Can I Get A Job?

Carl Meyer

Department of Mathematics
North Carolina State University
Raleigh, NC

Colorado State University
Fort Collins, Colorado
November 1, 2007

Careers

- **Teaching**

Careers

— **Teaching**

— **Private Industry & Business**

Careers

— **Teaching**

— **Private Industry & Business**

— **Government Labs & Agencies**

Different Flavors

Theoretical Math

Applied Math

Different Flavors

Theoretical Math

— Advance mathematical knowledge by discovering new principles and relations

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··· engineer ··· computer scientist ··· physicist ··· economist ··· statistician ··· actuary ··· operations research analyst ··· financial consultant ···

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$\cdots$ engineer $\cdots$ computer scientist $\cdots$ physicist $\cdots$ economist $\cdots$ statistician $\cdots$ actuary $\cdots$ operations research analyst $\cdots$ financial consultant $\cdots$

— Almost always requires collaboration with others from diverse backgrounds

$\cdots$ Almost never works in isolation

Recent Employers For NC State Math Graduates

— Aetna Life Insurance

— American Management Systems

— Analog Devices

— AON

— AT&T

— Bank of America

— Bankers Insurance Group

— BlueCross/BlueShield

— Branch Bank&Trust

— Capital One

— Census Bureau (US)

— CIA

— Commercial Software

— Dataflow Companies, Inc.

— Data General

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- EDS
- Federal Reserve Board
- Fidelity Investments
- First Union
- General Electric
- Glaxo Wellcome
- Godwin, Booke & Dickenson
- Google
- Guardsmark Inc.
- Hewlett Packard
- IBM
- Impact Technology
- ING
- Intelligent Information Systems
- Interisk
- Itex

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- Itex

- Liberty Mutual
- Lucent Technologies
- Marketech
- MCI
- Mercer
- Memorex-Telex
- MetLife Insurance
- Micromass Comm, Inc.
- MicroCraft Corp
- Milliken
- MuniAuctions
- NCS Pearson
- Naval Surface Warfare Ctr
- NORTEL
- National Security Agency
- Nationwide
- Peoples Bank
- PPD
- Procter & Gamble

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- Interisk
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- Liberty Mutual
- Lucent Technologies
- Marketech
- MCI
- Mercer
- Memorex-Telex
- MetLife Insurance
- Micromass Comm, Inc.
- MicroCraft Corp
- Milliken
- MuniAuctions
- NCS Pearson
- Naval Surface Warfare Ctr
- NORTEL
- National Security Agency
- Nationwide
- Peoples Bank
- PPD
- Procter & Gamble

- Progress Energy
- Raleigh Federal
- Random Programming
- Royal Insurance
- RTI
- SAS
- Sedgwick James Insurance
- Sprint
- State Farm Insurance
- Towers-Perrin
- TRW
- Twinstar Semiconductor, Inc.
- Unisys
- U.S. Air Force
- U.S. Army
- U.S. Navy
- Wachovia
- Western Auto

Starting Salaries

Average Offer to NC State Undergraduate Math Majors

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All are for non-teaching positions

Sample Job Titles

Analysts

— Policy Analyst

— Accounting Analyst

— Operations Research Analyst

— Project Analyst

— Program Analyst

— Systems Analyst

— Business Analyst

— Economics Analyst

— Global Manufacturing Analyst

— Operations Research Analyst

— Principal Analyst

Technical Management

— Consultant

— Cryptologist

— Marketing Associate

— Research Associate

— Systems Level Designer

— Contracts Specialist

— Finance Associate

— Program Manager

— Relations Manager

— Test Technician

— Product Marketing Manager

— Quality and Customer Satisfaction Consultant

— Actuary

Engineering

— Product Quality Engineer

— Quality Assurance Engineer

— Software Engineer

Profiles

Julia S. Kimbell

Applied Mathematician
[Chemical Industry Institute of Toxicology](#)

Applications from Julia Kimbell, [Chemical Industry Institute of Toxicology](#) Applied Mathematician

Application	Key Mathematics Areas
Airflow patterns in the respiratory tract	computational geometry, three-dimensional grid generation, numerical solution of Navier-Stokes equations, visualization of numerical results
Regional uptake of inhaled materials by respiratory tract	numerical solution of transport equations, visualization of results
Transport and disposition of chemicals through the body	numerical solution of systems of ODEs and PDEs, reaction-diffusion equations, parameter estimation techniques, Monte Carlo simulations
Onset and progression of cancer and pre-malignant cells	birth-death processes, Markov chains, parameter estimation techniques, probability and statistics
Molecular and cellular mechanisms of toxicity	pattern recognition, numerical solution of systems of ODEs and PDEs

- Matthew Windham
- North Carolina State University
- Data Analytics Specialist
- DeticaDFI
- Defense/Intel Industry

What Matthew Does:

- I perform data cleansing, data analysis, and data mining for a variety of defense/intelligence clients.
- 3.5 years (total experience)
- Prerequisite jobs held before this job – Experience performing data analysis and programming for a defense contractor.

On the Job :
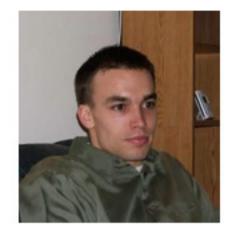
- As stated above, my clients need me to perform the cleansing, analysis, and mining of data in order to solve their problems. However, those are not the only things that I do in my job. On a daily basis, I have to communicate results to those who don't know anything about my subject matter. Therefore, in order for me to be effective at my job, it is imperative for me to be an effective communicator in both written and spoken forms.
- Topics Used: Calculus, Differential Equations, Numerical Analysis, Linear Algebra, Applied Statistics, and Probability.
- Skills Used: C++, Matlab, SAS, Perl
- My past experience includes improving a mathematical model for a ballistic missile moving at supersonic/hypersonic speeds, performing tradeoff analysis for various ballistic missile designs, analyzing countermeasures for Weapons of Mass Destruction, improving a model of the Navy's "Force Structure", and participating in 'man-in-the-loop' war-game simulations.

Background:

- B.S. in Applied Mathematics, NC State University ('04)
- Part-time student: MS in Mathematics and Statistics at Georgetown University (expected – '09)
- Previous work experience:

    - Systems Planning and Analysis Inc., Analyst
    - United States Census Bureau, Mathematical Statistician - Intern

Advice:

- For High School Students: Try to take Calculus before graduating from high school. If you already have Calculus under your belt, then try taking Differential Equations, Linear Algebra, Statistics, or some other college-level math/stats courses. Taking an extra physical science course would also be beneficial if you can't get the above math/stats courses. I would also recommend trying to get a programming language (C++/ Java), if that is available at your school. The more you can get done while in high school, the easier your transition to college will be.
- For College Students: Talk to your advisor about courses that would not only give you a better idea of what mathematics is really like, but will also count towards your current degree choice (this will always be the case if you have any free electives left).

- Derek Culp
- North Carolina State University (MS)
- Consultant
- SAS Institute Inc.
- Risk Management, Computer Software Consulting

What Derek Does :

- Demo, implement, and support credit risk management software solutions, primarily for major financial institutions such as large banks
- Began in March 2005
- Prerequisite jobs held before this job - Interned with same company for one year as a student and gained familiarity with our risk software products

On The Job :

- More details of the job This job involves providing our clients and potential clients with the tools they need to manage to manage their credit risk. For example, many banks would like to meet regulatory requirements such as those outlined in the "Basel II Accord." My job is to demonstrate that our software will allow them to effectively meet those requirements and to help them get up-and-running using our software with their masses of portfolio data.
- Understanding and interpreting statistical results, explaining mathematical computations implemented by software, writing computer programs to value financial derivatives.
- Designed sample investment portfolios; translated software documentation from Italian to English.

Background:

- Liberty University: B.S. in Mathematics, 2002, NC State University: Master of Financial Mathematics, 2004.
- Math skills used for the job (mentioning specific courses if applicable) Calculus, linear algebra, probability & statistics, operations research, numerical analysis, differential equations.
- Programming, broad understanding in computer science, presentation skills, finance, econometrics.
- Any other relevant details about the path to the job Interning with the company helped in attaining a full-time position.

Advice:

- Don't listen to that "math majors can only become teachers" baloney. While teaching is a great profession, there are many other career possibilities for those who are mathematically skilled. It's a good idea to complement your math coursework with other related subjects/fields. Some examples include finance, economics, computer science, and/or statistics. If you like math, being a math major is a good, safe bet. Even if you don't end up proving theorems and evaluating integrals for the rest of your life, the analytical skills you gain should give you a good foundation for your postgraduate pursuits.

Sara Ford

B.S., Mathematics and Computer Science, Mississippi State University, 2001

Software Design Engineer in Test, Microsoft Corporation

You can visit Sara's workblog at:
http://blogs.msdn.com/saraford

I am a Software Design Engineer in Test for the Microsoft Corporation, working on the Visual Studio Core Team. Visual Studio is a development environment that allows everyone from the 'Introduction to Computer Science' student to the professional software engineer to write programs and develop software. I graduated from Mississippi State University with a double major in Computer Science and Mathematics and a minor in French. Yet, I put all the emphasis on my Mathematics degree during my interview.

Mathematics teaches you logical thinking and problem solving skills – skills all employers look for in new candidates. While interviewing at Microsoft, I introduced myself as a problem solver. What made me so special, in comparison to all the other applicants? My answer was simple, "I have a mathematics degree."

Mathematics builds the foundation for learning how to problem solve. A chemical engineer is a chemical engineer, a biologist is a biologist, but a mathematician can learn how to become either one. I never took a college course on how to test software, and yet I was hired as a software tester. The recruiter understood that someone with a Mathematics background has the discipline and the analytical way of thinking it takes to test new types of software.

One of my job descriptions is to automate testing. Automation is code that simulates what a user might experience when interacting with a program and records any unexpected or undesired results as failures, more commonly known as bugs. In this ever-changing world, the issue of figuring out how to best test or automate these new technologies is never solved. Testers always search for better methods and approaches to testing software which require less time and effort and find the most failures or bugs. Having a strong background in mathematics is essential to creating these new testing methodologies, since this is problem solving in its purest form.

The best thing I did for my career was declaring a double-major in mathematics and computer science.

John Parkinson

Actuary, Vice President, The Savitz Organization
BA Mathematics, BA Economics, East Stroudsburg University

John's Background

The fear of math is not uncommon, even for math majors. John was an economics major when he discovered his mathematics interest and ability. "I came to learn that the foundation of some key economic principles was rooted in the application of calculus to those principles." John became fascinated and wanted to learn more. He ended up taking more mathematics courses, "this after fearing math for most of my life." In addition to economics, philosophy contributed to John's interest in math. "I noticed how many of the great philosophers were mathematicians. The two subjects have an interesting and natural connection."

In college, John found a subject that specifically sparked his interest -- Econometrics. "This course really influenced my decision to pursue a career in the field of applied mathematics. I found applying regression analysis techniques to economic problems and theory to try to determine explanatory variables and forecasting to be truly interesting." From there, the actuarial profession was a natural fit. "Embarrassing as it is to admit, I wasn't very informed about the actuarial profession in college. I stumbled onto the profession at a job fair my senior year and was quickly intrigued." After passing the rigorous professional exams, John entered "a field where I would deal with assessing the financial and economic impact of contingent events."

The Career

John is currently a consulting actuary for an employee benefits company. "We help companies determine their plan's financial liabilities." Determining these liabilities is dependent on quantifying expectations of future events, including how long the employee will live, when and how the employee will leave employment (termination, disability), how much money the employee will make during his/her career.

The future of financial mathematics careers is a bright one. John told us that while current actuarial science takes a deterministic approach to valuing financial liabilities, in the future, stochastic modeling should become more prevalent. "As financial analysis and modeling becomes more complex, the opportunities for mathematicians in business and consulting should increase greatly."

John recommends that students spend some time investigating what mathematicians are doing in other fields—but start early!

Skills Required for this position
(5 = most important; 0-1 hardly at all)

Computation   5

Communication   4

Computer   4

Math   3

Programming   3

Teamwork   3

Statistics   1

Engineering   0

Leslie Lahl

Developmental Editor, Mathematics, Brooks/Cole Publishers
BA, MA in Mathematics, Cleveland State University

Leslie's Background

Leslie taught at the undergraduate level prior to her career in publishing. When asked what led her to her current job, she said, "I know that a great book is priceless to a student. Of course having a good teacher is a plus too!" Leslie said that it was her first calculus course, and later a course in Abstract Algebra, that spawned her lasting interest in mathematics. "The subjects seemed so beautiful. They were interesting and challenging. I think it helped that I got to use two exceptional books for these courses. They were clearly written for the student: friendly but not condescending, concise but not terse, filled with illustrative examples that don't 'give away the store' but guide the user through the challenges of the material. These books made a huge difference. For me, they provided stepping-stones to go beyond the coursework assigned in each class. I started reading other math books on my own, and I went on from there."

The Career

Developmental Editors perform many of the duties that make a book ready for production. They shepherd the project through the editorial process, working closely with the author. Leslie told us that "As a developmental editor for math text books, I read manuscripts and use the skills associated with both an English major and a mathematician. I look at content on two levels: Does the material make sense from a mathematics perspective? Does it also clearly express the concept?" Leslie also works with reviewers during the editorial process. "For example, I send out the manuscript with a questionnaire that I develop and the reviewers are asked to answer questions regarding content and pedagogy. Their feedback is invaluable."

Leslie's math background is important during this review process. "I consider my background in mathematics to be a huge asset to my position. I am able to have discussions based on the subject matter. I also like this material and I'm genuinely interested in it. I think it really makes a difference that I can share this interest with the author and reviewers."

Leslie feels that the primary responsibilities of a D.E. won't change significantly, even with the advent of things like "books on demand" and other emerging electronic formats. "The actual format of the book may vary, but we still need to develop the content. I think that the way I do my job will change, naturally, with advancements in technology. I perform a large portion of my job using e-mail as communication, sending out things electronically. The speed of communication has accelerated the rate at which a developmental editor is expected to produce the end product. I have to stay on top of changes in publishing software and other PC developments." We asked Leslie for some general advice for students and other emerging mathematicians, "As early as you can, start talking to your professors about what you can do with a math degree. Get internships. Foster an appreciation of other subjects as well. A good general background comes into play when interviewing for a job, and performing that job. You might be a brilliant mathematician, but can you express your ideas clearly and effectively?"

Other jobs with related responsibilities: Acquisitions Editor, Book Editor for elementary and secondary mathematics textbooks, Educational Software Developer

Skills required for this position:
(5 = most important; 0-1 hardly at all)

Skill	Rating
Mathematics	5
Communication	5
Statistics	3
Business	3
Computer know-kow	4
Engineering	1
Computer Science	1

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— **Ability to work & develop ideas in team settings**

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— Ability to work & develop ideas in team settings

— **Ability to communicate well at different levels**

Common Job Requirements

— Broad knowledge of mathematics

— Knowledge of applications of mathematics

— Possess computational & computer skills

— Ability to learn new technical & abstract concepts

— Ability to reason and solve problems

— Ability to work & develop ideas in team settings

— Ability to communicate well at different levels

— **Interests beyond mathematics**

SIAM's Emerging Areas

Computational Biology and Genomics

— Genetic interactions

— Need for sophisticated mathematical and computational tools

— Career opportunities in technology, medicine, and drug development and design

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— Reveal and explain patterns in large data sets

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Materials

— Metallic alloys, composites, liquid crystals, biological materials, and thin films

— Design and analysis of materials depends on mathematical models and computational tools

— Career opportunities in manufacturing, aerospace, engineering, electronics, and biology

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Computer Animation and Digital Imaging

— Combines mathematics, computer science, fine art, classical animation, physics, biomechanics, and anatomy

— Scientific computation, statistics, signal processing, linear algebra, control theory, and computational geometry

— Career opportunities in entertainment, medical diagnostics, and fine arts (dancing, sculpture, painting)

Actuarial Science

— Solve problems involving financial risk

— Determine optimal insurance rates

— Manage & design pension plans

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Money Magazine's Top Ten Best Jobs

· · · Income · · · Working environment · · · Employment outlook
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8   Paralegal assistant

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6 Software engineer

7 Meteorologist

8 Paralegal assistant

9 Statistician

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7   Meteorologist

8   Paralegal assistant

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5   Accountant   10   Astronomer

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		7	Meteorologist
3	Financial planner	8	Paralegal assistant
4	Computer-systems analyst	9	Statistician
5	Accountant	10	Astronomer

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··· Physical demands ··· Job security ··· Stress

		6	Software engineer
2	Actuary	7	Meteorologist
3	Financial planner	8	Paralegal assistant
4	Computer-systems analyst	9	Statistician
5	Accountant	10	Astronomer

Actuarial Science

— Solve problems involving financial risk

— Determine optimal insurance rates

— Manage & design pension plans

Money Magazine's Top Ten Best Jobs

· · · Income · · · Working environment · · · Employment outlook

· · · Physical demands · · · Job security · · · Stress

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Math Intensive

Be An Actuary

What is An Act–u–ary?

Actuaries are professionals who provide expert advice and relevant solutions for business and societal problems that involve financial risk. An actuary working for an insurance company might calculate how much a company would charge for a new type of car, homeowners, or health insurance. He or she may have to figure out how much money needs to be invested in a pension fund today so that years from now, when the employees retire, there will be funds to pay them benefits.

An actuary could work in finance, marketing, manufacturing, or in the development of new products. For example, an actuary might determine how a company should invest its money based on risk and potential return.

Actuaries have diverse roles and responsibilities within their organizations. Some of these responsibilities include product development and pricing, financial advising and planning, risk management, pension plan design, implementation and funding, and asset/fund management and investment.

"Actuary" is Rated One of the Best Jobs in America!

The job "actuary" has been consistently rated as one of the top four best jobs in the U.S. by the Jobs Rated Almanac in each of its six editions. Occupations are ranked on the basis of six key criteria including environment, income, employment outlook, physical demands, security, and stress. The data comes from government sources, such as the U.S. Bureau of Labor Statistics and the U.S. Census Bureau, as well as studies from trade associations and industry groups.

In addition, a 2003 study of industry data and figures from the Bureau of Labor Statistics that was published in Money magazine ranked "Actuaries" second on a list of the "highest paying hot job opportunities." Actuaries have gained in importance and will continue to be in high demand as companies prepare for future risks, according to the study.

Actuary—One of the Best Jobs Around

The job "actuary" has been consistently rated one of the top four best jobs in the U.S. by the *Jobs Rated Almanac* for each of its six editions. All occupations are ranked on the basis of six key criteria including environment, income, employment outlook, physical demands, security and stress. In addition, *Money Magazine* recently rated "actuary" as the second top job based upon its salary and likelihood to remain in high demand for the next 10 years.

Salaries

Average starting salary	$46,000
Average salary after 5 years	$76,000
Average salary after 10 years	$120,000

Actuarial Examinations

Actuaries achieve professional status by passing a set of examinations prescribed by the Casualty Actuarial Society (CAS) or Society of Actuaries (SOA). Unlike other professions, such as law and medicine, in the actuarial profession you can earn while you learn. Actuaries receive on-the-job training while enrolled in the examination process. Employers are supportive by granting exam study time during working hours, paying exam registration fees, and awarding raises for each exam passed. However, most employers prefer to hire people who have started the series of examinations on their own and have already passed at least one or two.

Top 10 Reasons to Consider Being an Actuary

10. You enjoy continually learning.

9. You want a professional title, but don't want to be a doctor, lawyer, or accountant.

8. You want a career that is dynamic and challenging.

7. You want a career that you control because advancement is merit-based.

6. You want a career with many opportunities that will provide you with skills that are transferrable across multiple industries.

5. You want a career with superior job security through economic cycles.

4. You would like to "earn while you learn."

3. You want to be able to choose among several job offers.

2. You are self-motivated, goal oriented, and have superior math aptitude and communication skills.

1. You want a highly competitive salary and excellent benefits.

If you are interested in becoming an actuary, there are things you can do to prepare for the career while in school:

High School

- Follow a college preparatory curriculum.

- Take math classes every year.

- Take advantage of advanced courses, such as calculus.

- Enroll in computer science courses to develop your computer skills.

- Explore colleges and universities that offer actuarial science curriculum.

College

- Aim for a broad-based education that concentrates on business and mathematics.

- A degree in business, math, or actuarial science is helpful, but don't rule out a major in other subjects like economics, liberal arts, or finance. A double major is not necessary, but might be a plus.

- Whatever your major, it is essential to have a strong mathematical background. Your curriculum should include math courses, such as calculus, probability, statistics, and any courses your school offers in actuarial science.

- Business courses, such as finance, accounting, management, economics, and computer science, will increase your career options.

- Courses in English, speech, and business writing will help you acquire the communication skills that actuaries need.

- Because actuaries are involved in a growing variety of social and political issues, courses in the social sciences and humanities will help round out your capabilities.
As their careers move beyond the traditional insurance industry boundaries, actuaries are finding that a versatile storehouse of knowledge pays off.

What all actuaries have in common is a passion for problem solving and an appetite for knowledge. Many insurance companies and consulting firms have actuaries as presidents and CEOs. Some actuaries work as individual consultants, while others teach, work for the government, or invent jobs for themselves.

Did you know that all newspaper baseball box scores are provided by a firm started by an actuary?

Students with strong analytical and math skills should visit the only Web site devoted to actuarial career information — *www.BeAnActuary.org*. The site offers a wealth of information including sample actuarial exams, a streaming video about the profession, profiles of actuaries, and a list of employers offering actuarial internships and training programs. Visit *www.BeAnActuary.org* today!

The August 2003 issue of *Money* Magazine ranked Actuary as the 2nd highest paying job that is currently in demand and will remain in demand for the next five to 10 years.
(Source: Challenger Gray & Christmas)

www.BeAnActuary.org

Be An Actuary

SOCIETY OF ACTUARIES

CASUALTY ACTUARIAL SOCIETY

Preparation

Acquire breadth — math + science + computing

Preparation

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Learn & appreciate contemporary applications beyond the traditional

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Focus on reasoning & logic — go beyond symbol manipulation

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— Corporate summer internships

Preparation

Acquire breadth — math + science + computing

Learn & appreciate contemporary applications beyond the traditional

Focus on reasoning & logic — go beyond symbol manipulation

Become a problem solver — not a template follower

Prepare to work productively with others — practice collaboration

Learn how to communicate effectively — write & speak math

Remain engaged — participate in summer programs

— Corporate summer internships

— Summer workshops & math camps

Challenging Summer Mathematics Programs For High School Students

Summer, 2007

Teachers and Counselors: Please help with distribution of this document to talented mathematics students and their parents.

Quick links to all programs and future versions of this booklet can be found on the AMS web site at www.ams.org/employment/mathcamps.html

Please note: It is suggested that students submit their applications **well in advance of the application deadlines.**

All Girls/All Math

University of Nebraska, Lincoln, NE

Contact: *Professor Gwendolen Hines, Director*

Mailing address: *All Girls/All Math Summer Camp for High School Girls*
UNL Center for Science, Math and Computer Education
203 Avery Hall
Lincoln, NE 68588-0130

Phone: *402-472-7220*

Fax: *402-472-8466*

e-mail: *agam@math.unl.edu*

web addres: *http://www.math.unl.edu/pi/outreach/agam*

The All Girls/All Math summer camp at the University of Nebraska is a week long program for high school girls from across the country. Campers will attend a class in Codes three hours every morning. In this class, students wull learn basic number theory and applications to cryptography. In the afternoon, students will attend mini-courses in such areas as Bioinformatics, Knot Theory, Aerodynamics, and Fractal Geometry. The camp offers girls a unique opportunity to explore sophisticated mathematics in an all-girl environment and to meet other girls and women who have a love and talent for mathematics. With only 28 campers, we have a low camper-staff ratio and the staff is experienced and enthusiastic (and all-girl). This is the 11th year that we have offered the camp and previous campers have found their experience very rewarding. Said one, "It was the best week of my life!"

During the camp, there will also be some opportunity to explore other career possibilities. A scientist from the National Security Agency will give a presentation to the campers about life and work at the NSA. The camp also offers recreational evening activities and opportunities to build life long friendships.

Girls will spend the week in a university dormitory with a counselor who is also a math graduate student, and they will have meals in the dormitory cafeteria. The cost for the camp is $250 including room and board ($125 for Nebraska students). Scholarships are available. For more information or an application form, contact agam@math.unl.edu or go to our website at:
http://www.math.unl.edu/pi/outreach/agam. Application deadline is May 15, 2007.

AwesomeMath Summer Program

University of Texas at Dallas

Contact: *Dr. Titu Andreescu*

Mailing address:
AwesomeMath
c/o Dr. Titu Andreescu
The University of Texas at Dallas
Science/Mathematics Education Department FN 33
2601 N. Floyd Road
Richardson, TX 75083

Phone: *214-549-6146*

Fax: *972-542-8039*

e-mail: *titu@awesomemath.org*

web addres: *http://www.awesomemath.org/*

AwesomeMath Summer Program is a three-week residential summer camp for mathematically gifted students from around the globe. It provides students the opportunity to hone their problem solving skills and further their mathematical education in general. Our students engage in meaningful problem solving activities and explore in detail areas in advanced mathematics. The high quality instruction is provided by renowned lecturers and Olympiad coaches, such as: Dr. Titu Andreescu - US IMO Team Leader (1995-2002), Director, MAA American Mathematics Competitions (AMC) at University of Nebraska-Lincoln (UNL) (1998-2003), Director, Mathematical Olympiad Summer Program (MOSP) (1995-2002), Coach of the US IMO Team (1993-present); and Dr. Zuming Feng - US IMO Team Leader (2003-present), US IMO Deputy Team Leader (2000-2002), Academic Director of MOSP (2003-present), Coach of the US IMO Team (1997-present).

Students also have the opportunity to learn from the best former IMO medalists and USAMO participants by interacting daily with our talented mentors, such as Zac Cox (USAMO qualifier 2001-2004), Oleg Golberg (IMO Gold medalist 2002-2004), Anders Kaseorg (IMO Gold medalist 2002, 2003), Thomas Mildorf (IMO Gold medalist 2005), Charles Chen (US IMO Team alternate 2005).

AMSP is not an "intense Olympiad training." Instead, we have strong problem-solving courses that fit the age and common interests of youngsters. We make what we feel is an important distinction: we do lots of math for the sake of math. Through this pursuit, we are confident that our students' performance on AMC and Olympiad-style contests will improve significantly. Students interested in applying for our program should visit our website at www.awesomemath.org

Colby College,
Waterville. ME

Contact: *Mira Bernstein, Executive Director*

Mailing address: *129 Hancock Street*
Cambridge, MA 02139

Phone: *617-812-6339*

Fax: *617-812-6339*

e-mail: *mc-info@mathcamp.org*

web addres: *http://www.mathcamp.org*

Canada/ USA Mathcamp is a five-week-long summer program for 110 mathematically talented students. Mathcamp 2007 will take place from July 8 to August 12, at Colby College in Waterville, Maine. Students from Canada, USA and around the world, who are between 14 and 18 years old, are invited to apply; exceptional 13-year-olds will be considered as well.

Unlike most academic camps, Mathcamp does not have a set curriculum or even a list of required activities. In the words of one student, the camp's design "helps convey the idea that math can be almost anything that you want it to be". We encourage our faculty to teach what they are most passionate about, and then we let the students choose what they are most interested in learning. Class topics in the last two years have included topology, voting theory, theoretical computer science, number theory, fluid dynamics, information theory, probability, cryptography, complex analysis, mathematical logic, problem-solving ... the list goes on and on. Classes vary widely in duration, level, and format, but all are interactive, with the students actively engaged in the process of discovery. In addition to classes, students have the option of attending lectures by distinguished visiting researchers, doing a research project and participating in problem-solving competitions.

With five or more different mathematical activities offered in any given hour, choosing just one can be tough. With the guidance of an academic advisor, each student is challenged to design a program of study reflecting his or her personal interests and abilities. Some students decide to devote most of their time to a particular class or project, while others seek a broader perspective on the various branches of mathematics. Some are most interested in sharpening their problem solving skills and preparing for competitions, while still others want to learn about applications of mathematics to other fields. Almost all of these students, however, say that academic freedom and the chance to take charge of their own education are the aspects of Mathcamp that they value most.

In the evenings, the same wealth of opportunities continues into the non-academic sphere, with students and staff organizing numerous activities, from soccer games and bridge tournaments, to contra dancing classes, to live action role-playing games. On weekends, the camp offers numerous field trips such as hiking, white water rafting and visits to local museums and amusement parks.

Mathcamp is committed to enabling every qualified student to attend, regardless of financial circumstances. The full camp fee, including room. board, tuition and weekend activities is $3,200. However, almost 50% of students qualify for an automatic reduction based on family income, and many students receive further financial assistance, including some full scholarships.

COSMOS - California State Summer School for Mathematics and Science

University of California (4 campuses: Davis, Irvine, Santa Cruz, San Diego)

Contact: *(see below for addresses of the four locations)*

Mailing address:

Phone: *(530) 754-7325*

Fax:

e-mail: *see below*

web addres: *http://www.ucop.edu/cosmos/*

The California State Summer School for Mathematics and Science (COSMOS) is an academic four-week residential program for talented and motivated students who are completing grades 8 - 12. The COSMOS courses address topics not traditionally taught in high schools. These courses are in the areas of astronomy, computer science, wetlands ecology, ocean science, robotics, neuroscience, cognitive science, game theory, volcanology, and more.

The California State Legislature established COSMOS with a mission to motivate the most creative minds of the new generation of prospective scientists, engineers, and mathematicians who will become leaders for California, the nation and the world. The program is designed to create a community of students who participate in an intensive academic experience delivered by distinguished educators, scientists, and researchers. The program has three locations (see below).

Students currently enrolled in grades 8-12 are eligible to apply for admission to COSMOS. To be considered for admission, students must have achieved academic excellence in science and/or mathematics.

Tuition for the summer 2007 program will be $2,200 for California students ($6,200 for out of state students). Tuition covers the costs of housing and meals and some field trips and special events.

Students may apply for need-based financial aid through the application process. Full and partial scholarships are awarded to applicants from California to help with the cost of tuition.

Please contact one of the following locations for further information.
UC Davis COSMOS
Jennifer Judkins
Program Coordinator
University of California, Davis
One Shields Avenue
Davis, CA 95616-8812
530-754-7325; cosmos@ucdavis.edu; http://cosmos.ucdavis.edu

UC Irvine COSMOS
Melina Duarte
Program Coordinator
Center for Educational Partnerships
University Research Park
5171 California Ave., Suite 150
Irvine, CA 92697-2505
949-842-6806; cosmos@uci.edu; http://www.cosmos.uci.edu/

UC San Diego COSMOS
Susan Kelly
Program Manager
University of California, San Diego
Jacobs School of Engineering
9500 Gilman Drive, MC 0429

Hampshire College Summer Studies in Mathematics (HCSSiM)

Hampshire College, Amherst, MA

Contact: *David C. Kelly, Director*

Mailing address: *Hampshire College Summer Studies in Mathematics*
Hampshire College
893 West St.
Amherst, MA 01002-3359

Phone: *413-559-5375*
Fax: *413-559-5448*
e-mail: *dkelly@hampshire.edu*
web addres: *http://www.hcssim.org*

The 33rd Hampshire College Summer Studies in Mathematics will invite approximately 45 motivated and talented students to join college professors, math majors and graduate students on our rural campus to do, share and enjoy mathematics. The entire faculty live in the program dormitory and join students for meals and recreational activities as well as for more than 8 hours of mathematics each day.

In small and lively classes and 3 hour evening problem solving seminars, 15 students guided by a professor and two assistants, will collaboratively investigate challenging and rewarding problems from number theory, group theory, combinatorics, probability, the fourth dimension, graph theory, infinity, fractals, chaos and other active branches of mathematics. Emphasis will be placed on the processes of mathematical thought - discovering patterns, formulating questions and definitions, making conjectures, and creating proofs - rather than the simple accumulation of results. By doing mathematics and living with mathematicians, participants will experience what it is like to be a mathematician.

Activities include classes for four hours each morning (M-S), evening problem seminars (M-F), daily Prime Time Theorems, visits by pure and applied mathematicians, a weekly program journal, computers, math films and field trips. Regular contacts (including regional reunions, a web site, Yellow Pig's Day reunions during the program, mailings, e-mail, videotapes, pamphlets and software) will seek to engage alumns and their teachers with serious mathematics and to maintain the spirit of the Summer Studies intellectual community.

Institute of Technology Center for Educational Programs (ITCEP)

University of Minnesota

Contact: *Marianne Pfromm, Enrichment Coordinator*

Mailing address:
Summer Institutes
IT Center for Educational Programs
University of Minnesota
4 Vincent Hall, 206 Church Street SE
Minneapolis MN 55455

Phone: *(612) 625-2861*
Fax: *(612) 625-0844*
e-mail: *itcep@math.umn.edu*
web addres: *http://www.itcep.umn.edu/sumenrich/index.php*

The Institute of Technology Center for Educational Programs (ITCEP) offers summer mathematics enrichment programs for pre-college students ages 8 - 17. The common purpose of these programs is to keep young students interested in mathematics, science and engineering, and to give them a realistic picture of what these disciplines are all about. Institutes do this in three ways: first, by immersing students in mathematics coursework, establishing the foundation for related, interactive science and engineering activities; second, by introducing students to as many positive role models and opportunities as possible; and third, by fostering friendships. Students thrive intellectually when working with other local, national, and international students who, like themselves, enjoy being challenged in math and science. Recreational and social activities are critical contributors to forming lasting friendships.

Programs will be held on the Minneapolis campus of the University of Minnesota. Residential students live in Argyle House, a privately owned building designed especially for residential academic programs. All students attend classes in Argyle House and in various facilities on the Twin Cities campus.

Students are supervised at all times. The staff-to-student ratio of 1:5 ensures close interactions between students and instructors. The instructional team is comprised of University faculty, undergraduates, and graduate students. Residential mentors live with students in Argyle House.

Within thirty days of receipt of completed application materials, ITCEP mails acceptance packets, which include needs- and merit-based scholarship information, to eligible applicants. Applications are accepted until each session is filled. Sessions have a maximum enrollment of 15 students each.

Math Contest Camp

Southwest Baptist University, Bolivar, MO

Contact: Dr. Kevin Hopkins

Mailing address:
c/o Dr. Kevin Hopkins
Mathematics Department
Southwest Baptist University
1600 University Ave.
Bolivar, MO 65613

Phone: 417-328-1675
Fax: 417-328-1658
e-mail: khopkins@sbuniv.edu
web addres: www.sbuniv.edu/~khopkins/2007mcc.html

Students will spend one week at the camp. They will work through old math contests (see http://www.sbuniv.edu/~hopkins/tournoth.html for information on contests). After working through these contests, we will talk about how to do the problems and what other kinds of problems are similar. This will develop creativity, problem solving abilities, discipline, and self-confidence as students learn new mathematics.

Problem solving (especially problem solving under pressure) is a valuable life skill and that skill is developed by math contests. Students will learn and be challenged by working with peers. Students will have opportunities to practice these skills as we will simulate some contests. Students will be working on developing these skills so they do not need to possess all these skills to come and enjoy the camp. There will be other mathematically related activities and time for recreation and social activities.

MathPath

Colorado College, Colorado Springs, CO

Contact: George R. Thomas, Executive Director

Mailing address:
MathPath
Box 416
3560 Pine Grove Avenue
Port Huron, MI 48060

Phone: 519-672-7990
Fax: 519-434-6244
e-mail: info@mathpath.org
web addres: http://www.mathpath.org

MathPath is a four-week summer program for students in the age range of 11-14 years who are profoundly gifted in mathematics. MathPath is held in answer to this question: What is the mathematics enrichment appropriate for the future mathematician who is now in middle school or junior high school? So the purpose of the program is to catch students at an early age, place them in the habit of writing mathematics properly, help them gain comfort with mathematical rigor, instill in them the tendency to ask questions on the scope of a presented result, train them to construct mathematical proofs, and give them a sense of the early history of mathematics. The minor purpose of the program is to show the heuristics of problem solving. These purposes are described in a nutshell by MathPath's slogan "Bright & Early."

A MathPath student will face several strands of interactive sessions during a four-week period and emerge with a broader and deeper understanding of mathematics. Mathematics is like an ever-widening and deepening stream which, however, being relatively narrow and less deep up to the mid 1800's, affords, with the stories comprising the history of mathematics up to that time, a solid foundation to the brightest students. A rigorous course in Hyperbolic Geometry is given to illustrate the deductive method of mathematics as well as to provide the student a bigger picture of geometry. Analytical Geometry is offered partly as a useful prerequisite to the student's university course in Algebraic Geometry and partly to illustrate the transformational approach to solving problems - that is a problem can be expressed in the frame work of another branch of mathematics, the fruitfulness of which was illustrated by the proof of Fermat's Last Theorem as a special case of a theorem outside Classical Number Theory. The fun of communicating precisely what one means in a mathematics sentence is taught in the "Writing in Mathematics" strand. Noting that the creation of mathematics proceeds from answers to questions - the conjecture and prove process - the problem solving sessions for the advanced group at MathPath deal mainly with "prove" and "show" problems that lead students to ask questions like "will this also be true" or "will this hold in general." All students are afforded opportunities to experience the mathematician's proof trajectory, viz. Intuition - Trial - Error - Speculation - Conjecture - Proof.

The sessions at MathPath are led by professors who are experts in training the young students of middle school and early high school age. Research has shown that a higher proportion of girls than boys lose interest in mathematics in middle school years; therefore, although boys and girls must equally show evidence of talent to qualify for the program, MathPath strives harder to recruit girls with the highest talent and give them training and peers.

Michigan Math and Science Scholars Summer Program

University of Michigan, Ann Arbor, MI

Contact: MMSS Program Coordinator

Mailing address: Michigan Math & Science Scholars
The University of Michigan
Department of Mathematics
530 Church Street
2082 East Hall
Ann Arbor, MI 48109-1043

Phone: 734-647-4466
Fax:
e-mail: mmss@umich.edu
web addres: http://www.math.lsa.umich.edu/mmss/

Each year, the Michigan Math & Science Scholars (MMSS) program attracts a broad spectrum of students from intensely dedicated young mathematicians to students who are open to learning more about mathematics in a congenial setting and who might be drawn into a deeper interest in the field. Our student body is diverse - all are welcome, and all find appropriate challenges. Students can attend 2 two-week mini-courses on mathematics, statistics and the gamut of physical sciences. During the summer of 2007, we will offer at least nineteen such mini-courses, nine of which will be in mathematics and statistics. Courses for the summer of 2007 include, "Codes, Ciphers and Secret Messages", "Mathematical Modeling in Biology", "Mathematics and the Internet", "Sampling, Surveys, Monte Carlo and Inference", "Combinatorial Combat", "Fortunes Made and Lost: Financial Mathematics", "Pythagorean Triples and Number Theory", "Fibonacci Numbers", and "Hex and the 4 C's".

In a typical day, students attend morning lectures and other activities with University of Michigan faculty members; and spend afternoons in computer labs, working on problem sets, and doing research with advanced graduate students. Sports and social activities under the supervision of University of Michigan graduate and undergraduate counselors (including many former Michigan Math and Science Scholars) are the main focus of evenings and weekends, although there is always a group of students to be found doing yet more mathematics after the formal learning period has ended. To encourage participants to continue developing mathematically, all students receive full computing privileges at the University of Michigan for the duration of the program.

Missouri Scholars Academy (MSA)

University of Missouri-Columbia, Columbia, MO

Contact: Ted Tarkow

Mailing address:
Associate Dean
College of Arts and Sciences
University of Missouri-Columbia
317 Lowry hall
Columbia, MO 65211

Phone: 573-882-4421

Fax: 573-882-3404

e-mail: Tarkowt@missouri.edu

web addres: http://www.moscholars.org

The Missouri Scholars Academy (MSA), founded in 1985, offers academically talented "rising high school juniors" a state-funded opportunity for immersion into rigorous study of one or more core disciplines (mathematics, communication arts, science, humanities, etc.). Students are nominated from all Missouri public and private schools, and are selected by a state wide panel of teachers, counselors and school administrators. Those selected live in a university residence hall which is transformed for the three weeks into a hub of activities that enrich the academic program and the socialization that "dorm life" can create. Full information is at www.moscholars.org.

Prospective students should contact their high school counselors for information on the school's own selection process. To be eligible for consideration, applicants need, in general, to rank in the top 0.5% of all current Missouri sophomores. The selection process results in a "pool" of highly talented and highly energetic 15/16 year olds who are frequently not challenged in ordinary high school programs and curricula.

Courses are taught by master teachers from across the state. They, in turn, get to develop curricula that they can take back to their own schools and share with their home districts. Afternoon, evening and weekend activities promote healthy and rigorous intellectual inquiry, but also allow for much creative "fun." MSA becomes, for the vast majority of its participants, a crown jewel in their high school experiences.

PROMYS

Boston University,
Boston. MA

Contact: *Glenn Stevens, Director*

Mailing address:
PROMYS
Department of Mathematics
Boston University
111 Cummington Street
Boston MA 02215

Phone: *617-353-2563*

Fax: *617-353-8100*

e-mail: *promys@math.bu.edu*

web addres: *http://www.promys.org*

PROMYS offers a lively mathematical environment in which ambitious high school students explore the creative world of mathematics. Through their intensive efforts to solve a large assortment of unusually challenging problems in number theory, the participants practice the art of mathematical discovery -- numerical exploration, formulation and critique of conjectures, and techniques of proof and generalization. More experienced participants may also study galois theory, geometry and symmetry, or combinatorics. Problem sets are accompanied by daily lectures given by research mathematicians with extensive experience in Professor Arnold Ross's long-standing Summer Mathematics Program at Ohio State University. In addition, a highly competent staff of 18 college-aged counselors live in the dormitories and are always available to discuss mathematics with students. Each participant will meet with professional mathematicians several times per week for problem-solving and open-ended explorations. Special lectures by outside speakers offer a broad view of mathematics and its role in the sciences.

PROMYS is a residential program designed for 75 ambitious high school students from grades 9 through 12. Admission decisions will be based on the following criteria: applicants' solutions to a set of challenging problems included with the application packet; teacher recommendations; high school transcripts; and student essays explaining their interest in the program.

Cost: The cost of room and board and instructional fees is $2,400. Financial aid is available. PROMYS is dedicated to the principle that no student will be unable to attend because of financial need.

PROMYS is directed by Professor Glenn Stevens. Application materials can be obtained by writing to PROMYS, Department of Mathematics, Boston University, 111 Cummington Street, Boston, MA 02215, by e-mail at *promys@math.bu.edu,* by visiting our web site at http://www.promys.org or by calling (617)353-2563 . Applications will be available in January and accepted from then until June 1, 2007.

PROTaSM (Puert Rico Opportunities for Talented Students in Mathematics)

University of Puerto Rico, Mayaguez Campus

Contact: Dr. Luis F. Caceres

Mailing address:
Mathematics Department
PO Box 9018
University of Puerto Rico, Mayaguez
Mayaguez, PR 00681

Phone: 787-832-4040 ext.3291/3848
Fax: 787-265-5454
e-mail: lcaceres@math.uprm.edu
web addres: http://ifem.math.uprm.edu/

Very few efforts are made in Puerto Rico to tend to the needs of talented students in mathematics. **PROTaSM's** main objective is to provide, for the talented students in mathematics of Puerto Rico, extracurricular activities that allow them to develop academically and allow them to learn skills and concepts that are not usually taught in their schools. These experiences contribute to help the talented students so they may exploit to a maximum their real potential. There is no doubt that these efforts will, in the long run, influence the whole student body of the Island and will help improve the level and motivation of the mathematics courses in Puerto Rico. **PROTaSM's** efforts shall be directed to all students of all levels: elementary, intermediate, and high school levels of public and private schools in Puerto Rico.

PROTaSM's activities may be divided into 4 categories: Math Olympiad, Sabbatical Academy for mathematically talented students, camps for mathematically talented students, and PROTaSM's web page. *Math Olympiad*: the main objective of these activities is to motivate students through the solution to problems to deepen their knowledge in different areas of mathematics such as geometry, combinatorics, algebra, number theory and games and strategies. The problems that usually are employed in the Olympiad allow the students to face skills and concepts that they do not see in most schools and that focus particularly on the students with greater skills and interest in mathematics. In this component of PROTaSM's, we impacted more than 3,000 students last year. The competition will be as follows: Pre-Olympic Competition 1st and 2nd Phase and Puerto Rico Math Olympiad. PROTaSM coordinates other Olympiads such as the May Olympiad. *Sabbatical Academy for Mathematically Talented Students*: The main objective of this activity is to provide the mathematically talented students courses in mathematical content and math problem-solving sessions. The themes that are studied in these courses are not covered in the traditional schools' curriculum, and they mean to take the student to higher levels of knowledge and abstraction, so as to exploit their abilities to a maximum. The Sabbatical Academy takes place at the University of Puerto Rico, Mayagüez Campus (UPRM) during 6 Saturdays. *Camp* - **Summer Camp for Mathematically Talented Students**: The objective of this camp is to offer mathematically talented student courses of mathematical content that they usually do not see in their schools, accompanied with problem-solving sessions. Also, the students will have other recreational and social activities. **PROTaSM's web page**: PROTaSM's web-page will be found through IFEM's web page that was created in 2002 and has been updated frequently: http://ifem.math.uprm.edu/. Through this page all the students on the Island may access information about activities and get links to other web-sites on the Internet that provide information about mathematical Olympiads, as well as use the tests, exercises and activities developed in the camps and in the Sabbatical Academy. This allows many students to benefit from PROTaSM's efforts.

PROTaSM's activities are open to all students in Puerto Rico. PROTaSM's impact will be island-wide. This is in part the reason why the Puerto Rico Department of Education has strongly supported PROTaSM's activities. The activities benefit not only the participants directly involved, but also their peers, as these students elevate the quality of math classes wherever they are enrolled. The web page, for example, and all materials available there, are freely available to teachers, and to other students who might become interested.

To apply, a student must participate in the first phase of the Pre-Olympic Competition, which is distributed through our web site in November. Students must subsequently participate and make it

Ross Mathematics Program

The Ohio State University, Columbus, OH

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Mailing address:
Ross Mathematics Program
Department of Mathematics
The Ohio State University
231 W. 18th Ave.
Columbus, OH 43210

Phone: 614-292-5101
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e-mail: ross@math.ohio-state.edu
web addres: http://www.math.ohio-state.edu/ross

Participants in the Ross Mathematics Program are involved in an inquiry-based study of abstract mathematics. For the eight weeks of the program, students are immersed in a world unlike anything they have seen before. This is the first time most of them will be asked to consider entirely new questions and to develop new approaches and methods. Instead of the standard classroom approach of presenting facts for memorization, we build a community of scholars who struggle with basic mathematical questions and discover many of the facts for themselves. By working through examples they come to recognize which of their discoveries will be the most useful.

Students who join this community and participate in this distinctive style of learning benefit in several ways. They acquire a deep appreciation of the ideas they have tackled and they gain some understanding of scientific thinking. During the course of the summer, most participants begin to relish their ability to discover things on their own and they acquire a taste for hard problems. They start searching for patterns and ideas in many different contexts. Once the spark of creative thought is lit, it burns bright in them during that summer and, we hope, for the rest of their lives.

Rutgers Young Scholars Program in Discrete Mathematics

Rutgers University, New Brunswick, NJ

Contact: *Debbi Toti*

Mailing address:
Rutgers University
Young Scholars Program
SERC Building, Room 225
Busch Campus
118 Frelinghuysen Rd.
Piscataway, NJ 08854-8019

Phone: *732-455-2825*
Fax: *732-445-3477*
e-mail: *toti@dimacs.rutgers.edu*
web addres: *http://dimacs.rutgers.edu/ysp/*

The Rutgers Young Scholars Program in Discrete Mathematics is designed to encourage talented students to consider careers in the mathematical sciences. Selected students participate in an intensive four-week academic program that provides a challenging introduction to discrete mathematics - a new and growing area of the mathematical sciences with many applications on the cutting edge of modern research. During the program, you will develop and enhance your problem-solving abilities by applying mathematical concepts to a wide range of problems. You will also meet distinguished professionals in the field of discrete mathematics who will serve as role models and mentors and help you decide if mathematics is the right field for you. Teaching assistants who are embarking on their own careers in mathematics will provide additional academic support. You will also have an opportunity to participate in a year-long research project.

Approximately thirty high school students from across the United States will be selected for admission. Students will participate in instructional sessions, field trips, research projects, technology-based activities (including a Robotics Challenge) and workshops on careers in the mathematical sciences. Informal evening and recreational programs will also be provided.

The program is held on the Busch campus of Rutgers University. Students are housed in a modern, air-conditioned residence hall. The classroom building, computer laboratories, student center and recreation center are within walking distance of the residence hall. Residence life staff members coordinate the residence program and recreational activities.

The cost of the program is $3,500, which includes tuition, materials, housing, and meals. A limited number of scholarships will be available for students in need.

SEARCH

Mount Holyoke College, South Hadley, MA

Contact: *Dr. James Morrow*

Mailing address:
Search @ SummerMath
Mount Holyoke College
50 College Street
South Hadley, MA 01075-1441

Phone: *413-538-2608*

Fax: *413-538-2002*

e-mail: *search@mtholyoke.edu*

web addres: *http://www.mtholyoke.edu/proj/search*

If you want to explore ideas for your future, see another side of mathematics, work in a group, spend a month on a college campus - and you take yourself seriously - then SEARCH might be for you!

The SEARCH Program at Mt. Holyoke College is designed for young women who have done very well in high school mathematics, have a sense of adventure and would like to experience a research-like atmosphere in mathematics. Prospective students should have a good working knowledge of algebra and geometry, strong logical reasoning ability and a strong desire to explore open-ended problems in small groups guided by a teacher and an undergraduate teaching assistant.

During the day students will take classes, graph coloring, modular arithmetic, combinatorics and symmetry groups. There will also be instruction in the use of the mathematical software Maple and Excel spreadsheet software. There will be field trips, and - most of all - lots of interesting problems to work on! Students will have the unique opportunity to live on a college campus, meet a diverse group of students from across the country and find out some surprising things about mathematics. SEARCH is designed to give the feel of a research laboratory and of the world and work of mathematicians. Unique to this program is the chance to work on problems of your own design!

Many more details plus application materials can be found on our web pages at:
http://www.mtholyoke.edu/proj/search/

Stanford University Mathematics Camp (SUMaC)

Stanford University

Contact: *Dr. Rick Sommer*

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SUMaC
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Stanford, CA 94025-2125

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web addres: *http://math.stanford.edu/sumac*

The Stanford University Mathematics Camp (SUMaC) is a four-week residential summer program designed for high school students who have exceptional interest and ability in mathematics, who enjoy being challenged with in-depth mathematical pursuits and who will be entering their junior or senior years in the Fall. SUMaC's goals are to provide an intensive exposure to advanced mathematics in a supportive atmosphere, to give students a chance to interact with like-minded peers as well as Stanford undergraduates, graduate students and faculty, to convey some of the excitement and beauty of mathematics, and to motivate further study in mathematics or related subjects.

While the development of problem-solving skills is an important aspect of the program, SUMaC's focus is not on math-contets training, nor is it intended to be equivalent to a college-level course; rather, it is directed at helping students attain a deep understanding of some general and important mathematical ideas.

SUMaC has maintained a relatively even balance of girls and boys, and has drawn students from over twenty states and a dozen foreign countries. Students come from many backgrounds and cultures. Admission is by a competitive process which involves an entrance examination. Scholarships are offered so as to allow all admitted students to attend.

SUMaC's academic component consists of two tracks: Program I centers on abstract algebra and number theory, and covers basic group theory with an emphasis on symmetry groups, unconstructibility in geometry, coding theory and cryptography; Program II is devoted to topics in low dimensional topology, leading to an exploration of the fundamental group and the classification of surfaces. Counselors and tutors are primarily Stanford graduate students and undergraduate math majors, and include SUMaC alumni. Courses are taught by instructors from the Stanford math department and Stanford's Education Program for Gifted Youth.

The daily schedule includes morning lectures and time devoted to working on problem sets and individual tutoring. Students are introduced to many other mathematical ideas and topics through colloquium-style lectures by mathematicians from the Stanford community and elsewhere. Students also work on research projects related to their core studies. The academic program is supplemented by many social and recreational activities including organized sports and several field trips in the greater San Francisco Bay Area.

Summer Math Institute (SMI)

The Texas Academy of Mathematics and Science (TAMS), University of North Texas, Denton Texas

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Summer Math Institute
The Texas Academy of Mathematics and Science
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Denton, TX 76203-5309

Phone: *940-565-4033*

Fax: *940-369-8796*

e-mail: *boydbrown@tams.sch.unt.edu*

web addres: *http://www.tams.unt.edu/academics/SMI2006.shtml*

The Summer Math Institute (SMI) is an intensive residential program for middle and high school students. Admission to the program is selective and is based on a combination of factors, including test scores, grades, and a recommendation from the student's current math teacher. The program has grown from 28 students to 60 students, which is the maximum number of students the program can accommodate. Students are placed in one of the following courses: Algebra I, Geometry, Algebra II, or Precalculus. Each class is limited to between 15 and 20 students.

Students have the opportunity to master one year of high school mathematics during the three-week program. The program uses a diagnostic-prescriptive learning model. This model was developed specifically for mathematically talented students who have the motivation to learn at a faster and more advanced level. Since the academic program is essential to the structure of the program, students must have a strong interest in mathematics.

At SMI, students also learn responsibility, self-motivation, community participation and respect for others. Central to this residential program is the idea that living where they learn will encourage students to become a part of a community of like-minded young people who are committed to academic excellence and social and emotional growth.

Summer Mathematics Institute

Oakland University, Department of Mathematical Sciences

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Department of Mathematics and Statistics
Oakland University
Rochester MI 48309-4485

Phone: *(248) 370-3430*

Fax: *(248) 370-4184*

e-mail: *lipman@oakland.edu*

web addres: *http://www.oakland.edu/links/math/ousmi.html*

The Summer Mathematics Institute is a free opportunity for bright and gifted pre-college students to interact with university faculty and each other, to take some challenging math classes that earn college credit and have fun in an academic atmosphere.

The Institute runs approximately from late June through the first week of August each summer. Students are encouraged to apply early (before the deadline of mid-May).

The Summer Mathematics Institute at Oakland University provides an exciting mathematics program to stimulate the mathematical development of bright students from Southeast Michigan. Students are selected based on both exceptional talent and interest in mathematics. Those selected will generally have completed the tenth or eleventh grade, but very bright students at the ninth grade level who have exceptional talent and have accelerated their mathematical studies should also apply.

A major component of The Summer Mathematics Institute at Oakland University is the teaching of advanced undergraduate mathematical concepts from probability theory, number theory, group theory, combinatorics, graph theory, statistics and linear algebra for college credit, in a creative environment with a high level of mathematical activity. These are interesting topics which can expand the horizons and confidence of bright students, and encourage them to work to their fullest potential. During the program the students also participate in supervised computer lab activity.

The Institute will have the use of a computer laboratory reserved for the participants. Students at the Institute will be given instruction on the use and ideas behind symbolic mathematical software (such as Maple or Mathematica), which enable computers to answer sophisticated mathematical questions. Students will also be encouraged to explore self-directed mathematical investigations independently.

Texas State University Honors Summer Math Camp

Texas State University, San Marcos, TX

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Texas State University Honors Summer Math Camp
Department of Mathematics
Texas State University
San Marcos, TX 78666

Phone: 512-245-2935
Fax: 512-245-1469
e-mail: max@txstate.edu
web addres: http://www.txstate.edu/mathworks

The Texas State University Honors Summer Math Camp is a 6-week residential program for academically talented students. The goal is to excite young students about doing mathematics, to teach the students to reason rigorously and precisely, and to develop questioning minds. Following in the tradition of the Ross Summer Program, we teach students to "think deeply of simple things" (Arnold Ross), while inspiring students to share in the joy and excitement of finding the simple mathematical ideas which underlie and explain seemingly complex problems. Perhaps the best description of the program is from our participants:

"Texas State HSMC is different from other academic camps in that it lets students explore the mathematical frontier by themselves."
"This camp brought together students of all races and social/economic clases."
"This camp has exposed me to more than any other single experience in the last 15 years of my life. Obviously I learned number theory, but that isn't even what I'm talking about. I learned how to turn a group of strangers into some of the closest friends I have ever had; I enhanced my self-confidence; I learned more patience, and the list goes on."

First year students take courses in Elementary Number Theory and Mathematica Computer Programming. Career opportunities, the dynamics of group work, and leadership development are discussed in an Honors Seminar course. Returning students study Combinatorics, Abstract Algebra, Analysis and Topology. Advanced students may work individually or in teams on a research project to submit to the Siemens-Westinghouse or Intel competitions, supervised by a faculty mentor. Extracurricular activities include weekly seminars by guest speakers, picnics, recreation each afternoon including aerobics, volleyball, basketball, or tennis, and weekend excursions that give the participants a chance to relax and enjoy the local surroundings. Students are provided with a copy of Mathematica to use in their schoolwork or research project, and also make presentations at their high school to math clubs or classes. In the past 6 years, 54 HSMC students have been semi-finalists in the Siemens-Westinghouse Math, Science and Technology Competition, with 26 regional finalists, and 6 national finalists (2 teams).

The application form consists of a personal essay, teacher recommendation form, and transcript including SAT or PSAT scores. Students should be rising 10th - 12th graders. Interested students should contact Professor Max Warshauer, Honors Summer Math Camp, Texas State University, San Marcos, TX 78666. Phone: (512) 245-3439, Fax: (512) 245-1469, e-mail: max@txstate.edu. For an on-line application, see www.txstate.edu/mathworks.

Texas Tech University Summer Mathematics Academy

Texas Tech University, Lubbock, TX

Contact: *Padmanabhan Seshaiyer and Jerry Dwyer*

Mailing address: *Directors, Texas Tech Summer Mathematics Academy*
Department of Mathematics and Statistics
Texas Tech University
Lubbock, TX 79409-1042

Phone: *806-742-2566*

Fax: *806-742-1112*

e-mail: *jerry.dwyer@ttu.edu,*

web addres: *http://www.math.ttu.edu/~padhu/academy07.html*

Texas Tech University presents a three-week summer program for talented high school students. This builds on the TexPrep Program, which has run a summer program for about 100 high school students since 1986. We are seeking a select group of about thirty mathematically talented high school juniors. Ten to twenty of these will be local students, including members of the existing TexPrep group, and we will recruit the rest from the larger geographical area of West Texas and Eastern New Mexico.

We will offer five advanced math courses in the form of lectures during the first week, and group research projects during the second and third weeks. We assume that participants will have a working knowledge of single variable calculus. The focus will be on computational mathematics, and the courses will include differential equations, numerical analyasis, biological and engineering applications, fractals and statistics. These lectures will be offered during the first week, so that students can get the background they need for their group projects. They will be supplemented with computational labs (for two hours each afternoon) that will introduce students to software, such as MATLAB, MAPLE and SAS. The group projects, lab work, field trips and so forth will work on real life projects developed in conjunction with local industry and agriculture.

The recruitment of minority and female students in the existing TexPrep program has been a major success, and we particularly invite applications from such students. A primary objective is to have a program that creates enthusiasm for mathematics and its applications among the participants. Full-time, regular faculty will teach the mathematical courses in order to provide exposure to the rigor and elegance of high-level mathematics. The application deadline is April 30, 2007. Application forms can be obtained by e-mailing the program directors: Dr. Jerry Dwyer (jerry.dwyer@ttu.edu) or Dr. Padmanabhan Seshaiyer (Padmanabhan.Seshaiyer@ttu.edu).

a guide to
online resources
for high school
math students

summer programs
who wants to be a mathematician
math in the media
career choices

...and more

ams resources for math students

Maybe you already like math. Maybe you already do well in math. Maybe you would like to do well in math! Maybe you are already using math in everyday ways and didn't even know it! The AMS website has resources and links to other websites that will open your mind and expand your experiences as you study and progress in algebra, geometry, and calculus and begin to explore the ever-changing world of mathematical research.

summer programs

www.ams.org/careers-edu/mathcamps.html

For very talented high school students, the best chance to spend time with other gifted students and explore the world of mathematical research is at a summer math camp or program. Visit the web page for an up-to-date list of programs all around the U.S.

who wants to be a mathematician

www.ams.org/wwtbam/

In this game developed by Mike Breen (AMS Public Awareness Officer) and Bill Butterworth (DePaul University), high school students compete for cash and prizes by answering multiple choice mathematics questions. The top prize in each game is $1500, donated by the AMS. Read highlights of past games and watch videos of games!

math in the media

www.ams.org/mathmedia

MATH in the MEDIA www.ams.org/mathmedia
A Monthly Magazine from the American Mathematical Society

Here's a centralized tracker of articles about mathematics that appear in newspapers and science magazines. The collection includes "Tony Phillips' Take on Math in the Media," "Math Digest" (summaries of math in the news), and "Reviews" of books, plays, films, and TV shows with math themes.

arnold ross lectures
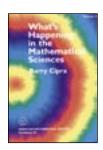
www.ams.org/meetings/ros-lect.html

The AMS sponsors a series of annual lectures for advanced math students. Read about past lectures and see if the next one will be in your area.

what's happening in the mathematical sciences

www.ams.org/ams/happening.html

Read sample chapters from this series of books published by the AMS on current mathematical research and applications.

web page for high school math students

www.ams.org/outreach/highschool.html

This AMS web page provides links to competitions and contests, posters and tools, math clubs and events, and sources for math help.

career choices

College graduates with a bachelor's degree in mathematics can qualify for a broad range of positions in business, industry, government, and teaching. Companies in the computer and communications industries employ many mathematicians, as do energy companies, banks, insurance companies, and consulting firms. Almost every bureau and branch of the federal government employs mathematicians in some capacity – in accounting, statistics, computer programming, energy, defense, space, among other areas. Those with a B.S. or M.S. degree in mathematics are in demand as K-12 math teachers, and those with a Ph.D. degree may find a career in research and teaching. Mathematical ideas and models are used in physics, chemistry, astronomy, and increasingly in the biological sciences. Even the social sciences – particularly economics and psychology – use mathematics. Actuarial science, computer science, and statistics all have math as their foundation.

All these careers can begin with an education in mathematics and a curiosity about the use of mathematics to solve problems.

the early career profiles network

Most students have only a vague idea about the utility of a major in the mathematical sciences: "What can I do with a math degree?" In response, the AMS recruits and supports a network of math departments to systematically provide job profiles of their recent bachelors-degree alumni. Read about graduates of small colleges and large universities who majored in math, where they work, how they use math on the job, and what advice they give to students. The program is supported in part by the Alfred P. Sloan Foundation.

investment analyst
computer programmer
actuary
climate analyst
financial manager
credit/loan officer
numerical analyst
mortgage broker
cost estimator
banker
forensic analyst
buyer
bank examiner
information scientist
data analyst
animator
insurance agent/broker

market research analyst
foreign-exchange trader
inventory control specialist
investment researcher
irs investigator
mathematician
budget analyst
appraiser
external auditor
cryptoanalyst
benefits administrator
commodities trader
claims adjuster
epidemiological analyst
controller
contract administrator
financial planner
estimator
air traffic controller
financial aid director
engineering analyst
college professor

mathematical moments

www.ams.org/mathmoments

Mathematics is used in careers in many fields. Mathematical Moments is a series of mini-posters that promote appreciation and understanding of the role mathematics plays in science, nature, technology and human culture. See the integral role mathematics plays in:

- Routing Traffic through the Internet
- Securing Internet Communication
- Being a Better Sport
- Recognizing Speech
- Listening to Music
- Describing the Oceans
- Designing Aircraft
- Storing Fingerprints
- Investing in Markets
- Tracking Products
- Making Movies Come Alive
- Manufacturing Better Lenses
- Defeating Disease
- Beating Traffic
- Bringing Robots to Life
- Forecasting Weather
- Enhancing Your Image
- Mapping the Brain
- Making Votes Count

careers in mathematics

www.msri.org/ext/CareersInMathematics.html

This video contains interviews with mathematicians working in industry, business and government – at industrial based firms such as Kodak and Boeing, business and financial firms such as Price Waterhouse and D. E. Shaw & Co., and government agencies such as the National Institute of Standards and Technology and the Naval Sea System Command. Hear from people working outside academia about what their day-to-day work life is like and how their background in mathematics contributes to their ability to do their job. Careers in Mathematics was developed jointly by the American Mathematical Society (AMS), the Society for Industrial and Applied Mathematics (SIAM), and the Mathematical Association of America (MAA). The video is posted at the Mathematical Sciences Research Institute.

visit these interesting and entertaining math websites

mathematics awareness month
www.mathaware.org

Read the theme essays and download posters.

math forum's student center
www.mathforum.org/students/

Get help from Ask Dr. Math, try the Problems of the Week, and find math ideas for science fair projects.

plus magazine
www.plus.maths.org

Bookmark this website to read each month's articles, career interviews, puzzles and more.

mactutor history of mathematics archive
www-groups.dcs.st-andrews.ac.uk/~history/

Look up mathematicians, mathematical topics, and mathematics in various cultures from ancient times to the present day.

mathematics is everywhere
www.pims.math.ca/education/everywhere/

See illustrated essays about "Soccer Ball Symmetries," "Prime Numbers," "The Violin String," and "Chance and Randomness."

contact these professional societies for more information and resources

American Mathematical Society (AMS)
www.ams.org

American Statistical Association (ASA)
www.amstat.org

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

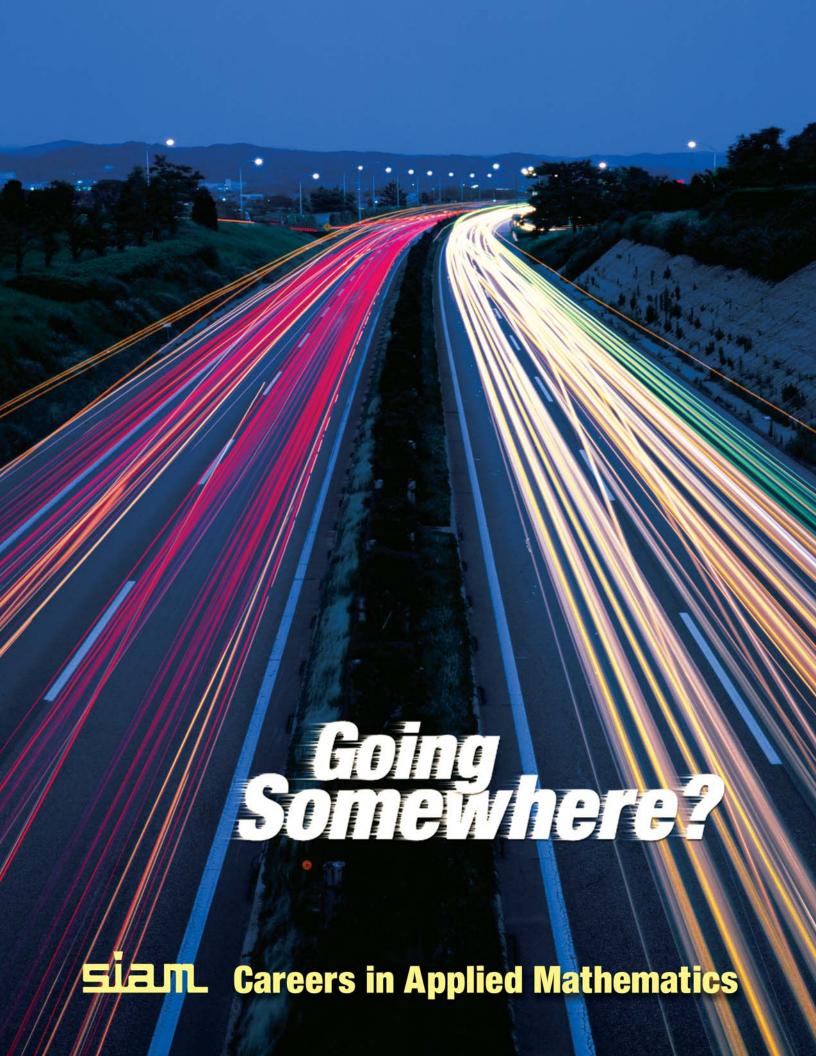**Mathematical Association of America (MAA)**
www.maa.org

National Council of Teachers of Mathematics (NCTM)
www.nctm.org

Society for Advancement of Chicanos and Native Americans in Science (SACNAS)
www.sacnas.org

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

Going Somewhere?

siam **Careers in Applied Mathematics**

"Applied mathematicians **believe** that new mathematical **ideas** and areas of study can **come from using mathematics to solve problems** in physics, chemistry, biology, medicine, engineering, and technology."

In the following pages, you'll learn that a career in applied mathematics isn't just about crunching numbers. It's a career that uses mathematics to solve problems in the environment of your choice.

Industrial careers for those with a background in mathematics rarely carry a simple title like "mathematician." The very idea of a career in mathematics has evolved and diversified. Mathematics may stand alone as a science, but as a career, it's almost always coupled with a specialty or area of research interest. This guide was assembled to provide answers to the questions asked most frequently by people interested in the study of applied mathematics and computational science: What's out there for someone with my interests and background? Where can I work? How should I pursue my studies? Who are the people working in industry today?

What kind of problems do you want to solve?

The careers may differ, but one thing remains the same—problem solving. Listed below are some potential industrial problems that a mathematician or computational scientist would solve at his/her place of work. Take note of which of the following sample problems you find most intriguing, and why.

- A pharmaceutical company wants to search a very large database of proteins to find one that is similar in shape or activity to one they have discovered. What's the most efficient way to do so?
- How might disease spread in populated areas in the event of a bioterrorism incident?
- How do you cram enough data through a high-bandwidth communications network to deliver large data sets reliably?
- When we pick up a quarter, our brain sends complicated signals to our nerves and muscles. How do you design a mechanical hand to grip a coin and drop it in a slot?

- An automobile production plant is falling far short of the capacity for which it was designed. Why?
- How can you mathematically model the spread of a forest fire depending on weather, ground cover, and type of trees?
- How can you allocate an investment among various financial instruments to meet a risk/reward tradeoff?
- How does a protein, like an enzyme, fold into a molecular shape? Where are the active sites on the molecule?
- Computer chips are "printed," much like photographs, from a negative. But manufacturing the "negative" is too expensive to permit cut-and-try testing of proposed layouts and the corresponding "print." Are there accurate mathematical models of the exposure process? Can they be coupled with efficient computational implementations to obtain practical, low-cost simulations to guide chip design and manufacture?
- A chemical manufacturer must shift one of its product lines to a new family of compounds that will not harm the ozone layer. Since it cannot test possible new products by releasing them into the atmosphere, it must develop models of atmospheric chemistry that simulate the complex chemical reactions in the atmosphere, the action of the sun, etc. Can computational simulations show sufficient detail to capture the effects of the chemicals, but still be fast enough to permit studies of many different chemicals?

These problems are just a sample of what industry has to offer. Your career search should involve deciding how you'll parlay your interest in mathematics into your eventual career path.

Part of the preparation for your future is mathematical knowledge—tools like differential equations, probability, and matrices, as well as central skills like the art of abstraction, good communication skills and the ability to program computers. Another part of preparation is experience using these ideas in real applications, experience in finding the general patterns among specific problems in engineering, science, finance, medicine, and many other areas. With preparation in mathematics and a background in another field, you can enjoy the dual reward of applied mathematics: using your skills and seeing the results.

Where do you want to work?

Below is a list of real-life organizations that hire mathematicians and computer scientists. It's interesting to note the variety— from governmental research organizations to independent consultants. Experience gained through internships and work-study opportunities can help you determine your personal preferences in a workplace, such as organization size, the issue of non-profit vs. for-profit, and customer contact vs. no customer contact.

Learn more about these and other organizations and corporations by searching the web for additional information. You can learn things like company size, location, mission statement, history, and job requirements.

Some examples of organizations, corporations, and research institutions where mathematicians work:

- Government labs like Oak Ridge National Lab, Sandia, Pacific Northwest National Labs, and Los Alamos; and agencies like the National Security Agency, the Center for Communications Research, the Supercomputing Research Center, the Institute for Defense Analysis Center, and NASA's Institute for Computer Applications in Science and Engineering;
- A federally funded contractor like the Mitre Corporation and RAND;
- Engineering research organizations like AT&T Laboratories-Research, Telcordia Technologies, Exxon Research and Engineering, Schlumberger-Doll Research, and NEC Laboratories America, Inc.;
- Computer service and software firms like MSC.Software Corporation, The Mathworks, Palo Alto Research Center, Mentor Graphics, Adobe, and Microsoft;
- Energy systems firms like Lockheed-Martin Energy Research Corporation and the Schatz Energy Research Center (SERC)
- Electronics and computer manufacturers like IBM, SGI, Philips Research, Honeywell, Motorola, and Lucent Technologies;
- Consulting firms like Daniel H. Wagner Associates and McKinsey and Company;
- Aerospace and transportation equipment manufacturers like Boeing, General Motors, Aerospace Corporation, Ford, and United Technologies;
- Financial services firms like Citibank, Morgan Stanley, and Prudential;

- Communications services providers like AT&T, Verizon, and Qwest Communications;
- Chemical or pharmaceutical manufacturers like Kodak, DuPont, GlaxoSmithKline, and Merck & Co., Inc.;
- Producers of petroleum and petroleum products like Amoco and Exxon Research and Engineering;
- University-based research organizations like the Institute for Mathematics and Its Applications, the Institute for Advanced Study, and the Mathematical Sciences Research Institute.

What else is there?
Emerging Fields to to **Consider**

Computational Biology and Genomics

By now, we've all heard of terms like "genetic sequencing" and "human genome." The mapping of the human genome depended on the use of sophisticated mathematical and computational tools. Now that sequencing is complete, the next challenge is to understand how genes interact, how they are switched on or off, and how they differ from individual to individual. The need for newer and better mathematical and computational tools will create new career opportunities in technology, medicine, and drug development and design.

Data Mining

If you're looking for a broad mathematical area with lots of applications, look no further—data mining is the answer. Data mining involves the discovery of patterns and previously unknown information in large data sets. Emerging career opportunities will be found in applications of data mining in, for example, security, forensics, e-commerce, and sciences, such as genomics, astrophysics, and chemical engineering.

Neuroscience

As described by organizers at the Mathematical Biosciences Institute (MBI), beginning with "the discovery of the fundamental Hodgkin-Huxley equations, which model electrical impulses and oscillations in neurons, mathematicians have been involved in developing models and computational schemes for systems of neurons." This mathematical and computational research provides tools for the study of the brain, the progression of neurological diseases, and the emerging treatments for such diseases.

Materials Science

Materials science is the study of the properties, processing and production of a broad range of existing and new materials, including metallic alloys, composites, liquid crystals, biological materials, and thin films. The rational design and analysis of materials depends on mathematical models and computational tools. Career opportunities abound in science, manufacturing, and materials design for applications in fields such as aerospace, engineering, electronics, and biology.

Computer Animation and Digital Imaging

To get an idea of what this field entails, consider the following description from the Fields Institute in Toronto. "Computer animation is an eclectic science that uniquely combines mathematics, computer science, fine art, classical animation, physics, biomechanics, and anatomy, to name but a few fields. Algorithms for computer animation rely heavily on techniques from scientific computation, statistics, signal processing, linear algebra, control theory, and computational geometry." With a diverse and exciting set of applications to such areas as entertainment (movies, video games), medical diagnostics, and fine arts (dancing, sculpture, painting), there are many avenues to explore.

Who are the applied mathematicians and computational scientists working in industry today?

An actuary, a librarian, a director of pharmaceutical research—mathematicians are involved in more fields than you may have thought possible. The following professionals with degrees in math-related fields will tell you that they were guided toward their career path by the first great math textbook they used, a crucial internship, or the advice of an enthusiastic professor. There are many choices to make and elements to consider when choosing a career. The following individuals share their educational background, interests, and experiences so that emerging mathematicians—such as you—will benefit.

Profiles

Alex Karavousanos

SENIOR DIRECTOR, BUSINESS DEVELOPMENT
Reuters
BS in Applied Mathematics and Statistics
State University of New York at Stony Brook

Alex's Background:

"From a young age I found mathematics interesting and challenging," recalls Alex, and when it came time to search for a job, his interest in math carried over. Alex naturally gravitated toward a career in which math skills were valued, if not required. He now works in business development and has found that "the analytical skills I developed through all of my courses gave me an excellent foundation that allows me to think creatively and structure interesting business relationships."

The Career:

Initially Alex used his mathematics background to pass the National Association of Securities Dealer's series 7 exam in order to become a registered representative. "I enjoyed selling stocks but was interested in learning more about financial planning and stock selection." Alex eventually took a position as a research analyst with Market Guide, a small publicly traded company on Long Island that collected financial information on all publicly traded companies. After a series of acquisitions, this position became Alex's current position at Reuters. "My role here has a few different functions," says Alex, including managing and growing the revenue for an existing client base, structuring strategic partnerships with companies that will redistribute fundamental and estimates financial data, and facilitating the sale of data through existing channel partners. Alex told us that he "ended up in business development because of the creative and analytical nature of the job." Daily responsibilities include anything from responding to client inquiries to projecting and/or forecasting revenue models for various strategic partners. Alex believes that the future of financial mathematics careers is stable. "The financial services industry relies heavily on math and will continue to do so. The industry continues to evolve, but everything revolves around numbers—offering math folks many interesting opportunities."

Alex offers this advice: "I would suggest that someone majoring in math be open minded as to a career path. An analytical type of degree can be applied to many different roles and careers. I would recommend that students intern at a few different companies in order to get a good understanding of the different jobs with which a math degree could be associated."

Skills required for this position:
(5 = most important; 0-1= hardly at all)

Communication..5
Teamwork 5
Computer...4
Analytical..4
Sales..4
Math...3
Computation 3
Engineering 2

John Parkinson

ACTUARY, VICE PRESIDENT

The Savitz Organization
BA Mathematics, BA Economics
East Stroudsburg University

John's Background:

The fear of math is not uncommon, even for math majors. John was an economics major when he discovered his mathematics interest and ability. "I came to learn that the foundation of some key economic principles was rooted in the application of calculus to those principles." John became fascinated and wanted to learn more. He ended up taking more mathematics courses, "this after fearing math for most of my life." In addition to economics, philosophy contributed to John's interest in math. "I noticed how many of the great philosophers were mathematicians. The two subjects have an interesting and natural connection."

In college, John found a subject that specifically sparked his interest—Econometrics. "This course really influenced my decision to pursue a career in the field of applied mathematics. I found applying regression analysis techniques to economic problems and theory to try to determine explanatory variables and forecasting to be truly interesting." From there, the actuarial profession was a natural fit. "Embarrassing as it is to admit, I wasn't very informed about the actuarial profession in college. I stumbled onto the profession at a job fair my senior year and was quickly intrigued." After passing the rigorous professional exams, John entered "a field where I would deal with assessing the financial and economic impact of contingent events."

The Career:

John is currently a consulting actuary for an employee benefits company. "We help companies determine their plan's financial liabilities." Determining these liabilities is dependent on quantifying expectations of future events, including how long the employee will live, when and how the employee will leave employment (termination, disability), and how much money the employee will make during his/her career.

The future of financial mathematics careers is a bright one. John told us that while current actuarial science takes a deterministic approach to valuing financial liabilities, in the future, stochastic modeling should become more prevalent. "As financial analysis and modeling becomes more complex, the opportunities for mathematicians in business and consulting should increase greatly."

John recommends that students spend some time investigating what mathematicians are doing in other fields—but start early!

Skills required for this position:
(5 = most important; 0-1= hardly at all)

Computation 5
Communication...4
Computer...4
Math...3
Programming...3
Teamwork 3
Statistics- 1
Engineering 0

Leslie Lahr

DEVELOPMENTAL EDITOR, MATHEMATICS

Brooks/Cole Publishers
BA, MS in Mathematics,
Cleveland State University

Leslie's Background:

Leslie taught at the undergraduate level prior to her career in publishing. When asked what lead her to her current job, she said, "I know that a great book is priceless to a student. Of course having a good teacher is a plus too!" Leslie said that it was her first calculus course, and later a course in Abstract Algebra, that spawned her lasting interest in mathematics. "The subjects seemed so beautiful. They were interesting and challenging. I think it helped that I got to use two exceptional books for these courses. They were clearly written for the student: friendly but not condescending, concise but not terse, filled with illustrative examples that don't 'give away the store' but guide the user through the challenges of the material. These books made a huge difference. For me, they provided stepping-stones to go beyond the coursework assigned in each class. I started reading other math books on my own, and I went on from there."

The Career:

Developmental Editors perform many of the duties that make a book ready for production. They shepherd the project through the editorial process, working closely with the author. Leslie told us that "As a developmental editor for math text books, I read manuscripts and use the skills associated with both an English major and a mathematician. I look at content on two levels: Does the material make sense from a mathematics perspective? Does it also clearly express the concept?" Leslie also works with reviewers during the editorial process. "For example, I send out the manuscript with a questionnaire that I develop and the reviewers are asked to answer questions regarding content and pedagogy. Their feedback is invaluable."

Leslie's math background is important during this review process. "I consider my background in mathematics to be a huge asset to my position. I am able to have discussions based on the subject matter. I also like this material and I'm genuinely interested in it. I think it really makes a difference that I can share this interest with the author and reviewers."

Leslie feels that the primary responsibilities of a D.E. won't change significantly, even with the advent of things like "books on demand" and other emerging electronic formats. "The actual format of the book may vary, but we still need to develop the content. I think that the way I do my job will change, naturally, with advancements in technology. I perform a large portion of my job using e-mail as communication, sending out things electronically. The speed of communication has accelerated the rate at which a developmental editor is expected to produce the end product. I have to stay on top of changes in publishing software and other PC developments." We asked Leslie for some general advice for students and other emerging mathematicians, "As early as you can, start talking to your professors about what you can do with a math degree. Get internships. Foster an appreciation of other subjects as well. A good general background comes into play when interviewing for a job, and performing that job. You might be a brilliant mathematician, but can you express your ideas clearly and effectively?"

Other jobs with related responsibilities:

Acquisitions Editor, Book Editor for elementary and secondary mathematics textbooks, Educational Software Developer

Skills required for this position:

(5 = most important; 0-1= hardly at all)

Mathematics 5
Communication...5
Statistics 3
Business...3
Computer know-how 4
Engineering 1
Computer Science...1

Barbara Hamilton
MANAGER, INFORMATION SUPPORT SERVICES

Institute for Defense Analyses
BS, MA Mathematics
Central Michigan University
Masters in Library Science
Rutgers University

Barbara's Background:

As a child, Barbara Hamilton helped her older brother with his math homework. She considered this to be one of the early signs that she had a knack for mathematics. Barbara remembers her sixth and seventh grade teachers as being particularly pivotal. "My math teachers realized that the kids at that age are at all sorts of different levels mathematically." In college she chose mathematics, even though she was faced with other options. "I found the more 'practical' majors (like accounting) really boring. I liked chemistry and physics also; I even worked in the chemical lab during the summers doing quality assurance (where I was hounded by the chemists to change my major from mathematics to chemistry, but I liked mathematics better.)" After college, Barbara worked as a cryptologic mathematician for the Department of Defense. She also worked for Renaissance Technologies, where she wrote documentation that would describe the software used for modeling the commodities market. RenTech used mathematical models to forecast the market, and thus trade accordingly.

The Career:

Barbara is currently in charge of the mathematics library for the Institute for Defense Analyses; Center for Communications Research Division in Princeton, New Jersey. IDA is an FFRDC (Federally Funded Research and Development Center). "We do research work for agencies in the Department of Defense." The IDA's library of books, journals, and electronic materials has been in existence for nearly forty years. As fate would have it, Barbara was looking for something new when the position opened up. "I was offered a temporary research job, but wasn't sure I wanted to do that anymore. While we were negotiating

this position the librarian retired (with rather short notice) and they offered the job to me. I took it and then got a Master's in Library Science." Barbara uses her math skills everyday in the library. "I sort of live in both worlds. Because of my MS in Mathematics, I can understand what my clients are trying to ask me. And with my MLS, I can understand what librarians mean." Daily responsibilities include buying books for the library. "I complain to publishers about high prices," she jokes. She makes sure the library is getting what it needs. She also supervises typists who prepare reports for their sponsor on the work that their research staff is doing, and corresponds with the research staff to make sure they have the appropriate research materials.

As far as advice goes, Barbara suggests that students take classes that they're interested in. "You'll learn more," she says. She suggests getting an early start. "If I could do it over again, I would start looking at potential careers earlier. I waited until my senior year before I started thinking about a career."

Barbara feels that in general, mathematics and research have a very bright future. Barbara told us that, "research into mathematical theories and ideas is not shrinking. Over the past few years, the IDA has started looking into new areas of mathematics that we were not inter-ested in before. I think there will always be new things to discover in mathe-matics, as long as people keep looking."

Skills required for this position:
(5 = most important; 0-1= hardly at all)

Mathematics	5
Communication skills	5
Statistic	5
Computer Skills	4
Computation	2
Teamwork	4
Engineering	0

Dr. Jeff Sachs
DIRECTOR AND SENIOR INVESTIGATOR
Applied Computer Science and Mathematics Department
Merck Research Labs, Merck & Co. Inc.
Sc.B. & Sc. M. Applied Mathematics, *Brown University*
Ph.D. Mathematics, *Massachutes Institute of Technology*

"I think there will always be new things to discover in mathematics, as long as people keep looking."

– Barbara Hamilton, Institute for Defense Analysis

Jeff's Background:
When Jeff was a small child he always wanted to be a doctor. He told people that he wanted to be a neurosur-geon. "But I was always surrounded by and enjoyed science and mathematics, largely because my father was a physics professor. Also, I was lucky enough to go to the University of Chicago Laboratory Schools elementary school where the science curriculum (and teachers!) were inspiring, and I lived only about four blocks from the Museum of Science and Industry in Chicago." When he was 11 he learned Fortran, a scientific and mathematical programming language. "I remember thinking 'well, that's it for medicine, I think I want to do this science and math stuff instead… It'll be fun to use computers to do that."

Jeff entered college as a physics major, then changed to mathematics, and then to applied math. "My switch to applied math was partly due to the great teachers I had, like H. Thomas Banks, Wendell Flemming, Russel Calflish, (the late) A. C. Pipkin, and Harold Kushner. Another part was feeling that I didn't think like a physicist when I solved physics problems, yet wanted to feel a connection between what I studied and its practical appli-cation."

"Certainly the style of research and analysis in applying continuum electromechanochemistry taught by my thesis advisor Alan Grozinsky and his advisor Jim Melcher had and continues to have a profound influence on my thinking. One of the most important skills I learned from Alan was scientific writing. I still hope to someday be as clear and concise as I was after he edited my work!" Specifically, some of the courses Jeff mentioned that made a difference in applying Jeff's course of study to his career are: Differential Equations (Tom Banks), Stochastic Processes (Harold Kushner), Partial Differential Equations (Phil Davis, K. K.Tung), Asymptotic Methods (Steven Orszag), Fluid Mechanics (Andrew Fowler, Alar Toomre, Harvey Greenspan), and Numerical Analysis. "Also my non-math graduate courses in mechanical engineering, chemical engineering, and physiology have had a large influence on my ability to collaborate effec-tively in multi-disciplinary environments."

Jeff worked in academic labs during his summers in high school and as an undergraduate, mostly doing computer programming (software engineering), but also some lab work repairing instrumentation and building things. After graduate school he worked first in academia in applied physics at University of Tokyo, in math and computer science at Clarkson University, biomedical engineering

at Northwestern University, and at NIST in the biotechnology division. He then went into industry, working for a mathematics consulting firm. "This was a great educational experience, as I had an excuse to learn many new subjects, including signal processing, pattern recognition, and biotechnology basics. It also gave me a lot of practice in presenting very technical work to non-technical audiences. This is a key skill for scientists and mathematicians in industry!"

The Career:

Jeff's current position at Merck draws on his past experience, and presents some new challenges. "In close collaboration with my colleagues, I perform scientific research. I also design technologies and experimental and data analysis protocols that help other scientists do their work. I design and (usually with support from others) implement algorithms and user interfaces to help make it easy for colleagues to use the methods that we invent." Jeff leads others in doing similar work and in implementing the software, helps evaluate technologies brought to Merck by other companies, and contributes to strategic technology planning. Jeff was introduced to his job at Merck by participating in a meeting held by one of many professional organizations. "I gave a technical talk at a SIAM conference that my current supervisor [at Merck] attended. He was just starting to build the department and asked me to have lunch, then an interview, … then to join." Jeff joined the Applied Computer Science and Mathematics team at Merck because "I had always most enjoyed applications of math to biotechnology and healthcare. I felt that this position would be my best opportunity to learn new things and to have a real impact on improving human health."

"The most important thing is to find something you really love to do and would enjoy doing all day for a few years.

– Jeff Sachs
Merck Research Labs

Daily tasks for Jeff are similar to many other office jobs, "I read and send email, talk on the phone, and meet with people. The difference from most jobs, though, is the subject matter for all these interactions. Typically, I speak with scientists about their goals for a class of data analyses, scientific questions of interest to them, or results of analyzing a particular data set. I meet with my colleagues to review a version of software in terms of either its algorithm or user interface. I meet with members of my team to make sure I am informed about their activities, to coach them (when needed), and to make sure they have the resources and training needed to get their

work done and to continue to grow technically and professionally. When I get really lucky I get time to read scientific literature or analyze data or write some software."

"Study software engineering, writing and public speaking, statistics and probability, and at least two fields of application of mathematics. The rigor of the thought process we learn in math is extremely valuable even in non-technical fields. But if you want to use math in industry (and in many arenas in academia) you will need to put some of your ideas into an acceptable format through software, or at least to understand what that process involves. I don't know any employers of 'mathematicians as mathematicians' (outside pure math academic departments) who don't require some knowledge of the software engineering process. Writing and public speaking are two critical communication skills that will have at least as much impact on your career as the technical content of your work. Statistics and probability will be useful in almost any technical career, and necessary for most. And understanding applications, even if they are different than anything you do in a job, will be critical to learning how to understand different perspectives on problem solving and the necessity of understanding the vocabulary relevant to people working on that application."

Jeff thinks that applications of math in biology and biotechnology will be an exciting and productive field for a very long time. He also believes that there will always be positions available for those who enjoy applying math to very practical problems. However, the requirements for those positions will continue to be very competitive, due to hiring rates being limited by economic conditions, and because of an increasing number of people aware of and qualified for such positions. Those applicants with excellent scholastic records who can demonstrate successful experiences in obtaining and communicating results will have the best advantage.

Jeff offers some inspiring thoughts: "The most important thing is to find something you really love to do and would enjoy doing all day for a few years. It is such a joy to have a job that is fun and feels like it contributes to society. If you can do this, then you are very likely to feel fulfilled in your life and to do well in your career."

Skills required for this position:

(5 = most important; 0-1= hardly at all)

Communication skills	5
Teamwork	5
Computer skills	4
Statistics	4
Math	4
Biology, chemistry, physical chemistry, biochemistry	3
Engineering	3

1 How do I get there?

The preceding profiles show the wide-range of possibilities available to individuals studying applied mathematics or computer science. Now, here are a few suggestions for mapping out the future…

Use your school's resources. How do you find such a career opportunity? Your school's career center will help you find a job in your area of interest. At the very least, services like assessment tests can help you narrow your search to suit your personality and ability. There are many resources available through a career services venue such as resume help, interview preparation, and job opening announcements.

Arnie Kohen is a career counselor at Drexel University's Steinbright Career Development Center. Arnie's position provides an interesting set of services for students— services that are not always utilized. "I help students with a career assessment through the administration of personality and interest inventories. Interpretations are individualized and are gratis to the student. These assessments and subsequent interpretation will enable a student to look at the elements of a program or major and say, ' I know I want to research or pursue these options '. They can come to me and learn about other available career center and university services, that will help them determine their field of interest."

Arnie told us that quite often students don't realize that the Career Center offers many additional services. The career center has "several events throughout the year at which students can make contacts and network with employers: they can receive resume critiques by employers; attend job and career fairs; participate in on-campus recruiting; and come to various networking functions and information sessions. If a student doesn't take advantage of these services, they are probably missing out on understanding the current job market." As far as non-academic careers in the applied sciences, he

explained that universities make up a small portion of the potential co-op and post-grad employers in those fields. "Recently, we've seen increased recruiting efforts by government agencies, and especially in the Philadelphia area, we've seen a variety of scientific positions available from pharmaceutical companies."

Overall, a visit to your university's career center could only help your search for a career that best suits your interests. That's what they're there for— to make sure that students are well equipped in making the transition from school to career, and to make that transition as smooth as possible.

2 Experiment with internships, summer jobs, work-study, etc.

What better way to determine the range of opportunities and explore possible areas of interest than to actually be in the workplace? Internships allow you to get a realistic feel for the field in which you're interested. Most importantly, you can make connections for future opportunities. Many internships turn into permanent positions, and even if they don't, the experience will broaden your perspective and help narrow your career search.

3 Do your research.

There are mountains of information available on the web, in libraries, and in bookstores. This may sound like simple advice—but while you're obtaining your degree, be aware of the career options that correspond to your studies. Too often, students emerge without a point of reference or general direction. Listed below are specific resources that offer support, information, and more professional profiles.

www.siam.org/careers
Check the web for the most up-to-date information and additions to these lists.

Links!!!

SIAM corporate members and sponsors have shown their support for the applied math and computational science community through their interest in SIAM. We recommend that students look at the company home pages listed on our website at *http://www.siam.org/careers/corpmem.htm.*

Search for career opportunities, explore the job descriptions for keywords and catch phrases, and get acquainted with the type of opportunities available!

Professional Societies for Mathematical Sciences, Computational Science, and Statistics…

American Mathematical Society (AMS)
201 Charles Street
Providence, RI 02904-2213
(401) 455-4000
Toll free: 800-321-4AMS (4267)
fax: (401) 331-3842
ams@ams.org • http://www.ams.org

American Statistical Association (ASA)
1429 Duke Street
Alexandria, VA 22314-3415
(703) 684-1221
Toll free: 888-231-3473
fax: (703) 684-2037
asainfo@amstat.org • http://www.amstat.org

Association for Computing Machinery (ACM)
1515 Broadway
New York, NY 10036
(212) 626-0500
Toll free: 800-342-6626
fax: 212-944-1318
webmaster@acm.org • http://www.acm.org

Association for Women in Mathematics (AWM)
4114 Computer & Space Sciences Building
University of Maryland
College Park, MD 20742-2461
(301) 405-7892
fax: 301-314-9363
awm@math.umd.edu

Computing Research Association (CRA)
1100 Seventeenth Street NW, Suite 507
Washington, DC 20036-4632
(202) 234-2111
fax: (202) 667-1066
info@cra.org • http://www.cra.org

Institute for Operations Research and the Management Sciences (INFORMS)
901 Elkridge Landing Road, Suite 400
Linthicum, MD 21090-2909
(410) 850-0300
Toll Free: 800-4INFORMS
fax: (410) 684-2963
informs@jhuvms.hcf.jhu.edu • http://www.informs.org

Mathematical Association of America (MAA)
1529 Eighteenth Street, N.W.
Washington, DC 20036-1358
(202) 387-5200
fax: (202) 265-2384
maahq@maa.org • http://www.maa.org

Society for Industrial and Applied Mathematics (SIAM)
3600 University City Science Center
Philadelphia, PA 19104-2688
(215) 382-9800
fax: (215) 386-7999
siam@siam.org • http://www.siam.org

Books…

101 Careers in Mathematics, Second Edition
Andrew Sterrett, Editor, The Mathematical Association of America; 2nd edition (January 3, 2003)

Great Careers for People Interested in Math and Computers (Career Connections, Vol 1)
Peter Richardson, Bob Richardson, U*X*L; (June 1993)

Prentice Hall Guide to Scholarships and Fellowships for Math and Science Students: A Resource for Students Pursuing Careers in Mathematics, Science
Mark Kantrowitz, Joann P. Digennaro (Contributor), Prentice Hall Trade; (March 1999)

Great Jobs for Math Majors
Stephen E. Lambert, Julie Ann Degalan, Ruth J. Decotis, McGraw-Hill/Contemporary Books; (November 11, 1998)

Young Women of Achievement: A Resource for Girls in Science, Math, and Technology
Frances A. Karnes, Kristen R. Stephens, Prometheus Books; (March 2002)

Video and CD: "Careers in Mathematics"
-Part of the Sloan Career Cornerstone Series, available from SIAM.

4 Network!

Join a professional organization, such as SIAM or AMS. Attend meetings. Connect with other individuals in your field.

Terry Herdman, Director at the Interdisciplinary Center for Applied Mathematics and member of SIAM, had this to say about the benefits of networking: "Through networking, one has the opportunity to gain knowledge from the experiences of others, learn of the various environments and opportunities of the applied mathematician and computational scientist and thus have a solid basis for making career decisions."

About SIAM

www.siam.org

Inspired by the vision that applied mathematics should play an important role in advancing science and technology in industry, a small group of professionals from academe and industry met in Philadelphia in 1951 to start an organization whose members would meet periodically to exchange ideas about the uses of mathematics in industry. This meeting led to the organization of the Society for Industrial and Applied Mathematics (SIAM).

The goals of SIAM are to advance the application of mathematics to science and industry, promote mathematical research that could lead to effective new methods and techniques for science and industry, and provide media for the exchange of information and ideas among mathematicians, engineers, and scientists.
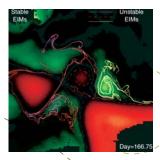
Today, SIAM publishes both books and journals, and our monthly periodical *SIAM News*. There are roughly 12 SIAM conferences per year, along with various networking opportunities. Academically, we look forward to the continued development and growth of SIAM student chapters, student membership, and our Visiting Lecture Program. Please see our website for more information!

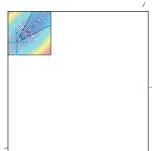# Acknowledgements

Works Cited, Contributors:

- Bill Kolata, Technical Director at SIAM

- *SIAM News*

- *101 Careers in Mathematics, Second Edition*
  Andrew Sterrett, Editor, The Mathematical Association of America;
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- The Fields Institute for Research in Mathematical Sciences,
  Workshop on the Mathematics of Computer Animation,
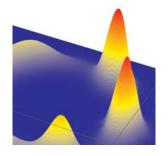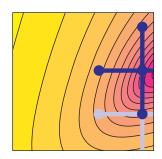 *http://www.fields.utoronto.ca/programs/scientific/02-03/numerical/computer_animation*

Images featured in the SIAM Journal on Applied Dynamical Systems (SIADS).

siam

Math can MOVE you

...just go.

What Does It Take

Good Mentors

What Does It Take

Good Mentors

Good Preparation

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Good Preparation

Talent

What Does It Take

Good Mentors

Good Preparation

Talent — Plus

· · · Insight · · · Concentration · · · Taste

· · · Luck · · · Drive · · · Ability to visualize & guess

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··· Luck ··· Drive ··· Ability to visualize & guess

Django Reinhardt