A Mathematician's Survival Guide: Graduate School and Early Career Development

Reviewed by Elizabeth Theta Brown

A Mathematician's Survival Guide: Graduate School and Early Career Development
Steven G. Krantz
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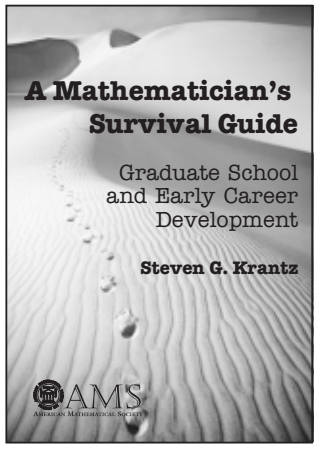
The serious undergraduate considering a Ph.D. in mathematics is almost entirely ignorant of what it is he or she really proposes to undertake. Even a very sophisticated student who has had advanced coursework and perhaps research experience is usually not in a position to foresee that graduate school and an academic career in mathematics will require patience, toughness, and social graces, in addition to the obviously necessary qualities of diligence, insight, and luck. Although the current fashion of undergraduates doing original research has helped, it is still the case that most prospective graduate students in mathematics who have been educated in the United States have no idea of the vicissitudes of mathematical research or even of the broad outlines of academic careers in mathematics. The resulting situation is bad for everyone: some students who would be good mathematicians do not apply, while their peers enroll at institutions to which they are ill suited. Students lose or diminish their potential careers, departments waste their limited resources on students who do not fit their programs, and the mathematics community as a whole loses by the squandering of nascent talent.

This issue has become more important than ever over the past ten years, as directors of graduate



studies from around the country reminisce over the effortless recruitment of top-caliber students in days gone by. Mathematics faces stiff competition from other scientific and technical fields; a mathematically talented student can pursue an intellectually rewarding career without becoming a Ph.D. mathematician. Of course, the increased use of mathematics in these other areas provides delightful benefits for mathematics. Funding for, and progress in, our field is robust precisely because the public derives practical benefits from the applications of mathematics. Nevertheless, the increased competition for students has brought new pressure on mathematics graduate programs to find, retain, and graduate quality students. It is therefore in the interest of the mathematics community that students enter graduate school with a realistic picture of what they will need to do in order to succeed and what they can expect to be the fruits of their success.

There are many things that a student may not know, though to readers of the *Notices* these may appear self-evident. The basic structure of a graduate program—coursework, exams, thesis, and defense—the advisor/student relationship, and the practice of graduate funding through teaching

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assistantships and research support are among the aspects of graduate education that a prospective student may be ignorant of, especially if he or she is not on familiar terms with any current mathematics graduate students.

The transition from undergraduate to graduate status is accompanied by a change in social status from consumer of education to a position of responsibility as a professional in training with a teaching or research assistantship. Most students grow into their new roles without serious trouble, but there are many opportunities for mishap along the way. The naive view that some instructional gaffes are too obviously wrongheaded to be committed by any well-meaning beginning instructor, however clueless, is regularly met with hearty guffaws from senior faculty in charge of teaching, followed by agonizing counterexamples drawn from their own departments. Outside the realm of teaching, every graduate program has had mathematically talented students whose problems adjusting to their new setting undermined their mathematical productivity, sometimes leading to their departure from the program and mathematics altogether.

A Mathematician's Survival Guide, by Steven G. Krantz, is an omnibus of information and advice relating to every aspect of doctoral study in mathematics. Drawing on his almost thirty years as a research mathematician at three major universities and experience as current chairman of the mathematics department at Washington University in St. Louis, Krantz sets out to give prospective mathematics doctoral students a detailed and realistic picture of what graduate school entails and how they can succeed in academia. This book is in the same vein as his earlier books, *A Primer of Mathematical Writing* and *How to Teach Mathematics*, as well as Tom Rishel's book, *Teaching First*; it is a conversational, direct, professional development guide to the business of being and becoming a mathematician. The book's target audience is graduate and pregraduate students of mathematics, though pretenure faculty can also find useful information here. It is surprising that a short book can effectively treat such a big topic, but the *Guide* is largely successful in its goals. It outlines the roughly standard procedures for applying to and completing a Ph.D. program in mathematics, touches on the variety of employment possibilities for mathematics Ph.D.'s, and describes the first few years of an academic job. In addition, it dispenses advice regarding standard pitfalls and strategies for avoiding them. The final chapter provides a concrete overview of qualifying exam-level mathematics, while the appendices describe various aspects of academy structure. They form a unique and very useful component of the book.

The *Guide* is divided into five sections of several chapters each. There is a preface that outlines the contents of the book, establishes Mr. Krantz's conversational approach, and summarizes the book's goal as helping aspiring mathematicians to succeed by educating them about the graduate school process. A typical comment: "It is my fervent belief…that the main reason that people often fail at tasks or programs that they set for themselves is that they never figure out what it was that they were supposed to be doing" (p. xiv). In the preface he also comments on his own qualifications for writing such a book. This sincere concern with helping the reader—understood as a prospective doctoral student—realize his or her full mathematical potential helps to redeem the *Guide* from some grating aspects of the author's style.

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We will discuss the style of the *Guide* and the substance of its advice below, after a summary of the factual information that is the heart of the book. The first section, "Getting Ready for Graduate School", discusses how to get into graduate school. It is mostly advice, although there is a flow chart of graduate study (p. 6) and important information about English as a second language and graduate funding.

The second and third sections, Chapters 3 through 6, give a thorough outline of what to expect as one progresses through a doctoral program, from qualifying exams and their preparatory courses, through finding an advisor and writing a thesis. The various important players in a graduate student's life are described. Krantz takes time to mention many small but essential points that would not all be included in oral advice one might give a student, like the importance of attending colloquia, of maintaining a relationship with more faculty than just the thesis advisor, and of respecting the departmental staff. One of the strengths of the book is the way it collects this advice in an organized written format that students can refer to as needed. These chapters also

discuss some of the uncomfortable dilemmas that will eventually arise for any student, such as competing with other graduate students, handling conflicts with faculty, and difficulties with the thesis. The sections give sound, straightforward advice in a mentorlike and encouraging manner.

This is followed by a chapter about finding a job as a newly minted Ph.D. The *Guide* takes seriously the possibility of industrial employment, though it does not do much beyond acknowledging that this is a legitimate source of jobs. Most of the job advice is oriented to the academically employed Ph.D., and again the advice is solid. Finer points of life as a mathematician, for instance the tensions of research and teaching, the importance of having collaborators, and particulars of how the tenure system interacts with academic ranks, are addressed in Chapter 8, "Afterthoughts". The specific information about academy structure and history is especially worthwhile, since not many graduate students will know it all, and it is nice to have everything laid out together in one place. A careful review of this section would help in a job search.

Saving the best for last, Krantz ends with the "Elements of Mathematics", a lovely chapter addressed again to early-stage graduate students. In the first sections he gives an overview of the mathematics that is roughly standard for qualifying exams. Then he ends with an even better section, 9.5, "How Do All of These Subjects Fit Together?" Nowhere does he claim or try for detail or completeness; instead, he provides a big-picture gloss that most graduate students do not bring to their program and will rarely hear articulated by the people around them. Last come appendices that outline the organizational structure of a mathematics department and a university, and the academic ranks. Again this is information that most graduate and prospective graduate students will neither have nor know that they should have but will need. The third appendix is a checklist of questions students should ask when considering a graduate program.

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Together with nuts and bolts information, Krantz dispenses commentary and advice throughout the text, especially in the preface and early chapters. He is not at his best when giving advice to pregraduates. His style is at times condescending, to the point that one worries that self-respecting students might be so repelled that they will not read on to the informative later chapters. The comment in the preface that he aims to present information in "an accessible but authoritative tone" (p. xiv) would have annoyed this reader as a pregraduate, as would the statement in Chapter 1, "You are now an adult and you should look after yourself" (p. 4). For readers familiar with Krantz's *Primer* and *How to Teach*, his style in the *Guide* echoes the old boy tone that surfaced in the earlier books, as when he quotes Woody Allen's remark about a liaison with a minor, "The heart wants what it wants" (p. 89), in the book's discussion of sexual conduct in graduate school. Although the book goes on to point out the shortcomings of this attitude for people who want to be employed in universities, it is a jarring choice of source. These remarks and others like them give the impression that Krantz has not thought as carefully about his readers' sensibilities as he has about what they need to know. This is unfortunate. The text will needlessly alienate some students.

Advice about graduate school is a subject on which reasonable minds can differ, regardless of delivery. The thoughtful faculty reader will probably find that he or she would not offer the same opinions as does the *Guide* on various points. This does not detract from the book's value, since where one disagrees, one is spurred to reflect on what advice would be more appropriate. In an ideal situation, this book would be given or recommended to students by a faculty member (undergraduate mentor, director of graduate studies, thesis advisor, etc.) who has read the book, with comments on those passages where he or she disagrees with the text.

The *Guide*'s advice strays outside the realm of reasonable difference, however, in one case. Section 2.6, "Special Concerns for Underrepresented Groups", is poorly thought out. (One might also feel that the subtleties confronting such groups are given short shrift in section 6.4, "Intimacy with Members of the Mathematics Department".) "Special Concerns" is a very short section that opens with a credible lament that some groups are underrepresented among mathematicians. The prospective student is then urged to put a premium on finding a program in which he or she is not the only member of the relevant group, if possible a program in which there are faculty from that group. The text

says that the goal is to find a program where one will "be comfortable and happy and feel that you are supported and valued in your new environment" (p. 25), but the main specific advice about how to achieve this is to find a program with people who are from the same underrepresented group, on the theory that they will provide the most natural role models. Other specific suggestions, to look for "special housing" and "special counselors", are bizarre. A charitable reader might conclude that the first applies to people with physical disabilities, but the second is difficult to interpret.

Whatever is meant by this advice, it is inaccurate. The most successful mathematicians from underrepresented groups that this reviewer is aware of are those who went to highly rated graduate schools, like Harvard, Yale, and Michigan, and worked with first-rate faculty. Integration of mathematics being what it is, almost all of these women and minorities had peers, professors, and thesis advisors who were Caucasian males. Indeed, this is the pattern for any group's entry into the ranks of mathematical researchers. Today it is not surprising to meet a prominent American mathematician who is Jewish, but there was a time when Jews were not welcome at elite U.S. universities. Social values changed, and talented Jewish graduate students found forward-thinking non-Jewish mentors. Of course it is important to find a program in which the faculty and other graduate students take one seriously. It is insulting to all parties, though, to suggest that this is best accomplished by sticking with members of one's own group. On the evidence, the best plan for a student from an underrepresented group who wants a career as an academic mathematician is essentially the same as for anyone else: find an honest and powerful advisor at a highly ranked program.

In summary, *A Mathematician's Survival Guide* is an informative and useful reference for aspiring mathematics Ph.D.'s and faculty who mentor them. It would make an attractive component of an introductory package for incoming graduate students or a counseling book for senior undergraduates considering their options. It is also a worthwhile read for any faculty member who is interested in graduate education as a starting point for his or her own reflections, and as a window onto another thinker's point of view.

References

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