ACADEMIC PROGRAM REVIEW:

COLLEGE OF BUSINESS, ENGINEERING, COMPUTER SCIENCE AND MATHEMATICS: SCHOOL OF COMPUTER SCIENCE AND MATHEMATICS

5-YEAR REVIEW: 2019-2023

Lake Superior State University

Contents

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5-Year Academic Program Review 2023

Due to the Dean's Office by October 27, 2023

This reporting form was introduced in FY2020; numerical data prior to FY2020 may be excluded.

COMPUTER SCIENCE

Submitted by: Schemm, Smith, Bartus
Date: *9/27/2023*
School: Mathematics and Computer Science
Academic Program(s): BS and AS in Computer Science

Annual Program Data Reporting

The following table summarizes data from the Annual Update Reports conducted for this program:

	2019-2020	2020-2021	2021-2022	2022-2023
Enrollments	No Data Available for this year	Freshmen: 8 Sophomores: 4 Juniors: 6 Seniors: 9	Freshmen: 3 Sophomores: 6 Juniors: 3 Seniors: 10	Freshmen: 10 Sophomores: 3 Juniors: 2 Seniors: 5
Retention as of fall 2023	No Data Available for this year	Fr to So: 3 So to Jun: 8 Jun to Sen: 6	Fr to So: 1 So to Jun: 2 Jun to Sen: 3	Fr to So: 1 So to Jun: 0 Jun to Sen: 6
Degrees Conferred		4	4	1

Graduate Placement Data:

Our graduates are routinely able to find jobs in their field upon graduation. Our recent graduates (last 5 years) are employed at places like General Motors, several hospitals, a number of governmental contractors and governmental entities, and several schools and colleges. We also have several graduates that have gone on to graduate school.

High Impact Practices:

Group Projects, Applied Homework Assignments

It is nearly impossible to teach Computer Science in a modern environment without using these practices. A number of our lower level courses have lab components included in the course. For most

all the others, the Homework assignments given are to apply the abstract concepts learned in the course to solve specific real-world-like programming problems.

Additionally, these programs have both a Sophomore (and for the BS) a Senior level project experience. So far as we have been able to find, our program is unique in having both of these experiences. In these classes, students are given real-world clients who have a need they are supposed to meet with their project. Almost all of these at the Senior level, and many at the Sophomore level are group projects.

Summary of Annual Assessment Updates

The following table summarizes assessment data from the Annual Update Reports conducted for this program:

	2019-2020	2020-2021	2021-2022
Program Learning Outcome Findings	A number of courses had issues due to the abrupt transition to online delivery. A number of objectives were not as rigorously enforced or even assessed due to a lack of infrastructure to do so. Senior Projects was especially disrupted, as students were no longer able to meet with their clients, were not able to meet in-person with their advisors, and we were forced to do presentations completely online. While heroic efforts were made to overcome these issues, this year was clearly not 'normal'.	We made changes to the CSCI 211 based on identified needs in our students at the Senior level. This will give us a much stronger foundation for several upper level courses, as well as Senior Projects. We have also added MATH 215 in order to improve student performance and understanding in CSCI 341 / CSCI 342.	Of largest concern is the loss of so many students during their Freshman/Sophomore years (as well as fewer actual students enrolled in the program). This is affecting the pass rates of CSCI 121 and CSCI 201, as students are 'giving up' on their academic careers in these classes. We believe it is not the fault of the classes, but more that students are arriving at this decision during these semesters.

Summary of decisions, recommendations, and/or improvements concerning the future of the program

Decisions and recommendations should include budgets, additions of new courses or concentrations, discontinuation or suspension of the program, etc.

Our decisions, concerns, and recommendations over the period 2019 – 2023 have centered around three areas:

- First, we have noted a problem with our students ability to communicate effectively to others. We have noticed this both with their oral presentation skills, as well as their written skills in weekly reports and presentations.
  We had worked with the English department to create a class (ENGL 306) that would meet these needs, and better prepare students for upper level classes where these skills are needed. That was working for a while, but due to staffing changes in their area, COVID, and some other issues, this course is no longer meeting our needs as well as it was.
  We are not certain at the time of this writing how we wish to proceed. Due to staffing issues in the English department, it seems that they will not be able to directly meet our needs. We are looking into whether we can do so ourselves, or other methods to give the students the skills and

practice needed to succeed in these areas.

- Second, we noted that our students had some deficiencies in their Mathematics skills. This was making it difficult for them to handle some of the abstract concepts in our upper level courses. After discussion with the math faculty in the department, we decided to add two additional courses to our curriculum. The first is the standard math course in discrete mathematics taken by math majors. We noted that such a class is often required at other universities. This change is recent enough that we do not have follow-up data for it yet (the courses most affected is only taught every two years). The second is to revive a class in numerical methods. Students were fairly comfortable with the abstract CS concepts we were teaching them, but weren't always best at applying them to real-world situations, or real data sets. Adding this course to the program strengthens their skills in this area.
- Third, we are very concerned about the lack of support from Admissions and Marketing for this program. This has been a problem for a long time. For decades, the university has chosen to favor some programs to the exclusion of others. Recently, though, several incoming students told us they were actively discouraged from pursuing degrees in our area, in favor of the 'cool programs'. Worse, we have been told that we are not allowed to do any recruiting (or even to contact incoming students) on our own. While our numbers have not decreased as dramatically as other areas (even the 'cool' ones), we have been hurt by this lack of recognition. Lately, we have had to decrease offerings because there have not been students to fill classes. This can lead to delays in students graduating, and affects the reputation of the institution as well as our department.
  We attempted to combat this with the introduction of a new set of Data Science degrees, but so far, they are largely being ignored by Admissions and Marketing. Only 3 students have selected that major, and two of them were originally assigned elsewhere.

Rationale or justification for decisions made for the future of the program

This is covered in the preceding and following sections, inline with the actions and future goals.

Long-range future goals or plans for the program

Long term, we would like to see this program grow back to it's former size. In general, there is capacity to increase the number of students in this program by a factor of two without any additional cost to the institution. Only one, possibly two, lab courses would need to be added to support this, at a fairly low cost to faculty salary. All the other classes that are part of the degree would have room to spare, and thus require no increase in salary, support, or other costs. At a time when the University claims a need to save money (or at least spend less), this seems like an obvious win. Yet, it does not seem to be a priority for those same Administrators.

Looking at national career projections, there is nearly no end to jobs in this field. This is not (nationally) a dead or dying field. It is not an area with limited career possibilities. As shown elsewhere in this document, our students are quite capable compared to their peers across the country. It is indeed odd that CS enrollments are up at many institutions (who in some cases are turning away Freshmen), and yet ours are down. This is very frustrating to us.

We have attempted to create articulation agreements with some additional community colleges

to try and boost upper-level enrollment, but as of yet, these have not seen any fruit.

Quality, Resources, and Support for the program

Summarize Strengths and Weaknesses in each area.

Student Learning:

Our primary concerns in this area revolve around two items. First, we continue to have concerns about our student abilities with professional communication. Some years students have met this objective, but other years, their performance has been too low. Originally, we had worked with the English department to address this problem via ENGL 306. However, due to recent changes in staffing in their department, the course is no longer meeting our needs. We have started discussions on how to address this problem.

Second, our upper level numbers are a little low in recent years due to loss of students during and immediately after COVID. Smaller numbers of seniors in our primary assessment class make it easier for a single outlier to adversely affect the goal status of program objectives. While our numbers do seem to be rebounding a bit, this trend will actually continue for a couple years until our larger incoming classes make it to the upper level.

Graduate Success:

Our graduates have been successful in both job placement and graduate school acceptance. Recently, we have sent students to Michigan Tech for a Masters in CS. We have also had students employed at a number of national and regional companies.

The biggest 'concern' we have had with this is the number of employers that come to LSSU for career day that have been predisposed to only hire 'Computer Engineers'. Sadly, most of the jobs they are hoping to hire for are actually CS jobs that our students are very qualified for. Our advertising and marketing emphasis on 'Engineering' has led to us being seen as a second-rate program by some of these companies. Some students have been able to get around that when they can convince the recruiter to actually look at their resume.

Academic Programming and Rigor:

The course selection and organization for this degree were based off the ACM Computer Science guidelines. We met to determine exactly which components are incorporated into which classes, but all all components recommended by that organization are covered by our degree program. As the needs of our students, and the needs of world have changed over the years, we have adjusted our curriculum slightly to have these new emphases. For example, we noted that our students needed additional communications ability, and added ENGL 306. We also noted they needed additional preparation for the discrete mathematics components of CSCI 341, and have added a MATH course to give them that additional prep.

Faculty Qualifications, Staffing, and Effectiveness of Instruction:

All faculty teaching our courses have a terminal degree in a related field (the naming of degrees varies enough from institution to institution that giving a specific degree title is difficult). Currently we share an Academic Assistant. While it would be nice to have one full time, that is very unlikely to happen.

Assessment Practices:

Data for the assessment of this degree comes from the yearly evaluation of Sophomore and Senior projects. After students have completed their project presentations (and for Seniors, their poster presentation) the CS/CN faculty of the school meet to discuss the students project and presentation work. We do this both individually, and collectively. Individually gives us additional feedback for assigning final grades to the student. It is also used to find outliers or oddities in the data gathered. Collectively lets us identify patterns or trends across all the students in the degree program.

At this time, we also discuss how courses leading to these project experiences have influenced student abilities and presentation skills. A number of curricular recommendations have come from this discussion over the years.

Note: this assessment practice is done concurrently with the CN assessment, as there is some overlap between students and coursework feeding into the projects.

Resources / Facilities:

Our programs primarily make use of 2 classrooms that we control the scheduling and equipment for. We also have access to computer labs that are used solely by programs within our school. This gives us the ability to control exactly the software and resources that go into those facilities.

Computer equipment for the classrooms and the labs is currently on a six-year replacement plan. So far, we have been very fortunate to have the co-operation of our Dean it maintaining the funds (from lab fees) to be able to make those replacements.

For software infrastructure, we make use of cooperative license agreements with VMware. We also make heavy use of open source software that we can legally obtain free. Our lab computers have all software that our students need to complete assignments, but they often will take advantage of the availability of the software to do their work on their own personal computers. Our Deans have, again, been very helpful in making sure that we still have access to our funding to keep these products running.

While these resources are not the best, they are adequate to our needs, and given the size of our current enrollments, we are unlikely to get additional funding.

5-Year Academic Program Review 2023

Due to the Dean's Office by October 27, 2023

This reporting form was introduced in FY2020; numerical data prior to FY2020 may be excluded.

COMPUTER NETWORKING

Submitted by: Schemm, Bartus, Smith
Date: *9/27/2023*
School: Mathematics and Computer Science
Academic Program(s): BS and AS in Computer Networking

Annual Program Data Reporting

The following table summarizes data from the Annual Update Reports conducted for this program:

	2019-2020	2020-2021	2021-2022	2022-2023
Enrollments	No Data Available for this year	Freshmen: 4 Sophomores: 2 Juniors: 2 Seniors: 6	Freshmen: 0 Sophomores: 1 Juniors: 2 Seniors: 7	Freshmen: 5 Sophomores: 2 Juniors: 0 Seniors: 5
Retention as of fall 2023	No Data Available for this year	Fr to So: 2 So to Jun: 1 Jun to Sen: 2	Fr to So: 1 So to Jun: 2 Jun to Sen: 3	Fr to So: 2 So to Jun: 9 Jun to Sen: 5
Degrees Conferred		3	2	4

Graduate Placement Data:

Our graduates are routinely able to find jobs in their field upon graduation. Our recent graduates (last 5 years) are employed at places like Google, several hospitals, a number of governmental entities, and several schools and colleges (both as IT support and as Instructors).

High Impact Practices:

Group Projects, Applied Homework Assignments

It is nearly impossible to teach Computer Network in other than an applied way. The majority of the classes have lab components in them where students are required to implement material learned in class on their own version of a 'real world' environment. We make heavy use of virtual machines to accomplish this. A few of the classes in the degree make use of applied homework assignments; these

classes are usually the ones shared with the CS degree.

Additionally, these programs have both a Sophomore (and for the BS) a Senior level project experience. So far as we have been able to find, our program is unique in having both of these experiences. In these classes, students are given real-world clients who have a need they are supposed to meet with their project. Almost all of these at the Senior level, and many at the Sophomore level are group projects.

Summary of Annual Assessment Updates

The following table summarizes assessment data from the Annual Update Reports conducted for this program:

	2019-2020	2020-2021	2021-2022
Program Learning Outcome Findings	All the lab classes were significantly impacted by the abrupt switch to online mid-semester. With no access to lab facilities, and no way to overcome that, several objectives were met with 'compromise' activities. Senior Projects was especially disrupted, as students were no longer able to meet with their clients, were not able to meet in-person with their advisors. In some cases, students had difficulties getting to project resources due to university policies. Finally, we were forced to do presentations completely online. While heroic efforts were made to overcome these issues, this year was clearly not 'normal'.	We made changes to the CSCI 211 based on identified needs in our students at the Senior level. These changes will lead to changes in a couple other classes (CSCI 106 and CSCI 325) as they roll forward. There will also be some minor impact in other courses as students will have a much firmer grasp of these concepts.	COVID related compromises in lower level courses have led to less prepared Seniors. Students have gotten a larger than normal number of exceptions on due dates, assignment requirements, etc, and have come to expect these as the norm, rather than the exception.

Summary of decisions, recommendations, and/or improvements concerning the future of the program

Decisions and recommendations should include budgets, additions of new courses or concentrations, discontinuation or suspension of the program, etc.

Our decisions, concerns, and recommendations over the period 2019 – 2023 have centered around three areas:

- First, we have noted a problem with our students ability to communicate effectively to others. We have noticed this both with their oral presentation skills, as well as their written skills in weekly reports and presentations.
  We had worked with the English department to create a class (ENGL 306) that would meet these needs, and better prepare students for upper level classes where these skills are needed. That was working for a while, but due to staffing changes in their area, COVID, and some other issues, this course is no longer meeting our needs as well as it was.

We are not certain at the time of this writing how we wish to proceed. Due to staffing issues in the English department, it seems that they will not be able to directly meet our needs. We are looking into whether we can do so ourselves, or other methods to give the students the skills and practice needed to succeed in these areas.

- Second, COVID was especially hard on this program. As mentioned elsewhere, this program makes heavy use of in-person lab experiences in order to give students the opportunity to implement things learned in class. With the quarantine procedures in place during the early stages of COVID, all lab sections were canceled. We were eventually able to come up with some alternative methods for lab delivery, but these were not as effective as the in-person labs. Student understanding and competency on the course and program objectives was lower due to these compromises. Second, COVID seemed to affect the morale of our networking students more so than many other programs. Whether this was due to LSSU's COVID policies, the stress of the continuing pandemic, the lack of satisfaction with the 'alternate methodologies', or a decrease in the general level of student self motivation, we are unable to say. Likely it was some of each for different students. The net result, though, was a larger than usual number of students who left the university rather than complete the degree program. This seemed to affect our Freshman/Sophomore level the most, which has lead to a sudden decrease in the number of upper level students. When you combine this with item three (below) we have had a drastic decrease in the number of students in this program. This year, we have had to cancel several alternate year courses because the number of students who would be taking it is 0.
- Third, we are very concerned about the lack of support from Admissions and Marketing for this program. This has been a problem for a long time. For decades, the university has chosen to favor some programs to the exclusion of others. Recently, though, several incoming students told us they were actively discouraged from pursuing degrees in our area, in favor of the 'cool programs'. Worse, we have been told that we are not allowed to do any recruiting (or even to contact incoming students) on our own. While our numbers have not decreased as dramatically as other areas (even the 'cool' ones), we have been hurt by this lack of recognition. This year, no students were signed up for Computer Networking, even though, many had indicated it on their admissions applications. Historically, this program has picked up students that were mis-assigned to Computer Science by Admissions. This year, however, only 8 students were brought in to that program, and only 1 should be Computer Networking.
  We have recently collaborated with Criminal Justice to take components from this degree and combine it with components from their degree to create a new Cybersecurity degree. If marketed, this program could boost our failing numbers in those courses. But, if instead it gets the same attention as Data Science, then it too will die on the vine.

Rationale or justification for decisions made for the future of the program

This is covered in the preceding and following sections, inline with the actions and future goals.

Long-range future goals or plans for the program

Long term, we would like to see this program grow. If enrollment trends, and marketing of the program continue as they have for the next couple of years, though, this program will die. Given the number of jobs in this field, this would be a loss to the university, and the communities that we serve.

We have tried to work out articulation agreements with a number of community colleges, but they are not bearing as much fruit as we would like.

We have worked to create a new hybrid degree in Cybersecurity in order to fill up some of the capacity available in the courses (currently) unique to this program. Whether that program gains any traction is something we will not know for a couple years. Using that capacity (for this degree or for Cybersecurity) would only cost the university money as compared to canceling the courses outright. At a time when the University claims a need to save money (or at least spend less), this seems like an nearly obvious win. The faculty needed are already here, the facilities and other resources are already in place, and the capability for career placement is definitely there.

Looking at national career projections, there is nearly no end to jobs in this field. This is not (nationally) a dead or dying field. It is not an area with limited career possibilities. As shown elsewhere in this document, our students are quite capable compared to their peers across the country. Additionally, many of the jobs in this field are being filled by under- or un-trained individuals because of a lack of graduated students in programs like ours.

Quality, Resources, and Support for the program

Summarize Strengths and Weaknesses in each area.

Student Learning:

Our primary concerns in this area revolve around two items. First, we continue to have concerns about our student abilities with professional communication. Some years students have met this objective, but other years, their performance has been too low. Originally, we had worked with the English department to address this problem via ENGL 306. However, due to recent changes in staffing in their department, the course is no longer meeting our needs. We have started discussions on how to address this problem.

Second, our diminishing enrollments in this program make garnering any useful data from the Program Outcomes difficult. Further, with less than 4 students many years, having a single student that does not perform can skew otherwise acceptable results into a failure to meet the objectives.

Graduate Success:

Our graduates have been highly successful from this program. Recently, we have sent graduates to Google, IBM, and other big-name companies. Other students have found good placement in IT/Telcom companies across Michigan and Wisconsin, several hospital and other Governmental entities.

Academic Programming and Rigor:

The course selection and requirements for this degree were originally based off a survey of industry needs at the time. Due to faculty changes over the years, we have repackaged bits of the courses a few times since that original setup, but the core content and objectives have not changed.

One of the primary objectives with our current program content is to teach and prepare students for the networking needs of the future, not just the operating systems and needs of today. Toward that end, we spend a lot of time teaching the ‘why’ of how things are organized, not just the ‘what’ to pass a certification exam. In fact, we have specifically avoided tailoring our courses too closely to specific industry exams, as it would too narrowly focus our students knowledge base. Many of our upper level courses deliberately focus on two or more perspectives (OSes, products, methodologies) specifically to allow for discussion on the strengths and weaknesses of each approach. This is very different from the approach used at many community colleges, which only ‘teach to the exams’.

Having said all that, our students (who have been so inclined) have been able to pass these external exams without difficulty. We do not require that they do so, as not all employers require them, and they are a significant financial burden to students (and generally have a fairly short lifespan).

Faculty Qualifications, Staffing, and Effectiveness of Instruction:

All faculty teaching our courses have a terminal degree in a related field (the naming of degrees varies enough from institution to institution that giving a specific degree title is difficult). Currently we share an Academic Assistant. While it would be nice to have one full time, that is very unlikely to happen.

Assessment Practices:

Data for the assessment of this degree comes from the yearly evaluation of Sophomore and Senior projects. After students have completed their project presentations (and for Seniors, their poster presentation) the CS/CN faculty of the school meet to discuss the students project and presentation work. We do this both individually, and collectively. Individually gives us additional feedback for assigning final grades to the student. It is also used to find outliers or oddities in the data gathered. Collectively lets us identify patterns or trends across all the students in the degree program.

At this time, we also discuss how courses leading to these project experiences have influenced student abilities and presentation skills. A number of curricular recommendations have come from this discussion over the years.

Note: this assessment practice is done concurrently with the CS assessment, as there is some overlap between students and coursework feeding into the projects.

Resources / Facilities:

Our programs primarily make use of 2 classrooms that we control the scheduling and equipment for. We also have access to computer labs that are used solely by programs within our school. This gives us the ability to control exactly the software and resources that go into those facilities.

Computer equipment for the classrooms and the labs is currently on a six-year replacement plan. So far, we have been very fortunate to have the co-operation of our Dean it maintaining the funds (from lab fees) to be able to make those replacements.

For software infrastructure, we make use of cooperative license agreements with VMware and Microsoft. Our Deans have, again, been very helpful in making sure that we still have access to our funding to keep these products running.

While these resources are not the best, they are adequate to our needs, and given the size of our current enrollments, we are unlikely to get additional funding.

5-Year Academic Program Review 2023

Due to the Dean's Office by October 27, 2023

This reporting form was introduced in FY2020; numerical data prior to FY2020 may be excluded.

MATHEMATICS and MATHEMATICS EDUCATION

Submitted by: *Jennifer Gorman, Rob Kipka, Joni Lindsey, Bridgette Russell*
Date: *10/25/2023*
School: *Computer Science and Mathematics*
Academic Program(s): *BS Mathematics, BS Mathematics-Secondary Education, BS Mathematics-Elementary Education*

Annual Program Data Reporting

The following table summarizes data from the Annual Update Reports conducted for this program:

	2019-2020	2020-2021	2021-2022	2022-2023
Enrollments	Freshmen: Sophomores: Juniors: Seniors: **Data doesn't exist for this year**	Freshmen: *1* Sophomores: *4* Juniors: *1* Seniors: *3*	Freshmen: *4* Sophomores: *0* Juniors: *7* Seniors: *1*	Freshmen: *1* Sophomores: *2* Juniors: *2* Seniors: *2*
Retention as of fall 2023	Fr to So: So to Jun: Jun to Sen: **Data doesn't exist for this year**	Fr to So: *2 of 2* So to Jun: *0 of 1* Jun to Sen: *3 of 3*	Fr to So: *n/a* So to Jun: *1 of 1* Jun to Sen: *7 of 7*	Fr to So: *n/a* So to Jun: *1 of 1* Jun to Sen: *5 of 6*
Degrees Conferred	4	4	2	3

Graduate Placement Data:

Of the 11 students who graduated in the last five years 10 of the students immediately found jobs either teaching or in industry. The 11th student, having just graduated in Spring of 2023 was still looking for a job at the time of last contact. This student was an international student, who had added visa restrictions that needed to be filled when looking for a job.

High Impact Practices:

In the Mathematics degree we require our students to take Math 490, which gives them experience at

performing mathematical research, which is project oriented.

Across all Math related degrees (Mathematics, Mathematics Secondary Ed, and Mathematics Elementary Ed) students are given the option to present and disseminate mathematical ideas. This primarily has occurred through Math 490 presentations (required for mathematics majors), Talk Math to Me, and student-led semester-long specific topic seminars such as knot theory or number theory. Mathematics education majors are required one semester of student-teaching, during which they work with both an inservice and a faculty mentor.

Summary of Annual Assessment Updates

The following table summarizes assessment data from the Annual Update Reports conducted for this program:

	2019-2020	2020-2021	2021-2022
Program Learning Outcome Findings	In the Mathematics Program all outcomes were met. The general discussion was heavily focused on Math 401 and helping students to be more successful on the project assigned by working on group dynamics. In the Secondary Ed Program all outcomes were met except the Mathematical Process and Number Concepts in the Math 401 class and Measurement and Geometry in the Math 325 class. In the 401 class one of two students choose not to be an active participant in their learning. Instructors felt this was due to dealing with Covid during the Spring semester. In the Math 325 class the discussion focused on how students struggled with tests and it was suggested that more formative assessments before tests might help. The Math Elementary Ed program had no students this year as this	In the Mathematics Program all outcomes were met with the exception of Problem Solving and Analysis in the Math Program: There were two students this year being evaluated. One excelled, while the other was going through some personal crisis and did not do well on any assessments. In the Math Secondary Ed program the Patterns, Algebraic Relationships and Functions outcome was not met in the Calculus I or II classes. In Calculus I there were multiple problems that could have been used to assess and unfortunately the problem chosen the student did not perform well on, however had a different problem been picked the student would have met the outcome. In Calculus II there were only two students who needed to be assessed and one excelled while another didn't. The Math Elementary Ed program had no students this year as this	In the Mathematics Program all outcomes were met. Discussions focused on how the caliber of students who were assessed for the program were of exceptional quality. Faculty still looked critically at the outcomes and how they could be improved and talked about the success of adding a Math 390. In the Math Secondary Ed program all outcomes were met. The discussions around program learning outcomes were heavily focused on looking at and deciding what should be assessed in the new program for MDE that the department was working on creating. The Math Elementary Ed program had no students this year as this

Summary of decisions, recommendations, and/or improvements concerning the future of the program

Decisions and recommendations should include budgets, additions of new courses or concentrations, discontinuation or suspension of the program, etc.

The following changes/improvements/actions were made to the program over the last five years:

2019-2020
MATH 087 removed;
MATH 102 changed from 4 to 3 credits;
MATH 088/102 single semester option introduced; MATH
107 introduced;
MATH 390: Directed Study in [Topic] successfully proposed (explain);

2020-2021
Recommended teaching integral theorems in Calculus III

2021-2022
Integral theorems added to CLOs for Calculus III;
MATH 215: Change course description to include "recurrence relations" and change credits from 3 to 4;
Removed MATH 216 from mathematics program;
Require MATH 421 for mathematics and mathematics education majors;
Changed structure of MATH 411 from specific topics (series solutions to ODE, integral theorems, Fourier series) to general topics course, with topics to be announced by instructor, following specific guidelines.

2022-2023
Restructure mathematics education into 5 - 9 and 7 - 12 grade bands; Delete
elementary education program

Rationale or justification for decisions made for the future of the program

Changes to 087/088/102 were made as part of a research-based improvement to the developmental mathematics program, led by Drs. Ray DeWitt and Brian Snyder. MATH 107 was introduced at the same time as part of an attempt to improve student confidence in this area.

MATH 390 was introduced to take advantage of our small size: we had a student who needed a course in Abstract Algebra (MATH 341) that would not run for another year. Rather than have her take an Independent Study (MATH 290), we developed MATH 390 so that it would (1) have a junior-level course number and (2) so that it would appear on her transcript as "MATH 390: Directed Study in Abstract Algebra," rather than "MATH 290: Independent Study." This course has run several times since to meet the needs of various students.

MATH 421, Real Analysis, is an essential part of the undergraduate mathematics curriculum for *all* mathematics majors. Several of the major professional organizations in mathematics have released statements supporting this point of view. In particular, the MAA supports the presence of this course for all mathematics majors, including secondary education majors. We have begun to require this course as a result.

MATH 216 was a kind of catch-all course that overlapped with MATH 341 and MATH 351. We removed this course from the program in order to make room for MATH 421. The loss of content was insignificant, especially in comparison with the content added by 421. Some topics taught in MATH 216 were essential and those were moved to MATH 215. To make room for these topics, we changed MATH 215 from three credits to four.

Nearly every undergraduate institution in Michigan teaches the integral theorems (Green's, Stokes', divergence) at the end of Calculus III *even those that have a 14-week semester*. Lake State has long left these theorems out of Calculus III and, consequently, our Calculus III will not transfer to University of Michigan. We have added those topics to Calculus III CLOs. Instructors for this course are expected to budget their time appropriately, spending less time on topics such as quadric sections or curvature in order to reach the integral theorems.

Since the integral theorems will be taught in Calculus III, we no longer require MATH 411 to teach integral theorems. This course has been given a more flexible structure, again to take advantage of our small size. Instructors may teach nearly *any* advanced topic in Calculus, provided that: (1) the tools and techniques of the Calculus sequence are on display; (2) applications are present; and (3) the course content is at the senior level (Fourier series, complex variables, and partial differential equations are all good examples).

The state of Michigan required changes to Education Preparation Programs for certification. The department added two teaching methods courses and now requires the secondary math majors to complete the full probability and statistics sequence and two courses in computer science.
Additionally, there has been an additional requirement for the secondary grade bands. There is a STEM and Modeling cognate that requires courses to be chosen from the following fields: Biology, Chemistry, Political Science, Economics, or Data Science.

Long-range future goals or plans for the program

The program goals for the next force years are:

- Initial and continuing assessment of the grade bands program is a goal for the next five years.
- Efforts to increase program visibility and enrollment.
- Evaluate changing the graph theory requirement to a junior seminar in the Mathematics Program.

- Evaluate the feasibility of streamlining a way for engineering majors to become double majors by adding a Mathematics majors.

- Continue to work to improve the culture and connections among Mathematics majors, especially with the addition of more regional center students.

- Assessment and possible restructuring of developmental mathematics (the people who designed this are gone) and pathways through gen ed mathematics.

Quality, Resources, and Support for the program

Summarize Strengths and Weaknesses in each area.

Student Learning:
In the Mathematics Secondary Ed program one of the major components of developing the new program has been to give students more field experience. The Mathematics Secondary Ed program also requires a lot of upper level mathematics, which is reflected in the pass rate MTTC, which over the last five years has been 100%

In the Mathematics Program Math 390 allows faculty the flexibility to individualize a student's learning plan to account for a student's future plans, such as learning topics needed for grad school or investigating an area of research that they are passionate about.

Graduate Success:
Almost 100% of our graduates have success in finding a job as noted above in this report. One area that the department wants to improve on is to help students going into non-academic/non-teaching jobs aware of what options are available.

Academic Programming and Rigor:
Over the last five years the department added the requirement of Real Analysis, one of the most rigorous mathematical courses. Students in the Mathematics and the Mathematics Secondary Education program are both required to take this course. In Calculus III we also have added the integral theorems. This has strengthened the rigor of this class and puts our class in alignment with Calculus III at many other institutions.

Faculty Qualifications, Staffing, and Effectiveness of Instruction:

During the past five years two new faculty members were hired. One faculty member brings a wealth of understanding of first gen college students through extensive teaching at the community college level. The other faculty member who was hired brings an abundance of knowledge of developmental education and mathematics education.

Faculty teaching in the program bring quality instruction to the classroom. They have adapted to

teaching students who are virtual and located at the remote centers.

There has been a changeover of instructors in the department due to some retirements and non-renewals. This has resulted in the loss of an instructor line.

Assessment Practices:

The department assesses both class level Course Learning Outcomes, General Education Outcomes, and Program Learning Outcomes each semester. Data is loaded into TracDat and is looked at each year. Many informal conversations around assessment occur throughout the semester. These conversations have led to many changes that have improved our program.

Resources / Facilities:

We have updated our CAS 205 classroom to have the technology necessary to provide high quality remote synchronous instruction for students in our majors who are at our regional centers. This has included converting the room to be a Zoom room with a high quality sound system. The department has also gotten foundation grants to supplement this classroom with ipads to help facilitate group work between the remote and in person students.

The department also worked on updating CAS 208, our Mathematics and CS student lounge. The space is now more inviting for our majors to hang out and work in and students have started to use it more regularly.