

Tips for Success in PhD Admissions in Mathematical Sciences

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Introduction

The purpose of this talk is to present key ideas for succeeding in PhD admissions in mathematical sciences. All opinions here are my own. This is an outline of my talk:

1. Research
2. Program selection
3. Math Subject GRE (MGRE)
4. Courses
5. References
6. External fellowships
7. Sample timeline
8. Networking

Introduction

1. The main task of the PhD admissions committees is to assess your potential to complete PhD thesis research (and pass the relevant exams along the way).
2. Since producing a publishable paper in the relevant area is best indicator of that potential, **finding a research supervisor should be your number one priority.**
3. Master's thesis is the best process for this.
4. For courses, think whether they could help you establish a relationship with a prospective advisor and/or recommender.
5. Prepare to tell a story about how research experience, coursework and other background demonstrate commitment and ability to perform PhD-level research in the relevant field.

Research

1. There is no process for pairing MS students with research advisors. You need to develop an ad hoc strategy, which may involve contacting:
 - 1.1 instructors of courses in which you received high grades and/or completed a successful research project;
 - 1.2 faculty who advised MS students in the past;
 - 1.3 faculty who supervised you or other MS students as part of a Directed Research course; and
 - 1.4 new faculty who aren't yet advising other students.
2. Faculty from other department who have affiliated appointments in the math department would be eligible to be your advisors.
3. A clinical faculty member or a post-doc at Courant can be your thesis advisor. This can be your backup plan if you can't find tenured or tenure-track advisor.

Program selection

1. Your research will inform what types of PhD programs you will be targeting.
2. Relief from teaching/grading is extremely important for your ability to produce research during PhD (Princeton, NYU, Georgia Tech).

Program selection

In addition to the traditional math PhD, there are other types of doctorate programs in mathematical sciences:

1. Computational and applied math (Brown, Caltech, *JHU*, Maryland, Minnesota, Northwestern, Rice, *Stony Brook*, Texas, Cornell, Yale);
2. Statistics (Chicago, Michigan, NYU Stern, UCLA, URutgers, UWashington, *Wisconsin*);
3. Data science (*NYU CDS*);
4. Mathematical sciences in engineering (MIT, *WashingtonU*)
5. Algorithms, Combinatorics and Optimization (ACO) (*Georgia Tech*, CMU);
6. Computational neuroscience (UChicago, Berkeley, NYU CNS);
7. Theoretical computer science (Courant, *Northwestern*);
8. Operations research in engineering (Columbia, Princeton) and business schools (NYU Stern); and
9. Electrical engineering (Stanford, Duke).

MGRE - Applied Math

1. Nearly all traditional math programs, and many top applied math, statistics and ACO programs require an MGRE score. Below are 2016 MGRE requirements for applied math programs (*=strongly recommended).
2. ("recommended" = required) In my opinion, admissions commissions will infer a very low MGRE score if you don't submit it, even if it is just "recommended."

Not requested	Recommended
JHU	Princeton PACM ¹
Northwestern	UWashington
Texas	Harvard
Maryland	Caltech*
Stony Brook	Brown*
Rice	Minnesota*
	Stanford*
	Duke*
	Columbia*

¹But apparently not ORFE.

MGRE

1. **Obtaining even a 40th percentile score is not a given:** 66 questions, 2.5 min per question.
2. For leading math programs you need at least 80th percentile.
3. The test is only offered in September, October and April (registration is 5 weeks in advance).
4. Some locations, e.g., Martin Luther King HS in Maspeth, in the past accepted walk-ins on the test date.
5. Take as many tests as you can since you can send only the highest score.

MGRE

If you target programs that expect an MGRE, you need to allocate plenty of time to prepare. I recommend joining a study group. Courant's undergraduates formed very successful study groups in previous years. Here are the main prep resources:

1. Official tests from previous years (online);
2. SubjectMath.com lectures and practice questions (online) and 2 full tests (hard copies);
3. UCLA MGRE workshop materials (online);
4. UCSB workshop materials
(http://web.math.ucsb.edu/~padraic/ucsb_2014_15/math_gre_w2015/math_gre_w2015.html)
5. Princeton review book, incl 1 test (hard copies);
6. REA review book, incl 6 tests (hard copies)

Courses

1. Since the PhD-level courses (Linear Algebra, Real Variables, Complex Variables) substitute for 6 of the mandatory courses, taking those course will create capacity to take research-oriented courses for your remaining coursework.
2. If you do well in a PhD-level course, you can get a strong reference letter comparing you to current PhD students.
3. But you should only take a PhD-level course if you have a very high chance of an A (and you should be certain you can get a 3.70 or higher GPA overall).
4. Understand the historic grade distributions for masters students in all courses you plan to take, especially for (a) PhD-level courses and (b) courses that have an in-class final and no midterm before the drop deadline.
5. Try to get old exams from the professors/other students and practice taking them under realistic exam conditions.
6. Get feedback from professors on your performance before the withdrawal deadline.

References

1. Try to get reference letters from your thesis supervisor and two other professors who were your instructors.
2. Ask your recommenders to submit as many letters as they can (applying up to 30 programs seems reasonable since letters are submitted electronically).
3. Reference letters often ask the writer to provide the applicant's class percentile. Ask your prospective recommenders about your percentile even if you got an A in his or her course.
4. If you are a non-traditional student and your background may invite questions from admission committees, ask your prospective advisors to clear up those questions.
5. For example, if you had a finance career, committees may question whether you apply to PhD programs because you got burned out at your job. Ask your advisor to explain how you demonstrated motivation and passion for research.

External fellowships

1. Understand as soon as possible, e.g., today, the graduate fellowships you are eligible for and the relevant deadlines.
2. **You may be ineligible for some important fellowships after your first year of graduate study.**
3. You can use a fellowship to finance the MS education, and having a fellowship award is going to substantially improve your PhD admission prospects.
4. In the past Courant, held fellowship application workshops. Courant publishes a list of PhD students who have external fellowships: <http://math.nyu.edu/dynamic/phd/awards/>

Sample timeline

Time is of the essence!

1. *Fall 2017*: Register for Linear Algebra (one-term) and two research-oriented classes. Determine the list of potential thesis advisors. Determine eligibility and deadlines for PhD fellowships.
2. *Spring 2018*: Register for Multivariable Analysis and two research-oriented classes. Get ≥ 3.70 GPA and select your thesis advisor and two other recommenders. Determine whether you need to take an MGRE.
3. *Summer 2018*: MGRE preparation and/or thesis research.
4. *Fall 2018*: Register for MS Thesis Research, Real Variables (one-term) and Complex Variables (one-term). Complete the thesis before the PhD applications deadline.
5. *Spring 2019*: Register for the remaining two courses.

Networking

Connect with alums in the PhD programs that interest you.

Table: PhD admissions for Courant MS alums

2013	2014	2015	2016	2017
Courant Math	UCLA Math	Courant Math/TU Berlin	Courant CS	Courant Math
		Oxford Math	NYU Stern	NYU CDS
		UNC Math	NJIT Math	NJIT Math
			Rice Applied Math	Columbia GSB
			Rutgers Math	ETH Zurich Math
				UMD Applied Math