J. Daniel Hare
Telephone: (510) 987-9303
Fax: (510) 763-0309
Email: *dan.hare@ucop.edu*

Chair of the Assembly of the Academic Senate
Faculty Representative to the Regents
University of California
1111 Franklin Street, 12th Floor
Oakland, California 94607-5200

May 27, 2016

AIMÉE DORR
PROVOST AND EXECUTIVE VICE PRESIDENT
UNIVERSITY OF CALIFORNIA

Re: Approval of Master of Computer Science (MCS) at UC Irvine

Dear Aimée:

In accordance with the *Universitywide Review Processes For Academic Programs, Units, and Research Units* (the "Compendium"), and on the recommendation of CCGA, the Academic Council has approved UC Irvine's proposal to establish a new self-supporting Master of Computer Science (MCS) degree program.
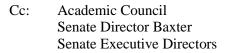
Because this is a new degree, and the Assembly of the Academic Senate is not meeting within 30 days of CCGA's approval, Council must approve the program per Senate Bylaw 125.B.7.

I am enclosing CCGA's report on its review of the new degree, and respectfully request that your office complete the process of obtaining the President's approval.

Sincerely,

J. Daniel Hare

J. Daniel Hare, Chair
Academic Council

Cc: Academic Council
       Senate Director Baxter
       Senate Executive Directors

COORDINATING COMMITTEE ON GRADUATE AFFAIRS (CCGA)
Valerie Leppert, Chair
vleppert@ucmerced.edu

ACADEMIC SENATE
University of California
1111 Franklin Street, 12th Floor
Oakland, California 94607-5200

May 23, 2016

ACADEMIC COUNCIL CHAIR DAN HARE

Dear Dan:

At its May 2016 meeting, the Coordinating Committee on Graduate Affairs (CCGA) voted to approve a proposal to establish a self-supporting Master of Computer Science at the Irvine campus that will be directed at foreign and domestic students, and is intended to prepare them for careers in high-technology industries, businesses, and government. Eight members voted in favor of the proposal and four members abstained, including the one required abstention by the UCI representative to the committee. Three of the abstentions were due to concerns about the impact of the program on the existing state-supported Masters Program in Computer Science. There were no votes against the proposal.

The campus proposes a professionally oriented Master of Computer Science degree with intensive hands-on development, an internship component, two capstone classes (professional writing and communication for computer science careers and design project for computer science), and significantly increased support for career planning and placement. It is a four-quarter (15 month) academic program with a one-quarter internship component; full-time students with prior work experience preferring to finish in one calendar year will be allowed to forego the summer internship component and instead complete the capstone classes in summer. The program is primarily aimed at full-time students, though working professionals or students with other obligations will be allowed to study part-time. Students in this program will receive extensive academic and career planning support, and will also receive extensive faculty advising throughout the program and during their capstone-intensive final quarter.

Reviewers provided enthusiastic support and unanimously agreed that the program is well conceived and addresses a compelling need in the field. More specifically, reviewers identified the following as strengths of the program:
- Excellent academic quality and rigor.
- Academic curriculum and potential for positive impact on the PhD and MSCS graduate programs.
- Expertise of the faculty.
- Excellent potential for applicant pool and placement of graduates.
- Professional employment and starting salaries for graduates.

At the same time, UCPB and reviewers raised concern that the program's stated goals are very similar to the extant program. Moreover, the impact of the proposed program on the existing, state-supported M.S. program was questioned. The program proposers responded that the new Masters of Computer Science program would be more tightly focused on professional preparation (vs. research preparation) than the current M.S. program, with new courses created over time to promote curriculum differentiation between the two. The movement of students more focused on careers (vs. research) to the new program would

also alleviate overcrowding in the existing M.S. program, and allow better focusing on research within it. In addition, resources generated from the new program could help support the existing M.S. program. The majority of CCGA members found the program proposers' arguments compelling and voted in favor of it. A minority of members abstained due to concerns over the anticipated decline in the total number of students served by the existing M.S. program. Some of the abstaining members were of the view that overcrowding should be addressed through the allocation of more state-funded FTEs, rather than by the creation of a new self-supporting program. Others hesitated to support the proposal due to a belief that better tracking mechanisms should be put into place at both the campus and systemwide levels to monitor the impact of self-supporting programs (both positive and negative) on state-supported programs, given the recent expansion in their variety and number. Overall, because the proposed program appears to be well-justified and of high quality, with substantial market demand, CCGA believes that the potential positive impacts outweigh the negative, and recommends approval.

As you know, CCGA's approval is usually the last stop of the Academic Senate side of the systemwide review and approval process, except when the new degree title must be approved by the President, under delegated authority from the Board of Regents. According to the Academic Senate Bylaws, the Assembly of the Academic Senate (or the Academic Council if the Assembly is not meeting within 30 days of CCGA's approval) must approve new degree titles. Given its status as a new graduate program title on the Irvine campus, CCGA submits it for formal approval by the Assembly of the Academic Senate. For your information, I have included the CCGA Lead Reviewer's final report as an enclosure. If you have any questions, please let me know.

Sincerely,

Valerie Leppert

Valerie Leppert, Ph.D.
Chair, CCGA

cc: Jim Chalfant, Academic Council Vice Chair
        CCGA Members
        Shane White, UCPB Chair
        Hilary Baxter Academic Senate Executive Director
        Michael LaBriola, Academic Council Analyst
        Ken Feer, UCPB Analyst
        Kimberly Peterson, Academic Planning Analysis Manager
        Chris Procello, Academic Planning and Research Analyst
        Judith Stepan-Norris, UCI Vice Provost for Academic Planning
        Frances Leslie, UCI Vice Provost for Graduate Education and Graduate Division Dean
        William Molzon, UCI Academic Senate Chair
        Hal Stern, Dean of the UCI Donald Bren School of Information and Computer Sciences

Enclosures (1)

CCGA Lead Reviewer Summary of UCI Master of Computer Science (MCS)

Ioanna Kakoulli

Date: 5/4/2016

Background

Based on preliminary review by the CCGA lead reviewer and informal communication by the UCPB on the new Master of Computer Science (MCS) proposed by UCI, the Department of Computer Science at UCI (via the lead proposer) was asked to address a few concerns before sending the report out to expert reviewers. These included:

1. What are the distinct features of each program (proposed vs current state supported program)?
2. What is the justification for the new program?
3. What impact will the new program have over the existing state supported program?
4. What are the academic merits of the new program?
5. Address the overload of teaching and supervision of capstone projects by faculty.
6. Elaborate on facilities and costs.

The department has responded promptly to the original request with a revised proposal dated to November 15, 2015. The revised proposal (with all revisions in track changes) was sent out for review to over twelve expert reviewers. From these, only three agreed to write and submitted a review (2 external and 1 internal-UC). A fourth review (also external) was obtained directly by the department proposing the new program. All four reviews and the UCPB report were sent to the lead proposer who has provided further clarification and answers to the reviewers' and UCPB comments and questions.

Program Summary

The proposal is to establish a self-supporting, professionally oriented, Master of Computer Science degree program based on Plan II, with intensive hands-on practical training in applied computing disciplines, an internship component and two capstone classes: 1) professional writing and communication for computer science and 2) design project for computer science.

The proposed time-to-degree (TTD) is four quarters with a one quarter internship component. Full time students with substantial prior work or internship experience will have the option to waive the internship component and complete the capstone projects in the summer. The program is primarily aimed at full-time students (both domestic and international). Part-time study will also be enabled for working professionals or students with other outside obligations. Students in this program will receive extensive academic and career planning support from day one and will also receive extensive faculty advising throughout the program and during their capstone-intensive final quarter.

The proposed degree program differs from the Master of Science in Computer Science (MSCS) and the PhD degree currently offered by the Computer Science Department, in that these are research-focused. It is also very different from other self-supporting programs offered at other UC universities. It will be the first "broadly defined" self-supporting program in the UC system. UC Berkeley's, UCSD's and UCLA's self-supporting are quite different. This one offers an internship and two capstone projects that will make students very attractive to companies.

Program of study

For the MCS they will require: 44 unit courses; 5 core courses and 6 electives all of 4 units each.

Each of the courses has a lab component, which is not offered in the MSCS allowing more supervised hands-on learning. Faculty will be compensated for re-structuring the classes. A the beginning there will be about 60% overlap between the curricula of the MSCS and the MCS, dropping to 40% later on as new faculty will be hired and new courses will be developed that are more specific to a professional degree.

Their aim is to admit 60 students in the first year, 75 in the second and cap the number to 90 thereafter.

Time-to-Degree

The normative time to degree is 4 quarters+ 1 summer but full time students with work-experience may be able to do this in 3 quarters and 1 summer. Maximum time to degree will be 3 years to allow enough time for the part time enrolled students to complete their degrees.

Benefits

1. Improve classroom experience for the MSCS and PhD as the focus of their classes will be shifted to more research oriented;

2. Revenue will provide fellowships for PhD and reader positions for MSCS;

3. Benefits to undergraduate as it will provide revenue for lecturers to increase number and improve quality of their minor courses.

Oversight

1. A director with the department chair and five-member steering committee from faculty

2. Academic and job placement counselors dedicated to this program

Advising

Program director will be the main advisor for all students in the program. Other faculty will supervise capstone projects. Counselors will be responsible for academic and job placement advising.

Program evaluation

All affiliated computer science faculty will evaluate the program on annual basis during faculty meetings.

Importance to the Discipline

Fulfills a need first, here in California but also elsewhere in the US and abroad.

Financial and other Implications

Expected to be self-supporting from year 1.

Hiring 1 lecturer (year 1) and 1 faculty FTE (year 2)

16 new courses (listed with a P for professional). Compensation will be offered to the faculty to develop the courses.

They do not plan to support financially these students but have drafted a proposal to NSF STEM for support of local diversity students in this program.

Strengths of the proposed program

Reviewers provided enthusiastic support and unanimously identified that the program is well thought out and very compelling addressing a real need in the field. More specifically, reviewers identified the following as strengths of the program:

- **Excellent academic quality and rigor.** *"I have complete confidence that this will be a quality program"* (Khuller). *"The program builds on the academic reputation of a highly ranked CS department and will benefit from the strong support indicated by its faculty, many of whom have agreed to serve a core faculty for the program."* (Tamassia)
- **Academic curriculum and positive impact on the PhD and MSCS graduate programs.** *"The curriculum plan is solid and well-conceived, and will provide a deep and detailed education to students"* (Whitehead). *"The curriculum includes highly relevant courses that span foundations and applications."* (Tamassia)
- **Expertise of the faculty.** *"The expertise is clearly adequate"* (Naughton). *"The program builds on the academic reputation of a highly ranked CS department and will benefit from the strong support indicated by its faculty, many of whom have agreed to serve a core faculty for the program.)* (Tamassia)
- **Excellent potential for applicant pool and placement of graduates.** *"This is of course where this program really shines. There is currently tremendous demand for this kind of program; at Wisconsin we accept a small fraction of applicants and I am sure UCI will have the same experience"* (Naughton).
- **Professional employment and starting salaries for graduates.** *"Industrial demand for professionals with a strong foundation in Computer Science skills is high, and hence students should have a reasonable expectation of being able to secure professional employment."* (Whitehead). **"Starting salaries for program graduates are likely to be substantially higher than the $80-$100K range indicated in the proposal. Placement data for Brown students show typical starting salaries of new CS Bachelor and Master's graduates in the range of $140K-$160K, with some employers routinely offering $180K. Students with specialized skills in high demand, e.g., mobile security and video compression, can earn starting salaries of over $200K."* (Tamassia)

Weaknesses of the proposed program

The UCPB analysis (completed prior to the revised proposal of November 15, 2015) and expert reviews brought up some issues of concerns that have been fully and satisfactorily addressed by the lead proposer. The responses of the proposer are cited verbatim below in *italics*.

- **Similarity to Goals of the Current MSCS Program**

While the new MCS program may look similar to the MSCS program it is really fundamentally different. It corresponds better with the needs of students planning to enter the workforce as technology producers, but not necessarily as researchers. Every course in the MCS program will have a lab and product development component and substantial teaching resources will be aimed at producing graduates who will be successful technology developers. While the initial description of the program is quite general, we will be adding new concentrations (data science, security, for example) if there is sufficient interest, and as our teaching capacity increases in the future, so the program will diverge a further from the MSCS program as time progresses. The current MSCS program is a research-oriented program leading either to continuing PhD study, or to a research and development job in industry or a government agency. The course

requirements are identical to those of our PhD program. The sheer size of that program makes it unsustainable, so even if we were not starting the MCS program we would be forced to reduce the number of students we admit. Graduate classes with more than 100 students enrolled do not lend themselves to developing independent researchers. The addition of the MCS program will improve the experience for all of our graduate students and will eventually raise our profile and rankings. The research-oriented classes will be able to add assignments such as in-depth literature reviews and implementation of complex algorithms that have been left out of the curriculum as class sizes increased. The reduction in size will allow us to prepare research-ready students, and to significantly increase our MS to PhD student conversion rate, thereby increasing the size of our PhD program, and most likely our retention and completion levels. We firmly believe that these changes will help us to increase diversity in the PhD programs because research oriented MS students will have much more regular interaction with faculty, and because we will have additional support for those students both through new TA/Reader assignments and because program surpluses could fund fellowship support directly.

- **Teaching and Advising Resources and Impact on State Supported Programs**

The MCS program will also improve conditions for undergraduates since we anticipate allocating much of the budget surpluses toward hiring faculty and lecturers. Because of a sharp increase in the demand for computer science degrees, we have been unable to offer sufficient seats in introductory computer science classes for non-majors. We anticipate that the new program will enable us to significantly increase our service teaching mission and we welcome that opportunity. Students from across the campus feel the need to develop computer literacy. Meeting the needs of those students is a challenge felt across all of the UC campuses. Please see http://dailybruin.com/2015/11/30/ucla-programs- [respond-to-rapid-growth-in-computer-science-field/](http://dailybruin.com/2015/11/30/ucla-programs-respond-to-rapid-growth-in-computer-science-field/) *and* [https://computinged.wordpress.com/2015/09/14/students-concerned-about-demand-for-cs-classes-at- berkeley-first-of-many/](https://computinged.wordpress.com/2015/09/14/students-concerned-about-demand-for-cs-classes-at-berkeley-first-of-many/) *and* [http://www.dailycal.org/2015/09/01/campus-computer-science-program- does-not-compute/](http://www.dailycal.org/2015/09/01/campus-computer-science-program-does-not-compute/) *which discuss the increase in demand and problems meeting that demand at UCLA and Berkeley. Or,* http://cs.stanford.edu/people/eroberts/CSCapacity.pdf *which is a longer article on the rise in demand for CS courses nationwide.*

By fall 2016 we will have at least 46 full-time faculty in computer science. The new program will allow us to hire a full time lecturer in the first year and a tenure track faculty member in addition to that lecturer starting in year two. While we will need off-load instructors in the first year, and while a handful of instructors might continue to teach a single course off-load in the future, we do not expect this to be more than 20% of our faculty in any given year, and time spent working on the program would count against consulting and expert witness work they could be doing instead. So yes, the additional compensation is in compliance with APM-662 and time spent on additional teaching during the academic year will be deducted from the days available for outside activities provided in APM-025.

We do not anticipate that this additional teaching will lead to negative impacts on our state funded program. And, while capstone supervision will be optional for faculty, we anticipate that the supervision of capstone projects will have many positive impacts on our state funded programs because it will naturally strengthen faculty ties to industry, and will give us opportunities to improve our upper division project courses by injecting new ideas into those classes. The strengthened ties to industry will also help shore up the jobs pipeline for students at all levels and in all programs.

Finally, as mentioned above, the program will help us to increase the number of students in our

PhD program and fully or partially supported students in the MSCS program.

- **Adequacy of Facilities and Budget**

With respect to facility costs, we developed the proposal in line with the detailed instructions we received from the central administration. If in the future we are asked to contribute more to campus facilities, then of course we will do so. In fact we have already suggested to the Executive Vice Chancellor, independent of this review, that we would welcome additional "taxes" to support central units such as the library. We have been told that such fees will be leveled in the future, once the self- supporting programs are well-established. And, while we do not anticipate needing to equip a computer lab in the first year of the program, we certainly could afford the estimated cost of $100-120K. We have already discussed this possibility with our facilities and IT managers and are prepared to equip such a lab quickly if we need to.
We have sufficient office space in Donald Bren Hall to house the additional faculty that will be hired and we will be using classroom facilities when they are least in demand – in the early evenings. Our classes will be relatively small, so we do not anticipate challenges finding available classrooms, nor interfering with the scheduling of state-supported programs. For now, we believe we have suitable lab facilities, and while the students will indeed be doing hand-on physical prototype development, these are typically small and easily transported by students back and forth to their residences. If storage space is needed we will work with our facilities director to find the space, and will compensate the School as appropriate.

- **Curriculum and Capstone Writing**

With respect to the Capstone Writing Course, we have considered the concerns of Professor Whitehead very carefully and we have had some of the same thoughts. In the first year the resume and cover letter development as well as training for interviews in the US technology sector (including developing compelling Linkedin and GitHub profiles) will be done in evening programs led by the program director, the full time academic counselor and the full time career (placement) counselor. And, the required introduction to algorithms class, which all students take in their first year, has been developed specifically to include algorithms related questions that often come up at interviews. In fact, these provide excellent opportunities to quickly examine the performance of fundamental algorithms and data structures. We believe that including these problems in that class will greatly improve students' engagement with important fundamental concepts in computing. Our current undergraduate and MS students have established several informal interview preparation clubs and of course the new students could participate in these or create additional clubs of their own. We will revisit the question of whether we need an additional professional development course in the future, but anticipate that professional development activities will take the place of a formal class for the time being.
It may well be that in the future we split the capstone professional writing into two – 2 unit classes so that we can tackle professional writing before students look for summer internships. We have considered that option and are very open to it. But for now, we believe that the full time career counselor, full time academic advisor and the director can meet students' needs. If we need a higher level career counselor in the future, or, as was suggested by one of the reviewers, two-three full time career (placement) counselors, then we will of course add those positions. While we did not discuss the pathway to success for students who fail the writing course in the proposal we have developed such a pathway. Please note that we consider this extremely unlikely, unless a student is facing personal issues completely unrelated to writing. We plan to be sufficiently rigorous in our evaluations of students (including interviews via Skype) so that those

who are admitted will be ready to succeed.

- **Mixing Students with Different Backgrounds**

Professor Khuller brings up an important point which we have not explicitly addressed in our proposal – namely how to mix students with undergraduate degrees in other fields with those from computer science. This is indeed a challenge, but one that we have been coping with for some time. We find that bright students with technical degrees in other fields (typically engineering, math or physics) can do well in our CS MS program provided they take six-eight lower division courses before coming. Because our undergraduate classes are at capacity, they typically take those at a community college or on-line. The required classes which students take early in the program should be sufficient to get those students up- to-speed, and the group work which is a key part of the program will mimic teams in technology companies which often include employees with differing backgrounds. We will carefully review each applicant to be sure that he or she has obtained the skills necessary to succeed in the program and in the work- force. Remember this is not intended to be a very large program. We intend to have very high standards for admission and to carefully weigh the strengths and weaknesses of all applicants.

- **Rational of the choice on the two applied courses: data management and system architecture (other courses proposed could be argued as essential).**

The choice of which classes to make required and which ones to made optional is somewhat arbitrary, but if we are to take students from engineering and science we would like them to know algorithms, data bases and computer architecture. While we don't disagree that machine learning could also be essential, we were not sure, when we wrote the proposal, that we will be able to teach into to AI, machine learning and data mining (another AI/ML class) every year (though we are finally about to hire one new machine learning expert).

- **Adequate advising by CS faculty**

We anticipate the program director and the faculty advisory board to host many in-depth advising sessions, and Capstone instructors and project advisors will have advising duties, so we do not think that staff will be the primary advisors for anything but course selection (progress to degree) and other administrative aspects of the program.

- **Consideration of offering 100% support to underrepresented minority groups**

We will start out with fellowships for domestic students with need, and focus our recruiting of URM students in the research-oriented program. Program funds will help to provide reader, TA and research fellowships in that program in addition to up to 50% fellowships in the MCS program. If we have sufficient resources in the future we will consider increasing fellowships for all domestic students with demonstrated financial need and of course will do our best to attract high quality URM students.

Final Recommendation

The proposal is to establish a new, self-supporting, professional Master of Computer Science in the Department of Computer Sciences at UC Irvine. The proposal fulfills the requirements for self-supporting degree for example: a) it is aimed for local professionals already employed and international students; b) all courses will contain a lab-component to provide supervised hands-

on experience; c) it will be scheduled in late afternoon/evening and will include summer instruction and d) plans to eliminate cross enrollments after three years.

Originally, based on verbal informal communication of the UCPB analysis, the lead proposer was asked by the CCGA lead reviewer to address issues pertaining to the academic program, overload of faculty and impact on state funded degree programs within the department and a revised proposal was resubmitted on November 15, 2015. The revised proposal was reviewed by four expert reviewers (three outside of UC and one within UC)[1]. All reviewers enthusiastically recommended approval of the program, with minor suggestions for improvement. The lead proposer was provided with the analysis and comments of the reviewers and asked to provide a response to the concerns raised. A detailed account and additional information clarifying all points was delivered. Overall, the revised proposal provided on November 15, 2015, and response letter on March 21, 2016 and email dated to April 26, 2016 adequately addresses the reviewers and UCPB comments and I recommend the proposal for approval by CCGA.

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[1] One review (that of Prof. Jeffrey Naughton) was provided/sent by the proposing department as they were sent the review directly. This was one of the reviewers originally contacted by the CCGA lead and who has declined to review the program due to other professional obligations.