

Computer Science Comprehensive Program Review December 2020

General and Overview

1. Describe your program's most significant opportunities and significant challenges.
(Narrative)

Opportunities

- Computer Science is an in-demand major with strong enrollment.
- There is a solid foundation of tenure-track faculty to lead the program forward, and recent hires have put staffing at a satisfactory level for the current number of majors.
- There are two emphases, one in a more traditional area (Software Engineering) and one in a rapidly growing area (Information Assurance and Security, aka Cybersecurity). There is also interest in developing additional emphases, including: Networking, Computer Engineering, Network Security, and/or Penetration Testing.
- The recent move to CSET and the Resch School of Engineering will foster collaborations among faculty and students.
- The program has strong support of administration.
- A new collaborative online MS in Cybersecurity began in Fall 2020. This program will enhance the overall Computer Science program and may help to recruit additional undergraduate students.

Challenges

- There are currently no tenured Computer Science faculty. Faculty development needs to be a high priority to make sure everyone successfully achieves tenure.
- Given the high need for Computer Science students in Northeast Wisconsin, the program should develop a stronger connection to the community. Several companies have shown an interest in providing feedback and this could form the basis of an Advisory Board to help guide the program going forward.

2. What are some things that would help make your program and its students more successful?
(Narrative)

- More time for faculty to focus on scholarship, with the ultimate goal of earning tenure. With the staffing shortages over the past few years, faculty have had to take on additional teaching, service, and advising roles, at the expense of time for scholarship.
- Work to address the gender imbalance and increase minority representation with students.
- Re-establish an active Computer Science student organization.
- Add emphases to the major, as mentioned above.

3. What are some program accomplishments worth highlighting? (Narrative)

- Recent funding obtained by the Computer Science program has come from a variety of programs, including Google Ignite, NSA/NSF Gen Cyber, Microsoft Tech Spark, and UW-System.
- A Google Outreach grant funded a UW-Green Bay Google Ignite CS Program in 2016.
- An NSA/NSF grant of \$100,000 funded a Gen Cyber Program to run a middle school student camp in cybersecurity education in 2017.
- An NSA/NSF grant of \$65,000 funded a Gen Cyber Program to run a high school teacher camp in cybersecurity education in 2018.
- A UW-System grant of \$86,000 funded a grant to purchase various gadgets (e.g., robots, drones, etc.) to use for recruitment activities to increase interest in the program and help attract students to UW-Green Bay.
- A significant number of conference papers, research posters, articles, etc. were presented and published in recent years. The majority of these activities were conducted by a faculty member that has since left the University; however, it strongly suggests that faculty members in Computer Science can have very successful research programs at UW-Green Bay, if given adequate time to focus on these activities.
- The Computer Science program is participating in a newly formed online UW-System collaborative MS program in Cybersecurity. Classes began in Fall 2020. UW-Green Bay is responsible for delivering two courses for the program, one lower level and one upper level.
- A Center for Cybersecurity has been established and will be a great vehicle for our new newest faculty members to engage students and conduct research activities.
- Staffing has recently returned to a reasonable level (as discussed in more detail in other sections of this document), and courses are again offered at a frequency that allows students to progress through the major without significant use of course substitutions or other waivers.

4. Have there been any significant changes that have affected your program? (Narrative)

- On July 1, 2018, the Computer Science program moved from CAHSS to CSET. It spent one year housed within the department of Natural and Applied Sciences before moving to the Resch School of Engineering on July 1, 2019. Other closely related programs within the Resch School of Engineering include Electrical Engineering Technology, Environmental Engineering Technology, Mechanical Engineering Technology, Mechanical Engineering, and Math and Statistics.
- Three recent hires (two tenure-track faculty and one lecturer) for the 2020-21 academic year have helped address significant staffing shortages in the program.
- A new collaborative online MS in Cybersecurity began in Fall 2020. The program is a collaboration between 8 UW System campuses: UW-Green Bay, UW-La Crosse, UW-Oshkosh, UW-Parkside, UW-Platteville, UW-River Falls, UW-Stevens Point, and UW-Superior.

5. Where do you want your program to be 5 to 7 years from now? (Narrative)

Program goals for the next 5-7 years include the following:

- Continue integration of the Computer Science discipline into the Resch School of Engineering and increase collaboration of faculty and students with those in Engineering, Mathematics and Statistics, as well as other areas of CSET.
- Maintain stability with regard to staffing (faculty and lecturers) in the program.
- Increase the percentage of female and minority students in the major.
- Add Computer Science course offerings to the Additional Campuses.
- Continue growth of the Information Assurance and Security emphasis and maintain strong interest in the Software Engineering Emphasis.
- Add relevant emphases to the major.
- Successfully implement the online collaborative MS in Cybersecurity program.
- Carefully manage enrollment growth, especially considering the small class sizes necessary because of computer lab capacities.
- Reestablish the Computer Science student organization and help it to collaborate with similar student groups like the Engineering Club and Women in Technology.
- Continue to provide outreach employment opportunities for students to staff booths and demonstrate robots and other tech gadgets. This has been tremendously successful over the past few years.

Demand

All data in this area is provided with the materials. (Graduates, majors, minors, etc.) This space is for any commentary you would like to apply to that material. (Narrative)

As shown below and in the accompanying spreadsheet, the Computer Science program has experienced strong enrollment growth since the 2013-14 academic year. The number of majors and minors in the program nearly doubled since then, increasing from 129 in 2013-14 to 230 in 2018-19, and now holding fairly steady the past few years at 229 majors in 2019-20 and 221 majors in 2020-21. Likewise, the number of Computer Science graduates has also increased from just 7 in 2013-14 to 36 in 2019-20. The number of minors has increased from 10 in 2013-14 to 18 in 2020-21, but this has not been a continual increase. The largest number of majors was actually in 2016-17 when there was 20.

We are hopeful that the number of majors will start to increase again as the program stabilizes with regard to faculty and staff, as well as affiliation with RSE and CSET. If that happens, staffing may again become an issue.

	Academic Year							
	2020-21	2019-20	2018-19	2017-18	2016-17	2015-16	2014-15	2013-14
Majors	221	229	230	194	177	115	137	129
Minors	18	15	14	16	20	13	9	10

Internal

1. Program goals (Mission, vision, learning outcomes; present as narrative/lists)

Mission:

The Computer Science program emphasizes the ability to design and create applications software and the need to understand the hardware and systems software resources needed to support those applications. It has this focus in part because the vast majority of students in the program are career-oriented. Many have enrolled out of high school but there are significant numbers who have been out of school for a while and are seeking a change in their current careers. Since the computing profession offers, and will continue to offer, important opportunities, Computer Science is an attractive option for many. We believe it important to provide them with necessary abilities to enter a computing related profession and become competent computing professionals.

Learning Outcomes:

- Students must be able to design the logic and information structures necessary to create software capable of solving problems subject to specified constraints.
- Students must develop both written and verbal communications skills that support the design and documentation of software products and help utilities.
- Students must be able to analyze software to determine correctness and, if incorrect, be able to determine the cause of errors and fix them.
- Students must understand fundamental principles and theory of both computer hardware and software and the mathematical foundations on which Computer Science is built.

2. Curriculum development (Lists, brief narrative if appropriate)

The Computer Science program offers two emphases in the major, as well as a minor.

- Major Emphasis: Information Assurance and Security – 64 credits
- Major Emphasis: Software Engineering – 64 credits
- Minor – 25 credits

The major emphases have recently been modified to add Calculus and Analytic Geometry I back to the curriculum to increase the rigor of the program. The major emphases also require Introductory Statistics as well as a Communications course in addition to a broad and appropriate range of Computer Science courses. There are no admission requirements for the Computer Science major or minor.

In Fall 2019, a more rigorous prerequisite structure was added back to the curriculum to ensure that students are appropriately prepared for courses as they progress through the major. This is consistent with other majors in CSET.

Given that there are currently over 200 majors in Computer Science, additional emphases will be considered in the near future. Possible options include: Networking, Computer Engineering, Network Security, and Penetration Testing.

3. Connections to other programs (Lists, brief narrative if appropriate)

Other closely related programs within the Resch School of Engineering include Electrical Engineering Technology, Environmental Engineering Technology, Mechanical Engineering Technology, Mechanical Engineering, and Math and Statistics. Outside of CSET, Computer Science also has a connection with INFO SCI and Business; several computer science courses are required by INFO SCI emphases, and several computer science courses are planned for inclusion in the new Business Analytics major. Faculty have also contributed to teaching in the HIMT program in recent years.

4. Number of courses offered (Overall number provided in materials. Chairs: short commentary if appropriate. Provide a sub-grouping of various modalities by percentage. For example, what percentage of your program is available online, hybrid, etc.?)

There are ~20 COMP SCI courses offered on a regular basis. All required courses are currently offered at least once per year, with just under half offered every semester. The number of necessary sections of COMP SCI courses has increased over the past several years to accommodate the increasing number of majors and minors in the program. All courses in the academic catalog have been offered at least once in the past three years.

Most Computer Science courses are offered face to face; however, there are now a good selection of courses that also have regular online offerings, including: COMP SCI 201, 221, 256, 292, 316, 358, 361, 450, and 451.

A goal is to increase the number of sections of courses offered at the Additional Locations. In Fall 2019 and Fall 2020 COMP SCI 201 was offered in-person at Manitowoc, with an enrollment of 13 and 5 students, respectively.

5. Diversity of students, faculty, and curriculum (Overall number provided in materials. Chairs: short commentary if appropriate; provide examples from curriculum if appropriate.)

Computer Science majors continue to be dominated by male students. The percentage of female majors has been relatively consistent since 2013-14, varying between 10 and 14%. Although this is a trend within the field as a whole, the Computer Science discipline is committed to increasing the number of female students in the major. There is now a Women in Technology (WIT) student group on campus, and their members are increasingly visible at outreach events and other functions. In addition, female students have recently been given prominent roles in program promotional materials, both in pictures and testimonials. We will continue to promote our major to female students and hope to increase interest in the program.

Regarding ethnic diversity, the program is dominated by white students; however, the percentage of non-white students has increased from 15% in 2013-14 to 26% in 2020-21.

The diversity of faculty and staff in Computer Science is good. All come from non-white ethnic groups. There are four male tenure-track faculty members and one female lecturer in the program.

6. Gen Ed, FYS/GPS, CCIHS (Lists)

There are currently no Computer Science courses listed in the General Education program.

In Spring of 2020, a COMP SCI first year seminar course entitled “Computer Science: Current Trends and Future Directions”, was offered for the first time. The course will continue to be offered in the future.

A CCIHS course (COMP SCI 256, Introduction to Software Design) was offered at Sheboygan in 2019-20, but that partnership has ended for now. The discipline would be open to offering these opportunities in the future at Sheboygan or elsewhere. Possible courses include COMP SCI 201 (Introduction to Computing & Internet Technologies), COMP SCI 221 (Database Design & Management), COMP SCI 231 (Introduction to IT Operations), or COMP SCI 256.

7. Program support and staffing (Chairs: History, trends, and future needs. Depending on program, could be connected to accreditation.)

Until recently, lack of staffing has been an ongoing significant concern. A full-time lecturer left the University for a tenure track position at the end of Summer 2019, and a tenure track faculty member left at the end of Fall 2019, leaving the program with two tenure track faculty to cover courses for over 200 majors. Fortunately, there are four well-established ad hoc instructors that have consistently been able to cover courses ranging from the introductory to upper level. Three recent permanent hires have helped to alleviate this problem and should allow for good coverage of the current course offerings. However, if the number of majors continues to increase, this may become an issue again.

As of Spring 2021, there will be four tenure-track faculty members and a full-time lecturer teaching in the program. The Computer Science discipline will consist of four Assistant Professors and one full time Lecturer. All positions are assigned to the MAIN campus. The current Chair is an Associate Dean in the College of Science, Engineering and Technology. The Executive Committee consists of the Computer Science Chair and two other tenured members of the Resch School of Engineering, including the Chair of Engineering and the Chair of MATH and Statistics.

Support center services (library collections/services, non-print media materials, marketing, IT/testing services) are adequate for the Computer Science program.

For the most part, physical facilities and equipment are adequate for the Computer Science program; however, as the program continues to grow, it would be good to have more of the larger (48 student) computer labs on campus.

Clerical and administrative support needs for the Computer Science program are adequate.

8. Cost per credit hour (TBD)

External

1. Outreach: student/faculty partnerships, collaborations, participation with organizations or individually (Lists)

Outreach activities include the following (note that some of these activities could potentially be classified as contributions to regional infrastructure):

- Howard Suamico School District Computer Science Advisory Board – several members of the Computer Science discipline are members of the HSSD Computer Science Advisory Board that is comprised of members from industry, non-profit organizations, and higher education. Advisory Board members attend meetings and provide input to help advise the HSSD Computer Science Steering Committee.
- Einstein Expo – Computer Science faculty and students staff a booth at this annual event where they demonstrate robots and other gadgets.
- NEW Connect IT Event – Computer Science faculty and students staff a booth at this annual event at Lambeau Field where they demonstrate robots and other gadgets to high school students that are interested in IT careers.
- Microsoft Tech Spark – Computer Science faculty obtained funding and led a WiSys TechSpark middle school outreach program in summer 2018. TechSpark website: <https://www.microsoft.com/en-us/corporate-responsibility/techspark>.
- Google Ignite CS – Computer Science faculty obtained funding and led a Google Ignite program involving extensive K-12 outreach curriculum design & development on the following CS topics: Privacy + Cyber Security & Machine Learning, Mobile Security, Robotics, Data Mining & Visualization and Coder Dojo. Google Ignite CS website: <https://sites.google.com/view/ignitecs>.

2. Contributions to regional infrastructure (Lists)

Contributions to regional infrastructure include the following (note that some of these activities could potentially be classified as outreach activities):

- NEW Digital Alliance. UW-Green Bay is a partner educational institution for this organization that promotes collaboration on IT initiatives among industry and educational groups in Northeast Wisconsin. Among other things, this group organizes the annual NEW IT Connect event mentioned above.

- Gen Cyber Program. As mentioned above, recent grants have funded both a middle school student camp in cybersecurity education in 2017 and a high school teacher camp in cybersecurity education in 2018.
 - NEW North Digital Technology Career Pathway Map Project – the COMP SCI Chair is providing input for this initiative that is designed to increase the number of students completing this career pathway in Wisconsin and to increase students' career readiness.
3. Scholarly activity of faculty (Lists that are not all-inclusive; maybe seek to highlight the different areas/types of activity)

As mentioned, the Computer Science program moved to the College of Science, Engineering and Technology on July 1, 2018. The examples provided here only focus on the Computer Science faculty that moved to CSET in July of 2018 and were in the program through Fall 2020.

Computer Science faculty have experience with the following research areas:

- Automated analysis of facial and behavioral expressions
- Analysis of text data
- Computer vision
- Machine learning
- Human-computer interaction
- Assistive technology
- Developing affordable and non-invasive mobile healthcare tools
- Designing mathematical models
- Designing multifactor authentication applications
- Security and privacy with a focus on access control systems and location-based services
- Developing algorithms for detecting physiological parameters that include analyzing healthcare data
- Large-scale social media mining
- Data science
- Computational social science
- Cybersecurity and cybersecurity education

Examples of recent research publications, presentations, and research projects include:

- Predictive modeling using Tiny Earth data to identify spots harboring bacterial isolates producing novel antibiotics
- Development of a Sonic Walking Tour (a guided audio tour) of the UW-Green Bay campus for prospective students and visitors
- Developing an Innovative Framework for Design and Analysis of Privacy Enhancing Video Surveillance
- Towards a Biometric Authentication-based Hybrid Trust Computing Approach for Improving Information Assurance in Online Healthcare

- Future Directions In Online Healthcare Consumerism Policy Making: Exploring Trust Attributes Of Online Healthcare Information
- Can Undergraduate Computing Research Be Student-Driven?
- A Middle-School Module for Introducing Data-Mining, Big-Data, Ethics and Privacy Using RapidMiner and a Hollywood Theme
- GICS Case Study: Building A Service Learning based Co-Curricular Program for Engaging CS Undergrad Students in Pre-University Teaching and Educational Research'
- A GenCyber Camp Case-Study: Teaching Defensive Programming at The Pre-University Level Using A Novel Data-Tampering Theme-Based Nifty Module
- A BERO CLF Themed Nifty Middle-School Module: Teach Functional Programming Using Music and Generate Interest in Coding and Robotics
- Secure Coding and Ethical Hacking Workshops With The NAO Humanoid Robot For Engaging K-12 Female Students In CS

Recent funding obtained by the Computer Science program has come from a variety of programs, including Google Ignite, NSA/NSF Gen Cyber, Microsoft Tech Spark, and UW-System. Examples were mentioned above in section 3 of the *General Overview* section.

Student Success

1. High-impact practices and individualized-learning opportunities (Some data provided; lists and/or brief narrative)
 - Capstone courses are available for both emphases in the major. These courses expose students to real-world experiences that add to their problem-solving development and provide valuable experience for their future careers.
 - Student participation in undergraduate research projects, including co-authorship on papers and attendance at scholarly conferences.
 - Involvement of students in outreach activities showcasing our NAO robots and other tech gadgets.
 - Peer mentoring activities where upper level students assist in lower level courses.
 - Participation by several Computer Science faculty members in UW-Green Bay's NASH HIPs grant activities.
 - Faculty continue to be involved with student independent study and research projects and are always willing to work with Computer Science students on these types of high impact practices. Computer Science students also work at off-campus organizations on paid internships, and Computer Science faculty are involved with on-campus oversight activities related to these activities.
 - Faculty have also been involved in significant outreach activities, including: Phuture Phoenix; camps and workshops for local middle and high schools, Junior Achievement, and TechGYRLS; the CSET Science Open House events, and the NEW IT Connect Event at Lambeau Field.

2. Retention (TBD. Note: if program-level data is not provided, maybe list some things your program does that you believe aid in retention.)

Example activities that aid in retention:

- Now offer classes at a frequency that allows students to get the courses they need to progress through the major.
- Have straightforward setup of the major emphases, and the prerequisite structure helps students navigate the coursework and ensures that they are prepared for subsequent classes.
- Faculty advisors respond to students in a timely manner and are knowledgeable.
- Prevalence of high impact practices (see above).

Mission Relevant

1. Relevance to mission (Narrative or lists as appropriate)

The Computer Science program relates to these aspects of the University's Select and Core Missions:

- Offer exemplary undergraduate and master's programs.
- Operate with a commitment to excellence in teaching, scholarship and research, and service to the community.
- Provide a problem focused educational experience that promotes critical thinking and student success.
- Embrace community-based partnerships, collaborative faculty scholarship and innovation.
- Promote cross-discipline collaboration (connections to INFO SCI, Business Analytics, Health Information Management & Technology, as well as areas in CSET already mentioned elsewhere).
- Offer associate and baccalaureate degree level and selected graduate programs within the context of its approved select mission.
- Offer an environment that emphasizes teaching excellence and meets the educational and personal needs of students through effective teaching, academic advising, counseling, and through university-sponsored cultural, recreational, and extracurricular programs.
- Expect scholarly activity, including research, scholarship and creative endeavor, that supports its programs at the associate and baccalaureate degree level, its selected graduate programs, and its approved mission statement.
- Promote the integration of the extension function, assist University of Wisconsin-Extension in meeting its responsibility for statewide coordination, and encourage faculty and staff participation in outreach activity.
- Participate in inter-institutional relationships in order to maximize educational opportunity for the people of the state effectively and efficiently through the sharing of resources.
- Support activities designed to promote the economic development of the state.

2. Cultural enrichment (Narrative or lists as appropriate)

N/A

3. Access (Does the program have any agreements with other institutions? For example, a transfer agreement with a technical college.)

The computer science program has an agreement with NWTC's Software Developer program (see link). Future agreements will focus on Fox Valley Technical College and Lakeshore Technical College.

<https://www.uwgb.edu/UWGBCMS/media/Admissions/files/NWTC-Software-Developer-to-Computer-Science-Final.pdf>