

# Overview of PhD Programs for **For New Students**

School of Mathematics, Georgia Tech



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August 7, 2017

See our **Current Students Page** for a hyperlink version of this presentation:

[www.math.gatech.edu/~ghomi/GraduateProgram/Orientation.pdf](http://www.math.gatech.edu/~ghomi/GraduateProgram/Orientation.pdf)

# Outline

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- Research Horizons Seminar

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# Degrees offered

## ▶ PhD

- ▶ Mathematics (Math)
- ▶ Algorithms, Combinatorics, and Optimization (ACO)  
joint with: College of Computing, and the School of Industrial and Systems Engineering
- ▶ Computational Sciences and Engineering (CSE)  
joint with: seven other schools
- ▶ Bioinformatics (BINF)  
joint with: five other schools
- ▶ Quantitative Biosciences (QbioS)  
joint with: six other schools
- ▶ Machine Learning (ML)  
New this year. Joint with Colleges of Computing and Engineering

## MS

- ▶ Mathematics (Math)
- ▶ Computational Sciences and Engineering (CSE)
- ▶ Quantitative and Computational Finance (QCF)  
joint with: Management, and Industrial and Systems Engineering
- ▶ Statistics  
joint with: Industrial and Systems Engineering

Many PhD students pick up an MS degree along the way.

If you wish to do so, you may petition for that as you complete the required coursework for MS.

See the bottom of our [MS Page](#) for the procedures for collecting an MS degree.

## Degree requirements

The PhD programs ACO, CSE, BINF and Math all require the following elements:

- ▶ Responsible conduct of research (RCR) training
- ▶ Course work
- ▶ Written comprehensive exams
- ▶ Oral comprehensive exam
- ▶ Minor — 9 hours of course work outside area of specialization.
- ▶ Dissertation

But each item is interpreted a little differently depending on the program. The QbioS does not require written comprehensive exams.

## Degree requirements: RCR

All PhD students at Georgia Tech must complete RCR training that consists of:

- ▶ **CITI module on-line training**

- ▶ 4-6 hours to complete
- ▶ Must be completed within 90 days (or hold on registration)

- ▶ **In person training**

PhD students from the School of Math will complete this by taking MATH 6001, taught by [Chris Jankowski](#).

Must be completed within a year on campus, but we highly encourage you to sign up for this course in the Fall (or else you will need to take a course that is not geared towards math and spend a great deal of time talking about things not really relevant to math). For more info see

**[Institute's RCR Page](#)**



## Degree requirements: Coursework in **Math**

You must complete 39 hours of course work:

- ▶ At least 30 hours must be in math courses at the 6000-level or higher.
- ▶ At least 9 hours must form the doctoral minor field of study.
- ▶ The overall GPA for these courses must be at least 3.0.
- ▶ These courses must be taken for a letter grade and passed with a grade of at least C.
- ▶ There are also certain *Breadth Requirements* that must be satisfied, see:

[www.math.gatech.edu/academics/graduate/phd-mathematics](http://www.math.gatech.edu/academics/graduate/phd-mathematics)

# Degree requirements: Coursework in **ACO**

- ▶ 7 Core Courses
    - ▶ CS 6505 - Computability and Algorithms or CS 6520 Complexity
    - ▶ CS 6550 - Design and Analysis of Algorithms
    - ▶ ISyE 7661 - Theory of Linear Inequalities
    - ▶ ISyE 7686 - Advanced Combinatorial Optimization
    - ▶ Math 6014 - Graph Theory
    - ▶ Math 6121 - Algebra I (Students in ISyE may substitute Math 6112 Advanced Linear Algebra)
    - ▶ Math 7018 - Probabilistic Methods in Combinatorics
  - ▶ 15 hours of additional coursework at the 6000 level or above including:
    - ▶ Math 6337 - Real Analysis I
    - ▶ Two of the following three:
      - ▶ Math 6112 - Advanced Linear Algebra
      - ▶ Math 6321 - Complex Analysis
      - ▶ A 6000 level or above topology/geometry course
- Math 6338 - Real Analysis II is not required but is strongly encouraged

## Degree requirements: Coursework in **CSE**

- ▶ 1 hour course "Intro to CSE"
- ▶ 12 hours of course courses chosen from
  - ▶ CSE/Math 6643 Numerical Linear Algebra
  - ▶ CSE 6140 Computational Science and Engineering Algorithms
  - ▶ CSE 6730 Modeling and Simulation: Fundamentals & Implementation
  - ▶ CSE/ISYE 6740 Computational Data Analysis
  - ▶ CSE 6220 High Performance Computing
- ▶ 9 hours of computation specialization: Courses that increase understanding of computational methods, approved by academic advisor.
- ▶ 9 hours of an application specialization: Courses that increase depth of understanding in an application field; these need not be computation focused courses.

## Degree requirements: Coursework in **BINF**

- ▶ 9 credit hours of Bioinformatics and Computational Bioscience (e.g. BIOL 7023 and BMED 6780, BMED 7027)
- ▶ 9 credit hours in Biology, Biochemistry or Biomedical Engineering (e.g. BIOL 6608, BIOL 7668, CHEM 6572)
- ▶ 9 credit hours of Mathematics and Computer Science (e.g. MATH 6266, MATH 6267, CS 6411)
- ▶ 9 credit hours of courses in an approved minor
- ▶ 24 research credit hours

## Degree Requirements: Comps in **Math**

Students must pass 2 of 7 exams offered in *Analysis, Algebra, Topology, Discrete Math, Numerical Analysis, Differential Equations, and Probability*.

- ▶ One of the exams must be in Analysis or Algebra
- ▶ Must be completed within 2 years of starting program
- ▶ Offered the first two weeks of each Fall and Spring terms

You can take each exam up to 4 times during your 2 years. No penalty for doing badly so try them whenever you like.

Algebra and Analysis exams are offered each Fall and Spring, but others will be offered only if students register for them in the prior semester.

## Degree Requirements: Comps in **Math**

In the Fall of 2017 the exams will be

- ▶ **Analysis** on Friday, Aug 25
- ▶ **Algebra** on Wednesday, Aug 30
- ▶ **Num. Analysis**, and **Diff. Equations** on Friday, Sep 1

To register send an email to

[dgs@math.gatech.edu](mailto:dgs@math.gatech.edu)

by Aug 18.

## Degree Requirements: Comps in **Math**

For syllabi of Math Comps, see:

[www.math.gatech.edu/academics/graduate/written-comprehensive-exams](http://www.math.gatech.edu/academics/graduate/written-comprehensive-exams)

In particular, the above site contains a library of past exams:

[www.math.gatech.edu/academics/graduate/sample-comprehensive-exams](http://www.math.gatech.edu/academics/graduate/sample-comprehensive-exams)

## Degree Requirements: Comps in **ACO**

- ▶ The exam contains questions based, more or less, on the material in the ACO core courses. The syllabi for the exams are at

[www.aco.gatech.edu/academics/examination-syllabi](http://www.aco.gatech.edu/academics/examination-syllabi)

- ▶ Must be passed by the end of the 4th academic semester (not including Summers), but encouraged to complete within 3 academic semesters.

You can pass the exam, fail with a recommendation to retake the exam or fail without being able to retake the exam. So do not attempt it until you are ready!



## Degree Requirements: Comps in **CSE**

- ▶ Select 2 exams from among 5 subjects: numerical methods, discrete algorithms, modeling and simulation, computational data analysis, and high performance computing.
- ▶ Must be completed within 2 years of starting program.

## Degree Requirements: Comps in **BINF**

Students must pass 2 exams:

- ▶ One exam in Bioinformatics
- ▶ One exam in home School (can choose among the 7).

# Degree Requirements: Oral Comp

For all programs must be completed by the 3rd year on campus.

- ▶ Math:
  - ▶ 1 to 3 page written proposal concerning area of research.
  - ▶ 40 minute oral presentation to committee plus questions and feedback from committee.
- ▶ ACO (also called Research Proposal):
  - ▶ Write 3-6 page proposal about research.
  - ▶ 20 minute oral presentation to a committee followed by questions from the committee.
- ▶ CSE:
  - ▶ Create a computational artifact.
  - ▶ Write 5 page proposal discussing work.
  - ▶ Oral presentation to committee.
- ▶ BINF:
  - ▶ Write proposal.
  - ▶ Oral presentation to committee.

## Degree Requirements: Minor

According to GT Catalogue,

[www.catalog.gatech.edu/students/grad/doctoral/minor.php](http://www.catalog.gatech.edu/students/grad/doctoral/minor.php)

all PhD programs at Georgia Tech should satisfy a minor requirement in their course work, which

- ▶ Consists of 9 hours, preferably outside the School,
- ▶ Be in a related group outside student's area of specialization and selected in consultation with student's advisor or the DGS
- ▶ Should be at the 6000 level or above, but the use of certain 4000 level courses may also be approved
- ▶ Courses should be taken with a letter grade and GPA of 3.0 or higher
- ▶ Specific programs might have additional or more restrict requirements, see

[www.math.gatech.edu/academics/graduate/doctoral-programs](http://www.math.gatech.edu/academics/graduate/doctoral-programs)

## Degree Requirements: Dissertation

The writing of the Dissertation constitutes the final phase of your graduate studies.

You need to finish your thesis within 7 years of passing the oral comp. This also involves a Thesis defense, sometimes called the final oral exam.

For more details, see our [\*\*Dissertation and Graduation Page\*\*](#)

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## First year: Mentors and PhD advisors

All PhD students in the School of Math are assigned an initial mentor when they arrive

- ▶ The mentor is assigned based on students interests.
- ▶ Your mentor will help you select classes, navigate the seminars and colloquia, help with teaching issues, ...
- ▶ You can change your mentor at any time. Please let me know when you do.
- ▶ Your mentor is not your PhD advisor. You will choose a PhD advisor sometime within your first 2 or 3 years on campus.

## First year: Research Horizons Seminar

- ▶ Seminar run by graduate students.
- ▶ Faculty give talks aimed at first and second year graduate students.
- ▶ Ideal place to learn about what type of research is going on in the department and possibly find an advisor!
- ▶ Also, free pizza!

All students should go to this seminar.  
STEM Fellows must go!

Attendance for most seminars will be part of the requirements for MATH 6001.



## First year: Other student activities

In addition to the Research Horizon Seminars, grad students organize several other activities, which you are encouraged to take part in or even lead.

These include the High School Math Competition, and student chapters of AMS, SIAM and AWM. For more info and to contact the organizers see

[Student Activities Page](#)

There are also teas every afternoon, which I usually attend every day.

We will also organize monthly board game nights for you.

## First year: Academics

- ▶ Take core courses and take other courses to explore your interests.
- ▶ Try written comprehensive exams (if you are in Math).
- ▶ Talk to me about your plan of study.
- ▶ Talk to your mentor about your plan of study.
- ▶ Go to the Research Horizons Seminar.
- ▶ Attend other Seminars and Colloquia.
- ▶ Talk to other students and faculty members about their area of interest.

Apart from your coursework and the comps the main thing you should be considering in your first year or two is who your PhD advisor will be. The best way to find your advisor is to talk to students and faculty!

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## Logistic Details

- A. **e-mail:** All of you have a Georgia Tech email account (either of the form @gatech.edu or @math.gatech.edu).  
*You should check this account daily to keep up with important announcements and messages.*
  
- B. **Offices:** We have 36 small 2 person offices and 5 larger 12 person offices. All located on the first level of Skiles. You will start in a large shared office and may be able to move to a smaller one shared with only one other student (usually after completing your comprehensive exams, but the space situation is not currently clear).

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## C. TA duties:

- ▶ Normally you will have "5 contact hours" a week. That is 2, 2 hour recitation sections and 1 hour in the math lab. In addition, you will need to hold one office hour, prepare for your recitation session, and grade.
- ▶ In your first semester you get a lighter load so you can take CETL 8000 and to help get acclimated to Georgia Tech.
- ▶ In a normal semester we expect you to work about 1/3 time on your TA duties. That should be about 13 hours. Of course in some weeks it might be a bit more and some a bit less, but if you are consistently working over the 13 hours please let Klara Grodzinsky or me know about it.
- ▶ After passing your comprehensive exams you will have the opportunity to teach your own class.

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# Registration Issues

- A. To be a **full time student** you must register for at least **12 hours** per semester (but no more than 21).
- ▶ **If you are a TA, RA or on a visa you must be full time; otherwise, you will jeopardize your funding and visa.**
  - ▶ At least 9 of those 12 must be taken Pass/Fail (P/F) or for a Letter Grade (LG). The remaining 3 hours can be Audit.
  - ▶ In the summer you still must take 12 hours of courses, but 6 of those hours can be Audit.
  - ▶ If you drop a class you must make sure that you do not go below 12 hours.
- B. Special Classes I:  
Each term you are a TA or RA you may take:
- ▶ Math 8997 — the TA course, 3 hours for Audit only.
  - ▶ Math 8998 — the RA course, 3 hours for Audit only.
- Further another course convenient for auditing is
- ▶ Math 7999 — Prep-PHD Qual Exam, 3 hours for Audit only.
- These classes help you keep your full time status.

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## C. Special Classes II:

- ▶ Math 8900 — Special Problems/Directed Study.
- ▶ Math 9000 — PhD Thesis Writing (only P/F)

You can take as many of hours of these courses as you like, subject to the approval of your mentor, advisor, or another faculty member.

- D. First time you TA you must take CETL 8000 with Klara Grodzinsky. This is 1 hour, P/F.
- E. In your first semester you should take MATH 6001 — Intro. to Graduate Math. It will complete your RCR training requirement and get your math career off to a fast start. This is a 2 hours P/F course.
- F. Many/most international students will also take Math 8305 (ESL) with Mo Burke. This is a 2 hour P/F course.



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First semester **Math** students typically take:

- i. CETL 8000 (1 hr, P/F)
- ii. 3 of the following courses (each is 3 hours and should be taken LG):
  - ▶ MATH 6112 — Advanced Linear Algebra
  - ▶ MATH 6121 — Algebra I
  - ▶ MATH 6337 — Real Analysis I
  - ▶ MATH 6452 — Differential Topology
- iii. MATH 6001 (2 hr, P/F)
- iv. Math 8997 (if a TA) or Math 8998 (if an RA) (3 hr, Audit)
- v. International students might take MATH 8305 — ESL. This is 2 hours and is taken P/F.

ACO, BINF and CSE students typically take the same except item ii is replaced with core courses from their programs (see above).

NOTE: If you sign up for 15 hours then you can drop a course later and still be full time (and hence keep being a TA/RA!).

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Comprehensive info about all **Graduate Programs** in the School of Math is available at:

[www.math.gatech.edu/academics/graduate/graduate-programs](http://www.math.gatech.edu/academics/graduate/graduate-programs)

In particular, see the **Page for Current Students**:

[www.math.gatech.edu/academics/graduate/current-students](http://www.math.gatech.edu/academics/graduate/current-students)

and specially the **Frequently Asked Questions**:

[www.math.gatech.edu/graduate/current-graduate-students-faq](http://www.math.gatech.edu/graduate/current-graduate-students-faq)

Please send me an email if you have any suggestions for improving above websites, or find any typos, errors, or broken links.

# Finding help

- ▶ Academic and programatic concerns:
  - ▶ **Mohammad Ghomi** — Director of Graduate Studies  
(All matters concerning graduate program, including student/advisor relations)
  - ▶ **Chris Jankowski** — Director of Advising and Assessment for the Grad Program (RCR training, Credit Transfer, MS degree, general academic issues)
  - ▶ **Mitchell Everett** — Grad. Program Coordinator  
(Office space, registration issues, visa issues, forms, general administrative issues)  
(all the above people read [dgs@math.gatech.edu](mailto:dgs@math.gatech.edu))
- ▶ For teaching concerns:
  - ▶ Klara Grodzinsky — TA Coordinator
  - ▶ Mo Burke — International TA Coordinator
  - ▶ Igor Belegradek — Director of Teaching Effectiveness
- ▶ For Registration and Permit issues:
  - ▶ Send an email to [academics@math.gatech.edu](mailto:academics@math.gatech.edu)  
(This is normally handled by Luz Arevalo).

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# Glossary

Georgia Tech uses some special terminology. These might be useful to you as you read the general catalogue, students handbooks, or other publications of the School or the Institute:

- ▶ **Institute** means the *University*.
- ▶ **School** means *Department*, as in School of Mathematics.
- ▶ **Math** refers not just to *Mathematics*, but also to the *PhD program in Mathematics*, as opposed to other PhD programs housed in the School of Math (ACO, CSE, BINF).
- ▶ **SOM** stands for the *School of Math*
- ▶ **Tech** means *Georgia Tech*



Best wishes and good luck!