

Narrative Report on UTC MS Mathematics

PART 1 – Learning Outcomes

How would you rank this program with similar ones in the state, region, and nation? Are the intended program and learning outcomes clearly identified?

- Top 25% by design of the program and top 50% operationally due to low enrollments.

The design of the program is excellent, however attempts need to continue to be made to increase enrollments in the program, including being assigned more GAs which are currently low. This ranking is based on my judgement from serving as recent chair of the mathematics department at College of Charleston for 12 years, during this time attending the workshops associated with the annual meeting of the American Mathematical Society Committee on Education and my regular exposure to graduate programs around the state and nation. Ranking a master's level -programs into quartiles is as close as I feel comfortable in refining my ranking of any institution. There are published rankings for doctoral programs.

Are the intended program and learning outcome clearly identified?

- Has the department specified program mission, vision, and goal statements? Do these statements clearly identify intended program and student learning outcomes? Are they appropriate for the program level (undergraduate) and for UTC? **Yes.**
 - My ranking of *excellent* is based on my judgement from serving as the assessment coordinator for the department of mathematics at College of Charleston since its development and inception over the past decade. Also, as a member of the institutional committee that developed the QEP for our most recent SACSCOC review in 2017, and having attended two of the annual national meetings of SACSCOC.
- What goals should the department establish regarding its curriculum? In particular, what advice should be offered to the department developing goals regarding the following aspects.
 - Student opportunities for research/involvement in faculty research.
 - The UTC math department tenured and tenure track faculty are fully engaged in research, which is formalized with a final thesis option. The program has an excellent record of research projects mentored by graduate faculty. Significant contributions to research by graduate students including peer reviewed publications can be found beginning on

page 54 of the self-study. As mentioned earlier, the administration should provide faculty lines in order to replenish positions lost over the past several years and the math department should continue to hire faculty of the quality it has hired in the past.

- Student opportunities for practical/field opportunities
 - As part of the MS concentration requirement students must complete a minimum of 6 credit hours in an area of application or an internship.
 - Where appropriate, internships have been available and successful. An example of this is given on page 56, where a student in the Actuarial concentration initially had an internship as an undergraduate which continued after one year in the MS program where the student became an intern in the Actuarial department. More internships opportunities are being sought out with companies in the Chattanooga area including BlueCross/BlueShield of Tennessee.
 - The math department REUs are excellent opportunities for graduate students to be involved as interns in helping faculty mentor the research projects for undergraduates. This is especially appropriate for students in the Pre-professional concentration.
 - Opportunities for internships in local industries for those in the Applied Mathematics and Applied Statistics concentrations should be continue to be sought out.
- What goals should the department establish regarding its teaching? Faculty qualifications? Faculty development?
 - Concerning faculty qualifications, I can only say keep up the good work building upon an excellent group of faculty. The quality of both senior and junior faculty tenured and tenure track faculty is enviable as well as the gifted group of lecturers. My comment here is that tenured and tenure-track faculty are down by 4 from where they should be based on all measures. This made more urgent considering that some of the senior extraordinary senior faculty could likely retire in the near future.
 - The Goal should be (including that of the entire institution) to increase the number of highly qualified exceptional tenure track faculty.
 - The institution offers many opportunities through the Walker Center for faculty development for improving teaching.
 - Continue with department goals for growth and improvement, including
 - Participation in multi-disciplinary discussion groups concerning pedagogical improvements.
 - Improve diversity among students and faculty.
 - Continued support for scholarship.
 - Continued support for seeking external funding/grant writing.

What criteria does the department use to evaluate sufficient achievement of intended program outcomes? Are the criteria appropriate for such evaluation and/or for the program?

- Student responses to course evaluations and results of program assessment requirements of SACSCOC. The criteria used are appropriate. As noted on page 21 of the self-study, these outcomes “...are regularly evaluated by the math department to measure student’s mastery of mathematical fundamentals and their proficiency in communication and writing.”

Does the department make use of evaluation information and/or information obtained from student, alumni, and employer surveys and/or data from institutional research to strengthen and improve the program?

- Considering the regular and extensive assessment reporting and evaluation required in the state of Tennessee for performance funding and quality assurance funding that depend upon surveys and data collected by Institutional Research, as well as SACSCOC reporting, the department of mathematics is able to get a three dimensional perspective of its performance from which it can decide on actions to strengthen and improve both its undergraduate and graduate programs, as well as its contributions to general education.

Does the program fit/align within the institutional mission?

- Yes, since the MS program in Mathematics contributes to achieving excellence by actively engaging students, faculty and staff; embracing diversity and inclusion; inspiring positive change; and enriching and sustaining our community

PART 2 – Curriculum

Is the current curriculum appropriate to the level and purpose of a graduate program? Is the program more advanced in academic content when compared to related undergraduate programs?

- The curriculum is excellent by disciplinary standards in mathematics. in its breadth and depth.
- The MS program in mathematics needs more students. The issue of enrollment is addressed elsewhere in this narrative and suggestions for growing the number of MS seeking students are offered. Until there is a sufficient increase in

enrollments, some of the 5000 level graduate courses will need to meet with equivalently named 4000 level courses. Although the outcomes, assessments and expectations will be different and appropriate for the degree level for undergraduate and graduates in these courses—since undergraduate and graduate students will be in the same sections—initially they will likely be exposed to the same content, however, graduate students in the mixed courses should be exposed to appropriate additional content. Currently, of the thirty-eight 5000 level courses listed in Appendix C, twenty-three have 4000 level versions. That doesn't mean whenever one of these 5000 level courses is offered there are undergraduates necessarily in those sections. Looking at the 2018-19 and 2019-20 academic years, twenty-three 5000 level sections were offered and nineteen had undergraduates enrolled in them.

- Based on these comments and my review of the course descriptions for 4130-5130, where in 5130 graduate students were exposed to appropriate additional content, in 4140-5140 content in the course descriptions appears to be the same. Consequently, I'm assigning a rating of "fair" to item 2.3, *"The program reflects progressively more advanced academic content than its related undergraduate programs."*

How has the program designed a process by which students can be assured of making timely progress in the degree program? How is it determined that courses are offered? Is there a set schedule for course offerings upon which the student can rely? Does the department clearly outline program requirements and offer courses regularly to ensure timely completion of the program?

- *"The MS degree requires 36 semester hours, at least 24 must be at the 5000 level. The program is designed to be flexible allowing Beginning in Appendix D, on page 114 there the degree requirements and sample course schedules are presented for the four concentrations: Applied Mathematics; Applied Statistics; Pre-professional Mathematics; and Mathematics Education. "* From page 37 of the self-study
 - *"The curriculum has been designed to be flexible and convenient with courses offered regularly, enabling students to make timely progress towards their degrees. Students can finish their master's degrees in two years by taking three courses per semester. It may be possible to finish more quickly by taking an additional fall or spring course, or by taking a summer course(s), subject to availability. In particular, Math 5210 (core) is offered every fall, Math 5500 (core) is offered each spring, and Math 5570 (core) is offered every other fall. Also, Math 5000, Math 5010, Math 5130, and Math 5140 are offered once a year. The rest of the graduate courses are offered on a 2-year cycle, dependent on demand. A schedule of course offerings over a 2-year cycle is available to students and advisors."*
 - Two graduate students that I spoke with during the interview portion of this review expressed concerns about completing their MS degree on time.

They complained that the sample course schedules were not accurate or helpful because courses listed were no longer offered or offered too infrequently for them to complete their degree requirements in a timely fashion. Based on these comments, I'm assigning a rating of "Fair" to item 2.2, *"The program has developed a process to ensure courses are offered regularly and that students can make timely progress towards their degree."*

Does the curriculum align with the program learning outcomes?

- Yes, the curriculum is excellent and aligns with the program learning outcomes.

How is mastery assured through the curriculum?

- The mastery is assured through assessments in course work, projects, internships and/or thesis evaluation.

How is the content reviewed on a regular basis with results used to determine actions to take to improve the curriculum? Does the department regularly review and revise curriculum content and organization to ensure that it is appropriate and that it prepares students to meet the specified learning outcomes?

- The self-study describes the process for changes in the MS program.
 - *"The Departmental Graduate Committee meets on a regular basis to discuss the state of the M.S. Mathematics program and how it might be improved. The committee collects suggestions from students and faculty and, when appropriate, develops curriculum proposals or asks the relevant faculty to do so. Any proposed changes to the program curriculum are received and discussed by the departmental Curriculum Committee prior to being brought to the attention of the Mathematics Graduate Faculty for discussion and vote."*
 - As evidence, on page 8 of the self-study there is a list of recent changes to the graduate programs:
 - MATH 5131 – Statistical Computation and Programming
 - MATH 5170 – Nonparametric Statistics
 - MATH 5280 – Analytic Number Theory
 - MATH 5350 – Mathematics of Finance
 - MATH 5530 – Calculus of Variations
 - MATH 5560 – Real Analysis
 - MATH 5590 – Functional Analysis
 - Three of these courses (MATH 4170, MATH 5280, and MATH 5350) have corresponding 4000- level courses.
 - The 2017-2018 Graduate Catalog reveals two program-level additions: a post-baccalaureate certificate in Computational and Applied Statistics and a

- PhD opportunity - the Computational and Applied Mathematics concentration - one of three in the Computational Science PhD program.

- The following 5000 courses were offered between Fall 2018 and Spring 2020

5050 *Introduction to Point Set Topology*
 5130 *Introduction to Probability and Statistics*
 5140 *Mathematical Statistics*
 5170 *Nonparametric Statistics*
 5210 *Linear Algebra and Matrix Theory*
 5310 *Operations Research (Linear)*
 5320 *Operations Research (Nonlinear)*
 5450 *Introduction to Biostatistics*
 5460 *Partial Differential Equations*
 5500 *Introduction to Analysis II*
 5131 *Statistical Computation And Programming*
 5150 *Introduction to Biostatistics*
 5180 *Analysis of Variance*
 5210 *Linear Algebra and Matrix Theory*
 5530 *Calculus of Variations*
 5560 *Real Analysis*
 5600 *Numerical Analysis I*
 5910 *Vector Analysis*

Will the department need to update the curriculum and/or develop new or alternative offerings in the near future?

- The immediate challenge is to increase enrollment in the MS program.

Is the curriculum adequate to enable students to develop the skills and attain the outcomes? Does the curriculum include knowledge of the disciplinary literature?

- Yes, to both questions.

Are opportunities available to students that allow them to engage in research, professional practice or training experiences? How are those opportunities communicated to students?

- Yes to both questions.
- The graduate faculty in the MS program in mathematics are research active and are exceptionally productive
- The MS program in mathematics (36 semester hours, at least 24 at the 5000 or above in mathematics course and consists of the following requirements:
 - Core Courses

- Concentration Requirements in
 - Applied Mathematics
 - Applied Statistics
 - Pre-Professional Mathematics (for students considering going on for a doctorate), and
 - Mathematics Education
- Area of Application or Internship, such as
 - Business
 - Economics
 - Computer Science
 - Engineering
 - Physics
 - Chemistry
 - Biology
- Electives
 - Any courses listed under the concentrations, or
 - Special Project, or
 - Research, or
 - Thesis

Is the program offered through distance education or online? If so, how are those offerings assessed compared to on ground programming?

- The catalog description of the MS program in mathematics at UTC makes no mention of a distance education or online delivery option.

Are appropriate pedagogical and/or technological innovations included that enhance student learning? Are the department's instructional practices consistent with the standards of the discipline?

- UTC and in particular the Department of Mathematics uses the CANVAS course management system. Computer labs are available to students and ZOOM is used when necessary. Programming languages and software such as MATLAB, Julia, Python, C++, R, Minitab, SPSS, excel, Desmos, etc, are used where appropriate.
- Yes, the UTC Department of Mathematics instructional practices are consistent with the standards in the discipline.
- Do the instructional practices provide adequate opportunities for student interactions with one another, faculty, and professionals?

- There are many opportunities for student interactions with one another, faculty, and professionals. These include departmental colloquia, joint Math Dept and SimCenter seminars including an Advanced Modeling and Simulation Seminar, presentations from local industries, participation in NSF funded Research Experience for Undergraduates (REUs) hosted at UTC (these are very competitive awards), the SEARCH Award Program supporting undergraduate and graduate research, and other research opportunities and support, such as being written into an NSF grant proposal.
- Does the department make adequate efforts to include students in the life of the program (e.g., seeking student advice in reviewing the curriculum/course schedules/teaching methods, etc.)?
 - Including students in the life of the program occurs socially and academically via the activities listed in the bullet above. Student input concerning curriculum/course schedules/teaching methods occurs formally through the student evaluation of instruction process and informally through discussions with the graduate director, advisors, instructors and mentors.

PART 3 – Student Experience

Does the program have enough students to allow an appropriate group of peers as they participate in the program?

- The Table below gives the MS enrollments since Fall 2014. They need to be higher.

MS Enrollments						
F 2014	F 2015	F 2016	F 2017	F 2018	F 2019	F 2020
13	17	21	16	10	10	13

- Enrollments of graduate students in math graduate courses at the 4000/5000 level grew from 63 in FY 19 to 87 in FY 20, as reported in section 6.3.1 on page 84 of the self-study. There were 23 courses offered over this time period, of which 19 were mixed undergraduate/graduate classes. Enrollments counting both graduate and undergraduate students over that time period remained fairly constant between 150 and 160. Mixing undergraduate and graduate students in 4000/5000 courses is an effective way to manage enrollments, providing there is clear and appropriate distinctions between assessments and expectations for undergraduate and graduate students as well as additional content appropriate for graduate students.

Are students offered the opportunity to evaluate both the curriculum and the faculty? How? Are these methods effective in getting feedback about the program and teaching effectiveness?

- Graduate student evaluation is addressed on page 52 of the self-study.
“Student evaluation of instruction data for graduate courses is combined with undergraduate courses in the tables presented in Section 3.1.2. As evidence of the high satisfaction among students with respect to graduate instruction, Table 3.6 displays results from student evaluations of math graduate courses, for the three instructor-related questions, in Fall 2018 and Fall 2019. The N value is 49 and the highest score possible (indicating a most favorable response) is 7. The Math Department is developing plans to get more feedback from graduate students, including exit interviews and strengthened alumni relations. UTC is implementing the First Destination Survey with efforts to increase response rates. More data should be available in the near future.”
 - These are effective methods in getting feedback about program and teaching effectiveness.
 - Plans for getting more feedback should enhance effectiveness.

Are there appropriate curricular and co-curricular offerings to enhance student experiences?

- Most of the opportunities for student enrichment and professional development described below apply to both undergraduate and graduate students.
- Graduate students who have completed 18 or more hours of graduate coursework in math may be given the opportunity to teach a freshman course, under the supervision of a faculty member. Three second-year master’s students each taught two classes in Fall 2020 and are doing so again currently.
- Student enrichment professional development opportunities include departmental colloquia, joint Math Dept and SimCenter seminars including an Advanced Modeling and Simulation Seminar, presentations from local industries, participation in NSF funded Research Experience for Undergraduates (REUs) hosted at UTC (these are very competitive awards), the SEARCH Award Program supporting undergraduate and graduate research.
- Are any short courses accepted toward the degree program? Is prudence exercised in the number and type of acceptable short courses?
 - It does not appear so.
- Does the program provide adequate opportunities for student professional development?
 - Graduate students who have completed 18 or more hours of graduate coursework in math may be given the opportunity to teach a freshman course, under the

supervision of a faculty member. Three second-year master's students each taught two classes in Fall 2020 and are doing so again currently.

- Graduate students can assist faculty in REUs.
- To what extent does the program encourage membership in professional organizations, support participation in conferences and workshops, and/or promote opportunities for student publication?
 - Along with an institutional membership, the Mathematical Society of America (MAA) offers free membership to graduate students
 - Conferences and workshops at UTC are regularly organized by math faculty. Graduate students are encouraged to participate.
 - Beginning on page 54 of the self-study is a sample of research projects/ thesis involving graduate students, several leading to peer-reviewed publications.
- Does the program provide students with enrichment opportunities, such as lecture series, student organizations, etc.? Are such opportunities adequate to promote a scholarly environment?
 - Student enrichment professional development opportunities include departmental colloquia, joint Math Dept and SimCenter seminars including an Advanced Modeling and Simulation Seminar, presentations from local industries, participation in NSF funded Research Experience for Undergraduates (REUs) hosted at UTC (these are very competitive awards), the SEARCH Award Program supporting undergraduate and graduate research.
 - These opportunities along with local conferences and workshops at UTC are excellent at promoting a scholarly environment.
- Does the program provide adequate opportunities for student internships, practica, and/or field experiences?
 - Internships are options woven into the MS program:
 - Area of Application or Internships, such as
 - Business
 - Economics
 - Computer Science
 - Engineering
 - Physics
 - Chemistry
 - Biology

- Are diverse perspectives and experiences provided for the students both through the curriculum and through extracurricular activities?
 - As mentioned throughout this review, we must all do better at recruitment of underrepresented groups at the student, faculty and administrative level. As the self-study states on page 57, “There is a clear need to improve diversity with respect to both gender and race/ethnicity in the department.” I agree and in this performance category too my rating was *Fair*. However, down four tenured, tenure-track faculty it may be possible to meet your desired specialty areas: artificial intelligence, machine learning, statistics, and get the administration’s support to dedicate a fourth position exclusively for an underrepresented minority hire without the constraint of finding a candidate with a specific specialty.

- Are students provided with appropriate academic support services? What services are offered? Do students use the services? How well do they meet the needs of the students?
 - As stated on page 56 of the self-study: *“UTC’s Graduate Student Association (GSA) offers programs geared toward opportunities for academic development of graduate students. GSA also organizes and sponsors social networking events that bring together graduate and professional students from across campus. All graduate students enrolled at UTC are automatically members of the GSA and are invited to attend events and meetings.”*
 - The duties of the Department of Mathematics Graduate Program Director include:
 - Supporting the educational and professional success of its graduate students.
 - Leading semester-by-semester reviews of graduate student progress
 - Ensuring clear communication of degree requirements, milestones, expectations, and probation criteria in an annually updated handbook.
 - Overseeing program orientation of new graduate students and assists them in their transition to graduate student life.
 - Ensuring that program mentoring is functioning smoothly, regularly advises newly admitted students in arranging programs of study, and monitors their progress quarterly (or more often if warranted).

- Regularly monitoring and updating, in partnership with program faculty, the progress of graduate students utilizing the advising software, approves student schedules, and ensures that students are aware of program and university requirements.
- Providing students with, at a minimum, annual communication informing them of their academic standing, e.g., face to face advising meetings and/or email updates.
- Ensuring that any capstone experiences are properly conducted theses, dissertations, internships, clinicals, and practicums.
- Facilitating academic and professional development support for all graduate students in the program.

PART 4 – Graduate Faculty Quality

Are the faculty competencies/qualifications those needed by the program and by UTC? Do all graduate faculty meet the standards set by the program and expected SACSCOC faculty credentials?

- Do faculty hold terminal degrees in the appropriate discipline?
 - Yes. *“Faculty teaching graduate and post-baccalaureate course work: earned doctorate/terminal degree in the teaching discipline or a related discipline*
- Do faculty specialties correspond to program needs and to the concentrations in which they teach?
 - Yes,
- If faculty need additional/different competencies/qualifications, how might these needs be addressed?
 - The number of tenured and tenure-track faculty are down by four. Recruitment of faculty will be targeted to meet the additional competencies/ qualifications needed.

Are faculty teaching loads sufficiently reasonable and equitable to accommodate the highly individualized nature of a graduate program, especially the direction of theses or dissertations?

- Overall, yes. Nevertheless, the significant research productivity of the faculty is notable considering the teaching load. However, considering that the math department participates in the Computational Sciences Ph.D. program thru the Computational Mathematics option, it is recommended that faculty who take on Ph.D. student(s) as their thesis advisor be considered for course reduction.

With respect to ethnicity, gender, and academic background, is faculty diversity appropriate for the program? Does the program student and faculty diversity mirror the demographics of the discipline?

- As mentioned frequently in this report, we must all do better at recruitment of underrepresented groups at the student, faculty and administrative level. As the self-study states on page 57, “There is a clear need to improve diversity with respect to both gender and race/ethnicity in the department.” I agree and in this performance category too my rating was *Fair*. However, down four tenured, tenure-track faculty it may be possible to meet your desired specialty areas: artificial intelligence, machine learning, statistics, and get the administration’s support to dedicate a fourth position exclusively for an underrepresented minority hire without the constraint of finding a candidate with a specific specialty.

Do the faculty have regular opportunities for professional development such as travel and participation in professional organizations, workshops, and other learning experiences? Do faculty take advantage of the opportunities provided?

- Considering the considerable research productivity of math faculty, it is apparent that they have regular opportunities for professional development such as travel and participation in professional organizations, workshops, and other learning experiences, and they take full advantage of these opportunities, some of which would be provided through their very successful grant awards. In addition, conferences and workshops at UTC are regularly organized by math faculty.

Are faculty engaged in the planning, assessment, and improvement processes that measure and advance student success? Does the program use assessment data, etc. to improve teaching, scholarship and creative activity and service? How does this work? Are the processes effective?

- The On page 37 of the self-study the issue of faculty engagement in the planning, assessment, and improvement processes that measure and advance student success, based on analysis of the data collected through student evaluations, SACSCOC assessment results etc.
“The Departmental Graduate Committee meets on a regular basis to discuss the state of the M.S. Mathematics program and how it might be improved. The committee collects suggestions from students and faculty and, when appropriate, develops curriculum proposals or asks the relevant faculty to do so. Any proposed changes to the program curriculum are received and discussed by the departmental Curriculum Committee prior to being brought to the attention of

the Mathematics Graduate Faculty for discussion and vote. If approved, the proposed changes are submitted in the form of a formal curriculum proposal electronically via the UTC Curriculog system. Proposals are processed through a chain of approvals in the system that includes the Department Head, College Curriculum Committee, Dean of the College, the Graduate Council, the Dean of the Graduate School, and the Associate Provost for Academic Affairs. Since the previous program review, the Department has made several changes to the graduate curriculum including:

1) A new Computational and Applied Statistics Certificate has been added. This certificate is for working professionals who wish to improve their career opportunities by expanding their knowledge in statistics and data analysis. All of the coursework in this certificate program is university accredited, recorded in a permanent transcript, and thus eligible for transfer credit to the Master of Science in Mathematics degree program.

2) New graduate-level courses (listed in Section C.3 of the Preface/History) have been added to the curriculum as faculty research interests and expertise allow. The addition of new courses increases the depth of the program as well as students' preparation for their future work or study."

- The self-study describes the process for changes in the MS program.
 - *"The Departmental Graduate Committee meets on a regular basis to discuss the state of the M.S. Mathematics program and how it might be improved. The committee collects suggestions from students and faculty and, when appropriate, develops curriculum proposals or asks the relevant faculty to do so. Any proposed changes to the program curriculum are received and discussed by the departmental Curriculum Committee prior to being brought to the attention of the Mathematics Graduate Faculty for discussion and vote."*
 - As evidence, on page 8 of the self-study there is a list of recent changes to the graduate programs:
 - MATH 5131 – Statistical Computation and Programming
 - MATH 5170 – Nonparametric Statistics
 - MATH 5280 – Analytic Number Theory
 - MATH 5350 – Mathematics of Finance
 - MATH 5530 – Calculus of Variations
 - MATH 5560 – Real Analysis
 - MATH 5590 – Functional Analysis
 - Three of these courses (MATH 4170, MATH 5280, and MATH 5350) have corresponding 4000- level courses.
 - The 2017-2018 Graduate Catalog reveals two program-level additions: a post-baccalaureate certificate in Computational and Applied Statistics and a
 - PhD opportunity - the Computational and Applied Mathematics concentration - one of three in the Computational Science PhD program.

PART 5 – Learning Resources

Does the program regularly evaluate its equipment and facilities and pursue necessary improvements?

- Has the program requested/encouraged necessary improvements of its equipment and facilities through appropriate internal mechanisms? Through appropriate external mechanisms?
 - The Department of Mathematics recently relocated, although some classes are still taught at the previous location. The new location, the third floor of Lupton Hall, is shared with by several departments. For instance, the 22 graduate student workstations, and the conference room is shared with the larger Department of English, whereas in the previous location the conference room was not shared, enabling the math department to use it for seminars, research groups and committee meetings. Perhaps the Department of Mathematics was not adequately consulted in the planning phase for the new space.
- Does it appear that the program's resources are appropriate within the context of overall college resources?
 - The cost per student credit hour is \$135. That is one of the lowest that I've ever seen and indicates that the Department of Mathematics at UTC is considerably under resourced.
 - A concern expressed earlier that would seem to fall under the category of resources is the need for more tenure and tenure track faculty.
 - Another concern is that for a department with a profile like that of mathematics: a major service responsibility in providing mathematics/statistics courses for general education and other departments major requirements, over 6000 students taught in its courses during a typical year, a highly productive research faculty, considerable grant funding, a graduate program and participation in a doctoral program, only one administrative assistant seems insufficient. Although their administrative assistant appears to be remarkable and manages to keep the balls behaving nicely in the air with the help of student assistants, from my perspective the very critical front office must be under some strain, even if it is not visibly apparent.
- How should needs of the program be prioritized? Could savings be realized from current program operations to fund any new budgetary needs?

- Increase the number of students in the MS program
- Increase the number of graduate assistantships.
- Consider introducing a 4+1 program where qualified undergraduates can double count towards their undergraduate and graduate degrees up to 12 hours of graduate level course work.
- Bring back up the number of tenure and tenure-track faculty
- Hiring faculty from underrepresented groups.
- Hiring a second administrative assistant.
- The math program is already creatively using lab fees to fund graduate students working in the Math Plaza in support of learning college algebra, which helps to improve the DFW rates.

Are library holdings and other learning and information resources current and adequate to support the teaching and learning needs of the discipline?

- There are no longer disciplinary standards for library resources, consequently I compared UTC library standards to those at College of Charleston since we are considered peer institutions and have similar profiles. In every measure: number of print books, e-books, print journals, e-journals; holdings in QA, HA, GA, and Q; number of library faculty, number of library staff; the UTC library exceeded or far exceeded the Adlestone Library at College of Charleston. When the College of Charleston Dean of Libraries, Dr. John W. White, learned that I was looking at UTC, he had this to say about the library and its dean, Dr. Theresa Liedtka, *“For what it’s worth, that library and their director have really good reputations. We modeled some of our digital production services and support after what they are doing. I’m planning to contact her for a visit at some point so I can see first-hand what they are doing.”*
- The College of Charleston library dean mention that a library quality benchmark for having a doctoral program in the College of Engineering and Computer Science would be having the IEEE Report. When I asked the UTC library dean about this she said that they have the IEEE Report and she successfully negotiated a good bargain for it with IEEE.

Part 6 – Support

Is the program’s operating budget consistent with the needs of the program?

- Considering current budget constraints, what are the most pressing resource needs of the program?
 - More graduate assistantships
 - Bring back up the number of tenure and tenure-track faculty

- Hiring faculty from underrepresented groups.
 - Hiring a second administrative assistant.
- Could these needs be met in ways without requiring additional budgetary resources, such as savings from current program operations?
 - Regarding more graduate assistantships, considering enrollments from page 50 and 51 of the self-study, as of fall 2020 there were 13 students in the math MS program and 191 total in the College of Arts and Sciences MS programs. This puts the math MS program enrollment at 6.81% of the CAS total. Considering that 35 graduate assistantships are allocated to CAS, based solely on percentages, 2.38 of the graduate assistantships would be allocated to math. Currently 1.5 graduate assistantships are allocated to math out of the 35. Under current allotments to CAS, it would seem that one more graduate assistantship to the math MS program would be warranted.
 - How should the needs of the program be prioritized? Could savings be realized from current program operations in order to fund any new budgetary needs?
 - Increase the number of students in the MS program
 - Increase the number of graduate assistantships.
 - As a cost saving, mix more undergraduate and graduate students in 4000/5000 courses by adding more existing 5000 level statistics courses to the list, providing there is clear and appropriate distinctions between assessments and expectations for undergraduate and graduate students as well as additional content appropriate for graduate students.

Does the program have a history of enrollment and graduation rates sufficient to sustain high quality and cost effectiveness?

- There needs to be more students in the MS program.
- The Table below gives the MS enrollments since Fall 2014. They need to be higher.

MS Enrollments						
F 2014	F 2015	F 2016	F 2017	F 2018	F 2019	F 2020
13	17	21	16	10	10	13

Is the program responsive to local, state, regional and national needs of the discipline?

- The design of the MS program in mathematics at UTC reflects its responsiveness to the local, state, region and national needs. It helps provide the local community, state, region and nations with teachers, mathematicians and applied statisticians with advanced degrees.
- Locally
 - Strengthening connections with high schools and post-secondary institutions to better prepare students for the transition to college.
 - Internships for students in the local community serves both the student and community entity, providing the student with the opportunity to apply their knowledge and skills and providing the community entity with intellectual labor and perhaps a future employee.
- State
 - Providing employees for state industries, community colleges, and secondary schools.
- Region
 - Providing employees for regional industries, community colleges and secondary schools.
- Nation
 - The national economy and security rely heavily upon the product of STEM education for employees, research, innovation, invention. Science, technology and engineering depend upon mathematics. In this way mathematics is foundational to our economy and security. Mathematics education is what nurtures, grows and perpetuates the foundation of STEM. UTC with its exceptional faculty, programs and courses is central to this responsibility in Chattanooga, Tennessee, the Southeast and the United States.

Does the program regularly and systematically collect data related to the success of its graduates, including placement? Do they also incorporate the results of that data to inform program improvements?

- As stated on page 85 of the self-study: “Department records provide the following information about students whose graduate research was earlier:
 - *Hersh Patel is an assistant professor at Chattanooga State Community College.*
 - *John Murphy is an actuarial analyst at BlueCross BlueShield of Tennessee.*

- *Chayu Yang went on to receive a PhD from UTC in 2020, and he is currently a visiting assistant professor of mathematics at the University of Florida.*
- *Philip Sofo was hired as adjunct faculty at UTC for a semester.*
- *Jeffrey Christopher is on the faculty at the STEM School Chattanooga, one of the Hamilton County magnet schools.*
- *Conrad Ratchford is in the UTC Math PhD program.*
- *Blake Smith is a PhD student at Clemson University, South Carolina.*
- *Lisa Nanni and Daniel Plaisted have both recently taught as adjunct faculty for the department.*

Are the program policies reviewed on a regular basis to ensure alignment with institutional policies and mission?

- *There is a required external review conducted every five years. One of the items considered is whether there is a fit/alignment with the institutional mission.*
- *Alignment with Institutional Policies is addressed on page 88 of the self-study: “The department works closely with departments and programs across the UTC campus to ensure that department policies are consistent with those at the College and University level. Recent examples of this cooperation are:*
 - *Department bylaws are being updated, with the new version meeting all the criteria prescribed by the College of Arts and Sciences and UTC Academic Affairs.*
 - *The Department requires that master’s students and students in the Computational and Applied Mathematics concentration of the Computational Science PhD program adhere to all institutional policies regarding admission and management of graduate student progress toward graduation.”*

Considering current budget constraints, what are the most pressing resource needs of the program? Does the program have acceptable completion rates? If unacceptable, what are possible contributing factors? How is this information used toward program revision

- *The cost per student credit hour is \$135. That is one of the lowest that I’ve ever seen and indicates that the Department of Mathematics at UTC is under resourced.*
- *A concern expressed earlier that would seem to fall under the category of resources is the need for more tenure and tenure track faculty.*
- *Increasing the number of graduate assistantships will help considerably with the recruitment of students.*
- *Another concern is that for a department with a profile like that of mathematics: a major service responsibility in providing mathematics/statistics courses for general education and other departments major requirements, over 6000 students taught in its courses during a typical year, a highly productive research faculty, considerable grant funding, a graduate program and participation in a doctoral program, only one*

administrative assistant seems insufficient. Although their administrative assistant appears to be remarkable and manages to keep the balls behaving nicely in the air with the help of student assistants, from my perspective the very critical front office must be under some strain, even if it is not visibly apparent.

PART 7 – Summary Recommendations

Overall, what are your impressions of the program?

- What are the major strengths of the program?
 - A distinguished faculty
 - Research opportunities for students
 - Internship opportunities for students
 - Good student support
 - Well-designed program
 - Supported by rigorous courses covering the depth and breadth necessary.
 - New and exceptional chair, dean and provost
 - An institution that is well supported by the state
 - A well organized, well run and thoughtful regulatory body.
- What are the major weaknesses of the program?
 - Too few students in the MS program.
 - Too few graduate assistantships
 - Too few tenure and tenure-track faculty, made more critical considering some senior faculty may retire in the near future.
 - Too few faculty members from underrepresented groups.
 - Too few students from underrepresented groups.
 - Insufficient budget allocation based in part on the very low Cost per Student Credit Hour

What goals would you suggest the program set for the next five years? Please list goals in order of priority (i.e., the most important goal first, followed by the second most important goal, etc,

- Increase the number of students in the MS program
- Increase the number of graduate assistantships.
- Consider introducing a 4+1 program where qualified undergraduates can double count towards their undergraduate and graduate degrees up to 12 hours of graduate level course work. This helps get undergraduate math majors to enroll in the MS program and it is also a recruitment advantage to the BS program. SACSCOC accepts 4+1 programs.
- Bring back up the number of tenure and tenure-track faculty
- Hiring faculty from underrepresented groups.

- Hiring a second administrative assistant.
- Mix more undergraduate and graduate students in 4000/5000 courses by adding more existing 5000 level statistics courses to the list, providing there is clear and appropriate distinctions between assessments and expectations for undergraduate and graduate students as well as additional content appropriate for graduate students.

How can the program work to achieve these goals over the next five years?

- Considering current budget constraints, what are the most realistic strategies the program can use to achieve the highest priority goals?
 - Bring back up the number of tenure and tenure-track faculty
 - Persuading the administration that these are necessary replacements not new positions
 - Hiring faculty from underrepresented groups.
 - down four tenured, tenure-track faculty it may be possible to meet your desired specialty areas: artificial intelligence, machine learning, statistics, and get the administration's support to dedicate a fourth position exclusively for an underrepresented minority hire without the constraint of finding a candidate with a specific specialty.
 - Introduce a 4+1 program where qualified undergraduates can double count towards their undergraduate and graduate degrees up to 12 hours of graduate level course work, by commencing the approval process.
 - Hiring a second administrative assistant.
 - Persuading the administration that this are necessary

- What goals would require additional resources? What level of resources would these goals require? How might the program secure these resources?
 - Bring back up the number of tenure and tenure-track faculty
 - Persuading the administration that these are necessary replacements not new positions
 - Hiring faculty from underrepresented groups.
 - down four tenured, tenure-track faculty it may be possible to meet your desired specialty areas: artificial intelligence, machine learning, statistics, and get the administration's support to dedicate a fourth position exclusively for an underrepresented minority hire without the constraint of finding a candidate with a specific specialty.
 - Hiring a second administrative assistant.
 - Persuading the administration that this are necessary