Graduate-student pre-orientation

Karen Yeats

Combinatorics and Optimization

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People

As well as your supervisor, mentor and colleauges, you will want to know

- Ashwin Nayak, cograd.officer@uwaterloo.ca or ashwin.nayak@uwaterloo.ca, As of Sept 1, Associate Chair for Graduate Studies (so you won't be seeing me so much)

- Melissa Cambridge, cograd@uwaterloo.ca or m2cambridge@uwaterloo.ca, Graduate Coordinator

- Chaitanya Swamy, cswamy@uwaterloo.ca, Chair

- Alena Gusakov, agusakov@uwaterloo.ca, grad student representative to the department

If things come up talk to us.

Things to do your first term

- Take courses
- Get started on research
- Work as a TA
- Graduate Skills seminar
- Attend seminars

And right away some onboarding things

- Complete the Graduate Academic Integrity Module
- Complete the More Feet on the Ground mental health module.
- Complete CMAHRO TA Orientation: Harassment and Discrimination Module
- Attend Faculty Graduate TA training: Sept 7 from 5-8pm (mandatory!)

Register for courses

If you are enrolled you should now be able to register for courses.

How many should you take this fall? 3? or 2?

Discuss with your supervisor.

Meet with your supervisor

Once a week is a good default for how often to meet with your supervisor.

More or less frequent meetings may end up being better for your situation/work style/project/etc.

In any case keep the lines of communication open.

What courses should you take?

What courses should you take

- Discuss with your supervisor.
- Consider your background and interests.
- Consider core requirements and other requirements.
- For PhD students consider your comprehensive exams.

Plan your courses

Core courses are offered every year. Most other standard courses are offered every year or every other year. Topics courses are one-offs.

Course requirements

- MMath (thesis option):
  - 2 Core C&O courses
  - 1 other C&O grad course
  - 1 other grad course
- MMath (research paper option):
  - 3 Core C&O courses
  - 1 other C&O grad course
  - 3 other grad courses
- PhD:
  - 4 Core C&O courses
  - 1 other C&O grad course
  - 3 other grad courses

Course requirement (QI)

- MMath QI:
  - the 2 QIC core courses
  - 1 other C&O core course
  - 1 other C&O grad course
- PhD QI:
  - the 2 QIC core courses
  - 3 other C&O core courses
  - a total of 8 courses of which 5 are C&O and 4 are QIC (can overlap)

Core courses

Don't let your core requirement drag on – get them done, ideally within the first 2 terms.

- CO 630 Algebraic enumeration
- CO 642 Graph theory
- CO 650 Combinatorial optimization
- CO 663 Convex optimization
- CO 681 Quantum information processing
- CO 685 Public key Cryptography

If you have done a core course in a previous degree (including doing well in its 400 level version) then you can request to have that part of the core requirement waived, but this does not waive the total number of courses required (4,7,or 8).

Fall 2022 courses

- CO 602 Fundamentals of Opt., Walaa Moursi
- CO 631 Symmetric functions, Kevin Purbhoo
- CO 642 Graph Theory, Penny Haxell
- CO 650 Combinatorial Opt., Chaitanya Swamy
- CO 666 Continuous Optimization, Levent Tunel
- CO 673 Optimization for Data Science, Richard Cleve
- CO 681 Quantum Info. Processing, Richard Cleve
- CO 685 Public-Key Cryptography, David Jao
- CO 687 Applied Cryptography, Douglas Stebila

and three topics courses

- Combinatorial commutative algebra, Oliver Pechenik
- Topological methods in combinatorics, Penny Haxell
- Topics in random graphs and prob. comb., Jane Gao

Winter 2023 courses (tentative)

- CO 630 Algebraic Eunmeration, Olya Mandelshtam
- CO 644 Algebraic Graph Theory, David Wagner
- CO 652 Integer Programming, Bertrand Guenin
- CO 663 Convex Optimization, Walaa Moursi
- CO 687 Applied Cryptography, Alfred Menezes

Topics courses by

- Henry Wolkowicz,
- Sophie Spirkl,
- Steve Melczer, and
- Luke Postle.

MMath degree requirements

For MMath the

- Academic integrity module
- Courses
- Graduate Research Skills seminar
- Thesis or research paper (and presentation of it for the latter)

are all the degree requirements

PhD degree requirements

For the PhD, as well as

- Academic integrity module
- Courses
- Graduate Research Skills seminar
- Thesis (and defense)

there is

- Comprehensive exam
- Lecturing requirement
- Thesis proposal

(not in that order)

Comprehensive exams

PhD students must write one comprehensive exam from **two** of the following categories

- Combinatorial enumeration, Graph theory
- Discrete optimization, Continuous optimization
- Quantum computing, Cryptography

To pass the comprehensive exam requirement you must pass both exams.

The core courses line up with the comprehensive exams, but not completely.

The exams will be in June or July.

Other PhD requirements

For the lecturing requirment you must have two faculty members each see 3 lectures or talks of yours.

One nice way to do it is to take someone's class for a week. Seminar talks can also count.

We have also counted participation in the Faculty of Math Teaching Seminar (currently run by Diana Skrzydlo and Carmen Bruni); check with the grad chair at the time!

Once you have a solid thesis topic you can do the thesis proposal. You'll need to write a 10 page document, give a presentation, and take questions. It is best done within your first 6 terms.

Seminars

There are many seminars going on that you can participate in.
Check out the seminar or seminars in your area.

Tutte Colloquium, Fridays at 3:30. This is our department
colloquium and everyone should plan to attend as often as they
can.

PMath-C&O joint student colloquium. About once a month with
social time afterwards.

Check out the seminar bulletin board outside MC 5491 and the
math faculty webnotices `https://www.math.uwaterloo.ca/
~wnotice/notice_prgms/wreg/notices_main.pl`

Grad student social events

There is grad student cookie time in the faculty lounge on
Tuesdays at 3:30.

Talk to Alena or your mentor about other activities (board games
with Martin Pei, etc) and to join the student Discord server.

Student wellness

Check out university resources for grad student wellness.
`https://uwaterloo.ca/graduate-studies-postdoctoral-affairs/current-students/graduate-student-wellness`

TA responsibilities

Your teaching assistantship (TA) is not **just** a job.

It's an important part of your training and academic experience.

We expect you to do a **good** job not just an **ok** job.

Workload is an average of 5 hours per week from Sept 1 to Dec 31. Some weeks will be busier than others, the 5 hours is an amortized workload.

Don't forget the Faculty Grad TA training on September 7!

TA tasks

Common tasks include

- Grading assignments and exams
- Monitoring and responding to questions on Piazza or other discussion boards
- Running in person tutorials
- Holding in person or online office hours
- Proctoring
- Supervising undergraduate markers

How to be a good TA

- Know the material.
- Give hints instead of telling students the solution.
- Encourage students to discover solutions themselves.
- Give comments when you grade.
- Be consistent when you grade.
- Don't mistake pedantry for rigour.
- Be punctual and responsive.
- Engage with the students.
- Respect the students, where they are, and how they can learn and grow.
- Ask if you run into problems.

Stuff can come up for various reasons. The most important thing is to stay in communication with the course coordinator.

Research

A strength of our system is that you can get started on research right away.

Talk to your supervisor and jointly choose a research project.

Meet with your supervisor regularly and frequently. They are your coach and ally.

Many supervisors will also have group meetings with all their students together.