Section 1: Introduction and Overview

The external reviewers – Karen Graham (U. New Hampshire), Bernard Madison (U. Arkansas) and Simon Tavener (Colorado State U.) – conducted a site visit on Sunday and Monday, February 17-18, 2013. Prior to the site visit, the reviewers were provided with a self-study of the Mathematics Department and considerable data on productivity. Some of this information was updated and supplemented with written information during the visit. What follows is a report of the three external reviewers.

Six internal review committee members joined the external members for the visit. These were: William Bogley (Academic Programs, Assessment, and Accreditation), Gary Beach (Curriculum Coordinator, Office of Academic Affairs), Alix Gitelman (Statistics), Janet Lee (Women Studies), Brenda McComb (Graduate School Dean), and Prasad Tadepalli (Computer Science).

Principal meetings during the on-campus visit were:
Sunday, February 17 - Working dinner of the entire review team, both internal (OSU) members and external members
Monday, February 18
- Tom Dick, Chair of Mathematics Department and David Finch, Graduate Chair
- Mina Ossiander, Associate Chair & Undergraduate Chair and Mary Flahive, Head Faculty Advisor
- Christine Escher, Assistant Chair, Keith Schloeman, Lower Division Mathematics Advisor and Deanne Wilcox, Office Manager
- Vince Remcho, Interim Dean of the College of Science
- Undergraduate students (30-40) and Graduate students (3)
- Mathematics instructors
- Mathematics faculty
- Tour of the facilities in Kidder Hall, including the Mathematics Learning Center (MLC).

We provide overall recommendations in Section 2. In sections 3 and 4 we present our detailed findings and recommendations respectively (not ordered by priority). Section 5 lists final impressions.

The external reviewers were positively impressed with many circumstances of the entire mathematics program – undergraduate and graduate. The Tenure Track Faculty (TTF) appears fully engaged in producing research and upper level instruction for a cadre of graduate students who have mixed academic backgrounds and differing goals for graduate education. Most, if not all, of the TTF members are productive researchers and many are, in accordance with the strategic goals of OSU, engaging in interdisciplinary research and teaching. The Fixed-Term Faculty (FTF) is large and carries a heavy load of teaching of a rapidly increasing undergraduate student population. The leadership of the department is solid, apparently well respected, appropriately distributed, and committed to quality programs of service, teaching, and research.

The suggested categories for overall recommendations of expand, maintain, restructure, etc. do not seem applicable to most of the components of the mathematics program. First, the service teaching is fundamental and essential to OSU. The undergraduate major in mathematics is a staple of universities such as OSU and is similar in content and productivity to many programs at research universities across the US. The graduate programs – seemingly relatively healthy and productive – are an essential
ingredient of mathematics programs of research and teaching. Graduate programs also help to attract new and active faculty at all levels. Although all of these programs – as is the case almost universally – can be improved, no major restructuring is needed, nor should there be any consideration to reductions or suspensions. The mathematics programs at OSU are quite healthy, but they can be better. The recommendations offered are for improvements, for moving OSU’s mathematics programs out of the middle of those at similar universities across the US and into positions of clear excellence and distinction. Overt expansion may not be necessary, but the resources and freedom to grow are essential.

Section 2: Overall recommendation

Construct a multi-year hiring plan and grow the tenure track faculty.

Growing the instructional capability of any unit by growing the number of fixed term faculty (FTF) has advantages and disadvantages. Typically (and the case at OSU) the university gains low cost SCH from well trained, dedicated instructors and maintains considerable year-to-year budgetary flexibility. While the university achieves its short term goals, the long term effects are harmful. Since there is no long-term career path for instructors the turnover must necessarily be large with instructors without personal connections to the Corvallis area leaving or becoming disaffected. More importantly, this structure encourages a dangerous disconnection between the faculty and the major source of revenue for the department. Tenure track faculty need to be engaged in and feel ownership for instruction at all levels. Secondly, holding TT mathematics faculty numbers constant as the university grows limits the scientific interactions mathematicians can engage in outside their own department. Joint grants such as “SOLAR: Enhanced photovoltaic efficiency through heterojunction assisted impact ionization,” “Residence and first passage time functionals in heterogeneous ecological dispersion,” and the NSF-IGERT program “Ecosystem informatics,” suggest that the department is already engaged with many activities aligned with stated university goals. Without increase in TTF, those predisposed towards such interactions will simply become overwhelmed.

Because there are ample reasons why the OSU mathematics TTF should be expanded, the following recommendation is seen as critical in moving OSU to a position of national distinction in admittedly limited areas of mathematics research.

In consultation with the College of Science Dean, the Dean of the Graduate School, and the Provost, develop a documented and agreed-on strategic faculty-hiring plan with the following goals.

- Utilize and build on existing faculty research strength in mathematics and other science and engineering departments.

- Seek to build more research connections between the mathematics faculty and other OSU departmental faculties. These connections will broaden both the intellectual bases of OSU faculties (which are smaller than those in many of the faculties of universities that compete with OSU) and the employment market for graduates.

- Build a nationally prominent research and graduate education group that produces PhD graduates with strong employment opportunities.

- Advertise the research and graduate education group’s strengths nationally to attract exceptional new faculty applicants and graduate students with exceptional potential.
• Raise the level of expectations and optimism about OSU’s programs of graduate study and research.

Section 3: Findings

Undergraduate Program

The Mathematics Learning Center (MLC) seems to be well connected to the Fixed Term Faculty (FTF) and the Tenure Track Faculty (TTF). This appears to be a result of the various faculty administrators in the department as well as the MLC faculty advisory group. This situation is very healthy and should be nurtured.

Undergraduate majors do not have a consistent advisor across the four years. This situation could create a lack of personal relationship between students and mathematics department faculty. Upper level students feel this makes it difficult to obtain letters of recommendations for jobs or graduate school and faculty could find them difficult to write. In addition, students may not know where to get advice on jobs or graduate schools.

The Mathematics Department has primarily relied on data collected through surveys to evaluate its undergraduate programs.

There were signs that the undergraduate major program should be analyzed to see if it needs changes. Having only one significant course change in the past decade might signal neglect. However, the fact that the mathematics major has grown over the last five years at a rate greater than that of the university as a whole suggests the program is well perceived and meeting the needs of the students.

Mathematics Education

One of the strengths of the OSU faculty is in mathematics education. The recent addition of four promising young faculty (two in Mathematics and two in the College of Education) to the 3-4 established faculty gives OSU exceptional potential to become nationally prominent in mathematics education teaching and research. However, being split between two colleges (Science and Education) can hinder this development, so careful nurturing is needed. Currently, the academic employment market for mathematics education PhDs with strong mathematics backgrounds is good, and OSU has the potential to be a major contributor.

Graduate Program

The graduate program serves in two distinct ways: to educate students beyond the baccalaureate degree level in mathematics and to provide graduate teaching assistants to help with the undergraduate teaching. Partly because of this dual role, the graduate students have different backgrounds and different commitments to graduate study. This is a common situation at universities across the US that are similar to OSU. Some of the graduate students are aiming directly at a Ph.D. and are eager to be challenged; however, some are likely to end their studies with a master’s degree. Serving both populations with one set of courses and one set of examinations is challenging, and some of the strains caused by this surfaced during the site visit. Some recommendations are offered below to address some of this.

There seemed to be little interaction between Statistics and Mathematics. With a probability and stochastic processes group in Mathematics, it would seem that the interaction would be more evident.
There seemed to be little interaction between Mathematics and Education. With new faculty being hired in mathematics education in both departments there is potential for a renewed culture of collaboration that could lead to joint degrees, research, and externally-funded initiatives.

**General Issues**

Budget – There is a heavy dependence on non-recurring funds for the mathematics programs. In particular the department’s revenue comes from multiple sources of one-time funds, e.g. access funds ($681K), distance courses ($400K) and INTO funding ($250K). These funds are used to fund the GTA program and must be considered rather precarious in view of still uncertain outcomes of distance courses and INTO program. Even though annual decisions seem to be made in a timely fashion, this dependence does increase the workload and worry load of the Chair.

Space – The space allocated to the Department is crowded, some uninviting, and currently dispersed. Exiling several FTF members to a re-purposed dormitory across campus has the potential to interfere with collegiality and, more importantly, to student-faculty interaction. GTAs lack facilities in which GTAs can hold office hours without disturbing their office mates. The Mathematics Department has only a single classroom it can schedule independently.

Collegiality – With two rather different large faculty components – TTF and FTF – continued attention to building rapport and mutual respect between these two groups is necessary.

**Section 4: Recommendations**

**Undergraduate mathematics major program**

1. Provide individual advisers for mathematics majors after their first year. Assign a single adviser for years 3–4 if a professional adviser has the capacity to handle the number of students for the first two years. Consider increasing the number of professional advisors by one FTE (two 50% instructor/advisers or one 100% adviser and one 100% instructor).

2. Offer courses Math 311/312 on a winter/spring schedule as well as the current fall/winter schedule.

3. The department’s WIC courses should be examined to make sure there is consistency and a set of agreed upon expectations. For example, learning \LaTeX{} is a valuable skill, but is this what is intended from these courses?

4. The department should consider adopting means to perform quantitative evaluations of undergraduate program, e.g. the major field test. Also, a capstone course offers various opportunities for assessing and consolidating the undergraduate major experience.

5. Examine the transition from 200- to 300- level courses (the bait and switch in mathematics programs that exists nationwide). The problem may be further complicated at OSU by the use of mymathlab.com for homework in all courses below the 300 level. Have numbers of mathematics majors grown to a size in which it is possible to run 200 level classes for mathematics majors? Failing that, is it possible to develop an introduction to proofs course for sophomores and transfer students? (These type of experiences can also be included in the first year seminar although this seminar reaches <1/2 the mathematics majors.)
6. Computer languages such as Matlab, (Octave, Scilab)), Maple, Mathematica, R, are valuable tools for mathematics majors. Consider developing or requiring an introductory course that can be developed as a calculus reinforcement course, eg. secants and tangents, Newton’s method, rectangle, trapezoidal and Simpson’s approximations, L’Hospital’s rule.

7. The Department might reconsider the sequence of upper division courses to ensure students have the material required for the GMAT and GRE exams at the appropriate time and consider addressing this in a capstone experience.

8. There is a relatively low enrollment in the department’s Honors option (as determined by relatively low number of Honors theses). Is this due to additional cost to the students? This seems a disincentive to the university as a whole. The long-term presence of an NSF REU site “Computation and modeling in pure and applied mathematics” indicates the Mathematics Department’s interest in undergraduate research.

9. Work with Science and Mathematics Education faculty in both mathematics and education to review current program and facilitate connections and early field experiences for students with area schools.

Undergraduate Service Courses

10. There are several models across the US of courses in quantitative reasoning (QR), and some of these might be more effective for many OSU students than the current 105 course. The major difference between most QR courses and the 105 course is that QR courses focus on applying quantitative reasoning (as well as writing and reflection) to everyday contemporary problems in the students’ world.

11. The lack of common exams and common grading schemes across multiple sections of lower division courses can cause problems of consistency. This seems to be a minor issue at present, but it is a potential source of conflict and is generally considered to be good practice. [“My roommate did half the work I did in math1xx and got an A but I got a B.”]

12. The Department should keep checking the effectiveness of the mathematics course placement program. As student populations shift – and they likely have with the recent large increases – then new placement issues may arise.

13. The income earned through distance courses (currently $400K/year) is an essential component of the Mathematics Department budget. Unfortunately little seems known about the effectiveness of these courses (though anecdotal information is not encouraging) and inappropriate given the university-wide investment in the e-campus.
   - Carefully monitor student performance in distance courses.
   - Understand the composition of students enrolled in distance courses and in particular the fraction of students taking distance classes who are also enrolled in regular face-to-face classes at OSU.

Fixed term faculty

1. Perform one-on-one annual reviews following submission of annual activity reports.

2. Provide opportunities for professional travel.
3. Consider involving the instructors more on departmental committees especially in the area of curriculum planning and assessment. Hold several department-wide meetings that include tenure track and fixed term faculty.

4. Develop career paths for instructors.

5. Co-locate tenure track faculty and fixed term faculty. The worrying disconnection between regular faculty and fixed term instructors is exacerbated by the physical separation between these two groups. It is of vital importance to house these two groups in a single location or failing that, in a single region, e.g. neighboring buildings on campus.

**Graduate program**

1. Reconsider the nature of the graduate program, which is currently trying to achieve multiple objectives with limited resources. How can the department best serve both its terminal MS and its PhD students? Is this possible with a single set of courses? In particular courses numbered 4xx/5xx suffer from trying to achieve multiple objectives of the program.

2. Consider developing a joint PhD degree that would involve faculty and course work in both Mathematics and the College of Education. A combined or cooperative graduate program between Mathematics and Education could have several good effects: graduate students in mathematics education could be supported by mathematics GTAs; GTAs could be helped by the expertise of faculty members with special knowledge about undergraduate mathematics education; and the intellectual basis of the undergraduate mathematics instructional program would be expanded. Capitalize on the recent establishment of a Center for STEM Education and how this could be used to move the research agenda forward.

3. Rethink the qualifying exam structure, especially in view of how it interacts with students who are surely Ph.D. intending and those who are likely to end their study with a master’s degree. As one can note from the comments in the self-study, a few graduate students see the qualifying exam system as too unforgiving and uneven in level of expectations between subject areas. The requirement to pass all exams or be delayed 12 months later seems unnecessarily discouraging. This is compounded by a reported pass rate less than 50%, which seems low.

4. Review source of incoming graduate students and consider how to enhance recruiting initiatives particularly among underrepresented groups.

5. Cultivate the employment market for all mathematics graduates – BS, MS, and Ph.D. Expansion, articulation, advertisement, and documentation are all goals and can be used to attract new students.

6. The training and orientation of graduate teaching assistants needs to be evident to all new assistants. The two-day initial sessions should be followed on throughout the year with continued mentoring and support. Instructors could play a critical role here.

**Section 5: Summary and Conclusions**

Determining the nature and culture of a program as large and complex as the mathematics program at Oregon State University from written materials and a brief visit is likely to be incomplete. Nevertheless,
we offer our impressions in the interest of improvements. We have focused on things we believe can be better rather than things that seem to be as good as they are likely to be over the short term. We did not see our role as one of trumpeting the good; rather one of looking for cracks that can be rather easily filled. Among the three of us we have participated in numerous similar visits to institutions of various kinds over the years. Some of the programs visited had serious cracks, more often than not known to those at the institutions. We saw no serious cracks at OSU; rather we saw a department pretty much in tune with its parent institution and making remarkably efficient use of resources, some more limited than others.