Lehman College Mathematics Department Visiting Committee Report

March 15, 2023

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Table of Contents

I. Executive Summary

Description:

The self-study produced by the mathematics department provides a valuable document for understanding in detail how the department operates. We found that the mathematics department is functioning well, and is doing about as much as possible with the staffing, support, and budget within which they are operating. Courses are offered in a responsive and efficient manner in terms of satisfying the significant service role that the department plays at Lehman. The mathematics major and minors are sound in their structures and requirements, though with additional support there would be opportunities to include important enhancements. The Math & Statistics Student Success Center plays an essential role, and operates effectively in supplying undergraduates with help in lower-level coursework and also with advising of undergrads. The Lehman tenured and tenure-track faculty continue to make significant research contributions in their respective areas, are active participants at the CUNY Graduate Center, and provide transformational experiences for Lehman undergraduates. The department's self-study described the department's program as a "three-legged stool," that provides Lehman students with quantitative and critical thinking skills that enhance their professional development, service to their respective communities, and allows them to add to the world's body of knowledge. Relations between the department's faculty and the department's administration (chair) are friendly, smooth, productive and there is a cooperative spirit within the ranks. In addition, the Lehman administration is positive about the department's administration and in the manner in which the department functions. We remark that the professional organizations: ASA – American Statistical Association, MAA – Mathematical Association of America, SIAM – Society for Industrial and Applied Mathematics regularly publish curricular guides. These can be of value to a department or administration in reviewing their own programs.

Recommendations for the department include:

1. The department should add a "fourth leg" to the three-legged stool of activities or goals they describe in their self-study as a means for active consideration. This fourth leg should define and emphasize the structure of the department's majors and minors, and expectations for students who will study mathematical sciences at advanced levels. In particular, the department should enunciate the important role of statistics and data science, and the need to develop a robust program in that area.

2. Tenure-track or tenured hires (initially two, if possible) should be made in the area of statistics in order to develop a statistics program that will benefit the many students at Lehman and lead to professional opportunities at all levels (from support to those who will ultimately seek employment in an area such as nursing or a career in a STEM field, to those who may wish to become statisticians, actuaries or finance professionals). Having a robust program in statistics and data science should be an initiative at Lehman that is considered to be of the highest importance. (See the following articles from several years ago whose revelations are even truer today: Wall Street Journal Article: https://www.wsj.com/articles/BL-DGB-43702 , Washington Post: https://www.washingtonpost.com/local/women-flocking-to-statistics-the-new-hot-high-tech-field-of-data-science/2014/12/19/f3e2e486-62ed-11e4-9fdc-d43b053ecb4d_story.html)

3. In keeping with the opportunities afforded by Lehman's location in New York City and affiliations with the CUNY Graduate Center, the department should be provided with faculty lines, at the least commensurate with retirements and resignations, to continue hiring tenure-track mathematicians with excellent research potential. In statistics, senior-level hires should be considered as a way to ensure that the statistics program, as it develops, has strong leadership; within mathematics, the department should be free to hire faculty at any levels that are in keeping with needs and opportunity. Even with consideration of the trend towards larger numbers of contingency faculty, or purely teaching staff, teaching larger portions of college and university offerings, these individuals will allow for mathematics and statistics to be taught at a number of levels by permanent Ph.D. faculty.

4. We recommend that the annual budget for the Math & Statistics Student Success Center be made available before August, so that expenditures may be planned in advance. In addition, we recommend that the budget for these essential activities be increased, as it is evident that, while the center currently functions well, this may not be possible to continue in the long term without an increase in staffing. In addition, the center is currently open only four days per week. A budget increase would allow the center to be open perhaps six days per week.

5. We endorse the math department's goals as stated in section 5.3 (beginning on page 50) of their self-study in the areas of: Faculty and Research Support, Program

Growth, and Curriculum Development. The one significant difference is our recommendation that the hiring of statisticians and the development of a robust program in statistics and data science be a deemed a high priority (as stated in items 1 and 2 above).

6. We recommend that a transparent policy be developed for instances of providing faculty with reduced teaching loads based on their research productivity. This seemed to be one of the few areas of friction in the department, owing to ambiguity and differing expectations of assignments versus realities.

7. We recommend that a statement of individual responsibilities and expectations be developed by the department for permanent faculty. This will become of increased importance when the department is successful in hiring statisticians, as the profession is somewhat different from mathematics. For example, although mathematicians sometimes perform consulting tasks on behalf of faculty, students (or sometimes the administration) at their home institutions, or outside of their home institutions, consulting is regarded as essential at some institutions for the statisticians.

8. We recommend that a student chapter of the Association for Women in Mathematics be explored at Lehman.

9. The Department may also consider investing in a departmental membership in the Mathematical Association of America; this provides one faculty membership but importantly, an unlimited number of student memberships. These memberships could be offered to mathematics majors of distinction in order to attract them to the discipline.

II. Introduction and Overview

During our visit we met with many members of the Lehman College community including: the mathematics department chair, Joe Fera, various full-time members of the mathematics department at the levels of assistant professor to full professor, Assessment and Institutional Effectiveness Manager Donald Sutherland, Dean Pamela Mills, Rafael Gonzalez, Director of the Math & Statistics Student Success Center (MS3), as well as – by Zoom – under the auspices of Professor Christina Sormani – approximately a dozen Lehman College mathematics graduates. All of the conversations we had were informative, valuable and did much to augment the impressions of the program we formed from the comprehensive self-study that was prepared by the department.

We are cognizant of, and moved by, the goals stated in Lehman's 2025 Roadmap to the Future, in particular, of the unique role of Lehman College in The Bronx as "an engine for social mobility" and "center [for] creative work" that "[provides] a transformational educational experience" for its students. (These goals were conveyed in the department's self-study.) We are aware of the imperatives that derive from such a large percentage of students coming from lower income families,

and underrepresented communities, in which in a majority speak a language other than English at home.

Our overall impression of the mathematics department is that its members and support staff are doing their best, and by any measure are doing excellent work, in serving their students, particularly in advancing Lehman's ambitious and lofty goals, as stated in Lehman's 2017 90x30 challenge, and 2021 strategic plan, which includes Lehman's 2025 roadmap of stated core values. We find the faculty are motivated to be effective teachers, and judging from certain objective measures mentioned in the self-study, are having considerable success with Lehman's students. The department is quite strong in research, with a long tradition of having top researchers among its faculty, as measured against other departments at Lehman, as well as within all of CUNY, and by the general standards of the discipline. The department's distinction in research has significant salutary effects on the undergraduates at Lehman, some of whom (judging from comments we heard from recent graduates) have had transformational experiences that go well beyond mere pre-professional training in areas such as nursing or accounting, etc. Former students generally were quite positive about the mathematics program, but did make several suggestions they believe would serve students well that we will address later. We should emphasize here that the Math & Statistics Student Success Center (MS3) plays an essential role in tutoring and advising students in most lower-level courses, justifying the name, "success center." The two members of the Lehman administration with whom we spoke also were generally positive about the mathematics program, both in terms of leadership, but also in terms of "objective" measures such as DWIF rates (more on this later).

The department has solid leadership and is doing an excellent job with the resources at their disposal. The chair has good relationships with the Lehman administration, with math department faculty and staff. We observed that the chair expresses appreciation and admiration to staff, faculty and administrators for the jobs they are doing, especially with sometimes limited resources. Recent hiring at the assistant professor level has been highly successful, and the newer faculty are research active (and have already achieved distinction in the form of two National Science Foundation CAREER awards, among the highest awards for early-career scientists in the country.) We remark that these individuals also are motivated to be effective teachers and mentors at Lehman and are enthusiastic about Lehman's mission. We further remark that, given adequate program support, there is no better positive indicator for the success of the mathematical sciences program at Lehman than the coupling of successful research and a serious commitment to excellent teaching among the faculty, and nothing better bodes well for the students of The Bronx and environs who attend Lehman.

III. The Department within the Lehman Environment

The department plays a very large service role at Lehman, particularly so because many students are interested in pre-professional training in areas such as nursing, STEM areas

outside of mathematics, and social science areas, all of which have as a requirement a mathematics course. Roughly 50% of the courses below Calculus II are taught by adjuncts and lecturers who service these groups. An essential element (judging by the staggering number of visits to the center: nearly 2500 students serviced in the Fall and Spring semesters this year) in the success of students in lower level courses are the services available in the Math & Statistics Student Success Center. The courses for the department's majors and minors are generally taught by permanent faculty; we regard this as a very good thing! The mathematics department is the biggest department at Lehman and the faculty have a record of producing excellent research and concomitant involvement at the CUNY Graduate Center. Hiring in the department has recently been increased – in addition to hires to replace retiring faculty, three new positions were approved in 2018, and, owing in part to Lehman's location in New York City, and its associations with the CUNY Graduate Center, excellent faculty have been hired who not only are top-notch researchers but are devoted to excellent teaching of Lehman's students. There is objective evidence that the department has served Lehman's students well. For example, DWIF rates have improved in lower-level required courses for majors in other departments, and (with possible ripples in data owing to Covid notwithstanding) in terms of healthy numbers of mathematics majors and the various minors. (The minor in actuarial mathematics is relatively new, and so there is not yet sufficient data.) Going forward, in addition to the sound recommendations offered in the department's self-study, based on imperatives at the national level, it should be a priority going forward to develop a robust program in statistics and data science. We observe that mathematics and statistics are separate disciplines and therefore the addition of a serious statistics program will require care and a substantial commitment from the Lehman administration.

IV. The Curriculum

The mathematics department offers a major in mathematics, a major in mathematics and economics, as well as minors in pure mathematics, statistics, and a relatively new minor in actuarial mathematics. There also are graduate programs at the master's level in pure mathematics, and mathematics and instruction, the latter designed for those who wish to embark on teaching mathematics. There is, as well, an advanced certificate program in actuarial mathematics.

The suite of available courses provides for a solid and largely traditional major in mathematics that serves, among its many functions, to prepare students for graduate-level work in pure mathematics. The graduate programs also provide majors with opportunities to either seek a master's degree, or to increase readiness for a strong program at the Ph.D.-level.

We have already weighed in on supporting a robust effort to develop enhanced emphasis in statistics and data science, with the eventual goal, a major in the subject. This undertaking will be aided by hiring new statistics faculty, as we have discussed.

With respect to the standard curriculum, we discussed with the chair the place of a course in discrete mathematics within their program. This course is often required for a degree in computer science, but also is often required in the mathematics major as a bridge to higher-level courses that require students to produce rigorous mathematical proofs. We learned that the computer science department has their own discrete mathematics course for their majors, and that the math department's course is not a requirement for the mathematics major, but is mostly taken by future teachers of mathematics. We wonder whether there may be a role for a course in discrete mathematics within the major.

With respect to STEM departments, including computer science, we understand that there are some demands that are not entirely met. For example, CS was interested in having the mathematics department offer a dedicated course designed for their majors in probability and counting, in addition to the courses in Calculus III and Linear Algebra that their majors now take. We understand that the mathematics department could not easily offer this course with current staffing, as 2 – 3 sections would be required each year.

We did wonder, given the paucity of students who graduate with a major in mathematics and economics, whether it might make sense to drop the program. The chair observed that there is no "cost" to keeping the program as all of the required mathematics and economics courses in place for the major would nevertheless continue to be offered in the respective departments even if the program were dropped.

We observe that the department has designed several brand new lower-level courses, for example, including MAT 124: Algebraic Functions and Thinking for Educators, and MAT 125: Explorations in Geometry, Probability and Statistics, which have been submitted for approval so as to satisfy the CUNY QR requirement for graduation. At the other end of the spectrum, the department has wondered whether there might be a possibility of offering honors sections in advanced courses such as abstract algebra, or whether there might be a possibility of data science courses of various flavors. We mention the above as it contributes to the strong evidence that the department is actively engaged in thinking about their curriculum and the ways in which they may enhance what they do for the benefit of students at all levels.

Especially given the makeup of the student body at Lehman, and the pre-professional leanings of many of these students, we think the relatively recent addition of a certificate program in actuarial mathematics is sensible and hope and expect, once data is available, that the program will be a popular success.

Recent alumni of the mathematics program (as long ago as 2009) whose present careers are as teachers, software engineers, data scientists, curriculum designers, sustainability and planning professionals, etc., had a number of suggestions for the mathematics program, some more practical than others. All seemed appreciative of their experiences as math majors and felt that the major had provided gateways that led them to their professional lives. They variously felt that their educations had provided "a solid foundation," had created "endless possibilities," that "exposure to computer science" — a requirement of the major — was important, that "exposure to professionals outside the department sharing their experiences had value," that "undergraduates partnering with

professors to do research," was a valuable experience. There was appreciation of the LSAMP, and Louis Stokes programs. (See also, below, in next section.) These former students mentioned that they thought that courses could be offered with greater frequency, at different times, that exposure to certain software packages, such as Mathematica or Maple, would be helpful for those seeking jobs in industry, that teachers-in-training would benefit from exposure to technology often found in classrooms. We do not make any particular recommendations based on these observations, but feel it is good to hear what these majors had to say.

V. Teaching, Research, Service and Infrastructure

1. Teaching

The department has enunciated clearly, for their lower-level courses, that while they "work hard to meet Lehman students where they are mathematically," and work to "eliminate obstacles, bottlenecks, and roadblocks to graduation," they "are also committed to maintaining "high academic standards," the latter of which, according to agreements across the CUNY system require "uniform syllabi, clear learning objectives, and standardized assessments across multi-section courses." With respect to their more advanced students, the department has developed a clear set of goals and objectives for their majors and minors that include: (i) perform numeric and symbolic calculations, (ii) construct and apply symbolic and graphical representation of functions, (iii) model real-life problems mathematically, (iv) use technology appropriately to analyze mathematical problems, (v) state and apply mathematical definitions and theorems, (vi) prove fundamental theorems, and (vii) construct and present a rigorous mathematical argument. We find this enunciation of challenges and goals involved in simultaneously taking students from where they begin mathematically, to a level of relative mathematical rigor, either at the elementary level, or the advanced level required for the major, entirely sound. (See, for example, Mathematics Association of America Guidelines: https://www.maa.org/programs/faculty-and-departments/curriculum-department-guidelines-recommendations/cupm/2015-cupm-curriculum-guide/overview-of-majors .)

We observe that lecturers and adjunct faculty offer close to 50% of the courses offered by the department. These are usually the lower-level courses. Full-time permanent faculty tend to teach courses beyond Calculus II. We acknowledge the important contribution made by so many dedicated and competent faculty who teach these lower-level courses. But, while we understand the reasons for this arrangement, and acknowledge the increasingly popular use of adjunct or non-Ph.D. faculty in lower-level courses at some colleges and universities, we also caution that the tendency to increase the use of adjunct faculty for the mathematics program is not in the best interests of Lehman's mathematics students.

An illustrative case in point is a conversation we had with a recent graduate of the mathematics program at Lehman. This individual, among the most articulate of the former students we talked to, spoke eloquently about how he came to mathematics with the attitude that mathematics consisted of a mere collection of procedures and skills one mastered that were routinely brought to bear in order to solve problems. It was his experience in a course taught by Melvyn Nathanson – a top researcher with an important presence at the CUNY Graduate Center – where he learned that mathematics is a most creative discipline and began to appreciate the inspiration, creativity and scholarly zeal

that goes into advancing the discipline. He mentioned how his outlook had "metamorphosed into an understanding of what an awesome experience it is to do math." Other former students spoke about how important exposure to the work of doing research in mathematics was in their professional development. (See above section.) These sorts of experiences, or even the intimation (in lower-level courses) that mathematics is more than a collection of already worked out procedures, are far more likely to occur in courses taught by tenure-stream faculty with active and successful research programs. Indeed, these are the "transformational educational experience[s]" referred to above in the goals stated in the 2025 Roadmap to the Future, which emphasizes Lehman's role in as a "center [for] creative work" that "[provides]a transformational educational experience" for its students.

With respect to other issues of staffing, and teaching efficacy, we are aware that average class size in mathematics courses at Lehman is 28- 30 students; while this figure is fairly standard in the school of Natural and Social Sciences at Lehman, it is significantly higher compared with the schools such as Arts and Humanities or the School of Education. While there are stronger elements in the case that a department may make in requesting additional faculty lines, the fact that class sizes in mathematics are at this level certainly indicates that the department is far from a situation of surfeit with respect to faculty lines. We believe this situation should be monitored carefully and may add to an argument for increased staffing for the department. Some lower-level courses have as many as 100 students. While we received some assurance that this approach of having courses with enrollment of roughly one hundred students works, especially with augmentations to the classroom experience provided by the tutoring and help with homework at the Math & Statistics Student Success Center, we wonder, given the high class size in certain courses, and the very high average class size, whether Lehman students would benefit from additional faculty allocations to mathematics.

A word about the Math & Statistics Student Success Center. Our visit to the center and discussion with the director, Rafael Gonzalez, led us to observe that the center is extremely well-run and provides essential support to students, particularly those in lower-level courses. We were informed that the budget for the center has not been made available in a timely way. It would be helpful to have the fall budget in place prior to mid-summer, so that purchases and schedules can be arranged well before classes begin. Further, the budget allows for the center to be open Mondays – Wednesdays, and Saturdays. Given the essential role of the center, additional funds in their budget so that the center can be open additional days would be advisable. In addition to the role of the center in tutoring and providing assistance with homework, much of the advising of undergraduates takes place under the auspices of the center. While we appreciate the outsized competency of the present director, and the Herculean efforts he makes in running the center, we believe the undergraduates would be better served if the center were better funded and additional staff were made available for tutoring and advising. As mentioned in the department's self-study, the mathematics department presented the Lehman administration with "a proposal outlining a 3-year plan to reimagine student support in mathematics and statistics" with 8 goals. We fully endorse this proposal.

In terms of student success, one measure in use at CUNY is "DWIF" rates. The self-study and the Assessment and Institutional Effectiveness Manager mentioned the improvement

in DWIF rates from about 30% to approximately half that rate, and we commend the department on this success. Nevertheless, we agree with the department chair that there may be better metrics for gauging student success in certain lower-level courses than DWIF rates. For example, many students who take statistics may be aiming for a D; that grade affords them advancement in their studies as statistics is not prerequisite for any other courses in their studies. Thus, they may not be motivated to perform better than merely passing the course. Moreover, as students are allowed to withdraw from a course up until the last day of class, the withdrawal component of the DWIF measure significantly affects the outcome, in such a way that it fails to accurately reflect instruction quality. We wonder whether looking at the simple ratio of fail/pass might not be a better measure.

We also wonder whether the administration might provide better access to data concerning about the department's programs. For example, we did not anywhere see a breakdown of students in math courses by gender. This and other sorts of facts about the program are good to monitor and may be useful to department chairs.

2. Research

There is a long history of exemplary research carried on by mathematics faculty at Lehman. The Mathematics Department has unique strength in research, both as one of the top (if not the top) research departments at Lehman, and also as one of the top math departments in the CUNY system. As just one marker of research distinction, one can compare the proportion of faculty who are Fellows of the American Mathematical Society. Recent hiring of new assistant professors who are research active (and have already achieved significant distinction in the form of two National Science Foundation CAREER awards, among the highest awards for early career scientists in the country) carries on this tradition. As we have mentioned, the location of Lehman in New York City, along with its affiliation with the CUNY Graduate Center, make mathematics positions at Lehman highly desirable. We hope that the hiring of new assistant professors, when that is warranted, will continue the tradition of excellent researchers who are also committed to excellence in teaching Lehman's students. Younger faculty do tend to have different and desirable forms of engagement with undergraduates, and add to the vibrancy of a department. Faculty grant activities have been highly successful, with members of the department, for example, receiving over 1.25 million dollars in NSF grants since 2015.

Faculty in the department described a lack of support for grant writing, e.g. budget and budget justification preparation, essential components of a successful grant proposal. There is also almost no staff to assist with post-award functions such as receipt and reimbursement handling, expense reporting, conference organization, etc.

As we have already observed, exposure of undergraduates to faculty who are actively engaged in research has important and desirable consequences for these students. These faculty also are in a position to mentor junior and senior math majors and play the very important role of informing them of even the possibility of post-graduate opportunities in mathematics.

There was a sense among math faculty that a clear policy for the awarding of release time for active research should be developed. The Faculty Research Advisory Board (FRAB) has not met in some time, and this should be remedied.

This is perhaps a good place to reiterate our recommendation for creating a quality statistics program. While this will be accomplished in stages, with the first step to hire statisticians in the department, it is important to keep in mind that statistics and data science as a field is distinct from mathematics. Given that this can create the problem of the "lone statistician," in the instance where a department of mathematics hires one statistician, we believe Lehman would do well to approve the simultaneous hiring of two statisticians. We have no doubt that their courses would be full and they could be able to work together to efficiently create the program in statistics at Lehman.

3. Service

Overall, service seems to be going very well. The math faculty seems appreciative of the chair's work that is protective of their teaching and research time, taking on himself the lion's share of the burden. Faculty are generally happy with the schedule and frequency of department meetings. An elected Personnel and Budget Committee handles searches and hiring.

4. Infrastructure

With an aging building there certainly is a need to improve physical infrastructure for the department. Faculty mentioned leaking or non-working radiators, shoddy flooring, and chipped blackboards. These are wholly unacceptable conditions for a program of such high esteem.

VI. Collection of Specific Recommendations

Recommendations for the department include: (This section also appears in I. Executive Summary)

1. The department should add a "fourth leg" to the three-legged stool of activities or goals they describe in their self-study as a means for active consideration. This fourth leg should define and emphasize the structure of the department's majors and minors, and expectations for students who will study mathematical sciences at advanced levels. In particular, the department should enunciate the important role of statistics and data science, and the need to develop a robust program in that area.

2. Tenure-track or tenured hires (initially two, if possible) should be made in the area of statistics and data science, broadly construed, in order to develop a program that will benefit the many students at Lehman, and lead to professional

opportunities at all levels (from support to those who will ultimately seek employment in an area such as nursing or a career in a STEM field, to those who may wish to become statisticians, actuaries or finance professionals). Having a robust program in statistics and data science should be an initiative at Lehman that is considered to be of the highest importance. (See the following articles from several years ago whose revelations are even truer today: Wall Street Journal Article: https://www.wsj.com/articles/BL-DGB-43702 , Washington Post: https://www.washingtonpost.com/local/women-flocking-to-statistics-the-new-hot-high-tech-field-of-data-science/2014/12/19/f3e2e486-62ed-11e4-9fdc-d43b053ecb4d_story.html)

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5. We endorse the math department's goals as stated in section 5.3 (beginning on page 50) of their self-study the areas of: Faculty and Research Supports, Program Growth, and Curriculum Development. The one significant difference is our recommendation that the hiring of statisticians and the development of a robust program in statistics and data science be a deemed a high priority (as stated in items 1 and 2 above).

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9. The Department may consider investing in a departmental membership in the Mathematical Association of America; this provides one faculty membership but importantly, an unlimited number of student memberships. These memberships could be offered to mathematics majors of distinction in order to attract them to the discipline.

VII. Concluding Remarks

We enjoyed learning about Lehman College, and were impressed with its mathematical sciences programs. As we already have observed, we believe the department is doing many things very well, given the current level of support for their program. With continued support in the area of faculty lines, the department can continue doing an excellent job for Lehman students. With additional support – especially in the area of statistics – the department could be doing much more.

We were likewise impressed by the collegiality within the department, and the enthusiasm and spirit of cooperation among faculty and staff in offering Lehman students an excellent education in mathematics at whatever levels they seek. We are especially grateful to the Chair, Joseph Fera, for his cordiality, and for all of his and his staff's efforts to make for a very pleasant visit. In addition, we thank all of those who contributed to the thoughtful and extensive self-study that the department produced.