

General Advice on the Writing Projects

If your instructor assigns one or more of the writing projects, you are fortunate. Written communication skills are of utmost importance in today's world of information. In doing the research for such essays, you will become familiar with the literature in many areas of mathematics and computer science, and you will hone your library and information gathering skills. In this section we offer some helpful advice and provide a list of information resources—including books, articles, and Internet resources—to get you started. At the end of the solutions section of each chapter in this *Guide*, we give specific suggestions of where you might look when working on the various writing projects. We do not guarantee that you will find exactly what you are looking for in the references we suggest, but at least our pointers will start you in the right direction. Tracking down the information is half the challenge!

Here are several ideas and points to bear in mind as you do the research for the writing projects:

- There is a meta-source for information today: the “information superhighway.” If you don't already have access to the Internet, ask the appropriate people for access privileges and some guidance on how to use the Internet. Then explore its nooks and crannies, such as e-mail, Usenet (try the `sci.math` newsgroup), gophers, the World Wide Web, and so on. You will find lots of sources of information, and you will get to communicate with other people who have the kinds of information you want, or know where to get it. Ask around—people tend to be very friendly and helpful in this community. It's a fascinating social dynamic!
- The *first* place to search for material on any of the writing projects is probably the World Wide Web. In fact, the existence of the World Wide Web and search engines makes it embarrassingly easy to find sources of information on any topic one desires. To use a search engine, you type in one or more key words or phrases (such as “graph theory” inside quotation marks), and the search engine looks over the billions of websites around the world to find those that mention these words or phrases; then you can visit those sites. The whole process takes only a few seconds. One particularly good search engine is called Google. It shows you the “best” hits (those sites that contain your words or phrases most prominently, and/or are sites that many people link to). The URL is <http://www.google.com>.
- You should definitely check the website for this textbook: <http://www.mhhe.com/rosen>. There you will find many useful links that can get you started on researching the writing projects. Notice the various Web icons throughout the textbook, which indicates relevant material on this website.
- Most libraries have on-line search facilities that allow you to look for key words in titles of books in their collection. For example, to find resources on fuzzy sets or fuzzy logic, you could search on the word *fuzzy*. You can also search for authors or titles, of course. Ask a librarian for assistance if necessary. Also, catalogs to many university libraries (and the Library of Congress) are available on the Internet; see <http://www.libdex.com>.
- The following library research technique should come in handy. If the source you are looking at does not deal in enough detail with the topic you are investigating, then consult the references given in that source. Continue this process backwards as deeply and broadly as necessary. Of course this is particularly easy to do on the Web.
- There is a comprehensive set of brief reviews of essentially every mathematical research paper and book written since 1940 (and being kept up-to-date at the rate of over 50,000 items per year), in a journal called *Mathematical Reviews*, published out of Ann Arbor, Michigan, by the American Mathematical Society. It comes in various forms—in hardcover volumes, on CD-ROM, and on the Internet. Ask your librarian for the forms you can have access to. In the best formats, you can search for key words, as well as authors or titles. The hypertext version on the World Wide Web (called MathSciNet) lets you quickly follow leads from one review to another. Your institution must be a subscriber in order for the computers on your campus to have access.
- We shouldn't need to mention obvious things, like using the index and table of contents of any book you consult. When looking up items in an index, don't forget to try possible variations of what you are looking for (e.g., you may find one of the entries “induction, mathematical” or “mathematical induction” but not the other).

- An excellent source for many of these writing projects is [MiRo] (see the bibliography that follows), which is published as a companion to this textbook. It has articles covering various parts of pure and applied discrete mathematics, at levels varying from elementary to intermediate. It is worth browsing through this book, even if you do not find anything in it relevant to a project you are working on. It will give you a feeling for the breadth of the subject you are studying.
- Popular accounts of mathematical topics often make their way into *The New York Times*. This premier of American newspapers has a detailed index, which is available in most libraries that carry the newspaper. One prolific writer of mathematical articles is Gina Kolata. The *Times* also produces on a regular basis a special edition of mathematics-related articles; ask your mathematics department whether they have a recent issue. The *Times* and most other major newspapers are also available on the Web, usually for free.
- Many of the essays assigned in this textbook deal with the history of mathematical topics. Most books on the general history of mathematics are filed under the call letters QA 21. See [Bo4] and [Ev3] for two good sources. There are also wonderful extensive collections of essays about mathematics, both historical and expository. A classic is the four-volume treatise [Ne]. A more recent one of high quality is [DaHe]. Perhaps the best resource for the history of mathematics is the MacTutor History of Mathematics archive on the Web; its URL is <http://www-history.mcs.st-and.ac.uk>. It has biographies of hundreds of mathematicians, as well as references, articles, links, and an unbelievable amount of information.
- The Mathematical Association of America (MAA) has a website with lots of interesting articles (updated monthly) and special sections for students. Its URL is <http://www.maa.org>.
- Some of these projects go into depth on various topics in discrete mathematics. There are several good, more advanced textbooks on combinatorics and graph theory, such as [Bo1], [BoMu], [Br2], [ChLe], [Ro1], and [Tu1]. The library classifications here are QA 164 and QA 166, where you will also find specialized books, research monographs, and conference proceedings. In addition, there are dozens of other discrete mathematics textbooks at a level comparable with or slightly more or less advanced than your textbook. An excellent one is [Gr2]. It has comprehensive discussions of most discrete mathematical topics and a wide variety of interesting problems, including some challenging and open-ended ones. It also has a bibliography of 335 books and articles, and a detailed index that will lead you to the right source for further reading. Another, slightly different, more advanced book to take a look at (if nothing else, for its style!) is [GrKn].
- There is an intimate relationship between discrete mathematics and computer science. Computer science books of all sorts, whether dealing with hardware and circuit issues, programming, data structures, algorithms, complexity, theoretical foundations, operating systems, compilers, artificial intelligence, or other topics, may well be relevant to many of these projects. QA 76 is where many such books are housed in the library, although specialized topics will have their own call numbers (e.g., Q 335 for artificial intelligence or the high TK 7800's for circuit design). Our list that follows includes several textbooks on data structures and algorithms. Another lively source is [De2], a collection of essays on various aspects of computer science and related mathematics, each with references for further reading. You will find those essays relevant to a large number of the writing projects, and you should definitely try to have a look at this collection.

Here are several points to bear in mind about writing essays (whether in mathematics or in other subjects):

- All the rules and advice you have learned over the years about good writing apply to technical writing as well as to other forms of prose. It is often more difficult to express mathematical ideas clearly and precisely, so do not expect these writing projects to be easy.
- Know your reader! Keep in mind for whom you are writing, and pitch the level to that audience. Think about how much you will assume your reader knows and how much you will need to fill in. (When in doubt, do not assume the reader knows much.)
- Organize, organize, organize! Essays need to have an introduction, a body, and a conclusion. If the work is going to be long, it probably makes sense to have labeled sections covering the different points. Make an outline of what you plan to say, and think a lot about how to order it, both before you start writing and throughout the process.

- Use a word processor if you have access to one. This makes it much easier to revise and edit your work numerous times, until it is just the way you want it. Make sure to take advantage of special features like spelling, grammar and usage checkers. Pay some attention to the format (fonts, spacing, layout, etc.); most word processors let you design a very pleasing document. Print your essay on a laser-quality printer if you can. If your essay will contain much mathematical symbolism, try to use a mathematical word processor or typesetter. The best of these is \TeX , which it would definitely be worth your while to learn to use (although it is not easy). To give you an idea of how nice \TeX can look, note that this solutions manual was produced using \TeX .
- Finally, be careful to give credit to the sources you use. Plagiarism has become a major problem, and if you copy material from the Internet or other sources and present it as your own, you are stealing another person's property. The consequences can include suspension from your school. When in doubt, ask your instructor about proper procedures for citations.

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