# Graduate Committee meeting of March 22, 2010 – Agenda
# Department of Mathematics, University of Toronto

1. Dror's report of the current status of the 2010-11 graduate course offerings.
2. Dror's report of the status of the admission process.
3. A discussion of the Supervisory Committees.
4. A proposed statement of prerequisites for new applicants.
5. A discussion of the definition of “pass” in the comps.
6. Dror's idea of an “Alumni Interview Project”.
7. What can we do to make our web page better?
8. Another meeting?

**1. Dror's report of the current status of the 2010-11 graduate course offerings.**

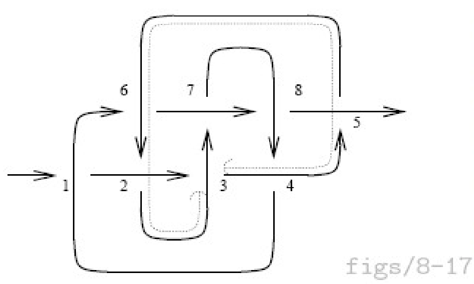
See attachment.

**2. Dror's report of the status of the admission process.**

| Type | Want | Offered | Said “yes” | Said “no” |
|---|---|---|---|---|
| Domestic Msc | 8 | 12 | 2 | 0 |
| International MSc | 1 | 1 | 0 | 0 |
| Domestic PhD | 3 | 5 | 1 | 1 |
| International PhD | 5 | 6 | 1 | 0 |
| Unfunded MSc | ? | 22 | 0 | 0 |

(all deadlines are April 15).

In addition to the above, 11-13 of our doctoral-stream masters students will be continuing to a PhD (of about 20). We also have 3 deferred PhD admissions and one deferred Msc admisson.




**3. A discussion of the Supervisory Committees.**

From our "graduate handbook" (http://www.math.toronto.edu/graduate/Handbook/2009-10GradHandbook.pdf):

> Supervisory Committee: Ph.D. student must select a supervisor by the beginning of the their second year in the PhD program. In accordance with School of Graduate Studies regulations, a supervisory committee will be established for each Ph.D. student who has chosen a research area and a supervisor. This committee consists of three faculty members including the supervisor. It is responsible for monitoring the student's progress on an annual basis. By the end of the third year of Ph.D. studies, a student is required to present preliminary results of his/her research work to the supervisory committee. Information about general graduate supervision is available in the SGS document *Graduate Supervision, Guidelines for Students, Faculty, and Administrators.* (http://www.sgs.utoronto.ca/Assets/admin+support/Supervision+Guide.pdf)

From the SGS "Graduate Supervision" document (http://www.sgs.utoronto.ca/Assets/admin+support/Supervision+Guide.pdf):

> THE SUPERVISORY COMMITTEE
>
> The academic experience is greatly enhanced if faculty members other than the direct supervisor are readily and formally available for consultation and discussion with the graduate student. To provide this element of supervision, a thesis supervisory committee or, as an alternative, an area supervisory committee should be in place for all Ph.D. students by the end of the second year of their programs. In some graduate units, supervisory committees are also established for students completing a master's degree. The graduate unit is responsible for monitoring the progress of the student through the supervisory committee, as follows:
>
> - A supervisory committee should consist of the supervisor and at least two graduate faculty members.
> - The supervisory committee must meet with the student, as a committee, at least once per year to assess the student's progress in the program and to provide advice on future work.
> - The committee submits a written report, at least once per year, detailing its observations of the student's progress and its recommendations.
> - The student must be given the opportunity to respond to the committee's report/recommendation and to append a response to the committee's report.
> - Copies of the report shall be given to the student and filed with the department.
>
> Members of the supervisory committee should be recorded on the student information system (ROSI). The School of Graduate Studies will monitor compliance with this requirement through ROSI reports and the annual audit of the official student file.

I (Dror) propose that our statement in the graduate handbook be changed as follows:

> Supervisory Committee:
>
> The purpose of the Supervisory Committee (SC) is to monitor the student's progress at least on an annual basis, keeping the following in mind.
>
> 1. No supervisor is perfect! The SC may be able to offer further mathematical and further

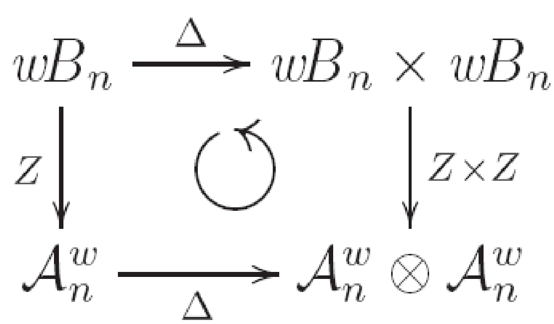
career advice beyond what the supervisor alone may offer. This is relevant both at the start of studies, when mathematical advice is most in need, and towards the end of studies, when career advice is needed.

2. No student is perfect! The SC should note if a student is falling behind and should propose ways for the student to catch up, if necessary.
3. While most student-supervisor relationships are cordial and productive, occasional misunderstandings, miscommunications and cases of false expectations do occur. The SC committee should note if a student-supervisor relationship is heading wrong and make sure that steps are taken to fix the problems.

Ph.D. students must select a supervisor by the beginning of  their second year in the PhD program. In accordance with School of Graduate Studies regulations, a supervisory committee (SC) will be established for each Ph.D. student who has chosen a research area and a supervisor. This committee consists of three faculty members including the supervisor. ~~It is responsible for monitoring the student's progress on an annual basis. By the end of the third year of Ph.D. studies, a student is required to present preliminary results of his/her research work to the supervisory committee.~~ The SC is expected to meet with the student at least annually, including on the last year of studies. Since some of the role of the SC is private and confidential, it is not appropriate to substitute these meetings with public lectures. The SC will file an annual written report with the graduate office.

Further information about general graduate supervision is available in the SGS document *Graduate Supervision, Guidelines for Students, Faculty, and Administrators.* (http://www.sgs.utoronto.ca/Assets/admin+support/Supervision+Guide.pdf)

6 Yey 2 Ney 1 abstain 1 departed



**4. A proposed statement of prerequisites for new applicants.**

At this time there is no formal statement of mathematical prerequisites for admission to our program. When applicants ask, Ida and Marie (now Donna, I presume) respond with the following email, which was never adopted formally. I've added the course syllabi in a smaller font.

Here's a list of courses (or their equivalent) that are recommended in order to be seriously considered for the doctoral stream master's program:

- 2nd year Advanced ODE's, e.g. MAT 267H

  First-order equations. Linear equations and first-order systems. Non-linear first-order systems. Existence and uniqueness theorems for the Cauchy problem. Method of power series. Elementary qualitative theory; stability, phase plane, stationary points. Examples of applications in mechanics, physics, chemistry, biology and economics.
- 3rd year Real Analysis, e.g. MAT 357H

  Function spaces; Arzela-Ascoli theorem, Weierstrass approximation theorem, Fourier series. Introduction to Banach and Hilbert spaces; contraction mapping principle, fundamental existence and uniqueness theorem for ordinary differential equations. Lebesgue integral; convergence theorems, comparison with Riemann integral, Lp spaces. Applications to probability.
- 3rd year Complex Analysis, e.g. MAT 354H

  Complex numbers, the complex plane and Riemann sphere, Mobius transformations, elementary functions and their mapping properties, conformal mapping, holomorphic functions, Cauchy's theorem and integral formula. Taylor and Laurent series, maximum modulus principle, Schwarz's lemma, residue theorem and residue calculus.
- 3rd year Algebra, e.g. MAT 347Y

  Groups, subgroups, quotient groups, Sylow theorems, Jordan-Hölder theorem, finitely generated abelian groups, solvable groups. Rings, ideals, Chinese remainder theorem; Euclidean domains and principal ideal domains: unique factorization. Noetherian rings, Hilbert basis theorem. Finitely generated modules. Field extensions, algebraic closure, straight-edge and compass constructions. Galois theory, including insolvability of the quintic.
- 3rd year Topology, e.g. MAT 327H

  Metric spaces, topological spaces and continuous mappings; separation, compactness, connectedness. Topology of function spaces. Fundamental group and covering spaces. Cell complexes, topological and smooth manifolds, Brouwer fixed-point theorem. Students in the math specialist program wishing to take additional topology courses are advised to obtain permission to take MAT1300Y. Students must meet minimum GPA requirements as set by SGS and petition with their college.

For admission to the terminal master's program they are

- Groups, Symmetries, ..., e.g. MAT 301

  Congruences and fields. Permutations and permutation groups. Linear groups. Abstract groups, homomorphisms, subgroups. Symmetry groups of regular polygons and Platonic solids, wallpaper groups. Group actions, class formula. Cosets, Lagrange's theorem. Normal subgroups, quotient groups. Classification of finitely generated abelian groups. Emphasis on examples and calculations.
- Complex Variables, e.g. MAT 334

  Theory of functions of one complex variable, analytic and meromorphic functions. Cauchy's theorem, residue calculus, conformal mappings, introduction to analytic continuation and harmonic functions.
- Real Analysis, e.g. MAT 337

  Metric spaces; compactness and connectedness. Sequences and series of functions, power series; modes of convergence. Interchange of limiting processes; differentiation of integrals. Function spaces; Weierstrass approximation; Fourier series. Contraction mappings; existence and uniqueness of solutions of ordinary differential equations. Countability; Cantor set; Hausdorff dimension.
- Number Theory, e.g. MAT 315

  Elementary topics in number theory: arithmetic functions; polynomials over the residue classes modulo m, characters on the residue classes modulo m; quadratic reciprocity law, representation of numbers as sums of squares.

Topology, e.g. MAT 327

Metric spaces, topological spaces and continuous mappings; separation, compactness, connectedness. Topology of function spaces. Fundamental group and covering spaces. Cell complexes, topological and smooth manifolds, Brouwer fixed-point theorem. Students in the math specialist program wishing to take additional topology courses are advised to obtain permission to take MAT1300Y. Students must meet minimum GPA requirements as set by SGS and petition with their college.

Linear Algebra, e.g. MAT 224

Abstract vector spaces: subspaces, dimension theory. Linear mappings: kernel, image, dimension theorem, isomorphisms, matrix of linear transformation. Changes of basis, invariant spaces, direct sums, cyclic subspaces, Cayley-Hamilton theorem. Inner product spaces, orthogonal transformations, orthogonal diagonalization, quadratic forms, positive definite matrices. Complex operators: Hermitian, unitary and normal. Spectral theorem. Isometries of R2 and R3 .

The following website has all the course descriptions:
http://www.artsandscience.utoronto.ca/ofr/calendar/crs_mat.htm

I propose that we add a minimal programming requirement, perhaps drop the number theory requirement, make some other small changes as we see fit, and make this into the law by putting it (along with the syllabi) on our web site and in the graduate handbook.

I would like to also add something about “we'd like to see some sort of overall mathematical maturity and experience, and we appreciate, though not require, evidence of in depth concentration in one mathematical discipline or another”.

The u–v–w Story

| | u-Knots → | v-Knots → | w-Knots |
|---|---|---|---|
| Topology | Ordinary (usual) knotted objects in 3D — braids, knots, links, tangles, knotted graphs, etc. | Virtual knotted objects — “algebraic” knotted objects, or “not specifically embedded” knotted objects; knots drawn on a surface, modulo stabilization. | Ribbon knotted objects in 4D; “flying rings”. Like v, but also with “overcrossings commute”. |
| Combinatorics | Chord diagrams and Jacobi diagrams, modulo $4T$, $STU$, $IHX$, etc. | Arrow diagrams and v-Jacobi diagrams, modulo $6T$ and various “directed” $STU$s and $IHX$s, etc. | Like v, but also with “tails commute”. Only “two in one out” internal vertices. |
| Low Algebra | Finite dimensional metrized Lie algebras, representations, and associated spaces. | Finite dimensional Lie bi-algebras, representations, and associated spaces. | Finite dimensional co-commutative Lie bi-algebras (i.e., $\mathfrak{g} \ltimes \mathfrak{g}^*$), representations, and associated spaces. |
| High Algebra | The Drinfel'd theory of associators. | Likely, quantum groups and the Etingof-Kazhdan theory of quantization of Lie bi-algebras. | The Kashiwara-Vergne-Alekseev-Torossian theory of convolutions on Lie groups and Lie algebras. |

**5. A discussion of the definition of "pass" in the comps.**

Ida's email to Dror, March 18, 2010:

Hi Dror,

I would like to bring to the table at this Monday's grad committee meeting (Monday, March 22nd, 11-1, BA 6180) what constitutes a pass/fail in the comprehensive exams.

Here's a brief history (Man-Duen, Ian and Henry can correct me on the details I list below). I won't mention exact dates since I would have to do quite a bit of checking as to when changes took place.

80's: Comprehensive Oral Exams consisted of a 2-3 hour individual exam with an analyst, algebraist and topologist, and in the case of an applied math PhD candidate, some specialist in an applied math field replaced one of the pure math specialists. Students were either passed or failed.

90's: Oral exams in analysis, algebra and topology became written exams, usually all written in a one-week period in September and in May. 60% was a pass. If all exams were written in the one week period, students could be passed by passing 2/3 exams. Applied math exams remained oral exams.

2000- To avoid having faculty write both comprehensive exam questions twice a year and core course exam questions, it was decided to have students pass comprehensive exam material if they took the corresponding core course and obtained a grade of at least A-. This grade was based on both term work and the final exam. Students who did not enrol in the course could write the final core course exam and obtain comp credit. The question now has always been what is the passing grade for such students, 80% (A-) or 60%.

We should keep in mind that the 60% pass grade was allowed when most students wrote all comp exams within a one-week period. The 80% grade for the course allows for term work to be included in the average. It is rare now that a student will write all all 3 comps in a one week period. With such confusion, I have recommended markers to assign only a pass/fail grade for each exam, but this should be decided on by the committee.

Thanks,

Ida

Dror's response:

Ida -

Orals was (and I imagine still is) the tradition in Princeton. Non-course written exams was (and I imagine still is) the tradition in Harvard. The Harvard "quals" often consist of challenging think-out-of-the-box olympiad-style questions, and the assumption is often that if you can say anything at all, you're good. I think the "comps" we used to have were built on a similar model. In course exams we tend to never ask what was not covered, and in general, the questions are easier. Hence it makes sense that the minimal passing grade would be 80 rather than just 60, and I think it makes sense both for students who actually took the course and for those who didn't. (Besides, how do you define "didn't take the course"? If a student sits in every lecture but didn't formally register, does (s)he count as "didn't take the course" and therefore may pass on a different mark?).

So my proposal is: The passing grade is 80, no matter what. If you've done the course work, what counts is the overall average (exam+HW+whatever). If you didn't do course work, only the final exam (now called a comp) counts.

I think we cannot change the rules on the people who are already in, so for another year we still go by the old rules, illogical as they may be. Yet we declare already now what the new rule will be, and declare that it will go into effect in September 2011.

Best,

Dror.

Decision – May or September, Core or Comp, the passing grade is A-.