Expectations regarding tenure and promotion to Associate Professor, in the Department of Mathematics and Statistics, Faculty of Arts/Faculty of Pure and Applied Science

Departmental expectations in scholarship

The pattern of dissemination of research, as well as the milestones of scholarly achievement are somewhat different in mathematics and statistics from those in many other disciplines. Monographs and published books are not as highly regarded as indicators of achievement as they are in the humanities and social sciences. Most mathematicians prefer to publish their research, as it is done, in articles in scholarly journals rather than to wait to publish a large body of work as a monograph. Even in the publication of articles, conventions in mathematics do not agree with those of other fields. Order of authorship, for example, is usually alphabetical and so has no bearing on the relative contributions of each author, unlike the conventions that have evolved in many of the physical and biological sciences.

It is expected that candidates will carry out high quality research, will publish it in highly reputable peer-reviewed journals, and will disseminate it further through presentations at internationally recognized conferences. Un refereed conference proceedings are not given the same weight as refereed journal publication. In evaluating published work, referees always ask if a submission is correct and well written. But the key question is always whether the work is interesting. What is valued is the introduction of new ideas — ideas that change how we think about a subject or a class of mathematical objects, or which allow problems to be solved that were previously thought to be intractable. Novelty that is merely formal or purely technical is not valued so highly. Rather it is criteria like originality, depth, and impact that are primary. This is hard to judge for people outside the specialized areas of investigation, so great weight is placed in the tenure and promotion process on the evaluations by external referees, who should be recognized experts in the field, and as far as possible, at arm’s length from the candidate.

Among the expectations of the department is that its members compete for external funding. One indication, though by no means perfect, of a mathematician’s or statistician’s professional standing has been provided by the size of their NSERC operating grant. Since the NSERC grant selection committee consists of experienced researchers from across the country, who rely on the
opinions of selected referees as well as their own experience, their opinions have usually been considered reliable. A tenure and promotion file will normally compare the candidate's grant with other grants from the same committee. In Pure Mathematics that is normally GSC 336 (Pure and Applied Mathematics A). In Applied Mathematics this is normally GSC 337 (Pure and Applied Mathematics B). In Statistics it is normally GSC 14 (Statistical Sciences). Note that comparisons between different committees are inappropriate, because of differences in research costs between disciplines. It should be noted that, while NSERC funding is the norm in this department, other sources of research funding may be appropriate benchmarks in the cases of certain researchers. It is also the case that first grants from NSERC to junior researchers tend to be more at a generic level, so are less informative indicators of research quality. With NSERC moving to a model of five year grants, this may mean that a high percentage of tenure candidates will still be on their first grant at the time of the tenure decision, making the grant level both out of date and relatively uninformative in these cases. A further confounding factor is that grant levels do reflect, to some extent, the researcher's support of highly qualified personnel. Since tenure candidates are less likely to have a record of supervising PhD students, this also biases their grants downward.

More and more, the norm in mathematical and statistical research is collaborative. In earlier eras most articles had single authors, but that is no longer the case. Credit for work is not diluted by joint authorship, and indeed, collaboration is encouraged. Nevertheless, tenure and promotion committees will look for evidence that the candidate has an independent and ongoing research program. There is an expectation that candidates will not just engage in research, but will be active in initiating and directing the course of the research.

Further indicators of active scholarship are supervision of graduate students, supervision of Masters or undergraduate research projects, editorial activities, seminar participation, and a variety of other activities. Some of these, notably graduate supervision, are dealt with at greater length in the teaching section.
Scholarship expectations specific to Pure Mathematics

The greatest honour the mathematical community can bestow upon one of its members is awarding of the Fields Medal. However, no mathematician working at a Canadian university has ever been awarded this prize, so it goes without saying that this is not part of the department's normal expectations. What is expected is a strong record of publication in top rate journals and presentation of research at internationally recognized meetings. In the hierarchy of mathematics journals, it can be argued that a small number of general journals occupy the top spots. However, many first rate mathematicians choose instead to target a specific audience by submitting their work to more journals specializing in particular areas of mathematics. Either pattern is acceptable, the emphasis being on the quality of the work itself.

Pure Mathematicians prove theorems, which are judged by the depth, impact and originality of the ideas introduced, and to a secondary degree by the elegance and difficulty of the arguments involved. The motivation for work in pure mathematics is often to understand some class of mathematical objects or techniques in a deep and profound way. Often this is accomplished by solving difficult and novel problems, that force one to develop such deep conceptual understanding.

It is typical for an article in mathematics to be between 10 and 30 pages in length. Many of the deepest results appear in articles of even greater length. A good publication record for a pure mathematician may be publishing a couple of high quality articles per year. But in fact, production varies widely across the discipline, depending on the individual and the area of specialization. Many fine researchers are very prolific, producing handfuls of articles each year, while others have had great influence with a relatively small body of work. Some individuals publish incrementally, so there might be a sequence of articles reflecting the evolution of an idea. Others prefer to delay publication till insights have matured. Both are respectable approaches, and the difference highlights the inadequacy of simple article-counting. Creativity and the depth of ideas remain the prime consideration in assessing research contributions.

Scholarship expectations specific to Applied Mathematics

Research in applied mathematics may have much in common with research in pure mathematics. In other words, applied mathematicians may prove deep theorems and strive for theoretical insights. They may work towards profound understanding of important concepts and ideas. But applied
mathematicians may equally well be driven by questions of the importance of the application itself, either to industry, or to other fields of scholarly research. In other words, while applied mathematicians may prove theorems, they may also do important and valuable work that is theorem free. For example, the resolution of sophisticated modelling problems, or carrying out intensive numerical computations. Ideally the complete body of work of a candidate will contain a mix of theoretical and applied insights.

The spectrum of journals favoured by applied mathematicians is likely to be even broader than those in pure mathematics. In particular, it will not be unusual for applied mathematicians to publish some fraction of their work in journals from outside mathematics.

By its very nature, applied research may be even more collaborative and team oriented than in pure mathematics. There may often be collaborations with researchers outside mathematics. There may be work carried out with input from the industrial sector. However, the standard by which research will be evaluated is the presence of substantial and interesting work in peer reviewed scientific journals. Consulting work carried out for industry may be viewed positively, but it does not replace the need for public and peer reviewed publication.

Scholarship expectations specific to Statistics

There are three broad types of research in statistics: theory, methodology and applications. Theory can be further subdivided according to its mathematical depth. The strongest statisticians tend to publish research in all categories but, in academic settings, a higher value is attached to theory and methodology than to applications. It goes without saying that faculty members are expected to disseminate their results by publishing them in recognized journals and giving presentations in conferences or other settings.

The desirability of a journal depends on the type of research. The leading journal in mathematical statistics is the Annals of Statistics. Three journals would be considered top-tier in theory and methodology: the *Journal of the American Statistical Association*, *Biometrika*, and the *Journal of the Royal Statistical Society (Series B)*. Despite its name, *Biometrika*, is unqualifiedly a statistical journal founded 100 years ago by Karl Pearson and edited during the last century by many of the most eminent statisticians of their time. Some journals published by national
societies would be considered second-tier but nevertheless very prestigious. The leading national journals are the *Scandinavian Journal of Statistics* and the *Canadian Journal of Statistics*. These journals publish both mathematical theory and methodology. Statistics research of very high quality is also published in journals aimed at specialized audiences in sub-fields of statistics such as multivariate methods or reliability, and in areas of application such as econometrics, epidemiology, biometrics, medical statistics or psychometrics. The journal *Biometrics*, for example, is widely read by statisticians because most of its results are of broad interest and importance. Other journals, such as *Communication in Statistics*, are considered less prestigious but are often selected by authors when they hope to publish results rapidly.

### Expectations in Teaching

1. Courses are expected to have substantial academic content, striking a balance between challenging the students to excel and setting goals that are reasonable and appropriate for the level of the students in the course.

2. Most courses in the department are delivered in lecture format. In such courses it is particularly important that the presentation be clear and well organized, that concepts be well motivated, that examples be relevant to course material, that the instructor speak loudly and clearly, and that good blackboard (transparency, powerpoint) technique be used. The pace should be set so that students can reasonably absorb material in class. Material should be presented in a way that engages and stimulates the students.

3. Evaluation (e.g. tests, quizzes, assignments) should be set at an appropriate level. Students should have sufficient evaluation to help them learn the material, and to allow them to fairly judge their progress in the course. Students should receive sufficient feedback about their work (e.g. through the availability of either graded assignments or solutions) to allow them to evaluate how well they are mastering the course material. Assignments and tests should be challenging. At the same time, most students should have a reasonable expectation of decent performance on tests, given sufficient preparation. Tests should be of a length that students are not under unreasonable time pressure. Test questions should have a range of difficulty, to
allow all students to demonstrate their level of understanding.

4. Instructors should endeavour to create an atmosphere in the classroom that fosters learning. Active participation should be fostered, with students encouraged to raise issues of concern, and to both ask and respond to questions.

5. Within reason, instructors must be accessible to student questions and inquiries, via questions in class, office hours, and by e-mail. Students should feel welcome to approach the instructor in these ways.

6. Instructors should be sensitive to the level and background of the students in a class. The approach appropriate for an advanced departmental honours class will differ from that appropriate for a large introductory service course, to students with modest mathematical training.

7. Instructors should be sensitive to the diversity of students within the classroom, and to the differences in learning styles between students. Students should be treated in a professional, respectful, and unintimidating manner.

8. Course directors must supervise course TAs to ensure that their work is both correct, and that they deal with students in a professional and helpful manner.

9. The course infrastructure must be well organized, with adequate information available to students about the syllabus, references, and adequate notice of assignments and tests.

10. Supervision of graduate students is a valued part of a faculty member's duties. A fresh PhD graduate could not reasonably be expected to be a principal thesis supervisor though, so it is recognized that supervisory duties would not necessarily figure into a candidate's early activities at York. After a candidate has been at York for a number of years, they would be expected to demonstrate willingness and interest in supervising PhD students, and in being engaged in the activities of the graduate program.

11. Candidates should demonstrate willingness to participate in activities outside the classroom that support teaching. These may include, but are not limited to: supervision of graduate student seminars or projects, participation in comprehensive examinations or thesis examining committees, supervision of undergraduate research projects, offering reading courses as the need arises, mentoring and advising students,
mentoring postdoctoral fellows and junior faculty in teaching activities, maintaining and improving the departmental curriculum, and engaging in pedagogical development or workshops.

12. Teaching will be evaluated by comparing a candidate’s teaching evaluation scores with departmental courses generally, and in courses similar to those taught by the candidate. If a teaching dossier is available, it will be assessed. Letters will be solicited from students commenting on teaching performance. Colleagues will attend selected lectures and will write letters commenting on teaching performance.

**Expectations in service**

In precandidacy, departmental service expectations are modest, and would consist of service on committees, and a willingness to participate actively in the life of the department. As a candidate moves towards and into candidacy, it would be expected that they demonstrate competence and willingness to carry out service obligations, including chairing committees, or carrying out more substantial tasks on behalf of the department. Service to the university or to the profession is encouraged, in addition to service to the department. But competence or high competence in service can be achieved based solely on departmental service. The kind of outstanding contribution to service that would earn a ranking of excellence in service would be unusual in an untenured candidate, who would normally be encouraged to focus on teaching and research at the beginning of their career. That kind of outstanding contribution would be more commonly seen among tenured faculty.