INSITUTIONAL PROGRAM REVIEW REPORT

BACHELORS OF SCIENCE

IN

COMPUTER SCIENCE

COLLEGE OF COMPUTING

SPRING 2016

DAKOTA STATE UNIVERSITY

ONSITE VISIT DATE: APRIL 11TH – 2016

EXTERNAL REVIEWER:
DR. SHERRI HARMS
CHAIR & PROFESSOR
DEPARTMENT OF COMPUTER SCIENCE & TECHNOLOGY
UNIVERSITY OF NEBRASKA AT KEARNEY
KEARNEY, NE

P**art 1: Executive Summary of Findings**

The academic program review (APR) of the Computer Science (CSC) Bachelor of Science (BS) program housed in the College of Computing (CoC) at Dakota State University (DSU) was conducted on April 11, 2016. The external reviewer was Dr. Sherri Harms from the University of Nebraska at Kearney.

The reviewer agreed with the strengths identified in the self-study and found that the overall quality of the CSC program was outstanding and in line with the national ACM CSC curricular model. As the self-study states, "What sets the program at DSU apart is that it is being delivered in an environment which also has strong programs in related areas such as Cyber Security and Computer & Network Security…. allowing the student to receive expert instruction" [in these areas] which "is unique at any college of this size in the region. The DSU program also is unique in that it is viewed by the State of South Dakota as having a focused mission in the area of technology." "The addition of the masters in applied computer science and a doctorate in cyber operations also brings opportunities for students."

Other strengths noted include the option for students to complete the CSC BS degree online or on-campus, with blended classes that allow all students to interact; connections to industry, with jobs, guest presentations, and career fairs; deep and meaningful student/faculty relationships; outreach to K-12 students; and the strong national reputation of the DSU CoC programs.

One key strength, the tremendous growth in the number of students in all of the undergraduate CoC programs over the last five years, has presented some difficult challenges. This growth is outpacing the capacity of the CoC faculty to deliver the CSC and related program courses. While three new positions are being added to the CoC for fall 2016, this is still not enough to meet current needs, nor allow for any new growth. Additionally, the workload expectations and the low pay for CoC faculty relative to similar programs in the region makes it extremely difficult to attract and keep high-quality new faculty members. The CoC faculty members teach course overloads, with extremely large class sizes. The workload of the faculty far exceeds both the national norm for similar-sized CSC programs as well as the norm for DSU itself. It has led to the loss of faculty members and could potentially result in faculty burnout. Students identified that this issues causes them concern about the future of their programs. It threatens DSU's ability to maintain the good qualities of the CoC's programs. It is concerning that there seems to be a disconnect between the DSU administration and the CoC faculty and students in regards to severity of this problem and its effects on the entire university, given the technical mission of the university.

Other areas that need to be addressed include seeking ABET accreditation; formalizing the process for onboarding and guiding graduate assistants (GAs) or other adjuncts as they teach CSC courses with standard curriculum; providing well-designed facilities that meet the growing needs of the new CoC, including adequate lab space for CSC students to complete innovative software projects in close proximity to classrooms and faculty offices; working with the foundation to provide support for scholarships and endowed faculty positions; and revising the CSC program assessment process and program goals to be in line with the ABET accreditation.

Part 2: Schedule of On-Site Visit

Dakota State University
College of Computing – BS in Computer Science
Institutional Program Review
Schedule for On-Site Visit
Monday, April 11, 2016
Dr. Sherri Harms

Sunday, April 10

Motel reservations at AmericInn in Madison for one person
(504 SE 10th Street – 605-256-3076 – Confirmation #1134933 - direct billed to DSU)

Monday, April 11

8:00 – 08:30 AM	Dr. Judy Dittman, Academic Vice President, Heston Hall 314 (820 North Washington Avenue – park in south parking lot visitor parking)
8:30 –9:00 AM	Assessment – Dr. Jay Kahl, Director of OIEA, Heston Hall
9:00 – 9:30 AM	Risë Smith, Karl Mundt Library
10:00 – 12:00 PM	Computer Science Faculty, East Hall College Office
12:00 – 1:00 PM	Lunch, Marketplace (Stephen Krebsbach)
1:00 – 1:30 PM	Computer Science Students, EH 105
1:30 – 2:00 PM	Stephen Krebsbach, Tour facilities
2:00 -2:30 PM	Dr. Chris Olson, Chair of Computing for the College of Computing, East Hall 104-B
3:00 – 3:30 PM	Exit Interview with Dr. Dittman, VPAA, Chris Olson, Stephen Krebsbach, East Hall College office

Part 3: Program Evaluation, organized by focus areas for review

1. **Evaluation of program goals and strategic planning**
   - **Appropriateness of goals and whether / not goals are being met**
     According to the Self-Study, the mission of the College of Computing (CoC) is: *to educate and prepare students to be lifelong learners and professionals in computer science, cyber operations, network & security administration, and computer game design. Inherent in the educational process is challenging individuals to develop information management skills, to think logically, and to make sound decisions. Information technology is integrated throughout the curriculum.*

     The goals of the Computer Science (CSC) program according to the Self-Study are:
     - *Goal #1 – Graduates will be prepared for entry-level positions in the Computer Industry.*
     - *Goal #2 – Graduates will be knowledgeable and competent users of computer technology*.

   - **Program goals relative to institutional mission**
     According to the DSU website, the new 5-year Strategic plan states the DSU mission as: *DSU provides learning that integrates technology and innovation to develop graduates ready to contribute to local, national, and global prosperity.*

   - **Program goals relative to current national trends and forecasts for the discipline**
     As noted in the Self-Study, the national trend in the enrollment of CSC majors continues to show sustained increases. The job outlook for CSC majors continues to grow much faster than average, both nationally and in the state of South Dakota.

   Based on a review of the assessment reports and data included in the Self-Study and discussions with faculty, students, and administration, the goals are being met, are in line with the overall university mission, and are relevant to the current national trends and forecast for the discipline. Additionally, the connection to industry, with invited talks, career fairs, and job announcements is a strength of the program.

2. **Program resources**
   - **Effective use of resources to meet program goals**
     Based on the Self-Study and discussions with faculty, students and administration, the reviewer believes that the CoC is making excellent use of its existing resources in meeting its programs goals. However, some deficiencies in resources were noted.

   - **Faculty -- staffing levels and credentials**
     The CSC program has five full-time equivalent (FTE) faculty, with five additional FTE faculty members in CoC that teach courses in the CSC program. Additionally, four faculty positions are currently open (three of which are new positions.) Of these open positions, two are tenure-track positions and two are instructor positions.

     The graph on page 13 of the Self-Study shows the growth in enrollment in the CSC major. Coupled with the growth in the other CoC undergraduate programs, enrollments have outpaced the capacity of the CoC faculty resources needed to deliver its programs. While the faculty members excellent credentials and "student-first" attitudes, they work an exorbitant

number of hours each week simply to meet the basic teaching needs of the CoC programs. Based on the Self-Study and discussions with faculty, students and administration, the reviewer finds the CSC program to be severely understaffed to meet the course load demand for the current number of students let alone allow for continued growth, even with the added positions starting in fall 2016.

The CSC faculty members all teach course overloads, with extremely large class sizes. They teach both undergraduate as well as graduate level courses. The workload of the faculty far exceeds both the national norm for similar-sized CSC programs. Regionally, most tenure-track faculty in CSC programs with undergraduate and graduate courses teach three courses per semester (9 credits), and are given one-course release for research and one-course release for service. (At schools with a research focus, the teaching load is reduced from this level.) With the demands of preparing and delivering four or five large courses, the DSU CSC faculty report that they regularly work more than 12 hours per day, and work seven days a week during the semester. Several of them teach during the summer as well. The faculty reports that they do have little time for their service and scholarship responsibilities. There is little time or energy left for them to work with students on research projects. There is a decline in morale and mistrust that administration recognized both their efforts and the need for more faculty resources. The workload for the CSC faculty has led to the loss of faculty members and is leading to faculty burnout.

The CSC faculty also noted some concern with the teaching, scholarship, and service requirements as specified in the DSU Standard Document. The requirements for promotion and tenure are not clearly stated. With a large teaching workload, untenured faculty expressed apprehension with their ability to meet the vaguely written scholarship requirements. This is another potential cause for young faculty to leave.

Students identified that the faculty workload issue causes them concern about the future of their programs. They have seen faculty leave because of the heavy teaching workload, and are concerned that more faculty may leave or become burned-out. They also state that they feel misled by the DSU advertised 16:1 faculty to student ratio, since the CSC average class size of 25 students is 50% larger than advertised.

The reviewer is concerned that the staffing level of the CSC program (even with the added positions for fall 2016) will not allow for the CSC program to handle an unexpected faculty member illness or death, or even allow for a faculty member to retire or take a much needed sabbatical. The teaching workload for the current faculty is hampering department effectiveness.

The reviewer is also concerned that the staffing level may hinder a successful ABET accreditation. The ABET criterion for faculty states, “The faculty serving in the program must be of sufficient number to maintain continuity, stability, oversight, student interaction, and advising.” Additionally, the ACM CS curricula model states, “CS Departmental hiring should provide not only sufficient capacity to keep a program viable, but also allow for existing faculty to have time for professional development and exploration of new ideas. To respond to rapid changes in the field, computer science faculty must have the opportunities to build new skills, learn about new areas, and stay abreast of new technologies. Faculty need to

be given the time to acquire new ideas and technologies and bring them into courses and curricula. In this way, departments can model the value of professional and lifelong learning, as faculty incorporate new materials and approaches."

The workload expectations and the low salary for CoC faculty relative to similar schools with both undergraduate and graduate programs in the region make it difficult to attract high-quality new faculty members. According to glassdoor.com, https://www.glassdoor.com/Salary/Dakota-State-University-Salaries-E34194.htm, the DSU Assistant Professor of CSC salary is $79,551, which is lower than the average DSU Assistant Professor of Information Systems faculty member ($90,445) and lower than the average Assistant Professor of CSC salary of $84,349. It is also not much higher than what the CSC BS students earn upon graduation, as it is not uncommon for the graduates to start with salaries in the $70-75,000 range.

Given the current staffing level that does not allow CoC faculty much release time for scholarly or service activities, it is difficult for the CoC to help the university meet several of the Five-Year Strategic Plan initiatives. This includes grant submissions, helping to develop student exchange programs, and developing endowment assets. It also takes away from the CoC's ability to invest energy in recruiting more students, and promoting and delivering its graduate programs.

Finally, when the CSC program suffers, it hurts other programs on campus. As of Fall 2015, the College of Computing had 39.6% of declared majors at DSU. All DSU programs require at least one CSC course. Thus, all DSU programs need a strong CSC program to support their own growth and success.

- **Classroom facilities**
  Based on the Self-Study, a tour of the classrooms and discussions with faculty, students and administration, the reviewer agrees with the Self-Study that: the classroom space is adequate but pressured by growing enrollment and increasing class sizes; space and facility needs will need to be augmented by the new Beacom Institute of Technology building that has a schedule construction completion date of Fall 2017; and the new construction will not solve all of the space challenges but it will allow specialized needs to have a dedicated space.

- **Laboratory facilities and equipment**
  Because all campus students are required to have a mobile computer, and freshmen and sophomores have standardized DSU-issued machines, the CSC students' general computing needs are met.

  Based on the tour of the Karl Mundt library and discussions with librarian Risë Smith and the CoC faculty and students, the SDU library resources and infrastructure adequately support the scholarly and professional activities of the CoC students and faculty.

  For ABET accreditation, "Modern tools, equipment, computing resources, and laboratories appropriate to the program must be available, accessible, and systematically maintained and upgraded to enable students to attain the student outcomes and to support program needs." As the ACM CS curricular standards state, "The needs of computer science programs often

extend beyond traditional infrastructure (general campus computing labs) and may include specialized hardware and software, and/or large-scale computing infrastructure. Having adequate access to such resources is especially important for project and capstone courses. Moreover, institutions need to consider the growing heterogeneity of computing devices (e.g., smartphones, tablets) that can be used as a platform for coursework."

Based on the Self-Study, a tour of the laboratory facilities and discussions with faculty, students and administration, the reviewer finds the laboratory facilities limited in their ability to support CSC faculty and student research, except for the Information Assurance (IA) lab, and the Game Design lab. CSC students should have lab space and equipment to be innovative, and explore emerging technologies and computing devices.

Additionally, it would be nice to have common meeting space for students to interact and socialize.

- **Financial support**
  Based on the Self-Study and discussions with faculty, students and administration, the reviewer noted several sources of funds to support the CSC program. As stated in the Self-Study, these include: Computer Science discipline fees - $45.00 per credit (on-campus undergraduate students only); Computer Science differential tuition fees – $124.25 per credit above base online tuition; and the WMCI fee - $390.00 per semester.

  The reviewer agrees with the Self-Study that the enhanced online tuition rate for computer science courses should provide support for course development and student services to meet the needs of our growing online enrollment.

  The reviewer was encouraged to see support for professional development and training through funds allocated through the Vice-President of Academic Affairs (VPAA) office, and that the CoC faculty make good use of this funding to attend Black Hat (and similar) training sessions. The CoC faculty expressed concern that the current faculty workload requirements make it difficult for CoC faculty to take advantage of professional development and training opportunities.

3. **Program curriculum**
   The reviewer finds the CSC program curriculum to be up-to-date and in line with the latest ACM curricular standards, as well as the ABET curriculum criterion. The faculty are doing an outstanding job with continuous improvement, making sure the curriculum meets current standards and business and graduate school needs.

   A key strength noted includes the strong ties between all of the programs housed in a college entirely focused on computing. This allows CSC students to take quality elective courses in related areas such as cybersecurity and game design. It also enables CSC students to work together with students in other IT-related fields, similar to what they will experience in the work place. Another strength is the wise use of resources through offering all of the courses in the program both on campus and online, with faculty videotaping course lectures for the online students. This enables student teams that include both on campus and online students within a single course, and utilizes faculty expertise. The addition of the masters in applied computer

science and a doctorate in cyber operations also brings opportunities for students, such as the 4+1 program and the ability to do undergraduate research with graduate faculty.

The curriculum management process works well in making the necessary adjustments required of CSC programs. This was shown through the curricular modifications that lead to required course in parallel and multi-core programming to meet the 2013 ACM CSC curricular model.

Curricular strengths noted by students include the way the CoC faculty make the material learnable, by focusing on its application and not just theory. Students stated that they were strongly encourage to take what they learn in the classroom and augment it with projects on their own – and many students do. Students also liked that the class materials chosen by the instructors were often times developed by industry experts.

Students noted concerns that they would like more opportunities to collaborate with other student; have a more standardized delivery of the introductory CSCC 150/250 courses. The students also suggested that the content of the CSCC 150/250 courses be reviewed. They mentioned that they would like more depth of the material covered in the 250 course.

4. **Technology integration**
   As noted in the Self-Study, DSU has an excellent technology infrastructure supporting wired and wireless access to computing resources. Information Technology Services staff provides technology support to faculty, staff, and students.

5. **Program assessment**
   - **Appropriateness of assessment measures / activities for the discipline**
   - **Major-field assessment activities, relative to the program goals**
   - **Program accreditation, if appropriate**

   As part of the assessment process, the CSC program currently conducts Alumni and Employer surveys, Major Field Tests, grades, and primary measures. The reviewer found some areas that need improved in the assessment process, which will be detailed in the recommendations below. The CSC program has done a good job making utilization of the assessment process in adjusting the curriculum.

   Based on the assessment materials online, https://public-info.dsu.edu/academic-assessment/major-field-undergrad-table/, the stated goals do not address the second part of the goal statement in the assessment plan, *Graduates of the Computer Science program will be knowledgeable in the practices and technologies in their field and be prepared for entry-level positions in the field. Students wishing to pursue a graduate degree in Computer Science will be well prepared. Students entering the job market after graduation will be well prepared for their first employment.*

   Note, the assessment measures did assess both preparedness for entry-level industry and graduate school. This is a minor revision to goal 1.

   Previously, the CSC program had chosen to not seek discipline specific accreditation. The CoC faculty are receptive to seeking ABET in the future.

6. **Student support / student enrollments**

- **Student recruitment efforts**
  The CoC faculty regularly visit high schools to provide outreach as well as recruit students. CoC also offers several camps for middle and high school students, which provides students with the opportunity to learn about the CSC program and DSU.

  One camp was specifically designated for female students, which is an outstanding idea, given the extreme shortage of female CS students and professionals in the U.S. While the percentage of female students remains low (at 13% of the CSC majors), this is at the national norm for CS programs. The reviewer was encouraged that DSU has a Woman in Science program, and that the CoC is looking for ways to attract and retain female students.

  Several CSC students mentioned that they heard about the DSU CSC program through their high school teachers who completed their education at DSU. The reviewer found it interesting that one student mentioned that he learned about the outstanding DSU CoC programs through a forum on reddit.com.

- **Student enrollment numbers**
  As noted in the Self-Study, the CSC program enrollment had shown a strong trend upward since 2009. This trend outpaces the national trend, and the trend for most regional CSC programs. This growth has provided strength to the programs as well as growing pains.

  The persistent rate for first-time full-time baccalaureate degree seeking freshman returning to complete a second semester has been remained above 88% since 2005, with a weighted average of 93.3%. The average rate of retaining students to a second year since 2005 is 76.6%. The retention rate has ranged from 70.6% to 90.5% in that timeframe.

- **Student graduation rates and student placement**
  Since the enrollment growth happened so rapidly, the number of degrees awarded has yet to catch up with the enrollment. The weighted average six year graduation rate starting with the fall 2002 cohort is 39.9%, and it has ranged from as low as 19.2% to as high as 71.4%.
  The job and graduate school placement rates reported for 2014 for CSC majors was 95%. The reviewer believes that the rate is most likely closer to 100% at this time, based on discussion with CSC faculty and students and given that there are on average two jobs available for each CSC graduate in the U.S., (based on data from BLS and NSF). The fact that 10% of the students choose to continue to graduate school given the strong labor market is a testament of the desire for CSC students to keep learning.

- **Student support services**
  As noted in the Self-Study, DSU has good student support services.

- **Academic advising**
  The advising process described in the Self-Study show a student-first attitude. In general, students report that they feel a true bond with the CoC faculty. They report that the faculty have a desire to connect with students, and they expect the relationships to last a lifetime. Faculty report that they feel strongly connected with the students. It is partly because of these

bonds that the faculty agree to work an exorbitant number of hours each week. The faculty are there for their students.

7. **Program strengths and areas for improvement**

The strong relationship bond between the CoC faculty and students is a strength of the program. Additional strengths include the unique focus of the university; the low cost of tuition; option for students to complete the CSC BS degree online or on-campus, with blended classes that allow all students to interact; connections to industry, with jobs, guest presentations, and career fairs; the growth in enrollment in the past five years; outreach to K-12 students; and the strong national reputation of the DSU CoC programs with strong tie to the security industry. The addition of the masters in applied computer science and a doctorate in cyber operations also is a strength of the program.

The key areas that need to be addressed is the course load for faculty and having a faculty size that meets the teaching, service, and scholarship requirements of the program. Increasing the graduation rate and the female student ratio are areas for improvement. Other areas for improvement are the process of onboarding and guiding graduate assistants (GAs) or other adjuncts as they teach CSC courses with standard curriculum; facilities that meet the growing needs of the new CoC, with adequate lab space for CSC students to complete innovative software projects in close proximity to classrooms and faculty offices; relationships with the foundation to provide support for scholarships and endowed faculty positions; and the CSC program assessment process

Part 4: Recommendations for Change

- **General comments**

As stated above, the CSC program is an outstanding program with numerous strengths. The rapid enrollment growth has caused issues that need to be addressed, especially with regard to the faculty teaching load. The CSC assessment could be improved, and the time is right to seek ABET accreditation.

The reviewer recommends the CoC faculty hold a half-day retreat each fall – focused on curriculum and strategic planning. The reviewer also recommends that the CoC develop SMART (Specific, Measurable, Action-oriented, Realistic, and Timed) Goals, and a Strength Weakness, Opportunity, Threat (SWOT) Analysis. These should be reviewed and adjusted each year. The SMART goals should include marketing, recruiting, relationships, and curricular goals. They should be used to drive the decision making process for the college.

The reviewer also recommends formalizing the process for onboarding and guiding graduate assistants (GAs) or other adjuncts as they teach CSC courses with standard curriculum; providing well-designed facilities that meet the growing needs of the new CoC, including adequate lab space for CSC students to complete innovative software projects in close proximity to classrooms and faculty offices; working with the foundation to provide support for scholarships and endowed faculty positions; and revising the CSC program assessment process and program goals to be in line with the ABET accreditation.

Other opportunities that could be explored as resources allow include more undergraduate research, exchange programs for faculty and students, and the use of the alumni and business partner advisory council.

- **Specific recommendations, organized by focus areas for review (above)**

1. **Program goals and strategic planning**
   The reviewer believes that the stated goals of the CSC program need improved. They should be more closely tied to the college and university mission to address "innovation and contributions to society". A goal for CSC students to be "*be knowledgeable and competent users of computer technology*" does not go far enough in matching what the true mission of the CSC program. Student learning outcomes need to be written to demonstrate higher-level skills, e.g. analysis, synthesis, evaluation. They should be concise, and focused on the student learning activities used in the assessment process.

2. **Program resources**
   The reviewer believes that the administration and the CoC faculty need to work together to establish a plan to outlines a timeline and budget for hiring the needed faculty. This will be a critical component that needs to be addressed as ABET accreditation is initiated. Based on discussions with CoC faculty and students and DSU administration, it seems that the administration and the CoC faculty and students are not in agreement in regards to severity and immediacy of this problem and its effects on the entire university, given the technical mission of the university. Working together toward a solution is critically important.

   As stated in the ACM CSC curricula model, "In the face of large sustained enrollment increases (as has been witnessed in recent years), the need for sufficient faculty hiring can become acute. Without sufficient capacity, faculty can be strained by larger course enrollments (each course requiring more sections and more student assessment) and more teaching obligations (more courses must be taught by each faculty member), which can result in lower quality instruction and potential faculty burn-out. The former issue causes students to abandon computer science. These outcomes are highly detrimental given the need to produce more, and more skilled, computing graduates as discussed above." A deeper argument for the need to maintain a strong faculty capacity in the face of growing enrollment can be found in the September 2011 issue of ACM Inroads.

   The CoC has started to utilize Graduate Teaching Assistants (GAs) to cover needed courses. While this is an excellent way to meet immediate teaching needs, and a wonderful opportunity for graduate students, this needs to be done carefully. The GAs need instruction and guidance prior to the start of the class and mentoring while teaching a class. Additionally, the CoC needs to ensure the learning objectives for the courses are being met, no matter who is teaching the course. The reviewer recommends that a full-time faculty member be given a course reduction for coordinating and mentoring the GAs.

   DSU should consider adjusting the workload and salary requirements to be able to hire high quality CSC professors and keep them. Doing so would ensure the long-term success of the CSC program.

Housing faculty offices, classrooms, meeting space, and lab facilities together within one building can assist with establishing the identity of the new CoC. The construction of the Beacom Institute of Technology building provides an opportunity to design the needed space that meets the growing needs of the new CoC. The reviewer recommends that the CoC be provided with adequate lab space for CSC students to complete innovative software projects in close proximity to classrooms and faculty offices. The reviewer also recommends that CoC be given additional space for student/faculty research and to adequately carry out the needs of the department.

The reviewer agrees with the Self-Study that the enhanced online tuition for CSC courses should be used to provide support for course development and student services to meet the needs of the growing online enrollment. The reviewer recommends that the administration and the CoC faculty work together to direct some of the CSC differential tuition funding back to the program. This funding can be utilized to support additional faculty hiring.

The reviewer also recognizes an opportunity for CoC to work with the DSU foundation to seek funding from external sources, such as business partners and alumni. These funds could be utilized for scholarships and endowed faculty positions. These specialized funds can be used to energize the overwhelmed CoC faculty body, and make the open CSC faculty positions more attractive to high quality applicants. Additionally, business partners and alums would make highly qualified adjuncts to assist with meeting instructional needs in the short term.

3. **Program curriculum**
   First, the reviewer would like to express admiration for the excellent CSC program with the strengths mentioned above. The reviewer recommends the CoC faculty to keep up the great work with the curriculum. The faculty could consider taking a half-day before the start of each fall to focus on curriculum and strategic planning. This helps focus the curricular adjustment goals for the year. The reviewer also recommends that the student concerns mentioned above be discussed by the CoC faculty. Sometimes these concerns can lead to opportunities for improvements.

4. **Technology integration**
   The reviewer has no recommendations for improvements in this area, and is impressed with the technical infrastructure and its utilization on the DSU campus.

5. **Program assessment**
   Both the DSU Director of Assessment and the CSC faculty agree that the CSC program goals and assessment process needs to be modified. They indicate that this will be worked on during summer 2016 and seem eager to put together an assessment plan that will be useful in driving programmatic improvements and in measuring outcomes. The reviewer recommends that this process be conducted.

   The reviewer recommends CoC to consider using curricular mapping and developing new direct measures to assess the targeted learning outcomes. Curricular mapping helps identify the courses where the learning outcome is introduced, reinforced, or emphasized. Using

direct measures such as grades on capstone projects, research papers, final exams, or final presentations tie the curriculum directly to the assessment process. Additionally, direct measures that are part of the curriculum are a much better measure of a program than alumni and employer surveys, or even the ETS Major Field Test in Computer Science, which lags behind current innovation in CSC. The reviewer believes that the assessment process can be streamlined while it is improved.

The reviewer recommends that the CSC program seek ABET accreditation in the near future. The new assessment should be tied to the ABET accreditation requirements, to facilitate that process. The assessment measures need to directly measure course specific outcomes, tied to the progression of student learning. The reviewer also recommends that the CSC program consider designating a capstone course. This is extremely valuable to meeting assessment measures, developing students soft skills, providing opportunities for students to work in teams, and is a valuable addition to an ABET accreditation application. The reviewer recommends that a full-time faculty member be given a course reduction for coordinating the assessment and ABET accreditation process.

6. **Student support / student enrollments**
   The reviewer commends the CoC faculty for their outreach activities, such as high schools visits and camps. As resources allow, these activities should be continued. The reviewer recommends that the CoC faculty continue to review opportunities to attract more female students. There are several outstanding resources for this, such as those developed by the National Center for Women in IT, and the Institute for Women in Technology, Trades and Science (IWITTS). DSU should consider taking female students to the biennial MinneWIC conference for Midwest Women in Computing.

   While the average persistent rate of 93.3% is outstanding, something must happen during the second semester, as the average retention rate to the next year is lower at 76.6%. The reviewer recommends that the CoC review the second semester requirements to verify that the students are adequately prepared for this coursework. Additionally, since many of the beginning courses are now taught by the GAs, it is important for CoC to mentor the GAs and ensure consistency of course content across all sections of the same course. The CoC should investigate ways to increase the average graduation rate (39.9%). There are a number of strategies that can be used. For example, the reviewer's home university CSC program uses student-led projects across numerous classes which has increased graduation rates to nearly 80% of the students who complete the first year.

   The reviewer has no recommendations to address with student support services.

7. **Specific recommendations relative to issues identified by the university**
   The recommendations for program curriculum, program assessment, and program enrollments are all embedded in the specific recommendation areas above.

Finally, the reviewer would like to thank everyone at DSU for the opportunity to conduct this external review. Clearly the CoC faculty and the DSU administration are working hard to deliver strong programs for students, with key ties to business and security industries. I am confident that DSU is extremely proud of the CSC program and the CoC faculty, students, and alums.