Sloan Career Cornerstone Center

Mathematics Overview

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The Field

Mathematics is one of the oldest and most fundamental sciences. Mathematicians use mathematical theory, computational techniques, algorithms, and the latest computer technology to solve economic, scientific, engineering, physics, and business problems. The work of mathematicians falls into two broad classes -- theoretical (pure) mathematics and applied mathematics. These classes, however, are not sharply defined and often overlap.

By the time you are an undergraduate, you probably have a good understanding of the role of a mathematician in an academic environment. You are able to observe your professors, speak with doctoral students, and participate in their work. You are probably not as familiar with what it's like to be a mathematician in industry, business, or government. The world is full of places to do rigorous mathematics. As you begin to identify potential outlets for your talent, it may be useful to get a sense of the dimensions of the 'field' in its entirety.

Business, industry, and government use mathematical expertise, often in the context of applications. However, the job titles often do not include the word "mathematics" or "mathematician," but do involve significant use of mathematics and/or quantitative reasoning. For people with advanced degrees in mathematics, careers involve development of new mathematical methods and theories and application to almost every area of science, engineering, industry and business. Those who major in mathematics in undergraduate institutions find a broad variety of opportunities. Some use their mathematical training directly and some use their training in rigorous thinking and analysis indirectly to solve problems in the business sector.

Many of the contributions and uses of mathematics are closely related to the need for mathematical modeling and simulation of physical phenomena on the computer. In addition, the analysis and control of processes, and optimization and scheduling of resources use significant mathematics. For example, the finance industry uses sophisticated mathematical models for pricing of securities, while the petroleum industry models the flow of oil in

underground rock formations to help in oil recovery. Image processing, whether producing clear pictures from satellite imagery or making medical images (CAT, MRI) to detect and diagnose, all use significant mathematics. Industrial design, whether structural components for airplanes or automobile parts, uses a tremendous amount of mathematical modeling; much of which is embodied in CAD/CAM computer software. Such techniques were used in the design of the Boeing 777, as well as in the design of automobiles. Computational modeling is also used in airplane and automobile design to analyze the flow of air over vehicles to determine fuel economy and efficiency.

The use of mathematics is pervasive in modern industry. The result is that mathematicians are found in almost every sector of the job market, including engineering research, telecommunications, computer services and software, energy systems, computer manufacturers, aerospace and automotive, chemicals and pharmaceuticals, and government laboratories, among others.

Preparation

A Ph.D. degree in mathematics usually is the minimum educational requirement for prospective mathematicians, except in the Federal Government. In the Federal Government, entry-level job candidates usually must have a 4-year degree with a major in mathematics or a 4-year degree with the equivalent of a mathematics major -- 24 semester hours of mathematics courses.

Ph.D. Training

In private industry, candidates for mathematician jobs typically need a Ph.D., although there may be opportunities for those with a master's degree. Most of the positions designated for mathematicians are in research and development laboratories, as part of technical teams. In such settings, mathematicians engage either in basic research on pure mathematical principles or in applied research on developing or improving specific products or processes. The majority of those with a bachelor's or master's degree in mathematics who work in private industry do so not as mathematicians but in related fields such as computer science, where they have titles such as computer programmer, systems analyst, or systems engineer.

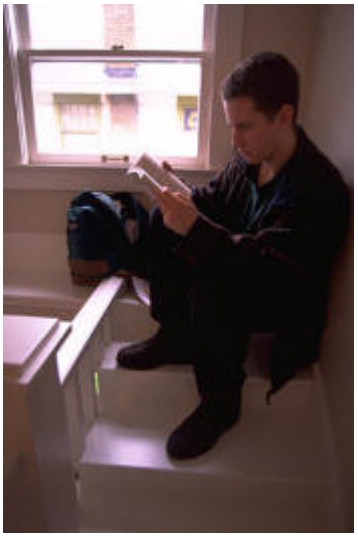
Bachelor's Degree Courses

A bachelor's degree in mathematics is offered by most colleges and universities. Click here to download a PDF showing current mathematics programs in the U.S. Mathematics courses usually required for this degree include calculus, differential equations, and linear and abstract algebra. Additional courses might include probability theory and statistics, mathematical analysis, numerical analysis, topology, discrete mathematics, and mathematical logic. Many colleges and universities urge or require students majoring in mathematics to take courses in a field that is closely related to mathematics, such as computer science, engineering, life science, physical science, or economics. A double major in mathematics and another related discipline is particularly desirable to many employers. High school students who are prospective college mathematics majors should take as many mathematics courses as possible while in high school.

University Selection

In 2004, about 200 colleges and universities offered a master's degree as the highest degree in either pure or applied mathematics; about 200 offered a Ph.D. degree in pure or applied mathematics. In graduate school, students conduct research and take advanced courses, usually specializing in a subfield of mathematics.

Specialized Training



For jobs in applied mathematics, training in the field in which the mathematics will be used is very important. Mathematics is used extensively in physics, actuarial science, statistics, engineering, and operations research. Computer science, business and industrial management, economics, finance, chemistry, geology, life sciences, and behavioral sciences are likewise dependent on applied mathematics. Mathematicians also should have substantial knowledge of computer programming, because most complex mathematical computation and much mathematical modeling are done on a computer.

Core Skills

Mathematicians need good reasoning ability and persistence to identify, analyze, and apply basic principles to technical problems. Communication skills also are important, as mathematicians must be able to interact and discuss proposed solutions with people who may not have extensive knowledge of mathematics.

Coops and Internships

Internships, co-ops, and research can be valuable because they allow you to see what it is like to work in your field. Many mathematicians mention hands-on experience before graduating as an asset when looking for a job and as valuable in helping them decide what kind of first job to look for after graduation.

Day In The Life

Real life as a mathematician bears little resemblance to cliché. Not everyone has a Ph.D. in operations research, nor do they spend days at the computer terminal isolated from human contact. In reality, a mathematician's working experience is a matrix of the type of problems you work on and the relationships among the members of your team. You will find that you need to bring a wide range of skills to bear on your various daily activities.

Typical Problems

At the heart of your work will be the kind of mathematics that you do. There are no typical problems any more than there are typical days, but it is possible to get a general idea of the work that goes on. Most problems in the real world require multiple levels of analysis, planning, detail work, and coordination.

Business:

Problem -- A firm wanted to decide statistically with a given confidence level what is the most it can lose over a given time interval. There are several methods to compute this value, the most precise of which tends to be very time-consuming -- requiring on the order of hours or maybe days to run on a computer, which makes it not feasible for a bank. The challenge is to come up with a quick analytical way to estimate this so-called value at risk.
Process -- In order to do this, we drew upon techniques from stochastic processes, differential equations, and also Fourier analysis because we implement a Fast Fourier Transform and we used complex arithmetic in its implementation.
Results -- The analysis resulted in a complete distribution of the firm's future portfolio values. For instance, in one day or five days the full worth of the portfolio could vary by +$50 million to -$7 million or less. We assigned a probability to each of these states. Coming up with such probabilities rigorously involved some fairly interesting mathematics at that level, and it involved other people from the group and collaboration with people overseas. Part of the result of this work was a paper, and it is something that ultimately will get incorporated into our company's product, which is software. In addition, it allowed us to do some interesting research.

Industry:

Problem -- The goal is to develop a methodology to reduce sonic boom in aircraft design.
Process -- We use computational fluid dynamics and a computational code to study the flow over the geometry of an aircraft. Once the solution is obtained, we use visualization tools to look at the physical flow field over the aircraft. We use a color monitor, called the work station, to bring the solution up visually. For example, if you want to look at the surface pressure of an aircraft we identify a blue color with the lower pressure, and a red color for the higher pressure. So by looking at the gradients of the color changes we understand the pressure on the surface of the aircraft. From this we understand a little bit more about the physics.
Results -- Once we have experience with this problem, we start the design phase using computational fluid dynamics codes and changing the shape of the aircraft. Bit by bit we get to what we want to achieve, a reduction in the sonic boom.

Government:

Problem -- Produce a forecast for Department of Defense budgets of how much production of a particular ship will cost in one year (or five years, ten years or 20 years.) We look at what types of factors will drive overhead costs and what kind of relationships exist when estimating future overhead costs versus how they have behaved in the past.
Process -- We use a lot of statistical procedures to build models to project these costs into the future. We look at regression analysis and data collection as well as historical data to figure out whether it will be an accurate indicator for what will happen in the future. We actually build models that will give us some sort of overhead estimate to include in our ship cost.
Results -- Changes occur that make the models nonlinear. Things that happened five years ago are not actually what are happening five years from now and things are just so dynamically changing, that it's very hard to predict what will happen.

Work Environment
Regardless of your job's specifications, it is very likely that you will be part of a team working with people of diverse backgrounds. These colleagues will be a resource for you, as you will be for them. You may be handed assignments directly and given a specific time frame in which to complete them, or your work may derive from a project for which you are generally responsible.

Skills
To accomplish your work successfully you will need more than just your mathematical abilities. The capacity to write well and to articulate your ideas to others is imperative no matter what kind of job you have. In addition to communication and interpersonal skills, familiarity with other technical specialties is important. Often the problems you tackle may originate in other disciplines, and knowing the `vocabulary' for that area may speed your work.

Activities
Checking email, planning meetings, calling clients, preparing for conferences, creating budgets, researching problems, hiring staff, developing specifications, assigning tasks, training colleagues, running computer applications, writing reports -- the list of activities you perform in any given day will be diverse and long.

Advice
Once you are on the job, you may find yourself working on projects that require knowledge in areas new to you. Most employers expect this to happen and give you time to obtain the background you need. When looking for a job, you will want to find out what opportunities and training an employer offers so you can stay abreast of changes in your field.

Application Spectrum

The spectrum of the field is perhaps best illustrated by observing the role of mathematics as it applies to different products.

Aerosol Can
Chlorofluorocarbons (CFCs), like the freon used in aerosol cans and air conditioning systems, could destroy stratospheric ozone, which protects the earth from biologically damaging ultraviolet radiation. Mathematical models, simulations and the numerical solution of a special set of differential equations, called "stiff" differential equations, are used to identify safer replacements from the members of hydrohalocarbon (HHC) family.

Oil Rig
Accurate models of oil reservoirs, including the simulations of oil and water moving through porous rock, sometimes covering hundreds of acres, are used by the petroleum industry to make decisions on where to drill. These problems are solved by reducing complex multidimensional differential equations to a sequence of simpler one-dimensional problems that are solved numerically

Airport
Operations research is used throughout the airline industry to make sure seats are sold and the airlines make money. Yield management, including mathematical models, optimization techniques, and probability calculations, is used for setting up automated reservation systems and complex systems of connecting routes.

Communications Satellite
Models based on computing solutions to partial differential equations are used to solve problems in signal processing and filtering of noise.

Circuit
The design of a circuit uses the concept of a graph, like a schematic map, with lines, called edges and intersections, called nodes. Systematic searches of the nodes are used to determine the most efficient connection from one node to another.

Aircraft
The design of an aircraft requires computational fluid dynamics, partial differential equations, and grid generation on complex geometries.

CD
CD players, digital audio tape and digital television read digital information that consists of "bits" -- 0's and 1's. Occasionally these devices confuse the two and error-correction codes, like Reed-Soloman codes, are needed. Mathematically, Reed-Solomon codes are based on the arithmetic of finite fields.

Fingerprint
The law enforcement community is interested in developing quick ways to match fingerprints with the database of fingerprints held by the Federal Bureau of Investigation. The problem is the FBI holds approximately 200 million fingerprint cards. They have now adopted a standard for digital fingerprint image compression that will allow the fingerprints to be stored electronically.

Space Vehicle
The equations of motion of a space vehicle are systems of ordinary differential equations. One may wish to solve an initial value problem, say where the initial position and velocity of the spacecraft is given and you want to determine the trajectory for some period of time. Boundary value problems also arise, for example when you want to design an orbit transfer maneuver between two different orbits. In that case you have beginning and end point constraints on the maneuver.

Submarine
The search for enemy submarines requires the application of a number of fields of mathematics, including probability, game theory and optimization.

Space Shuttle
The problem of separation of the space shuttle fuel tank involves ordinary differential equations and numerical solution methods.

Fabric
Color is the result of the combination of a light source, an object that it illuminates, and a visual system to perceive the color which is usually the eye and the brain of a human being working together. Color is commonly described by the attributes of lightness, chroma, and hue. Standardized color descriptions use values assigned to these three attributes to identify the color.

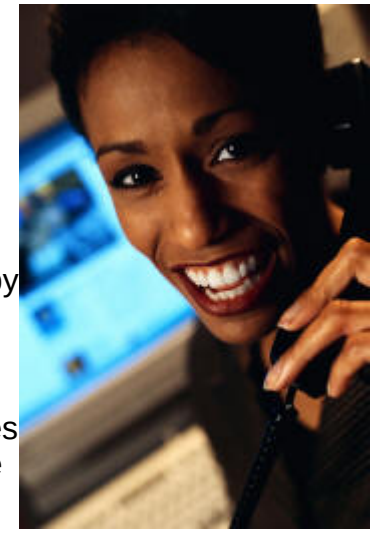
Crystal
Crystal growth can be modeled using partial differential equations.

Earnings

Because of the diversity of the type of work mathematicians do and their employers, the range of compensation is extremely broad.

Starting Salary
According to the U.S. Department of Labor Bureau of Labor Statistics, median annual earnings of mathematicians were $81,240 in May 2004. The middle 50 percent earned between $60,050 and $101,360. The lowest 10 percent had earnings of less than $43,160, while the highest 10 percent earned over $120,900. In early 2005, the average annual salary for mathematicians employed by the Federal Government in supervisory, nonsupervisory, and managerial positions was $88,194; that for mathematical statisticians was $91,446; and for cryptanalysts the average was $70,774.

Employment



Mathematicians held about 2,500 jobs in 2004. Many people with mathematical backgrounds also worked in other occupations. For example, about 53,000 persons held positions as postsecondary mathematical science teachers in 2004.

Many mathematicians work for Federal or State governments. The U.S. Department of Defense is the primary Federal employer, accounting for about three-fourths of the mathematicians employed by the Federal Government. Many of the other mathematicians employed by the Federal Government work for the National Aeronautics and Space Administration (NASA). In the private sector, major employers include scientific research and development services and management, scientific, and technical consulting services. Some mathematicians also work for software publishers, insurance companies, and in aerospace or pharmaceutical manufacturing.

Mathematicians work in every major sector of the economy: industry, business, government, and academia. These arenas are marked by very definite characteristics that will be important to consider as you explore options.

Industry

Consisting of manufacturing and consumer products companies, this sector is typically characterized by an emphasis on the bottom line. At companies like Boeing, Kodak, and Microsoft, mathematicians report that an appreciation for deadlines, a multiplicity of problems to solve, and the tangible impact of their work on a final product makes this sector personally rewarding.

Business

Companies whose primary function is service-oriented, like consulting or financial analysis, fall into this sector. Business depends on profits and thus offers a mathematician a variety of problems at a challenging pace; however, its profitability is proportional to client satisfaction and therefore might require additional capabilities from its employees -- strong interpersonal and communication skills foremost among them.

Government

The federal gov ernment includes organizations as diverse as the national labs, the Federal Reserve, and the U.S. Navy, each with disparate cultures. Despite variance in specific agencies, government work in general is distinguished by the necessity of operating within certain guidelines and procedures. The pace is often quick and the problems challenging. Salary, benefits, and promotions are likely to be dispensed in accordance with regulations.

Titles

A title is like the suit (or jeans, as the case may be) you wear to work. Underneath it all, you're still you. In the nonacademic world, mathematicians wear many different titles. They may be called Analysis Lead, Consultant, Design Engineer, Member of Technical Staff, or Section Head, but they function as mathematicians. Sample titles include:

Actuarial Scientist
Actuary Assistant
Air Pollution Meteorologist
Architect
Associate
Associate Consultant
Biostatistician
Business Analyst
CAD Engineer
Consultant
Contractor / Programmer
Cost Estimator
Cryptologic Mathematician
Customer Support Manager
Data Processing Consultant
Data Processing Consultant
Database Specialist
Developer
Field Inventory Asset Specialist
Financial Engineer
Intelligence Application Officer
Management Consultant
Manager of Financial Analysis
Market Strategy Analyst
Mathematical Software Programmer / Analyst
Mathematical Statistician
Mathematician Media Specialist
Member of Technical Staff
Network Analyst
Operations Research Analyst
Performance Analyst
Pre-Sales Consultant
Programmer
Project Scientist
Purchasing Agent
Research Assistant
Research Associate
Research Mathematician
Research Mathematician
Research Scientist
Research Statistician
Researcher / Software Design
Section Supervisor

Senior Consultant
Senior Engineer
Senior Structure Engineer
Software Analyst
Software Engineering Manager
Staff Mathematician
Statistician
Support Scientist
Systems Analyst
Systems Engineer
Technical Consultant
Vice President

Motivation

You may be surprised to find that your reasons for studying mathematics -- because it is your best subject, because you find the subject content interesting, because it is challenging, etc. -- are motivations shared by those in the field.

Specialties

Some topics are more prevalent than others. Mathematical specialties include Modeling and Simulation, Numerical Methods/Analysis, Statistics, Probability, Engineering Analysis / Differential Equations, Operation Research, and Discrete Mathematics. This graph displays the percentage of mathematicians surveyed with Master's degrees or Ph.D.'s who mentioned mathematical specialties as a primary technical requirement of their positions; multiple mentions were allowed.

Job Hunting Advice

Your career will grow in unforeseen directions, but the first moves are important. Before you can build the groundwork for a satisfying career you must understand the lay of the land. You need to research employers who intersect with your skills and interests, determine which occupations are attractive, and learn what starting a job is like.

Researching Jobs

Employers look for specific qualities in job candidates -- you should be just as selective in evaluating them. Resources in your career placement office, the library, and on the Internet will help you identify interesting employers. Research that list in depth to find the employment situation that will fit you best. In addition to the type of employment offered and how you will be compensated for your work, you should consider the size of the employer, its culture, and its location.

Size

A company's size will impact your job satisfaction. Large organizations tend to offer stronger benefits and professional development opportunities, but also come with a certain amount of bureaucracy. You would probably have less opportunity to be recognized for individual contributions, but greater resources to draw on for your work. Smaller employers may provide more client contact and greater exposure to upper management, but your individual successes and failures are more visible. There is less of a chance that you would be able to transfer to other assignments within the organization, but you might develop a more diverse range of skills.

Culture
The personality of an organization is difficult to pin down from the outside. You will want to understand how the employer treats its people, what kind of formalities exist between employees and their supervisors, how different departments are valued, whether the organization sponsors sports or other after-work activities, how people dress, if there is a structured mentoring program, etc.

Location
Employers are located across the country, so you should evaluate the role geography plays in your plans. When contemplating a move to a new location, consider the cost of living in that city as well as its demographic make-up, access to cultural and recreational activities, the quality of the local school system, its climate, and your own feelings about being far from family and friends.

Occupations
Mathematicians develop theories to predict traffic patterns on the World Wide Web, create models to optimize routing at call centers, chart financial markets, and counsel corporations on health benefits. They are designing flight simulators for Boeing, managing development teams at Intel, and forecasting the economy at the Federal Reserve.

Accounting and Finance
Occupations in this area include financial analysis and engineering, the preparation and verification of financial reports and taxes, and work with systems that provide information about financial institutions and markets. People in this field construct trading models for Wall Street firms, design mathematical tools to assess risk, and forecast cost estimates for government projects.

Computer Programming
Computer programmers write and maintain code that computers must execute to perform their functions. Programmers often follow descriptions prepared by systems analysts who have carefully studied the task that the computer system is going to perform. The code may be used to solve a very specific problem on one project or it may become part of a library of codes used by many to solve similar problems.

Sales and Marketing
Occupations in this area are driven by research related to the promotion of products or services. Market researchers design surveys, perform analysis on the data from surveys, and report on their results and recommendations. An individual in sales helps customers determine what resources they need to meet their requirements.

Management and Related Positions
Managers plan, coordinate and direct the many activities required to bring a project to completion. This includes research, development, design, production, and computer-related activities. They determine scientific and technical goals within broad outlines provided by top management; they hire, assign, and supervise staff, as well as forecast costs and manage budgets.

Actuarial
Actuaries build and run mathematical models, and collect and analyze data to answer risk-based questions by putting a financial value on future events. They work for insurance companies, investment firms, employee benefits consulting firms, and other types of companies that need to quantify financial risks.

Computer Systems Analysis
Analysts implement the means for computer technology to meet the individual needs of a product or organization. They study scientific and engineering data processing problems and design new solutions. They make sure an organization's computer code meets certain specifications for speed and efficiency.

Engineering
Engineers apply the theories and principles of science and mathematics to the economic solution of practical technical problems. They design machinery, products, systems, and processes for efficient and economical performance.

Statistics
Statistics is the collection, analysis, and presentation of numerical data. Statisticians design surveys and experiments, then collect the resulting information or data. In some companies statisticians help other scientists design their experiments and train managers how to use statistical tools in decision making.

Mathematics / Operations Research / Modeling
Mathematicians solve economic, scientific, engineering, and business problems using mathematical knowledge and computational tools. Operations Research (OR) analysts help organizations coordinate and operate in the most efficient manner by applying scientific methods and mathematical principles to organizational problems. Modeling enables complex systems to be understood and simulated.

Other Computer Science
Computer scientists solve problems related to the design of computer hardware and networks. They help determine the specifications new systems should meet and test new computer products.

Other Sciences / Health / Social Services
There are other occupations within the sciences where an education in mathematics may be applied. Included in this group are those working in meteorology, pharmacy, and biochemistry.

Other Technical Areas
Many occupations require technical skills that a degree in mathematics provides. Included in this group are land surveyors, draftsmen, and electrical technicians.

Other Occupations
There are other occupations outside the sciences that hire graduates of the mathematical sciences. Included in this group are occupations such as law clerk, air traffic control and legal assistant.

Beginning

Transitions are always unpredictable, but the start of your first job is perhaps even more so. Many employees receive formal training or become part of a mentoring or coaching program when they start a new job. Other organizations simply introduce new hires to the people they will be working with and the group takes the responsibility of explaining the job and getting new members started. In any case you should be prepared to learn the ropes and become a fully functioning member of the team as soon as possible.

Development

You, not your employer, are ultimately responsible for your professional life. You will need to look actively for opportunities to increase your personal satisfaction and nurture your career. Within your organization try to identify plum assignments, possible leadership roles, projects that will force you to stretch your wings, and coworkers from whom you can learn new skills. Graduate course work, professional societies, a network of mathematicians at other organizations, and a devotion to life outside of the office will also help develop your career.

Dual Tracks

Some organizations offer distinct career paths for their employees. After a certain number of years you may choose to move into a management track, enabling you to administer and supervise technical groups, or you can remain an individual contributor and concentrate solely on mathematics. Other employers do not provide explicit tracks, and mathematicians take on management responsibilities as they are willing or able.

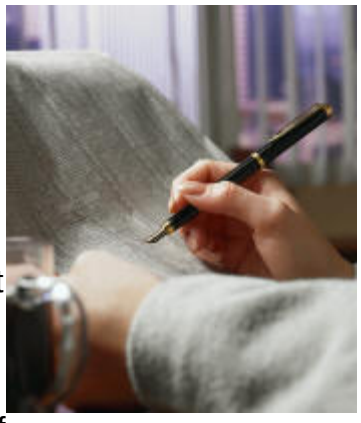
Continuing Education

Although you may decide to go back to school to acquire another degree, continuing education is not limited to the classroom. Attending industry conferences, reading technical publications and journals, as well as networking with other professionals will enable you to acquire and develop the skills you need. Your employer may sponsor educational opportunities, either by off-setting some of the costs associated with formal education programs and travel to conferences or by providing seminars and training in-house.

Life Outside

Balance between your professional and personal life is a necessity; you cannot perform at your peak as a mathematician unless you have a firm commitment to life outside your work. Spending time with your family, working out, going to a concert, hanging out with friends, spending a day in the mountains -- these are just as important to managing your career as industry conferences and mentoring opportunities. Concentrate on becoming fulfilled as a person, and your career will take care of itself.

Career Path Forecast

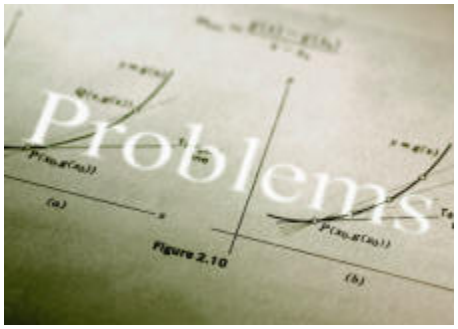


According to the U.S. Department of Labor, Bureau of Labor Statistics, employment of mathematicians is expected to decline through 2014, reflecting the reduction in the number of jobs with the title "mathematician." As a result, competition is expected to be keen for the limited number of jobs as mathematicians. Master's and Ph.D. degree holders with a strong background in mathematics and a related discipline, such as engineering or computer science, should have the best opportunities. Many of these workers have job titles that reflect their occupation, such as systems analyst, rather than the title mathematician, reflecting their primary educational background.

Advancements in technology usually lead to expanding applications of mathematics, and more workers with knowledge of mathematics will be required in the future. However, jobs in industry and government often require advanced knowledge of related scientific disciplines in addition to mathematics. The most common fields in which mathematicians study and find work are computer science and software development, physics, engineering, and operations research. More mathematicians also are becoming involved in financial analysis. Mathematicians must compete for jobs, however, with people who have degrees in these other disciplines. The most successful jobseekers will be able to apply mathematical theory to real-world problems and will possess good communication, teamwork, and computer skills.

Private industry jobs require at least a master's degree in mathematics or in a related field. Bachelor's degree holders in mathematics usually are not qualified for most jobs, and many seek advanced degrees in mathematics or a related discipline. However, bachelor's degree holders who meet state certification requirements may become primary or secondary school mathematics teachers. Holders of a master's degree in mathematics will face very strong competition for jobs in theoretical research. Because the number of Ph.D. degrees awarded in mathematics continues to exceed the number of university positions available, many of these graduates will need to find employment in industry and government.

Professional Organizations



Professional societies provide an excellent means of keeping current and in touch with other professionals in the field. These groups can play a key role in your development and keep you abreast of what is happening in your field. Associations promote the interests of their members and provide a network of contacts that can help you find jobs and move your career forward. They can offer a variety of services including job referral services, continuing education courses, insurance, travel benefits, periodicals, and meeting and conference

opportunities. The following is a partial list of professional associations serving mathematicians and employers. A broader list of professional associations is also available at http://www.careercornerstone.org/assoc.htm.

American Mathematical Society (www.ams.org)

The American Mathematical Society was created to further mathematical research and scholarship. Founded in 1888, it now has approximately 30,000 members, including mathematicians throughout the United States and around the world. It continues to fulfill its mission with programs that promote mathematical research, increase the awareness of its value to society, and foster excellence in mathematics education.

Association for Women in Mathematics (www.awm-math.org)

The Association for Women in Mathematics is a non-profit organization founded in 1971 with a continuing goal to encourage women in the mathematical sciences. The organization sponsors a variety of programs and awards to encourage girls and women in the mathematical sciences. Among these is the Noether Lectures, which honors women who have made fundamental and sustained contributions to the mathematical sciences.

Canadian Mathematical Society (http://camel.math.ca/)

The Canadian Mathematical Society (CMS) was originally conceived in June 1945 as the Canadian Mathematical Congress. The goal of the Canadian Mathematical Society is to promote and advance the discovery, learning and application of mathematics.

European Mathematical Society (www.emis.de)

The European Mathematical Society (EMS) was founded in 1990 to further the development of all aspects of mathematics in the countries of Europe. In particular, the Society aims to promote research in mathematics and its applications. It will assist and advise on problems of mathematical education.

European Women in Mathematics (www.math.helsinki.fi/EWM/)

EWM is an affiliation for women bound by a common interest in the position of women in mathematics. The organization was founded in 1986 and has its office in Helsinki, Finland.

Mathematical Association of America (www.maa.org)

The Mathematical Association of America is the largest professional society of college and university mathematics teachers in the world. Today MAA's 30,000 members include college and university faculty, two-year college faculty, high school teachers, government and corporate workers, graduate school faculty, research mathematicians, and graduate and undergraduate students.

National Association of Mathematicians (www.math.buffalo.edu/mad/NAM)

The National Association of Mathematicians is a non-profit professional organization which has always had as its main objectives the promotion of excellence in the mathematical sciences and the promotion of the mathematical development of underrepresented American minorities. It also aims to address the issue of the serious under-representation of minorities in the workforce of mathematical scientists.

Society for Industrial and Applied Mathematics (www.siam.org)

The Society for Industrial and Applied Mathematics (SIAM) began in 1951 and now exists to ensure the strongest interactions between mathematics and other scientific and technological communities through membership activities, publication of journals and books, and conferences.