University of New Mexico

Department of Computer Science

Academic Program Review

Review Panel Report

April 2, 2019

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Table of Contents

Introduction to the Report

This report is prepared based on the review and site visit conducted on April 1-2, 2019 and the self-study report provided by the Department of Computer Science. The review team included one internal reviewer, Dr. Rafael Fierro, and three external reviewers (Dr. David Brooks, Dr. Maria Gini, and Dr. Enrico Pontelli). This report basically follows the same format provided by the office of the Academic Affairs for the onsite report with few modifications. According to the instructions by the office of academic affairs, this report only points at the areas of strengths and weaknesses without providing suggestions for remedies and or improvements to the program. The contents of the report are organized according to the following sections:

- Summary of Findings
- Students Learning Goals and Outcomes
- Teaching and Learning Curriculum
- Teaching and Learning Continuous Improvement
- Students
- Faculty
- Resources and Planning
- Facilities
- Peer Comparisons

Summary of Findings

The overall findings are summarized below:

Strengths:
- The department is the home of hard-working, accomplished, and committed faculty. The site visitors have appreciated the research reputation gained by the department and the commitment to excellence in the classroom. The comments by the students confirm the continuous dedication of faculty members to the mentoring of students and the engagement of students in research and discovery.
- The department leadership has inspired a great sense of collegiality among faculty, staff and students, leading to a very accessible and welcoming working environment for all stakeholders. This was particularly evident among junior faculty members.
- Most of the faculty members are research active and they maintain a strong and growing research portfolio, with great students' involvement, and with more than adequate extramural funding.
- The recruitment efforts have led to a large undergraduate enrollment, still growing at a faster pace than most of the other programs in the institution. The department has embraced such growing enrollment as part of its mission, maintaining an ongoing commitment to promote diversity and inclusion at all levels and providing curricular revisions needed to accommodate the growing student population.
- The meetings with the students have painted the picture of a satisfied student population, provided with a strong learning experience in the Computer Science Department. The anecdotal evidence provided in the self-study report also denotes excellent success in the placement of graduates in rewarding careers.

- The department offers up-to-date educational programs, which are aligned with modern standards for Computer Science curricula and supported by excellent work in assessment and closing the assessment loop.
- The department is housed in a modern facility and benefits from access to a state-of-the-art computing infrastructure and highly qualified staff personnel.

Areas Requiring Improvements:

- The department has a relatively old strategic plan, and it is unclear whether recent changes in the department (e.g., enrollment growth, faculty hires) are reflected as components of such strategic plan.
- There is scope for improvement in the area of outcome assessment. While some of the instruments adopted are outstanding (especially at the undergraduate level), there is scope for improvement at the graduate level and in the placement tracking.
- The department is stretched too thin in order to meet the pressure in the areas of teaching and advising. Without an influx of new resources or revisions to the existing curricula and advising practices, it will be challenging to maintain the overall quality of the educational and research programs and avoid faculty burn-outs.
- Overall, the department is challenged by the limited resources in comparison to the explosive growth in undergraduate enrollment, especially in terms of teaching assistants and in terms of access to suitable computer labs.

Students Learning Goals and Outcomes

Strengths:

The department provides a range of undergraduate and graduate programs which is adequate and comparable to what one can find at similar departments in well ranked institutions. The undergraduate program is ABET accredited. The overall structure and goals of the Computer Science academic programs are well aligned with the mission of the institution. The infusion of evidence-based practices to promote diversity and inclusion have been effective and they are also well aligned with the institution's emphasis on serving the broad population of the state.

The learning goals of each degree program have been clearly described in the self-study document and they are well aligned with disciplinary standards (e.g., ABET). The learning outcomes and the instruments to achieve them have been undergoing continuous revision through an outcome assessment process; the process has been formally designed and implemented with participation of representatives for different stakeholder groups. The strategic activities of the department are reviewed and evolved through a formal assessment process, supported by an external advisory board.

The department has demonstrated an outstanding level of engagement in terms of outreach and in support of the educational needs of the local communities. In particular, the department is a clear leader in promoting diversity and inclusion in computing.

Areas Requiring Improvements:

The Mission and Vision statements are relatively old (2013). It is unclear to the review team how effective such documents are in guiding the recent and ongoing strategic directions followed by the department, especially in terms of curricular revisions, research directions, and faculty hires. The alignment between the UNM strategic plan and the department strategic direction is unclear. The senior faculty members in the department expressed their concerns about the frequent shifts in institutional strategic directions and the challenges in identifying a role for the department in such fast-moving landscape.

Teaching and Learning Curriculum

Strengths:

The review team appreciated the design of the curricula used in the three degree programs offered by the department. The curriculum is thoughtfully designed and properly captures the standards of the discipline. Some of the recent updates (e.g., within the large project capstone course) are aimed at enhancing the learning experience and improving students' success.
The review team was particularly impressed by the work done in recent years to improve the structure of the doctoral program, especially through the addition of the research milestone component. The excellent placement of graduates from the doctoral program represents anecdotal evidence of the benefits from this reorganization process.
The curricula offered is accessible, enabling students from diverse backgrounds to access advanced studies in Computer Science - this is particularly evident at the graduate level, where many doctoral students have undergraduate degrees in non-computing disciplines. Some of the recently introduced courses (e.g., the 108 course) are designed to serve a broad student population, providing broad education in computing and computational thinking. These courses also serve as excellent recruitment instruments.
As already mentioned earlier, the review team was impressed by the outcome assessment instruments, especially those used for the Bachelor of Science degree; the department is doing an excellent job in closing the assessment loop.

Areas Requiring Improvements:

The discussion with the students led to the identification of several challenges that are primarily related to course scheduling and access to classes. Several students expressed the desire to have access to a broad variety of elective courses and the opportunity to access a wider variety of specializations (e.g., natural language processing and computer vision were mentioned). The students also discussed the challenges of having too many courses clustered on the Tuesday/Thursday schedule, complicating the development of each semester's schedule.

Furthermore, several students mentioned the unbalanced distribution of courses between the Fall and the Spring semesters.

Some of these concerns have been confirmed by the faculty members - several faculty members expressed reservations on the pressure to cover core undergraduate courses and courses with a very high demand (e.g., data mining/machine learning), thus preventing them from being able to explore alternative curricula. Some of these concerns are directly related to the growth in undergraduate enrollment and the lack of corresponding growth in teaching capacity.

A final area of consideration concerns the limited effort in adopting alternative course delivery methods (e.g., synchronous or asynchronous online) - mostly due to limited access to adequate infrastructure (e.g., limited access to ITV-enabled classrooms).

Teaching and Learning Continuous Improvement

Strengths:

The department has articulated in its self-study report a wealth of instruments focused on outcome assessment and on closing the assessment loop. The undergraduate Computer Science degree is ABET accredited, and the accreditation visit took place very recently with positive results.

The instruments adopted for the assessment of the undergraduate program are extensive and embraced by all faculty members. The assessment metrics are continuously reviewed, and the outcomes analyzed on a 2-year cycle to establish the necessary improvement interventions. Some of the changes implemented during these 2-year review cycles have led to a much stronger program and more effective pedagogical practices being introduced (e.g., the improvements introduced in the large project course).

Areas Requiring Improvements:

The review team expressed some concerns on the effectiveness and granularity of the assessment instruments used in the graduate programs, which are primarily based on students' GPA in selected courses. These instruments are coarse grained and may not provide detailed insights to guide necessary interventions (especially at the level of the Master's degree).

The team appreciated the discussion provided in the self-study report about the use of exit interviews as part of the assessment of the graduate programs - a powerful instrument. Unfortunately, exit interviews are voluntary and not implemented in a systematic manner.

Students

Strengths:

The review team was truly impressed by most of what was presented concerning students and student engagement. The department maintains clear and well described admission criteria, which are documented on the departmental web site. The admission criteria are designed to provide multiple access pathways into the degree programs and this has resulted in students from

very diverse backgrounds gaining access to the Computer Science graduate programs. This is made possible by flexible admission criteria and intentional and individually-tailored advising practices. The review team found such diversity remarkable and applaud such efforts.

The department has implemented strong recruitment practices (e.g., through the remarkable work by Dr. Moses and the introduction of the 4+1 program), which have resulted in a steady and strong growth in the size of the undergraduate program.

The department provides a well-organized advising structure, composed of a team of full-time professional advisors and the participation of all faculty members. The strength of this structure was confirmed by the conversation with both graduate and undergraduate students.

The department has been proactive in introducing practices to improve retention and graduation of students. One of such practices - peer tutoring - has been very effective; the students have articulated the positive impact of this tutoring program, which has not only improved academic performance, but also provided students with a greater sense of belonging and leadership skills. Even though the department has not implemented a systematic process to track placement of students after graduation, the anecdotal evidence provided indicates that graduates from the UNM Computer Science programs find excellent placement on the job market and gain access to rewarding professional careers.

Areas Requiring Improvements:

There are very few areas that require improvements.

The self-study report indicates undergraduate retention rates that appear to be low - in particular, they appear to be lower than those at the institutional and college levels. The review team suspects that this is possibly due to the way such rates are measured (e.g., students declaring major but before taking CS/MATH courses). Nevertheless, this is an area that should be investigated and addressed.

The review team is concerned about the growing advising pressure on the resources of the department (2 full-time advisors and the members of the faculty); the workload of each member of the team is growing due to the explosive growth in undergraduate student population, and the current model might not be sustainable much longer.

The popularity of some of the elective courses (which is locking faculty members with specific expertise in the teaching of such courses) and unclear distribution of teaching of core undergraduate courses have raised concerns among students about the limited opportunities to interact with some of the faculty members until very late in their academic studies.

During the meetings with the students, some concerns were raised by international students about the lack of opportunities for internships compared to domestic students (this is probably exacerbated by the opportunities offered by neighboring national labs, which are traditionally restricted to students who can gain security clearance).

Faculty

Strengths:

All faculty members of the departmental are highly qualified with the right credentials to teach and perform research in the department. Most of the faculty members are active in research; all the

faculty members perform activities related to teaching, advising, service, and outreach. They demonstrated to be hard-working and committed to the mission of the institution.

The department faculty are active researchers, highly accomplished in their respective disciplinary areas, and well recognized by the national and international research communities. The faculty members have provided ample evidence of engagement of both graduate and undergraduate students in scholarly activities; in particular, the review team was impressed by the faculty members' recognition of the research talent present among the undergraduate students and the desire to develop such talent.

The department has established guidelines for mentoring of junior faculty members by the senior faculty and the department chair; nevertheless, most junior faculty members praised the entire departmental faculty for their willingness to advise, mentor, and guide, regardless of the specific formal mentoring assignments. Senior faculty members are invested in mentoring and ensuring the success of junior faculty members.

The faculty have established a cordial, collegial and cooperative working environment in the department, which is not affected by differences in titles and ranks. The department is committed to ensure that the voices of all faculty members are heard and respected.

Areas Requiring Improvements:

The review team understands that all New Mexico state institutions have been challenged in recent years by an uncertain economic landscape. This has unfortunately kept faculty salaries behind national trends and faculty members have expressed their concerns about being properly compensated, especially compared to their peers at similar institutions. Given the outstanding talent available among the UNM Computer Science faculty, there is a concrete danger of losing the star faculty to other universities.

The meetings with the faculty members have also raised the concern about unclear or inconsistent expectations about distribution of teaching core undergraduate courses among faculty members, especially at the Assistant Professor rank.

The growth in enrollment matched with a stagnant size of the faculty body is leading to an increasingly heavy teaching and advising pressure – with the concrete danger of harming research productivity and ability to pursue broader efforts (e.g., large collaborative grants).

Finally, the strategic planning and long term vision for the department are limited by the static size of the departmental faculty and the unclear institutional priorities as concerns Computer Science.

Resources and Planning

Strengths:

The department has made great strides while operating with limited resources. The department maintains a sound approach for management of resources, budget, guaranteeing classroom support and renovation of computing facilities. The meeting with the staff members of the department demonstrated the presence of a collaborative approach to budgeting and expenditures, with the goal of effectively supporting students and faculty members. The review team was also impressed by the quality and dedication of the computing support staff.

Faculty members in the department have been very active in seeking extramural funding, with great success.

The department has also explored with success alternative revenue streams (e.g., differential tuition, course fees); the resources gained from these streams are applied to meet the educational mission of the department.

Areas Requiring Improvements:

At this point, the review team feels that the available faculty and staff (e.g., teaching and advising personnel) are insufficient to meet the enrollment growth. The same concern expands to the very small number of Teaching Assistant positions that are provided to the department, which impacts not only the educational mission but also the possibility to further grow the graduate program.

The department faculty expressed concerns about frequent changes in policies on distribution of IDCs and late distribution of resources (e.g., differential tuitions). These factors prevent the department from adequate planning and accurate budgeting.

Facilities

Strengths:

The department is housed in a newly renovated building; the building is outstanding; research spaces are well designed and enable collaborative work. The facilities offer open spaces for students to study, work, and collaborate. The department controls excellent computing facilities, supported by a capable and highly qualified IT support team.

Areas Requiring Improvements:

The review team heard concerns about the limited availability of teaching computing laboratories to meet the needs of a growing undergraduate enrollment; the limited computing teaching facilities create also challenges to scheduling of classes.

While the new building provides, at this time, adequate space for the entire Computer Science team, there are concerns that the addition of even a relatively small number of faculty members could quickly outgrow the faculty space available in the new facility.

Peer Comparisons

Strengths:

The Department has demonstrated competitiveness in terms of research, funding, and quality of educational programs with peer institutions, in spite of differences in size (personnel). The department has articulated its strengths and unique capabilities, in terms of interdisciplinary research and commitment to the educational needs of its diverse student population.

Areas Requiring Improvements:

Similar departments across the country have significantly grown faculty size in response to growing enrollment. There is clear evidence (e.g., through the CRA Taulbee Survey) that faculty salaries have been lagging behind national standards and salaries at peer institutions.

APPENDIX E
REVIEW TEAM WORKSHEET

This worksheet should be completed by the end of the Site-Visit and used as a supplement to the Review Team Report to document any findings, shortcomings, or issues relative to the APR Criteria. For each criterion, please assess whether the criterion is Met (M) if no shortcoming or issue exists in the Self-Study Report and/or during the Site-Visit. If a shortcoming or issue is identified for a criterion in the Self-Study Report and/or during the Site-Visit, please assess the criterion as Met with Concerns (MC) or Not Met (NM) (refer to p. 19 of the APR Manual for a description of the evaluation measures). For each shortcoming or issue, please summarize the basis of your assessment in the comments column.

Review Team Members: Maria Gini – University of Minnesota, Enrico Pontelli - New Mexico State University, David Brooks – Harvard University, and Rafael Fierro - UNM

Unit: Computer Science   **Site-Visit Dates**: April 1-2, 2019

APR Criteria	Evaluation Measures (M/MC/NM)	Comments
1. STUDENT LEARNING GOALS & OUTCOMES		
Demonstrated significance of the unit and its programs to UNM's mission and the UNM community	M	Department is committed to support the strategic directions of the institution in creation of knowledge and support of diversity.
Provided clear student learning goals and measurable outcomes for each degree/certificate program (undergraduate and graduate)	M	Learning goals are clearly discussed for each degree program.
Published and clearly communicated student learning goals and outcomes to the students and the UNM community	M	Learning goals are clearly specified in the self-study report and in the department web site.
Established student learning goals and outcomes are relevant, current, and sufficient in meeting the academic and professional aspirations of constituents	M	Learning goals and outcomes have been tailored to national standards (e.g., through ABET).
Participated in outreach and/or community activities that were sufficient and appropriate in supporting the unit and its programs and students in achieving their goals	M	Several faculty members are engaged in outreach efforts.
Demonstrated the unit's diligence in taking steps that maximize its strengths and address shortcomings	MC	Outstanding work at the undergraduate level; the outcome assessment is more vague at the graduate level.
Demonstrated that the unit's strategic efforts have evolved with regards to its programs' goals and student learning outcomes, service of its constituents and stakeholders, and contribution to the university and UNM community	M	The self-study clearly described how the department is closing the loop on assessment, at the undergraduate level. The department has assembled a good Advisory Board to seek perspectives from different stakeholders.
2. TEACHING AND LEARNING: CURRICULUM		
Demonstrated that the curriculum for each degree/certificate program is adequate and consistent with its student learning goals and outcomes	MC	Excellent curricula, well aligned with learning goals and national standards; some concerns about lack of variety of areas of emphasis in the undergraduate program.
Provided clarity on the significance of the unit's contributions to or collaborations	M	The department has built a reputation for strong interdisciplinary collaborations.

with other internal units within UNM		
Demonstrated that the mode(s) of delivery for teaching courses for each program are efficient and necessary to address student demands and academic needs	MC	Most of the curricula is delivered using traditional face-to-face modalities. Lack of resources (e.g., access to ITV classrooms) prevents advances in this area.
Provided clarity on the unit's future strategic planning efforts for improving its programs' curriculum as needed	MC	The department has an outdated strategic plan. The dependence on central administration for growth in resources is preventing the development of a realistic long-term strategic plan.
3. TEACHING AND LEARNING: CONTINUOUS IMPROVEMENT		
Demonstrated that student learning goals and outcomes are clearly established and reflective of the skills, knowledge, discipline, etc. that students are expected to demonstrate for each degree/certificate program	M	There is clear evidence in the self-study report and in the interviews with students that learning goals are established and met. The learning goals are well aligned with disciplinary standards.
Demonstrated that the established assessment methods for each degree/certificate program are program-level and effective in measuring student learning and progression through the program	MC	Assessment instruments are very strong at the undergraduate level. The assessment instruments used at the graduate level are somewhat more coarse grained and general.
Demonstrated the efforts of each degree/certificate program to improve, evolve and/or maintain its assessment structure and activities in order to maximize and/or sustain student learning	M	The department has done a good job in revising its assessment instruments over time, with input from relevant stakeholders.
Demonstrated use of assessment results from program-level assessment methods to inform and support quality teaching and learning in each degree/certificate program	M	Outstanding efforts to closed the assessment loop and use the outcome assessment results to lead improvements of curricula.
Demonstrated use of assessment results to evaluate student learning and inform program improvements	M	
Demonstrated how each degree/certificate program monitors the short- and/or long-term impact of its changes or improvements on student learning and/or the quality of the program	M	The department has a 2-year assessment cycle, which allows the faculty to review the impact of changes.
4. STUDENTS		
Provided clarity on the unit's processes and policies for recruiting and admitting students and the impact of them on enrollment	M	The department has witnessed a steady growth, and part of that is a reflection of the activities conducted by several faculty members in engaging a broad audience of potential recruits.
Conducted a clear and accurate analysis of the unit's enrollment, persistence/retention, and graduation trends	MC	The recruitment analysis is well described in the self-study report. Retention has been only partially documented and discussed.
Demonstrated that sufficient efforts were made to address any significant issues in enrollment, persistence/retention, and	M	The department has made significant changes over time to adjust to changes in enrollment (mostly in terms of addressing growth).

graduation rates		
Established an efficient advising process that has been improved as needed	M	The department has a well-established and effective advising infrastructure in place.
Provided clarity on the adequacy, relevancy, and impact of the student support services available to students	M	This was discussed only briefly during the site visit, but the evidence supports the case for effective support services for students.
Demonstrated that graduates and their success are monitored and measured	MC	The documentation concerning placement of graduates is sparse. There is anecdotal evidence of a strong track record of placement of graduates in rewarding careers.
Provided clarity on the unit's future strategic planning efforts for improving or strengthening its recruitment, retention, and graduation processes and rates	MC	The department is well aware of its enrollment trajectory and has made adequate plans to address such projected trends. The strategic plan will require new investments on the part of the upper administration, especially in terms of new faculty lines to meet the pressing teaching needs.
5. FACULTY		
Demonstrated that the composition, qualifications, and credentials of the faculty are appropriate and sufficient to cover all program and curricular areas as well as student demands	M	The department has an outstanding faculty with national and international reputation.
Conducted a clear and accurate evaluation of the efficiency of faculty course-load assignments for lower division and upper division courses	MC	We found some disagreements during the meetings with the different groups of faculty members concerning the expectations for teaching at the lower division level.
Demonstrated that faculty actively and sufficiently participate in professional development activities that support quality teaching and student learning at the undergraduate and graduate level	M	The faculty are working on the cutting-edge of pedagogical innovations in computer science education. Some of the faculty members (e.g., Moses) are internationally-recognized leaders in this field.
Identified and demonstrated that the research/creative work and efforts of faculty at the undergraduate and graduate level are adequate and/or significant	M	There is an outstanding range of research programs in the department. The large majority of faculty members have active research portfolios and are active in engaging students in the research enterprise.
Demonstrated that the majority of faculty diligently participate in efforts to retain, support, and/or mentor students (i.e., undergraduate and graduate)	M	During our visit, we were impressed by the collegial approach adopted by the faculty in addressing students' success.
Provided clarity on the unit's future strategic planning efforts to regarding its instructional staff	M	There is evidence of collegial discussion among the faculty on the future of the department and the priorities to be pursued.
6. RESOURCES AND PLANNING		
Demonstrated that the unit engages in effective resource planning and allocation	M	The department itself has managed its resources in a responsible and effective way.
Demonstrated that the unit have attempted to utilize faculty research to generate revenue	M	The extramural funding levels are excellent.
Conducted a clear and accurate analysis on the unit's budget including the sufficiency of the resources and support provided by the institution and external sources	MC	The unit has identified its strategic needs and clearly articulated the needs during our site visit. The institutional support has been only partially adequate, considering the rapid enrollment growth and the stagnant size of the faculty.
Demonstrated that the composition and	MC	The majority of the operational needs are

effectiveness of the staff are appropriate and sufficient to cover all unit, program, and curricular areas as well as faculty and student demands			adequately met by the existing staff. There are some concerns about the adequacy of the advising staff in the unit due to the exploding growth in undergraduate enrollment.
Demonstrated that the library resources available to the unit are adequate	M		The library resources appear to be adequate.
Provided clarity on the unit's future strategic planning efforts to sustain the sufficient allocation of resources and institutional support towards its programs, faculty, and staff	M		The unit has a clearly defined strategic plan which includes an analysis of the projected needs for resources.
7. FACILITIES			
Conducted a clear and accurate evaluation of the appropriateness and adequacy of the space and facilities allocated to the unit, its programs, faculty, staff, and students	M		The department has access to a brand new building with excellent space and facilities. The review team was impressed by the design of the space, which is conducive of collaborative work for students and faculty members.
Demonstrated that the current space and facilities are sufficient for meeting academic requirements	M		The space is currently adequate for the needs of the programs.
Provided clarity on recent space management planning efforts of the unit	M		
Provided clarity on the unit's short- and long-term strategic planning efforts regarding space management and/or space allocation	M		The unit has a clear vision for the usage of the space and potential opportunities for further space acquisition.
8. PEER COMPARISONS			
Conducted a clear and adequate evaluation of the quality and sufficiency of the degree/certificate programs within the unit based on comparisons with similar programs at other institutions (i.e., demonstrated examination of student enrollment rates, degrees/certificates offered, number of tenure-track faculty, research/creative work of faculty, etc.)	M		The unit has provided a clear comparison with several peer institutions.
Provided clarity on the unit's future strategic planning efforts to improve or sustain the quality of its programs with regards to similar programs at other institutions	M		The unit has a clear plan on how to move forward and improve its educational and research programs, and gain greater competitiveness.