Afterword

Mathematics is the language of problem solving. It is at the heart of all science and technology. The beauty of an education in mathematics is that it gives you the freedom to pursue just about any technical career you can imagine. In the next few pages we will provide a brief discussion of some of the more common career opportunities for students with advanced mathematical training. This advice applies to, but is not limited to, those students who earn a degree in mathematics. It is also relevant to students who choose to gain advanced training in mathematics while they earn degrees in other areas. We will also provide some suggestions about how to achieve success in a job that uses mathematics to solve real–world problems. The number one question in the mind of most students is whether to go directly to work, or whether to pursue another, more advanced degree. We will begin by describing the most plentiful job opportunities for bachelor's and master's degree mathematics graduates.

Computer jobs are the number–one job opportunity for students with advanced mathematical training. Students who combine advanced mathematics with courses in computing, including advanced programming, operating systems, and data structures, will find a variety of opportunities for jobs in the industry. In fact, as the job market in computing becomes more competitive, the savvy computer student will seek out complementary areas of expertise to enhance their resume, and mathematics is one of the best ways to do this. It is also important to make sure that your computer studies include commonly useful programming languages like Java and C. Computing is a marketable skill that can open many doors for you. After you get a job and prove yourself, you will find that many other opportunities present themselves.

Another good job opportunity for mathematics students is actuarial work. Actuarial firms will often hire a good mathematics major just on the basis of his or her academic record, but if you are really interested, it is a good idea to take the first actuarial exam (covering probability) before you graduate. To become a full–fledged actuary requires passing a series of exams. There are graduate courses in actuarial science that will help you to prepare for the exams, or you can study on your own. If you have the ability and self-discipline, you can rise rapidly to the top of a very interesting and lucrative profession. Most Fortune 500 companies have at least one vice president who is an actuary, not to mention the opportunities at insurance companies and independent actuarial firms. Actuaries do the mathematical modeling for these firms. This is an

especially good track for people with a strong interest in business, but you do not need to have any course work in business, economics, or accounting to qualify.

Many students choose to combine their degree in mathematics with a second degree in engineering, computer science, or accounting. Of course, a good student in one of these areas will have no problem landing a respectable job. One question he or she may have is to what extent that job will use the full measure of his or her knowledge in mathematics. To be honest, there is good news and bad news here. The bad news is that during the first year or two of employment, there may be little opportunity to use much college–level mathematics. Everybody has to start somewhere, and most people have to start at the bottom. The important thing to remember is to perform with energy, enthusiasm, and accuracy. Look at this part of your working career as a test to see whether you are ready for a more sophisticated job. The good news is that once you get past the opening stanza, there will be a wealth of genuine opportunities to put your math to work on significant and interesting problems. Of course, you will have to prove that you can handle the challenge.

Next, we will discuss some of the opportunities for mathematics students who intend to pursue an advanced degree. Students with advanced mathematical training are welcome in virtually every graduate program, especially in science and engineering. When you look at the kind of work being done at the advanced levels in most of these areas, you will find that it involves a lot of mathematics. There is not enough room here to describe the incredible variety of opportunities available. We will concentrate on those fields primarily concerned with the mathematical aspects of solving real–world problems.

Advanced graduate education in mathematics is an obvious choice for someone with a degree in mathematics. If you are interested in solving real–world problems, you should look for a graduate school that offers a program in applied mathematics, statistics, or operations research. Computer science is another attractive choice, for reasons stated earlier. Bright mathematics majors with a good background in computing will find ample opportunity to use their mathematical skills during computer science graduate school. After graduation, these folks will possess a powerful combination of mathematical and computer skills that can be brought to bear on a wide variety of fascinating real–world problems. Statistics is another good option. Most statisticians started out by earning a degree in mathematics. There are plenty of job openings, and the work is much more varied than most people believe. Some of the most interesting work in mathematical modeling is done by statisticians. In fact, the author of this textbook is now employed in a statistics department!

Operations research is a very broad field of study that encompasses much of what we usually think of as mathematical modeling. It includes the study of problems in optimization, queuing theory, and inventory theory. It is possible to enter the field with a degree in mathematics, but it is better to start with an advanced degree in the field of operations research. The biggest problem here is to find the right program. Mathematics, statistics, computer science, engineering, and even MBA programs often offer a major or a concentration in this

area. Choose any one you like; it does not make too much difference which department grants the degree. Different schools have different philosophies about where such a program belongs. Another confusing problem is the name of the program. Operations research, operations management, management science, and systems science are all different names for essentially the same thing. Once again, it does not really matter which one of these appears on your degree.

If you are interested in research and teaching, consider a doctoral program. A doctorate in mathematics is one of the more marketable degrees in academics, and a doctorate in some branch of applied mathematics (e.g., numerical analysis or partial differential equations) can lead to a very good job in an industry research laboratory. These jobs are also very marketable in academics, since applied mathematicians are valuable both to teach applied courses and to participate in interdisciplinary research projects. If you are interested in an academic job, you should also consider earning your doctorate in statistics, computer science, or operations research. You will find that the work is mostly math, the job market is better, and the salaries are higher. In fact, a doctoral program in almost any field of science or engineering can provide a wealth of opportunities to use mathematics to solve real–world problems. You should not be afraid to pursue anything that captures your imagination. Finally, do not overlook the possibility of a combined doctorate. Programs in mathematical physics, mathematical biology, mathematical psychology, and mathematical economics offer unique challenges. You may also want to begin thinking about the choice between an academic job and an industry job. While academic jobs offer much in the way of lifestyle benefits, industry jobs typically pay about twice as much. You will want to be in a position to choose.

Further Reading

1. *101 Careers in Mathematics*, edited by Andrew Sterrett, Mathematical Association of America, 1529 18th Street NW, Washington DC 20036–1385, `www.maa.org/careers`

2. *Careers in Applied Mathematics*, Society for Industrial and Applied Mathematics, 3600 Market Street, 6th Floor, Philadelphia, PA 19104-2688, `www.siam.org/careers/`

3. *Careers in Operations Research*, Institute for Operations Research and the Management Sciences, 7240 Parkway Drive, Suite 300, Hanover MD 21076 USA, `www.informs.org/Build-Your-Career/INFORMS-Student-Union/`

4. *Careers in Statistics*, American Statistical Association, 732 North Washington Street, Alexandria VA 22314-1943, `www.amstat.org/careers`

5. *Occupational Outlook Handbook*, Computer and Mathematical Occupations, U.S. Bureau of Labor Statistics, Office of Occupational Statistics and Employment Projections, PSB Suite 2135, 2 Massachusetts Avenue NE, Washington DC 20212-0001, `www.bls.gov/oco/`

6. *Mathematical Sciences Career Information*, American Mathematical Society, 201 Charles Street, Providence RI 02904-2294, `www.ams.org/careers`

7. *The Actuarial Profession*, Society of Actuaries, 475 North Martingale Rd., Schaumburg IL 60173–2226, `www.soa.org/careers`