Institutional Effectiveness Report
2021-2022

Program: Computer Science MS

College and Department: College of Engineering – Computer Science

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Mission: "Our mission is to be widely recognized for enabling students to have global impact through innovative and quality programs, through research that emphasizes collaborative partnerships, and by enabling the success of a diverse student, faculty, and alumni community."

This mission is consistent with the University's mission to "provide leadership and outstanding programs in engineering, the sciences, and related areas that benefit the people of Tennessee and the nation" and with the University's commitment to the life-long success of students and to enrich the lives of people and communities in the Upper Cumberland region of Tennessee.

It is also consistent with Flight Plan, the University's strategic plan, and it's focus on improving student experience, transforming technology, and creating distinctive programs.

Program Goals:

PG 1: The student should gain breadth of knowledge in the discipline and depth in the specific area of his/her specialization.

PG 2: To establish and foster a culture of curiosity, excitement, collaboration, and engagement in the global research community, with a commitment to quality and academic integrity.

Student Learning Outcomes:

SLO 1: The student should demonstrate knowledge of the techniques, methods, and disciplines of computer science research.

SLO 2: The student should progress and graduate in a timely fashion.

A departmentally developed curriculum map can be found in Appendix 1 that shows the connections between courses and student learning outcomes.

Assessment:

1. *Graduating GPA* - Since our curriculum requires both breadth and depth, we believe a GPA of 3.5 or higher at the time of graduation demonstrates success in these areas. We will track the proportion of students with at least a 3.5 graduating each school year. Our target percentage is at least 70%. We will use this metric to evaluate not only the effectiveness of instruction, but also the quality and background of students accepted into the program, which may result in refinement of the acceptance criteria and process. *For the evaluation of PG 1*.

2. *Percent of students graduating with at least one research presentation or peer-reviewed publication* - Research presentations and publications provide evidence of student research and communication skills. For all graduating M.S. students each year, we compute the percent who have demonstrated such evidence. Given the short duration of the degree, we have set our desired level of attainment at 50%. The rate at which students are presenting and publishing may lead to informed decisions

about how and when students are exposed to research opportunities. *For the evaluation of PG 2 and SLO 1*.

3. *Time to degree completion* - Timely graduation is important for students and for the responsible use of department resources. Students going beyond 2.5 years for their M.S. should be an exception. Note that we use the 2.5-year measure due to the fact that many graduate students defend late in their intended semester of graduation and will miss the defense deadline for graduation. As such, while a student successfully defends their thesis or project in one semester, they are listed as a graduate of the following semester. Our desired level of attainment is 80% graduating within 2.5 years. We are not including direct-admit PhD students who are also pursuing their M.S. degree because their timeline can be very different. We will use this metric to determine the process for matriculating students through the program, including the clarification of key milestones and periodic demonstrations of progress. *For the evaluation of SLO 2*.

Results:

PG 1: The student should achieve at least a 3.5 GPA in breadth of knowledge in the discipline and depth in the specific area of his/her specialization.

	2017-18	2018-19	2019-20	2020-21	2021-2022
Number of graduates	7	10	16	12	21
% with at least 3.5	71.43%	100%	93.75%	83.33%	86%

Over the last five years, we have been able to reach our targeted percentage. For the **2021-2022** academic year, 4 students achieved a 4.0 GPA, and the lowest GPA was 3.28.

For the **2021-2022** academic year, the results are similar to the rest of the College of Engineering, but with a much larger number of graduates:

Major	Number of graduates	% with at least 3.5
Civil and Environmental Engineering	10	80%
Chemical Engineering	3	100%
Electrical and Computer Engineering	6	100%
Mechanical Engineering	16	88%

SLO 1: The student should demonstrate knowledge of the techniques, methods, and disciplines of computer science research through research presentations and publications.

	2017-18	2018-19	2019-20	2020-21	2021-2022
Number of graduates	7	10	16	12	21
% with publication or presentation	57.14%	70%	68.75%	66.7%	66.7%

The number of students engaged in publications and/or presentations of conference/journal research papers has been consistent over the last **four** years. In addition, many of the students had more than one publication – which is quite an achievement given that it is not a requirement to do so in order to get an MS degree.

SLO 2: The student should progress and graduate in a timely fashion completing degree in 2.5 years or less.

	2017-18	2018-19	2019-20	2020-21	2021-2022
Number of graduates[1]	7	10	16	11	15
% completing degree in 2.5 years or less	57.1%	100%	87.5%	81.8%	88%

Since **2017**, only **10** of the 59 graduates (**83**%) were unable to complete the degree in 2.5 years or less. For the **2** students this last year that did not graduate in the 2.5-year window: **both were working full-time, and were courses-only students – thus, out of control of the department (e.g., non-traditional student desiring not to be fill-time)**. However, we were still able to meet our percentage expectations for the **fourth** year in a row.

Modifications for Continuous Improvement

The CSC Department has in place a framework/process for the continual improvement of the MS program to ensure its learning outcomes are met and that the outcomes are themselves updated as necessary to reflect any changes that may occur in vision, mission, or the needs of the profession and research community.

Information that is regularly collected for evaluation of program objectives and learning outcomes were outlined in the previous sections of this report. As responses to the identified results, changes implemented in **2021-2022**, or planned for **2022-2023**, are as follows.
Revised Course Offerings (PG 1, SLO 2)

[1] Some students have been removed from this SLO because as stated earlier, we are not counting direct-admit-to-PhD students who happen to get their Masters along the way, and thus their timeline is different from typical Masters students.

Given the increased number of students in our program, in the summer of 2021 we revisited the 3-year graduate course offering schedule, so that our MS students would have more options to choose from. This included such changes as the removal of prerequisites, ensuring that each specialization had at least one offering each semester, and at least one theory course was offered each semester. The number of graduate course offerings went from 5-6 to 6-8 in a semester. In addition, the 2-year undergraduate course offerings were revisited in fall of 2020, allowing for core courses to be offered every semester – many of which have equivalent 5xxx level courses which our MS students can take. Also, starting in fall of 2021, students in the undergraduate fast-track program will be able to take the required graduate seminar course (CS 6910), further decreasing their time in the program.

Graduate Student Tracker (SLO 1, SLO 2)

In order to better manage our growing graduate program, in fall of 2022, we will employ a student work to help us better track the progress and successes of our graduate students. This will include e-mail reminders to students and advisors of upcoming deadlines, follow-through on the creation of advisory committees and programs of study, and tracking of exams and defenses.

Fast Track Program (PG 2)

As evidenced by the number previously shown, enrollment in our MS program has increased significantly. In order to further increase our enrollments, the department has put additional effort towards increasing the number of qualified Tennessee Tech students enrolled in our MS program. While the Fast-Track program (allowing a student to take courses as an undergraduate for graduate credit) has been in place for several years, in spring 2022, we held an in-person seminar on Fast-Track that was attended by 24 students and advisors, and have another one scheduled in fall 2022 (and every semester subsequently). We also hired a communications coordinator, who will help us improve Fast Track's visibility on social media and departmental web-sites.

Oral Defense and Thesis/Project Assessment Form

In order to collect more detailed data related to student learning, a new Oral Defense and Thesis/Project Assessment Form was implemented in Spring 2021. A copy of the form can be found in Appendix 2. Results from the **2021-2022** academic year can be found below. **3** students were evaluated.

Area	**Average**
Mastery of basic principles	3.00
Advanced problems in their chosen specializations	2.86
Oral presentation	2.71
Quality of written English	2.57
Technical writing content	2.57

Unfortunately, these scores were a significant drop from the previous academic year. One issue is the small sample size (only **3** students were evaluated). This process was just implemented in Spring 2021, and as such, is still new to the faculty. Due diligence will be taken to ensure that better evaluation collection mechanisms will be implemented. (There should have been 15 students evaluated.) The other issue was that one of the students was foreign with weaker communication skills, and because of the small sample size, that affected the overall average. Again, by making sure the sample size is not small, should improve the overall scores.

Appendices

1. Curriculum Map
2. Oral Defense and Thesis/Project Assessment Form

Appendix 1: Curriculum Map

Computer Science - Master's Program

Course	Title	Student Outcomes	
		SLO1	SLO2
CSC 5100	Operating Systems	X	X
CSC 5200	Computer Networks	X	X
CSC 5220	Data Mining/Machine Learning	X	X
CSC 5240	Artificial Intelligence	X	X
CSC 5320	Computer Architecture	X	X
CSC 5400	Analysis of Algorithms	X	X
CSC 5570	IT Security	X	X
CSC 5575	Info Assurance & Cryptography	X	X
CSC 5580	Software Reverse Engineering	X	X
CSC 5585	Software and Systems Security	X	X
CSC 5710	Dsgn/Dev-Human/Web Interface	X	X
CSC 5750	Computer Graphics	X	X
CSC 5760	Parallel Programming	X	X
CSC 5770	Distributed & Cloud Computing	X	X
CSC 6220	Data Mining	X	X
CSC 6230	Machine Learning	X	X
CSC 6240	Math/Theory-Machine Lrning	X	X
CSC 6260	Advanced Topics in A.I.	X	X
CSC 6300	Web-Based Database Systems	X	X
CSC 6320	Adv Computer Architecture	X	X
CSC 6400	Internet Algorithms	X	X

CSC 6450	Adv Theory of Computation	X	X
CSC 6575	Internet Security	X	X
CSC 6580	Advanced Reverse Engineering	X	X
CSC 6585	Secure Software Development	X	X
CSC 6730	Advanced Networking	X	X
CSC 6740	Parallel/Distributed Algorithm	X	X
CSC 6760	Grid Computing	X	X
CSC 6770	Service Oriented Computing	X	X
CSC 6780	Distributed Computing	X	X
CSC 6910	Computer Science Seminar	X	X
CSC 6980	Masters Project	X	X
CSC 6990	Research & Thesis	X	X

Appendix 2: Oral Defense and Thesis/Project Assessment Form

Master of Science in Computer Science
Oral Defense and Thesis/Project Assessment Form

Presenter's Name: _____

Committee Member: _____ Faculty: _____ Student: _____ Other: _____
(Please check one)

Date: _____

1. Each M.S. candidate is expected to demonstrate **mastery of the basic principles** of at least one of the specializations of CS. Please assess this candidate using the following scale:

   1 - shows little or no mastery of the specialization
   2 - shows marginal mastery of the specialization
   3 - shows basic mastery of the specialization
   4 - shows excellent mastery of the specialization

2. Each M.S. candidate is expected to be able to apply these basic principles to solve **advanced problems in their chosen specialization**. Please assess this candidate using the following scale:

   1 - shows little or no ability to apply basic principles to solve advanced problems
   2 - shows marginal ability to apply basic principles to solve advanced problems
   3 - shows basic ability to apply basic principles to solve advanced problems
   4 - shows excellent ability to apply basic principles to solve advanced problems

3. Graduates of the M.S. program in Computer Science will be able to communicate their ideas effectively with their technical peers and with others outside their discipline. Please assess this candidate's **oral presentation** using the following scale:

   *1 – **all** aspects of content, presentation, and responses to questions **not** at a graduate level*
   *2 – **some** aspects of content, presentation, and responses to questions **not** at a graduate level*
   *3 – **solid** content, presentation, and responses to questions at a graduate level*
   *4 – **excellent** content, presentation, and responses to questions at a graduate level*

---------- Evaluation of thesis writing (*if applicable*) ----------

4. Graduates of the M.S. program in Computer Science will display *grammatical* quality in their writing. Please assess this candidate's **quality of written English** using the following scale:

   *1 – **weak** grammatical form **throughout**; inconsistencies in voice/tense/punctuation; not at a graduate level*
   *2 – grammatical form **weak in places**; some inconsistencies in voice/tense/punctuation; needs work*
   *3 – grammatical form **solid** in most places; consistent in voice/tense/and punctuation; at a graduate level*
   *4 – **excellent** grammatical form and use of voice/tense/punctuation*

5. Graduates of the M.S. program in Computer Science will display *technical* quality in their writing. Please assess this candidate's **technical writing content** using the following scale:

   *1 – **weak**, consisting of the following: poor organization; unclear problem statement/technical approach; issues with figures/tables; missing relevant references.*
   *2 – **needs some work,** including some of the following: unclear organization; problem statement/technical approach need some work; some issues with figures/tables; missing some relevant references.*
   *3 – **good,** consists of the following**:** appropriate organization; clear problem statement and technical approach; no issues with figures/tables; solid list of references.*
   *4 – **excellent,** exhibiting the following**:** well organized, and consistently demonstrates a mastery of the proposed technical approach, including meaningful figures/tables, and relevant references**.***