1. Program Overview and Vision

Excellent.

The Department of Mathematics and Statistics has 46 tenure track positions, about 92 graduate students who are supported as teaching assistants and 10 instructors whose primary responsibility is undergraduate instruction. The department has a steady record of production of about 5 Ph.D. degrees, 19 Master’s degrees and 39 Bachelor’s degrees per year.

The Vision Statement for the department accurately expresses the activities of a solid department with solid aspirations. The strategic goals of the department—to increase and diversify the student body, enrich educational experiences, advance research and creative and professional endeavors, outreach, creating a productive work environment, promoting a stronger image for mathematics, and fiscal stability—provide an accurate and complete list of what a mathematics and statistics department should be doing. The department’s website gives an abundance of information indicating how these goals are being met.

2. Faculty Productivity

Excellent.

Almost all faculty are actively engaged in publication (of all types—journal articles, books, book chapters, etc.) and participation in professional meetings. The department has a strong success rate in attracting extramural funding. Most faculty members have national or international reputations as a consequence of the strength of their research.

Teaching productivity is high. Faculty members teach six hours per week and are expected to invest many more hours per week advising student research and holding office hours. This teaching load is comparable to peer institutions although a little on the heavy side.

Department members are active in service, for the department, the university and the profession. Several have invested efforts in organizing the Red Raider mini symposium which is important for its scientific content and the attention it brings to the department. Also to be noted is community outreach work involving summer workshops, the Emmy Noether High School Mathematics Day, and work by faculty members in local schools. Less visible, but important, is the work faculty members do serving on committees in the department and university, advising students, and refereeing papers and grant proposals.

3. Quality and Quantity of Graduates Students and Graduates

Good.

The department has difficulty attracting a significant number of strong beginning graduate students. International students beginning the program were found to be reasonably prepared, whereas domestic students were not. The typical domestic applicant has attended a small four-year college, most often in Texas or an adjoining state, and has been exposed to less than the minimal background necessary for graduate study in mathematics. The department is acutely aware of this and makes efforts at “leveling” — providing the necessary background. In many cases students take a year or more to achieve a level which is suitable to begin graduate school. Such difficulties are certainly not confined to Texas Tech and are experienced in all other comparable graduate programs.

A domestic student with a degree from a small four-year college can not compete with international students who in many cases already have a Master’s degree and the department is correct in noting this difference. There is a critical shortage of domestic students in the STEM disciplines (Science, Technology,
Engineering and Mathematics) and the department is to be commended for its efforts to make graduate school possible for these students.

Several faculty members expressed concern that some graduate students lacked the necessary motivation to earn an advanced degree in mathematics or that the graduate student culture of the department was not as serious as it ought to be. Again, this difficulty arises in many other mathematics graduate programs, and probably occurs for many reasons. Students with weak backgrounds have no knowledge of advanced mathematics or mathematics research and sometimes find they simply don’t like it. Heavy teaching workloads can take too much time away from studying and learning mathematics.

More social interaction, initiated by the department, might help to address these issues. Perhaps high performing graduate students could be recognized with awards. Faculty need to constantly impart their passion for the field, both in the classroom and informally. The department should always emphasize that graduate students are chosen, and retained, for their academic performance, and that a teaching assistantship is scholarship, not just a job.

In order to attract good students, the department must have a faculty that is internationally recognized and at the forefront of the research community. (Which the department has already.) But it is not sufficient to assume that if you build it, they will come. The department needs to aggressively recruit students. Most of this responsibility usually falls to the graduate director who must be given some release time and a recruiting budget to pursue this. However, all faculty members should realize that it’s also their responsibility.

4. Curriculum and Programs of Study

Good.

The department offers several degree programs:

The 150 hour combined Bachelor’s and Master’s in Mathematics or Statistics. This allows students to attain a Master’s with one additional year of study past the Bachelor’s. This course of study culminates with the student writing either a Master’s thesis or report.

This program attracts good students, who after obtaining a Master’s, are often inclined to stay in the department to continue a Ph.D. Consequently, this is a very good strategy for getting well- prepared domestic students.

The Master of Arts in Mathematics. This is a 36 hour program directed at students who wish to teach mathematics in high schools or at community colleges.

The education of such students is an important and necessary function of a public institution.

Master of Science in Mathematics. This has either 30 or 36 hour options. The 30 hour option calls for 24 hours of coursework and at least 6 hours of dissertation work. The 36 hour option calls for 33 hours of coursework and 3 hours of work on a departmental report. There is a variant of the 36 hour option which has an emphasis on computer science. All of these options have requirements that students take certain courses in “core areas”.

These programs of study are typical. There seems to be more formal course requirements than at other universities; if changes are wanted to be made, these could be eased up a bit. Some faculty members raised the issue that while there is a distinction between a thesis and report, this wasn’t so clear in practice.

The Master’s in Statistics. This is the only degree in statistics that the department offers. The requirements are similar to the Master’s in mathematics in that certain courses (or various options) are expected and that a student writes either a report or a thesis.
Again, this is very typical, although the list of course requirements is a little long.

The Ph.D. in Mathematics. This requires 60 hours, exclusive of dissertation credits. Students work in an area of specialization which is either Applied Mathematics, Pure Mathematics, or Statistics. The first important step is to pass preliminary examinations. Students must pass three from a choice of seven, but one of these must be from a group of four. Students then must pass a Qualifying Examination on advanced topics. Students are also required to take a set of courses in an area of specialization. Most importantly, the last major step is the Ph.D. dissertation.

The program is peculiar among graduate programs in the U.S. in the number of hours students take each semester. Students must enroll in 13 hours per semester in contrast to the typical 9 hours (or even 6) in most graduate mathematics programs. Most students are enrolled in 3 rigorous mathematics or statistics courses, an additional 3 hour course, and a one-credit seminar. The three rigorous courses are usually courses to prepare the student for department exams or are required courses for one of the areas of specialization. Experiences with the “additional” course and the seminar vary greatly. Some take an additional course to learn Matlab or TeX. Others receive credit for independent research, but in some cases very little research is accomplished. The one hour seminar requirement does get students involved (at the minimum as spectators) in mathematical research and is worthwhile even if students complain they aren’t able to follow the lectures. However, some graduate students indicated that their seminar attendance was very spotty and they suffered no ill consequences.

Passing the preliminary exams is the first major step, and many of the core courses are designed to cover the material covered in the exams. Surprisingly, however, not all of those courses are run each year. Students could progress through the program quicker if these were offered every year.

Also peculiar is the requirement that a student complete a certain number of courses in his or her area of specialization. Much of this coursework seems to happen after the student has already completed the preliminary exam. This would seem to be the necessary foundation for research in the area of specialization, but curiously, a student’s area of specialization does not need to be in the same area in which he or she writes the Ph.D. dissertation.

The requirement of a specialization area seems to be unnecessarily constraining. After passing the preliminary exam, a student should continue to take courses for the duration of graduate study, but those courses should be those most relevant to the student’s research. In many cases, the courses required in the specialization areas fulfill that goal, but not always—the required list leaves little room for a student to take topics classes or other courses lying outside the area requirements, but which are nevertheless useful for his or her research. Many faculty noted the flexibility of the requirements, but then it seems pointless to even have them at all.

Some students enter the program intent on a Ph.D. but are expected to obtain a Master’s along the way, which then requires that they write a Master’s report or thesis. This may be worthwhile for some students on the way to a Ph.D., but for others it may just be an unnecessary detour. The department should allow students to obtain a Master’s by passing an examination such as the preliminary examination. Conflicting information was given as to whether this is possible now: officially it seems to be not possible, but apparently it has happened recently. This should be made clear in the handbook. Students, together with their advisors, should determine if it is worthwhile to write a Master’s thesis en route to the Ph.D.

5. Facilities and Resources

Satisfactory to Poor.

Faculty have their own offices, some of which are a little cramped, but reasonable. However, there is a desperate shortage of space for the graduate students. Some offices, which should at most be used for one or two students, are used by as many as three or four students.

It is essential that graduate students have a quiet place to study, and in most graduate departments, students can make use of their office for this purpose. This is nearly impossible in an office of four graduate students, each of whom is required to have six office hours per week.
The building has a library area (the “stacks”) which is now only partially used for storage. This area could be renovated and used for graduate student office space.

Computing resources were good. The department is provided with reasonably current technology. The two IT staff in the department were praised for their talents at making the most out of the resources that they had.

Faculty who commented on library resources found these to be adequate although no one enthusiastically praised the library.

6. Recommendations

• The graduate students need much more space. Students need a quiet place to work.

• The department needs to develop a postdoctoral program. All major departments of mathematics, including most, if not all, Tier I schools have an active and vigorous postdoctoral program. Postdoctoral programs provide a constant influx of young researchers with new ideas and energy, who can themselves benefit from the further training they would receive from senior faculty. This would build connections between the mathematics and statistics department of Texas Tech, the Ph.D. institution of the postdoc, and the subsequent institution of the postdoc. Postdoctoral associates provide role models for graduate students and can often provide expertise on topics or in areas not currently represented in the faculty.

The point that a postdoctoral program is needed was made in the department’s self study, but no plan has been proposed to accomplish this. The department should work toward this goal. Certain constraints make this difficult, such as the teaching requirement that does not allow for reduced teaching loads which are necessary for a successful postdoctoral program. The department needs to enter into discussions with the university administration regarding this need and should try to find ways to work within the existing framework. For example, could postdocs be allowed to teach a little less if they directed undergraduate research projects? Perhaps the department could run a postdoctoral program using soft money or funding from some other sources for a few years, and approach the administration for permanent funding after demonstrating its success.

• Students take too many hours per semester. Furthermore, Ph.D. students must take a total of 60 hours of coursework; other universities have the same requirement, many require less, and this reviewer knows of none which require more. Students who have not yet passed preliminary exams need to take courses which prepare them for these exams with no other distractions. Students who have passed preliminary exams need to take the necessary advanced courses to begin to focus on a specific area of mathematics. Students working on dissertations need much free unfettered time to work on their research. Too many courses, requirements, and other distractions make these goals more difficult. For those on the way to a Ph.D., it should be possible to obtain a Master’s by passing the preliminary examinations. Degree requirements should be simplified—not made easier, just simplified.

• Teaching assistants have an excessive workload. The typical workload is two three hour classes as instructor of record, with an additional six office hours. These are usually service courses with class sizes ranging up to 30 to 40 students. Other teaching assistants, especially those who have not yet completed the Texas mandated 18 hours of graduate coursework, assist the instructors with grading and review sessions. However, graders are expected to work at least 20 hours per week, which is also excessive. Typical teaching loads at other universities are about 4 hours per week, and this usually involves recitation or review sections. At many universities, the teaching load is even less than that for beginning teaching assistants.

The distribution of teaching courses to teaching assistants should change frequently. In particular, by the time of graduation, a Ph.D. student should have taught all possible courses that a teaching assistant is allowed to teach. This solidifies the student’s knowledge of undergraduate mathematics and increases the student’s marketability for academic positions.

• There is no formal Statistics Ph.D. program, but a student can get a Ph.D. in Mathematics with an emphasis in statistics, meaning that a student can write a Ph.D. dissertation in Statistics. Ultimately, a student’s future success depends on the content of the student’s dissertation and courses taken, and not on whether his or her degree is listed as Mathematics or Statistics. Nevertheless, the department might want
to consider creating a Ph.D. in Statistics program, so that the degrees of these students are recorded as a Ph.D. in Statistics. An extreme measure would be to create a separate Statistics department; the resulting department would be very small and might fare worse on its own. At the minimum, all these issues need to be discussed.

• Likewise, there is no formal Mathematics Education program, and some members of the department may not be enthusiastic to have one. In most mathematics departments there are faculty members who do not believe that a Ph.D. in mathematics should be awarded to someone who writes a dissertation in Mathematics Education, so the department at Texas Tech is not unique in this regard. Possibly the department could create an area of emphasis in Mathematics Education so that students could write dissertations in Mathematics Education after passing preliminary examinations in Mathematics. Or possibly the department could create a Ph.D. in Mathematics Education. Some graduate students currently in the department have an interest in Mathematics Education and would like to write dissertations in that area, so this is an issue which needs to be confronted soon and won’t (and shouldn’t in a department which derives 60% of its extramural funding from grants in Mathematics Education) go away quietly.

7. Mathematics and Statistics

Although intimately related, Mathematics and Statistics are different disciplines with different professional cultures, and a department housing both could expect to occasionally have conflicts. The department currently has seven faculty listed in the statistics group, but one of these will be leaving and another has recently assumed an administrative position.

At the graduate level, the relation of the Statistics program to the Mathematics and Statistics Department is confusing. Statistics has its own graduate advisor who advises Statistics graduate students who then must receive final formal approval from the department’s graduate director. Both the graduate director of the department and the Statistics graduate advisor seemed fairly comfortable with this arrangement, although it seemed that some students were confused by it.

There is a very uneasy relation between the statistics group and a mathematician who directs dissertations which are often in the area of statistics. Some statisticians expressed concern regarding the quality of these dissertations. Rules are in place which require that members of the statistics group be represented on a student’s committee for the Master’s in statistics degree, and in fact, this mathematician has adjunct status in the statistics group. This mathematician has directed over 100 dissertations and is currently directing 15 dissertations, mostly for the Master’s degree, but some for the Ph.D. degree.

This is a difficult situation. At most universities, including apparently Texas Tech, the quality of a student’s dissertation is judged by the student’s committee. In this situation in the Mathematics and Statistics department, it appears that all rules are being followed correctly, so it seems that those who doubt the quality of these dissertations have little recourse. It would be possible for a department to limit the number of students an individual faculty member can simultaneously advise, but much beyond that is an infringement to academic freedom.

Dissertation defenses are expected to be public, but several faculty members complained that these are often announced at the last minute and not widely advertised. These should be announced well in advance—at least two weeks before. The department might want to consider placing dissertations in a public place, such as the library or department commons room, several days or a week before the public defense. This additional scrutiny may prevent students from graduating with substandard dissertations (or the impression that students are graduating with substandard dissertations). However, this might have the undesirable consequence of placing students in the middle of conflicts between faculty members.

8. Worthy of note

At a meeting with the graduate students, one student, a Muslim women, remarked that she felt included in the department and had never felt any discrimination or prejudice within the department, in contrast to the experiences of some of her friends in other departments. All other students at the meeting— a very diverse group in terms of national origin, religion, race, and gender— vigorously agreed with her statement.