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Advice for Those Applying to Graduate School

What does it take to get into graduate school, especially a graduate program in statistics? We asked David Banks and Mark Daniel Ward, both professors in statistics, to give their best advice to those determined to move their academic career forward.

David Banks earned his PhD in statistics in 1984 from Virginia Tech, and then did a postdoc at Berkeley. He is now at Duke University, but previously taught at Cambridge and Carnegie Mellon. Along the way, he worked for the National Institute of Standards and Technology, the U.S. Department of Transportation, and the Food and Drug Administration. He is a former coordinating editor of the *Journal of the American Statistical Association* and a founding editor of *Statistics and Public Policy*.

I've been asked to draw back the curtain on the graduate admissions process. But different people and different departments weigh applications differently, so I can only give my sense of how things often work, and how they should work, based on service upon admissions committees at multiple universities.

First, most places care less about grades than undergraduates imagine. If you are applying to a PhD program in statistics, nobody really worries if you flunked French literature. Buy if you get one or two low grades in statistics, mathematics, or computer science courses, you should explain the circumstances in your cover letter, and those low grades need to be balanced by excellent grades in other stat/math/CS courses.

Most departments value strong letters from people they know. Such people are calibrated, and we know they understand our academic program. So my advice is to seek letters from the most visible and senior people in your department (and plan ahead—take courses from them and do well so they can write good letters for you).

Asking for letters from famous people can be awkward. A relatively graceful way to do this is to ask them about which universities they think would be a good fit for you.

Don't be crushed if they don't suggest Harvard/Stanford/Berkeley/(Duke); they are giving you valuable guidance.

Also, this naturally leads to a nice discussion in which they advise you on safety schools, stretch schools, and the number of each to which you should apply. (My view is that 6–10 is sufficient.)

There are sometimes cultural problems in interpreting letters. Some professors in other countries are scant with praise—a curt comment that the applicant is probably adequate for our program can be equivalent to unqualified endorsement from U.S. faculty. For this reason, the admissions committees usually include faculty from China or India who are better able to assess such letters (and who better know the quality of the applicant's undergraduate program).

GRE scores are filters, and their use is a bit complex. If your scores are much below those of other students in the program to which you apply, then the wind is against you and you will want several safety schools.

Some departments value high scores more than others, and some value the Quantitative Reasoning scores more than the Verbal Reasoning and Analytical Writing scores. I tend to weigh them all equally, since so much of our professional life is about communication. (But I, and most others, make large allowances for applicants whose first language is not English.)

Note that some departments (notably Stanford) require the GRE Subject Test in Mathematics.

Often, the essay or cover letter or statement of interest has less impact than the applicant expects.

All the other résumé padding is at best irrelevant, or perhaps even evidence of distractability.

About two-thirds of them seem to follow a three-part formula: I worked hard in school; I overcame personal challenges (insert a touching story about a dead grandmother or illness or social alienation); and I dreamed of studying local asymptotic minimaxity from earliest childhood. I find these nearly useless in judging whether someone will succeed in our program and whether they would be interesting members of our community. Instead, I prefer essays that describe something the applicant did with statistics, or something they encountered in the classroom and really loved.

A soupçon of humor is good, and a bit of personality is nice. Sadly, many undergraduates think having multiple majors and minors is impressive, as is leadership in various university clubs, participation in sports, summer research experiences, and volunteer work for the community. But the admissions committee only cares about whether the applicant will thrive in its department's PhD program in statistics.

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There is a wide range of standards in statistics programs. The best skim off the top applicants in the world—the entire entering class has perfect GREs, perfect grades, and at least two out of three letters saying the person is a hands-down genius who will change the field.

But great statisticians have come from humbler programs, and career success depends on many more factors than most students imagine. The main trick is to be fundamentally interested in what you are doing.

I strongly encourage undergraduates to take a few graduate-level courses in statistics if they can. First, it is a good way to meet and impress eminent faculty whose letters count more. Second, it changes the admission committee's discussion: If you have already succeeded in a graduate class, then we know you have the necessary ability. Additionally, such classes tend to be smaller, more fun, more challenging, and more leniently graded (a C is usually a failing grade for graduate students, so the floor is high).

Also, be realistic. If you aren't a super-strong A student, don't bother applying to Harvard. Nobody is accepted by being lucky or personable.

There is a story about a famous mathematician who, as an undergraduate, didn't bother going to classes that didn't interest him. So after four years, he had a GPA of about 1.7. He applied to the graduate program at Berkeley, and when the admissions committee opened his folder, it contained three amazing letters from the math professors whose classes interested him. The GREs were spectacular—the guy is a genius. And there was a letter from his registrar saying the university could not release his transcript because he has an overdue library book. He was accepted, of course, and the anecdote underlines the reassuring fact that there are many paths to success.

Mark Daniel Ward is an associate professor of statistics at Purdue University, where he has been on the faculty since 2007. He is also a Purdue alumnus, with a PhD in mathematics with specialization in computational science (2005). His research is in probabilistic, combinatorial, and analytic techniques for the analysis of algorithms and data structures.

I will share some general advice for students who want to attend graduate school, especially a graduate program in statistics. I have been undergraduate chair in statistics at Purdue since 2008, so much of the advice I offer here is along the lines of what I would tell an undergraduate student who is planning to apply for graduate study. I will make several generalizations here, but I point out that the road to graduate school is ultimately dependent on the student, so not all of my discussion will ring true for everyone.

The process of being accepted to graduate school begins years before visiting potential graduate programs and/or applying to such programs. Students who want to go to graduate school should be talking to their academic advisers from an early point in their undergraduate careers. The students who are admitted to graduate school often have great time management, and they often make some sacrifices. They generally spend a lot of time

on the foundational courses in their major. This often means they decline to become involved in too many nonacademic activities or groups in college. They are usually pretty determined and focused.

Successful students often finish their undergraduate curriculum while they are juniors so they can devote most of their senior year to taking graduate courses. This requires advanced planning and consultation with one's academic adviser, to say the least. I notice many students no longer try to pursue two or three major programs of study. Instead, some of the most successful students are choosing to focus on just one major as undergraduate students so they can go deeper into their major more quickly. Of course, this often happens with some sacrifice of the breadth of a student's course selection, but the whole idea of going to graduate school is usually to go deeper into one chosen discipline after all.

Letters of recommendation are among the most important parts of an application for graduate school. It is usually necessary to find three professors (not lecturers, not advisers, and not graduate student teacher's assistants) who can write an insightful letter about a student's preparation for graduate study. I always encourage students to try to talk with six or seven professors about the potential of going to graduate school. Ask the professors: "What do you remember about me? Do you think I am well suited for graduate school? Do you think I will get admitted and be successful in the programs where I want to apply?" Depending on what the six or seven professors say during such conversations, the students can return later to three of the professors and ask for a letter of recommendation. Sometimes, a student will be surprised about which professors remember the student best and which professors think the student is ready for graduate study.

I strongly recommend students have their graduate school personal statement already written when they talk to their potential letter writers. They should bring this essay, their academic transcript, their résumé, and a note that gives the professor permission to discuss their grades.

The essay for graduate school is often a complete mystery for students. Many write about things they have been doing since kindergarten (e.g., when they fell in love with mathematics or statistics, the time they took AP Calculus or AP Statistics in high school, etc.). I tell students it is much more effective to write—in a concrete way—about what they want to be doing in 10 years. This allows the graduate programs to see if the student's goals are a good fit for the kinds of mentors in the graduate program, as well as for the kinds of research offered in the program.

While students discuss their goals for the future, they should naturally reflect on what is most pertinent to how they developed those goals (e.g., research experiences, especially influential coursework, internships, etc.). By focusing concretely on future goals, students will often avoid many of the extraneous subjects they would write about and only the most relevant details will remain.

I also insist students remove any sentences in their essays that are so generic another student could have written them (e.g., "I love statistics," "I am interested in doing research," etc.). Every sentence should contain specifics about the student who is writing the essay.

If a student has already pursued research as an undergraduate, this should be highlighted as early as possible in the personal statement. It is even better if the student published (or will publish soon) the results from such an experience. It is remarkably helpful when a student is able to tie their research experience into the larger narrative of why they are applying for a particular graduate program. A student's research experience is often what differentiates them from other applicants.

Students should be aware that graduate programs in statistics, especially in large departments, offer a variety of tracks. For instance, a student who enjoys theoretical study will usually focus on probability theory or statistical theory. A student who wants to do consulting or government work might focus on applied statistics. A student who likes computer science as well as statistics might focus on computational statistics or machine learning. Some students choose biostatistics. It is helpful to identify (if possible) which area a student wants to focus on. This allows the graduate program to pay more attention to the most relevant parts of a student's background and training.

Students should choose programs in which they have the greatest possibility of finding a mentor whose research is relevant to their own interests. It is helpful to visit a few graduate programs. Moreover, if a student visits a graduate program, the program knows a student is likely to accept an offer of admission. These are simply aspects of the student and the graduate program both trying to identify whether the one is a good fit for the other.

Finally, I always emphasize that the process of applying for graduate study is a natural selection process. Students are likely to be admitted only to programs in which they are likely to succeed. Graduate committees tend to be pretty talented at identifying students who will succeed in programs at their institutions. If a student is not admitted to a particular program, I console the student by telling them they probably were simply not the right "fit" for that graduate program.

Much like the sorting hat in the Harry Potter books, students must be classified according to their interests and strengths. Applying for graduate study is an exciting time! ∎