External Program Review

Master's in Computer Science

California State University-Los Angeles

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I. General Overview of Program

The Computer Science Department at CSU-LA offers three programs of study: a BS, an MS, and a blended BS+MS degree. This review focuses on the MS and BS+MS programs.

Both programs cover core material in advanced computer science and offer a choice of two culminating experiences: a thesis or a comprehensive exam.

The department and subsequently, the program is going through several important changes. First, in response to an EO from the Chancellor, the program is revising its curriculum, particularly its core offerings. Second, the department has new leadership in the chair position, after a long and successful term from its previous chair. Third, the department has hired several new faculty members and hopes to hire more in subsequent years as current faculty retire. Taken together, these changes provide the department with a rare opportunity to redefine itself, develop new strengths and initiatives, and align its curriculum with the identity of its new faculty.

The department has a strong culture of assessment and continuous improvement, which will help it greatly in this transition.

II. Evaluation of Program Quality including:

- **History, Mission, Goals, and Objectives**

The M.S. in Computer Science program was started in 2003 after the Computer Science department was formed in 2001. The program has grown successfully, with several revisions

and improvements. From the success of the M.S. program, a blended BS-MS program was created in 2012; this has been a success in retaining strong undergraduate students for an additional year. Even though the program is relatively young compared to programs offered in other sister campuses, the department established and has successfully maintained a high-quality program in the region. Some of the success factors include highly qualified and dedicated faculty, a modern, successful curriculum, and strong partnerships with local industry. The program has clear goals that are consistent with the department, college, and university's mission.

- **Program Data: Enrollment Data & Impact of Enrollment Trends**

Declining enrollment in the graduate program was raised as an issue by multiple voices in both the department and administration. It was not clear what the expected target was for the program; considering the number of available faculty members and available resources, the number of students enrolled in the program seems reasonable. However, given that graduate enrollment has been declining while undergraduate enrollment has increased steadily over the past five years, we would encourage the department and administration to work together to identify an appropriate enrollment target and to identify reasons for this decline and potential strategies for growth. Some potential reasons for decline that were identified include a change in admissions criteria, graduation requirements relative to other schools, nationwide decline in the number of international students studying in the US, and of course, the coronavirus pandemic.

If it is determined that the program can and should grow, we would encourage the department to be strategic and consider the sorts of students it might attract and the curriculum that would attract them. Current efforts revolve primarily around current CSU-LA students and international students; tapping into the domestic LA market (either recent graduates or working professionals) is worth considering but might require some adaptation and market research in order to develop a program that is appealing to these students.

- **Curriculum and Instruction**

The department is currently revising the curriculum to reflect the Chancellor's EO to require all students to take at least half of their courses from a core. In particular, they are moving from a model in which students must take 9 units of breadth (3 of 5 areas) to one in which students must take 18 units of Core classes, consisting of 6 units from each of 3 areas. This is a significant change but provides the department with the opportunity to align the curriculum with both the program goals and also with the interests and expertise of the new faculty.

The proposed new core ensures that all students will get a well-rounded CS education while also providing structured opportunities to integrate advanced topics and electives. The department has a plan to offer courses, including machine learning, data science, and cybersecurity courses based on technology trends.

Most M.S. courses are taught by full-time faculty, which we applaud. This provides continuity in the program, as well as opportunities for graduate students to get engaged with faculty

research.

- **Assessment of Program Learning Outcomes (PLOs)**

The department has done an excellent job of articulating and assessing their Program Educational Objectives (PEOs) and Student Outcomes (SOs). This is evidenced by their continued re-accreditation by ABET, most recently in 2018. (Note that ABET uses PEO to refer to goals and SOs to refer to Program Learning Outcomes. The department uses this terminology as well to maintain consistency with ABET.)

The PEOs and SOs are clearly described and connected to the department, college, and university mission. The department has developed a thorough and effective two-loop process to evaluate and refine PEOs and SOs - SOs are measured and evaluated annually, allowing for continuous improvement at the course level. PEOs are measured every three years, allowing the department to periodically review and refine the curriculum. This will be particularly important and helpful as they transition to their new curriculum.

All faculty are involved in the assessment process, and the department meets regularly to review mission statements, PEO and SO data, and to revise the curriculum in response to these measurements. This level of integration of assessment into curricular analysis and design is comprehensive and impressive, and the department should be commended for the work and dedication needed to build and maintain this system.

- **Department Faculty**

The department has been fortunate to hire highly qualified tenure-track faculty members in recent years. This has provided a big boost to the MS program; these faculty are highly active in research and engage MS students in research through students' thesis projects.

As it stands, the number of faculty, including full-time and part-time, seems reasonable, considering the number of undergraduates and graduate enrollment data. However, more faculty will be needed if the program grows.

As mentioned above, the department is anticipating that several senior faculty members will retire in the next few years. We are sure that there will be pressure to either leave these lines unfilled or replace them with lecturers in order to achieve budget savings. We would strongly encourage these positions to be refilled with tenure-track faculty members for the following reasons: 1) tenure-track faculty will be able to provide research opportunities for graduate students, thereby elevating the program's appeal and visibility 2) tenure-track faculty will be able to provide the continuity and long-term engagement needed as the program re-orients itself toward its new curriculum 3) as these faculty mature, they will then be able to develop into the leaders needed to grow the program in new directions.

- **Student Engagement, Outreach, and Recruitment**

The department has done a nice job of engaging students both in research and in capstone projects. The external partners we spoke with were very pleased with their experiences with

CSU-LA students, and wanted to continue and expand the relationship. It was our understanding that there were more of these team-based project experiences at the undergraduate level; we would encourage the department to explore ways to engage more Master's students in these sorts of experiences. We would also encourage the department to regularly receive feedback from the industry advisory board or external partners through a survey.

In terms of outreach and recruitment, the program (along with support from the college) should think about ways to better promote itself to students in the Los Angeles area. This might include targeted partnerships with industry partners or increased marketing in the LA region. Outreach activities to prospective students, e.g., people in industry without an M.S. degree and current students, may be more effective than outreach to community colleges or high schools. Particularly, current students with a positive experience from the program can be very effective and a direct promotional path to prospective students with a similar background.

- **Program Self Recommendation and Five-Year Plan**

The department's self-recommendation and five-year plan are reasonable. The plan includes adding modern technology-related subjects such as data science, machine learning, and cloud computing to the current curriculum, recruitment, and hiring additional faculty members. A plan to offer more hybrid or online courses is timely after both students' and faculty's experience from virtual learning and education. Establishing an active alumni network and strengthening industry partnerships are both excellent ideas.

The department should be commended for its leadership and planning; they are moving through this transition in the chair position, the curriculum, and faculty composition in a careful, strategic way. We would encourage the dean to continue to support planning efforts, and also encourage the department to take the opportunity to reflect on future directions, and also to refine their plan for developing and rolling out their new curriculum and teaching out the current curriculum.

III. Commendations of Strengths, Innovations, and Unique Features.

We would like to specifically commend the department in the following areas:

- The department provides excellent opportunities for students to do research with faculty. The junior faculty, in particular, have really hit the ground running in setting up successful research labs.
- This active research, combined with a low faculty/student ratio and the opportunity to retain strong undergraduates through the blended program, are factors that make it possible to support strong theses.
- Departmental planning and collegiality are strong; this will be critical in navigating the upcoming curricular transition.
- The department has an outstanding culture of assessment and continuous improvement, including both well-developed tools and a well-structured process.

IV. Opportunities for Improvement

- The department and the college should take this time to reflect and agree on the size and composition of the graduate program. We would encourage the department to articulate the sort of graduate student they would like to produce; is the goal to develop students ready to enter a PhD program, to provide advanced training to new undergraduates, or to retrain current professionals for a new career? The answers to these questions will help determine the structure of the program, including modality, curriculum, and experiential learning opportunities.

  Particular strategies to consider in growing graduate enrollment include:

  - Admission criteria, and foundational requirements, particularly for students without a CS degree.
  - Enhancing and updating the department webpage. Admission criteria and foundational requirements posted on the current department webpage may not be very clear to prospective students.
  - Surveying current students as they have their own network and alumni
  - Soliciting feedback from IAB members and other industry partners, both about potential markets and to understand what they are looking for in hiring.

- The blended BS/MS program is effective at retaining strong undergraduates for the fifth year. However, as implemented, it may have some negative impact on college performance metrics, such as the four-year graduation rate. We would encourage the

department to collaborate with the Dean's office to identify ways to preserve the program's effectiveness and appeal while mitigating these effects.

- We would suggest considering the current role of the comprehensive exam as a culminating experience for the following reasons:
    - Requiring one extra course when students choose the comprehensive exam option may discourage new students from applying for the program. Most students are sensitive to the time needed for the degree and cost.
    - Conversely, we got a sense from the students we spoke with (not a scientific study, to be sure) that the exam was considered the easy option.
    - We would encourage the department to consider a third option of multiple semesters of Design Project, similar to what exists at the undergraduate level. This may be particularly appealing to students planning to enter the industry, who are in need of additional real-world, team-based project experience. The alumni and IAB members we spoke with were enthusiastic about this sort of idea. This might also provide the opportunity to collaborate with other departments, such as mechanical engineering or aerospace engineering, on externally-sponsored projects. The alumni and IAB members also recommend the department to teach students more on software development process models commonly used in the software industry.
- Consistent and reliable IT support is essential for a Computer Science department. We would encourage the college to identify at least one designated IT technician who is able to provide timely support for classroom and research activities.

V. Overall recommendation to the review:

- **Recommend Affirmation**: This recommendation implies that the program is fulfilling its mission, is maintaining overall high quality, and has processes in place that assure continuous improvement. In the spirit of continuous improvement, the External Reviewer should identify issues appropriate for further improvement prior to the next five-year review.

  To summarize, we are impressed with the department's leadership, existing processes, and collegial approach to change. We recommend that the department use this transitional period in terms of staffing and curriculum to determine both the ideal size and composition of the program and use this to make decisions regarding future curriculum, admissions criteria, and marketing strategy. We would encourage feedback from the IAB, with an eye towards an improved understanding of industry needs.