

Report from the Computer Science & Engineering Program Review

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Overview

The program review committee sought to assess the quality and impact of the University of Washington Computer Science & Engineering (UW CSE) department through a series of meetings with students, staff, CSE faculty, other UW faculty, and external stakeholders from industry and K-12 educational institutions. The program, one of the very top computer science programs in the world, delivers a high-quality education to undergraduate and graduate students, generates excellent research, and provides important service to the university and broader community. Additionally, the presence of a top notch CSE department makes many other units of the university more competitive. For example, we heard how data-intensive science and engineering research across the university is becoming more reliant on collaborations with CSE faculty and students. The trend is spreading to other departments at UW and other universities; disciplines that have not been traditionally linked with computing now increasingly depend on computer science to help them model, produce, visualize, and interpret complex data. Moreover, the department feeds critical ideas and people into the Puget Sound innovation economy. In short, the success of this department is intimately linked with the success of the university and region.

Summary Recommendations

From data and evidence gathered during this review, we recommend that **the university**:

- (1) Provide continuing status to this program for the maximum 10 years.*
- (2) Grow the faculty in CSE in order to expand access to their high demand degree programs and high impact research collaborations.*

We also recommend that **the department**:

- (3) Increase the number of Ph.D. graduates per faculty member.*

Recommendation 1: Provide continuing status for the maximum 10 years

The Departmental leadership has instilled a culture of supportiveness and can-do attitude that permeates the students, staff, and faculty. Moreover, the department leadership and faculty have been self-reflective and active in their regular pursuit of external input. For example, two years ago, the department convened a panel of outside experts for a comprehensive review. The department received recommendations from the panel on the benefits of revising their

undergraduate curriculum and on strategies for engaging in more interdisciplinary activities. Two years later, it is clear they have taken decisive action on the panel's recommendations. The undergraduate curriculum has undergone a remarkable transformation and is continuing to evolve, with broad faculty and staff support and participation. In addition, several new or pending interdisciplinary centers and groups have been formed. For example, a Games for Science and Learning Center has been launched and funding for an NSF Engineering Research Center on Neural Engineering is pending.

Recommendation 2: Grow the faculty in order to expand access to their high demand degree programs and high impact research collaborations.

Application and admissions data for the department document that high demand at the B.S., B.S./M.S., and Ph.D. levels are not being served because the current size of the faculty makes it impractical to do so. For example, in 2010 CSE received 522 applications for its Bachelors program and was able to accommodate fewer than 1/3 of them. Similarly, fewer than 1/3 of CSE undergraduates who applied to the very limited 5th-year Master's program could be accommodated. Finally, CSE receives well over 1000 applications per year to its full-time graduate program and admits fewer than 10%. The department feels that quality applicants in the pool are not being admitted because of limitations in faculty resources. Regional business leaders also made it clear that there is demand from industry for UW CSE graduates at all degree levels. These graduates play an especially important role in small and medium sized firms who do not have the national recruiting networks harnessed by Microsoft, Google, and Amazon. Growing the CSE faculty in a proportionate manner to student growth would help alleviate the access issue.

The panel interviewed faculty from Astronomy, Biochemistry, Biology, Neurosurgery, and the Information School to better understand the impact of the CSE department on data-intensive science across the campus. It is clear that the support provided by CSE to the campus eScience Initiative is beginning to have transformational influences, as evidenced in part by the level of collaborative funding with which CSE faculty are involved. However, there is significant unrealized potential, perhaps most notably in environmental sciences, given the investments by the university in this area. Building deep intellectual collaborations is time consuming for those involved. Growing the CSE faculty will provide the time required to build collaborations that can convert data into knowledge, resulting in the next generation of UW discoveries in science, engineering, and health.

The panel also interviewed Puget Sound business leaders, including a former president of the Washington Technology Industry Association, a partner at Madrona Venture Group, and staff from Microsoft and Intel. The CSE department has played an important role for the regional business community. For example, a number of startups have been launched based on research done within CSE or by CSE alumni. Also, many smaller companies rely on CSE graduates for the high-quality technical staff they need to grow and be successful. Given the pull of large and smaller companies arrayed around the computer sciences, faculty members may move in and out of the business world, creating positive regional economic impact, but also straining departmental operations. For example: two CSE faculty left the department to found Google's Seattle Labs and a third faculty member is currently on leave there; four faculty have consecutively taken multi-year leaves to serve as director of Intel Research Seattle; numerous

faculty have taken leaves in other local companies, both large and small; and others have taken leaves to found new startups spun off from CSE technology. Growing the CSE faculty will expand synergy with regional industry, maintain the vibrancy and morale of the department, and help the department manage its internal affairs while doing all of these things.

Recommendation 3: The department should increase the Ph.D. graduates per faculty.

Several factors appear to impact the scale of the graduate program, all of which are in the department's hands to begin addressing. For a faculty of 45 tenure- and research-track faculty, with hopes to grow, the number of Ph.D. graduates per year is on the low side. At the same time, we heard from several research clusters and junior faculty that they had more funds than they had students available to receive the funds. We cannot be certain why CSE does not have more graduate students, but we hypothesize that one reason is the department's attitude: Admit only the best students and ensure they all succeed. While we applaud the enviable high retention in the PhD program, two changes in department culture could help increase PhD production. One is to ensure that "only the best" includes taking risks on people who may not appear to be "the best" *a priori* by traditional measures (e.g., quantitative scores), but have unusual characteristics or experiences and thus have the potential to succeed in a research setting. The second is to redefine the measure of success; if a student leaves with a Masters and not a PhD, it should not be considered a failure. Greater numbers of strong students may be discovered and admitted by taking educated and insightful risks, and redefining current notions of success and failure.

Other potential factors affecting Ph.D. productivity are found in the educational program. CSE provides graduate students with outstanding courses and facilities, and the Department has been working to control "scope creep" for the Qualifying and General Exams. However, there is still some feeling by students and faculty that several of the required courses place extraordinary demands on students, and have content better suited to specialist courses rather than a general education. Not only should course effort be commensurate with the credits and needs of the discipline, but excessive coursework load can retard the initiation of research and add time to graduation. The committee separately discussed this recommendation with the CSE Executive Committee.

Final Comments: Outstanding but Fragile

Computer science is a field with several traits that distinguish it from most other disciplines. Foremost is the mobility of leading academic researchers. Industry offers truly exciting opportunities for innovative research and real-world influence, along with enviable salaries, and thus remains a constant attractor for faculty talent. The density of these computer science research and development opportunities is higher in the Seattle area than any place outside of Silicon Valley. Moreover, in distinction to the situation in many other disciplines, a faculty member can move her/his academic research program and team to another university and return to full productivity in a very short time. These factors influence the stability of all computer science programs, but especially those who are not one of the widely recognized "Top Four" programs: Carnegie Mellon University, Massachusetts Institute of Technology, Stanford University, and U.C. Berkeley.

A small group of departments, including the UW, reside in the next group of outstanding CSE programs. U.W. faculty, staff, and students are motivated to join the four top programs cited

above to establish a new “Top Five” grouping, and they are not far from doing so. Faculty hiring, retention, and grad student recruiting are aided by the department’s belief that if the UW CSE pushes for excellence in teaching, research, and service, they will become part of this new “Top Five.” If the CSE community comes to believe that there are impediments that make it impossible for UW to take the leap to the next level, things could go downhill surprisingly quickly. The mobility of computer scientists means that CSE’s best faculty will have little trouble finding excellent jobs at other universities or within industrial research laboratories. In fact, the committee is aware of numerous instances in which CSE faculty members have turned down attractive offers to move elsewhere. To keep this outstanding program and faculty moving forward, we encourage the UW administration to actively support CSE’s ambition to reach the next level of excellence, even in these tough times.