science. This new program is designed to provide flexibility for students to tailor a major in computer science to include depth in another area of study, in preparation for careers of the future that integrate knowledge and strong skills in computer science with an understanding of other fields. The proposed program is largely based on the existing Bachelor of Science in Computer Science major but with a four-course concentration in another discipline replacing four upper-level computer science courses and a broadening of acceptable math and science requirements to correspond with the needs of the other disciplines. No new courses or resources will be necessary.

The proposed bachelor of arts program intends to graduate computing professionals who have the necessary depth of expertise in computer science to have lifelong careers in the field and who, at the same time, have sufficient exposure to a second discipline to be able to interact with professionals in that field in a knowledgeable manner, so as to apply advanced computer science techniques to problems in that second area. The Computer Science Department at UMass Amherst is uniquely positioned in the top twenty nationally, according to the *U.S. News and World Report* annual ranking of computer science programs.

The mission statement of UMass Amherst states, "The University's mission is to provide an affordable and accessible education of high quality and to conduct programs of research and public service that advance knowledge and improve the lives of the people of the Commonwealth, the nation, and the world." The goals of the proposed program are to directly enhance the lives of these students, and indirectly to open new opportunities for the application of computation in ways that will benefit the economies of the Commonwealth, nation and world, and the well-being of their citizens.

The University of Massachusetts Board of Trustees approved the proposed Bachelor of Arts in Computer Science on November 8, 2006. The required Letter of Intent was circulated February 19, 2010. No comments in response were received.

NEED AND DEMAND
The Computer Science Department currently offers a single degree, a Bachelor's of Science in Computer Science that has a software and mathematics core supplemented by a wide variety of electives that reflect faculty research areas. It prepares students for graduate studies and for careers in companies that have a principle emphasis on computing technology. However, there are additional jobs available in industries that apply computing in sophisticated ways, including entertainment, finance, medicine, and education, which expect graduates to have both a strong foundation in computer science and depth of knowledge in a second domain (Bureau of Labor Statistics, Occupational Outlook Handbook). There is also increasing emphasis on teamwork, communication skills, and lifelong learning.

There are approximately 290 undergraduate computer science majors, down from about 550 at the peak of the dot-com craze. A more flexible program that bridges to other fields of study will increase the number of majors, especially for underrepresented groups. The proposed program will facilitate more tailored studies in areas such as bioinformatics, computer arts, digital forensics, computational linguistics, etc., and will offer more flexibility for structuring double majors.

Computer science and allied fields are important for national scientific and economic life, and represent a continuing source of interesting, valued, and well-compensated work. The information technology minor at UMass Amherst has grown rapidly since its inception. Importantly, 40 percent of students in the program are women and 15 percent are African American or Latino/Hispanic. In fall 2006, new students enrolled with a female/male ratio of 59/41. The proposed BA in Computer Science will provide another option for those students who desire greater depth in computer science without committing to a traditional BS program.

Additionally, growth in the enrollment and diversity in information technology degree programs at higher education institutions that combine computer science with another field has grown over the last decade (Cohoon and Aspray, Women and Information Technology: Research on Underrepresentation, 2006, MIT Press). These trends demonstrate student interest in studies that combine other disciplines with computer science.

UMass Amherst states that there are no comparable programs within the public system. Private colleges and universities in Massachusetts offer some programs that are more comparable. For example, the proposed program is somewhat similar to the computer science degrees at Amherst, Mount Holyoke, and Smith Colleges but offers a wider variety courses and a more affordable price.

ADMISSION AND ENROLLMENT
Admission to the proposed program will follow the same admissions procedures as admission to the existing Bachelor of Science program. Some students will be admitted directly to the Computer Science major on their admission as freshmen or transfers, based on a profile given to the Admissions office by the department. Freshmen need grades and test scores above the average of the total pool, and a strong high school mathematics record, to be admitted. Transfers need coursework comparable to the introductory courses for the major in mathematics and computer science.

The UMass Amherst estimates eight to 12 students enrolling in the first year and anticipates a gradually rising number joining the program each year until it reaches steady state at 20 to 40 students per year and a total of 100 to 140 in the proposed program by 2015. Additionally, the goal is to reach the level of 20 percent women and minorities in the proposed program, which is about four times the current percentage in the existing BS program.

CURRICULUM (Attachment A)
The proposed BA in Computer Science requires 11 computer science courses, three math courses, and a four-course concentration in addition to general education requirements and free electives. Three semesters of mathematics, including two semesters of calculus (possibly at the level appropriate for business or the life sciences) will be required. Under current college requirements, the program will also require four semesters of foreign language (or equivalent) and two courses in the humanities in addition to general education.

The skills to be acquired will include essentials of computer programming, elements of software engineering, theory of computation as applied to large problems and/or problems in which there is uncertainty, and upper division electives in a wide variety of computer science subdisciplines, such as networking, databases, programming languages, artificial intelligence, robotics, computer vision, graphics, computing theory, and software engineering.

RESOURCES AND BUDGET (Attachment B)
The costs for the proposed program will be entirely subsumed within the existing budget for the Department of Computer Science. No additional expenditures specific to the new major are anticipated. No new courses are being created for the major, and no additional faculty will be hired. New major enrollments will be distributed across all existing courses. Revenues are based on additional student tuition and fees at current rates for the estimated 30 additional majors per year, up to a steady state of 120 per year.

The new program will be administered through the existing departmental organization of faculty advisors, chief advisor, undergraduate program director, and associate chair for academics.

PROGRAM EFFECTIVENESS
The proposed program's goals are to increase the number of computer science majors and the diversity of the student population. Part of the evaluation of effectiveness will be to review annually the rates of matriculation both in general and in terms of students from underrepresented groups. With graduating seniors, program administrators will conduct an online survey and hold a group feedback session. The feedback will include student comments about their experiences and their post-graduation plans. This information will be shared in an anonymous manner with the undergraduate program director, chief advisor, curriculum committee, and individual instructors as appropriate. Another goal of the program is to increase the number of double majors and the breadth of their second fields, for which statistics will also be kept. This information will be reviewed annually by the department curriculum committee and the undergraduate program director, to identify any weaknesses in the effectiveness of the program. If any are identified, they will work together to develop proposals to the faculty for adjustments to more effectively serve the needs of the students.

EXTERNAL REVIEW AND INSTITUTIONAL RESPONSE
The Computer Science department underwent a periodic review which included faculty reviewers from the University of California at Berkeley, Carnegie Mellon University, Rutgers, Princeton University, Cornell University, and Microsoft Research who considered all aspects the academic and research programs in 2007. They were presented with a slightly different version of the current proposal as part of their review of the undergraduate program.

The reviewers found that the department currently offers a strong traditional program for undergraduates and supported the addition of a B.A. as being greatly beneficial for students. The committee noted that it would be important to take this step without an extra teaching burden on the faculty so the department can preserve its strong research environment. The review committee strongly endorsed the plan to make the new undergraduate program more flexible and more problem- and idea-oriented noting that there is a critical national shortage in the workforce in computing.

The reviewers mentioned two concerns raised by the undergraduates interviewed: the variable quality of teaching assistants and the need for better integration of undergraduates into the department community. The reviewers suggested that a more flexible curriculum would also

help in attracting a more diverse group of students. The reviewers advised the University not to overreact to the current lower enrollment because CS enrollments are cyclical.

UMass Amherst responded that many efforts are being undertaken by the Computer Science community at large to address the national problem of underrepresentation in the field, and that the department is strongly engaged at all levels. UMass Amherst noted the major NSF Broadening Participation in Computing (BPC) grant that will enable the department to work with nearby community colleges in attracting women and underrepresented minorities to the major as well as departmental leadership in two national BPC alliances and close cooperation with two NSF Louis Stokes Alliances and the Northeast Alliance for Graduate Education and the Professorate demonstrate our commitment to addressing underrepresentation locally and nationally.

UMass Amherst also instituted requirements for language proficiency before a graduate student may serve as a TA and is working to provide wider opportunities for research experiences for undergraduates including a summer program for undergraduate research experiences, sponsored by the NSF, and encouraging faculty to submit proposals for research experiences for undergraduates supplements to all NSF grants.

STAFF ANALYSIS AND RECOMMENDATION
Board staff thoroughly reviewed all documentation submitted by the University of Massachusetts Amherst and external reviewers. Staff recommendation is for approval of the Bachelor of Arts in Computer Science.

Upon graduating the first class for this program, the University of Massachusetts Amherst shall submit to the Board a status report addressing its success in reaching program goals as stated in the application and in the areas of enrollment, curriculum, faculty resources and program effectiveness.

ATTACHMENT A: CURRICULUM OUTLINE

Major Required (Core) Courses (# Total courses required = 5)		
Course Number	Course Title	Credit Hours
CMPSCI 121	Introduction to Problem Solving with Computers	4
CMPSCI 187	Programming with Data Structures	4
	[Three of the following four core courses]	
CMPSCI 201	Architecture and Assembly Language Programming	4
CMPSCI 220	Programming Methodology	4
CMPSCI 240	Reasoning About Uncertainty	4
CMPSCI 250	Introduction to Computation	4
	Sub Total Core Credits	20
Other Required Courses in Related Subject Areas		
Course Number	Course Title	Credit Hours
CMPSCI [multiple]	Five Computer Science electives at the 300-level or higher (see www.umass.edu/ug_programguide/cscourses.html)	15-17
MATH 127-128 *or* MATH 131-132	Calculus for the Life and Social Sciences (I and II) *or* Calculus (I and II)	6-8
Varies	Additional Math course at the 200-level or higher (approved by department)	3
	Sub Total Related Credits	24-28
Elective Courses		
Course Number	Course Title	Credit Hours
Varies	Approved four-course outside concentration (200-level or higher) forming focused study in other discipline[s] with relevance to the theory or practice of Computer Science.	12-16
Varies	Free electives to make 120 credit total	10-30
	Sub Total Elective Credits	22-46
Distribution of General Education Requirements Attach List of General Education Offerings (Course Numbers, Titles, and Credits) [See www.umass.edu/registrar/media/Gen_Eds.pdf]		# of Credits
Writing (Freshman Writing and Junior Year Writing)		6
Arts and Humanities, including Literature and Foreign Languages		8-24
Mathematics (subsumed by requirements above) and the Natural and Physical Sciences		8
Social Sciences		4-8
Integrative Experience (Upper Division)		4
	Sub Total General Education Credits	34-46

Curriculum Summary	
Total number of courses required for the degree	32-36
Total credit hours required for degree	120
Prerequisite or Other Additional Requirements:	

ATTACHMENT B: BUDGET

NEW ACADEMIC PROGRAM BUDGET

One Time/ Start Up Costs		Annual Expenses			
	Cost Categories	Year 1	Year 2	Year 3	Year 4
0	Full Time Faculty *(Salary & Fringe)*	0	0	0	0
0	Part Time/Adjunct Faculty *(Salary & Fringe)*	0	0	0	0
0	Staff	0	0	0	0
0	General Administrative Costs	0	0	0	0
0	Instructional Materials, Library Acquisitions	0	0	0	0
0	Facilities/Space/Equipment	0	0	0	0
0	Field & Clinical Resources	0	0	0	0
0	Marketing	0	0	0	0
0	Other (Specify)	0	0	0	0
0	**TOTALS**	0	0	0	0

One Time/Start-Up Support		Annual Income			
	Revenue Sources	Year 1	Year 2	Year 3	Year 4
0	Grants	0	0	0	0
0	Tuition	46,000	146,000	246,000	346,000
0	Fees	126,000	398,500	671,000	943,000
0	Departmental	0	0	0	0
0	Reallocated Funds	0	0	0	0
0	Other (specify)	0	0	0	0
	TOTALS	172,000	544,500	917,000	1,289,000