AWM
ASSOCIATION FOR WOMEN IN MATHEMATICS

Volume 25, Number 2 NEWSLETTER March–April 1995

PRESIDENT'S REPORT

This is my first report for the *Newsletter*, and I would like to thank Cora Sadosky for the enormous effort and strong leadership she has given to AWM during the past two years as President. Hers will be a difficult act for me to follow.

Since many members do not know me, I would like to provide some background about myself. I was born in Taiwan and grew up in a village in Taipei. After receiving a Bachelor's degree in mathematics from National Taiwan University, I came to America in 1972 and received my Ph.D. from Brandeis in 1976. My research specialty is differential geometry, and I am currently a Professor at Northeastern University in Boston. Before joining the faculty at Northeastern I had spent two years as an instructor at Berkeley and four years as an assistant professor at Princeton. I have also spent a semester at the Institute for Advanced Study at Princeton and two years at Max-Planck Institute in Bonn, Germany.

Although I have long been aware of the difficulties women mathematicians face, when I was younger I felt it best to ignore these difficulties and just work hard to be my best. I have been very lucky to have had such good mentors and the support of many friends. Still, I was aware that many AWM members had contributed much time and effort to improve the climate for women mathematicians and that I had benefited from their hard work. So when I was asked to serve the organization, I was very honored — but also embarrassed because I really had not done my share of the work. Although I was taught by my parents and my culture to stay in the background and avoid sticking out, I felt an obligation to take my turn working for AWM. I hope that in the next two years I can play some part in the efforts of AWM to encourage women to have active careers in the mathematical sciences and to provide a center for networking and for sharing experience and advice. I also hope to encourage increased participation in our organization by women mathematicians both from education and from academic and industrial research. I feel strongly that education and research should go hand-in-hand and that we all need to work together developing new programs and activities to fulfill our

IN THIS ISSUE

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The Association was founded in 1971 in Boston, MA. The purpose of the association is to encourage women to study and to have active careers in the mathematical sciences. Equal opportunity and the equal treatment of women in the mathematical sciences are promoted.
The *Newsletter* is published bi-monthly.
The Editor welcomes articles, letters, and announcements.
Circulation: 4,000.

long-term goal: that eventually women will no longer be a minority in mathematics.

In the previous issue of the *Newsletter*, Cora gave a detailed account of the AWM activities planned for The Joint Mathematics Meetings in San Francisco (January 3–7, 1995). I am glad to report that all our activities were successful and well-attended. Ruth Charney (Ohio State) organized and co-chaired the AWM Workshop for women graduates and postdoctoral mathematicians. There were ten each of excellent talks and posters. During the lunch period, the UC Berkeley Noetherian Ring, a group organized by Berkeley women graduate students in mathematics, gave a presentation about their activities. These include lunch meetings with mathematics talks and a program of inviting distinguished women mathematicians to speak at the Department Colloquium. Cora chaired a lively panel discussion "Launching a Career in Mathematics" with panelists Dusa McDuff (SUNY at Stony Brook), Gail Ratcliff (University of Missouri, St. Louis), Catherine Roberts (University of Rhode Island), and Lloyd Douglas (NSF). The panelists shared their experiences and gave much valuable advice. Lloyd Douglas explained NSF programs designed to promote the careers of women in mathematics.

Judith D. Sally (Northwestern University), introduced by Sylvia Wiegand (University of Nebraska), gave this year's Noether lecture on "Measuring Noetherian Rings." Judith gave a beautiful and clear lecture, and it was obvious from the response that the audience appreciated it greatly. AWM's fifth Louise Hay Award was given to Etta Z. Falconer of Spelman College for her success in promoting mathematics and enhancing the movement of minorities and women into science.

The AWM panel discussion "AWM: Why do we need it now?" was chaired by Cora with panelists Sylvia Bozeman (Spelman College), Mary Gray (American University, former President of AWM), Susan Landau (University of Massachusetts at Amherst) and Ruth Williams (University of California, San Diego). Sylvia gave a presentation on the joint program for freshmen at Spelman and Bryn Mawr; Ruth explained the need for child care at research institutes and conferences, so that young couples with children can come; Mary (a mathematician and a lawyer) analyzed her recent phone log to show that AWM was still very much needed; and Susan presented a preliminary study on tracking MIT Ph.D. students graduating during the first half of 1980's (the raw data was rather discouraging). Many problems were identified, and only some had suggested solutions. The contributions of panelists from both panel discussions will appear in this and subsequent issues of the *Newsletter*.

Moe Hirsch and his band "The Unstable Attractors" provided live music for the AWM Party, which as usual was very popular.

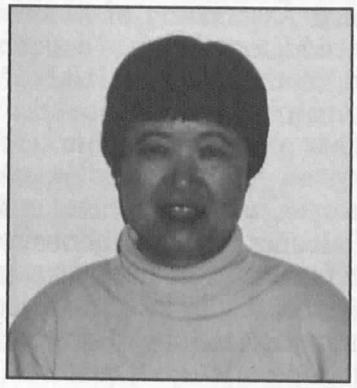
This Joint Meeting was one of the largest ever with more than four thousand participants. A very exciting scientific event was Cliff Taubes' (Harvard University) series of Colloquium Lectures: Mysteries in Three and Four Dimensions. Taubes gave an account of the very recent Seiberg-Witten equation and explained how it

simplified the proof of Donaldson theory and gave striking new results. The lecture hall was packed for every lecture. Many people commented that it was worthwhile attending the meeting just for these lectures. A number of the invited addresses were given by women mathematicians, including the MAA lectures of Lenore Blum (MSRI, former AWM President), Joan Ferrini-Mundy (University of New Hampshire), Karen Parshall (University of Virginia) and Karen Uhlenbeck (University of Texas, Austin); the AMS lecture of Leila Schneps (Université de Besançon, France); the AMS-MAA lecture of Doris Schattschneider (Moravian College) and the NSF lecture of Midge Cozzens (NSF). In her lecture "The Geometric Perspective in Research," besides giving a survey of new developments in geometric analysis, Karen Uhlenbeck brought up a very interesting question: since geometry plays such an essential role in many areas of current research, why is it omitted from our undergraduate required curriculum?

I am also happy to report that my old friend Sun-Yung Alice Chang was awarded the AMS Ruth Lyttle Satter Prize for her contributions to the study of partial differential equations on Riemannian manifolds.

I would like to end my first report by encouraging all members to send articles to the *Newsletter* to express their ideas, concerns, and suggestions.

Chuu-Lian Terng
Boston, MA
January 20, 1995



AWM IN SAN FRANCISCO

Hay Award

The Louise Hay Award for Contributions to Mathematics Education, established by the Executive Committee of AWM, is given to celebrate outstanding achievements in mathematics education. While Louise Hay was widely recognized for her contributions to mathematical logic and for her strong leadership as Head of the Department of Mathematics, Statistics, and Computer Science at the University of Illinois at Chicago, her devotion to students and her lifelong commitment to nurturing the talent of young women and men secure her reputation as a consummate educator. The annual presentation of this award is intended to highlight the importance of mathematics education and to evoke the memory of all that Hay exemplified as a teacher, scholar, administrator, and human being.

Citation for Etta Z. Falconer

AWM is pleased to present the Fifth Annual Louise Hay Award to Professor Etta Z. Falconer of Spelman College.

We can measure the impact of an educator and mathematical leader by the excellence and morale of her colleagues and by the number of her students who have undertaken successful careers in mathematics and in related fields. We can also recognize the intangible qualities that inspire and support both students and colleagues. Dr. Etta Z. Falconer of Spelman College embodies all of these qualities. Her many years of service in promoting mathematics at Spelman College and her efforts to enhance the movement of minorities and women into scientific careers through many forums in the mathematics and science communities are extraordinary.

In choosing a life of dedication to promoting and teaching mathematics at an historically Black institution such as Spelman College, Etta Falconer put on hold an extremely promising career as a research mathematician. The late Trevor Evans of Emory University, Falconer's Ph.D. advisor, insisted that she was the best of the numerous Ph.D. students he had in his 30 years at Emory.

Professor Falconer has promoted and led a cadre of colleagues to develop one of the most productive science programs at a liberal arts college in the United States, where some 38% of the students are majors in mathematics, computer science, biology,

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All members except family members receive a subscription to the newsletter as a privilege of membership. Libraries, women's studies centers, non-mathematics departments, etc., may purchase a subscription for $40/year ($48 foreign). Back orders are $6/issue plus shipping/handling ($5 minimum per order).

Payment

Payment is by check (drawn on a check with a U.S. branch), U.S. money order, or international postal order. Cash payment will be accepted if necessary, but only in U.S. currency.

Ad information

AWM will accept advertisements for the *Newsletter* for positions available, programs in any of the mathematical sciences, professional activities and opportunities of interest to the AWM membership and other appropriate subjects. The Association Administrator, in consultation with the President and the Newsletter Editor when necessary, will determine whether a proposed ad is acceptable under these guidelines. *All institutions and programs advertising in the newsletter must be Affirmative Action/Equal Opportunity designated.* Institutional members receive two free basic ads as a privilege of membership. For non-members, the rate is $60 for a basic ad (eight lines of type). Additional lines are $6 each.

Deadlines

Editorial: 24th of January, March, May, July, September, November
Ad: 1st of February, April, June, August, October, December

Addresses

Send all **Newsletter** material **except ads and book review material** to Anne Leggett, Department of Mathematical Sciences, Loyola University, 6525 N. Sheridan Road, Chicago, IL 60626; phone: (312) 508-3554; email: leggett@math.luc.edu; FAX: (312) 508-3514. Send all material regarding **book reviews** to Cathy Kessel, 2520 Etna, Berkeley, CA 94704; email: kessel@soe.berkeley.edu. Send everything **else, including ads and address changes**, to Dawn V. Wheeler, 4114 Computer & Space Sciences Building, University of Maryland, College Park, MD 20742-2461; phone: (301) 405-7892; email: awm@math.umd.edu.

chemistry, physics, and dual engineering programs. In her 25 years at Spelman College, she has served as Chairperson of the Mathematics Department (1972–82) and as Chair of the Natural Sciences Division (1975–90); she currently serves as Associate Provost for Science Programs and Policy. She has instituted program after program to strengthen the infrastructure, upgrade the curriculum and provide the necessary support, including mentoring and undergraduate research experiences, to prepare students for success in graduate school. Among her efforts is the NASA Women in Science Program, conceived in 1987, for the purpose of directing high-ability students toward doctoral programs. Beginning with a dozen high school students, the program included a curriculum enriched with science and mathematics courses supplemented by summer research at NASA installations. From the first class of NASA graduates, five entered graduate programs: Applied Mathematics (Brown University), Mathematics (University of Maryland), Operations Research (Georgia Tech), Chemistry (University of Florida), and Medicine (Baylor College of Medicine). Yet, in spite of the demands on her time, she has always insisted on teaching mathematics courses because of her desire to stay in touch with students, continuing to personally advise and mentor over 100 students who major in the natural sciences or who participate in the NASA Undergraduate Science Research Program, NASA Women in Science Engineering Program or the College Honors Program.

Professor Falconer is a dedicated citizen of the professional mathematics community. For the American Mathematical Society she organized meetings of representatives of book publishers to solicit help in removing gender barriers; in the American Association for the Advancement of Science, she served on the Committee on Opportunities in Science during 1979–82; and she is a founder of the National Association of Mathematicians, an organization which promotes concerns of Black students and mathematicians, and of the Atlanta Minority Women in Science Network.

Bringing her profound wisdom, vision, and vast experience to all her roles as mentor, organizer, project developer, teacher, writer, and role model, Dr. Etta Z. Falconer is a tremendous resource to the students and faculty in mathematics and science at Spelman College, in the local and national mathematics community and in the broader scientific community.

Dr. Falconer was unable to attend the prize ceremony. Her colleague Sylvia Bozeman read the following statement after accepting the award on Dr. Falconer's behalf:

I am deeply honored and extremely pleased to accept the fifth annual Louise Hay Award. My entire career has been devoted to increasing the number of African American women in mathematics and mathematics-related careers. I was greatly influenced by Dr. Lee Lorch who saw no barrier to success in mathematics for women and for people of color.

There have been so many people who have helped me in my efforts. Alice Schafer, a long-time friend, visited Spelman and gave me many valuable suggestions about the mathematics program. This type of collaboration continues between Sylvia Bozeman and Rhonda Hughes. Together, by sharing what each of us can bring, we can continue to change the spectrum of the mathematics community. AWM is a leader in this respect, and I am so proud to be a member. Again, I extend my warmest thanks to AWM for this wonderful award.

A longer response from Dr. Falconer appeared in the program for the prize ceremony:

I am deeply honored to receive the Fifth Annual Louise Hay Award for Contributions to Mathematics Educations from the Association for Women in Mathematics. It was such an unexpected pleasure to learn of my selection.

There are several persons who have had a tremendous impact upon my professional life. Dr. Lee Lorch inspired me to study mathematics and helped to mold me as a person because of his belief in the dignity of all people. He remains my mentor to this day. One of the first Black women to earn the Ph.D. in mathematics, Dr. Evelyn Boyd Granville, taught me during my college days and became my first career role model. Finally, Dr. Trevor Evans, my dissertation advisor, fostered my growth in the area of algebra.

It was with the highest aspirations that I began my career in the field of mathematics, teaching at a small junior college in Mississippi. I later joined Spelman College where I was able to crystallize my desire to change the prevailing pattern of limited access and limited success for African American women in mathematics.

I have devoted my entire life to increasing the number of highly qualified African Americans in mathematics and mathematics-related careers. High expectations, the building of self-confidence, and the creation of a nurturing environment have been essential components for the success of these students. They have fully justified my beliefs. Perhaps the most rewarding moments have come when younger faculty have undertaken the same goal and have surpassed my efforts — reaching out to the broader community to help minorities and women achieve in mathematics.

Dr. Etta Z. Falconer

AWM has been responsible for a great deal of positive change within the mathematics community and my membership has been very gratifying. I extend my warmest thanks to AWM for this wonderful award.

Noether Lecture

The Sixteenth Annual Noether Lecture, "Measuring Noetherian Rings," was delivered by Dr. Judith D. Sally, Northwestern University.

Judith Sally received her B.A. in mathematics from Barnard College in 1958 and her M.A. in mathematics from Brandeis University in 1960. The

next eight years were devoted mainly to the care and nurturing of three children.

In 1968, the year her youngest child began kindergarten, she returned to study in mathematics at the University of Chicago. She received her Ph.D. in 1971 under the direction of Irving Kaplansky. After spending 1971–72 as a postdoctoral visitor at Rutgers University, she was hired as a visiting assistant professor by Northwestern University. The visit lasted a long time! She is currently professor of mathematics there.

Sally received an Alfred P. Sloan Foundation Fellowship in 1977. She spent 1981–82 at Radcliffe College as a Bunting Fellow and 1988–89 at Purdue University under the auspices of the NSF Visiting Professorship for Women Program. She just completed a three-year appointment as algebra editor of the *Transactions*.

Sally's research is in commutative algebra, one of the fields in which Emmy Noether's work had such impact. Her main interests lie in the study of Noetherian local rings and graded rings with emphasis on Hilbert functions and birational extensions. These concepts play an important role in ascertaining the nature of singularities in applications in algebraic geometry. The Hilbert function of a local ring at a point on a variety is a very good measure of how bad the singularity is at the point. One of the themes in Sally's research is the interaction between the local ring and its associated graded ring. This interaction plays a critical role in understanding and computing the Hilbert function. She has also worked on birational blowing up of ideals, the extension of valuations and other concepts in the algebra involved in the resolution of singularities.

Sally enjoys teaching and is pleased with the renewed commitment in the field to undergraduate and graduate teaching. She feels her teaching was revitalized when she began emphasizing active student involvement in class (the syllabus be hanged at times, if necessary!).

In her Noether Lecture, Sally discussed measuring Noetherian rings. Noetherian rings are generally perceived to be the most tractable commutative rings. The well-known finiteness conditions in a Noetherian ring, namely Noether's ascending chain condition for ideals and the equivalent condition that all ideals are finitely generated, permit interesting finite measures of the "size" and behavior of such rings. However, it is quite surprising that these same finiteness conditions can also force other measures, which might be finite in some non-Noetherian rings, to be infinite.

Sally's husband, Paul J. Sally, Jr., is Professor of Mathematics at the University of Chicago. At the present time, their eldest son is an assistant professor in the business school at Cornell University, another son is assistant professor in the Slavic department at Stanford University, and their youngest son teaches mathematics and computer science at New Trier High School in Winnetka, Illinois. Their seven grandchildren, ages one to seven, have many interesting ideas about their future careers but no definitive plans as yet.

Panel: AWM: Why Do We Need It Now?

What Happens to the Women?

Over the last years, I've heard a lot of talk about the pipeline and that we need to encourage young women in science. I have become increasingly concerned about what happens at the other end. After their Ph.D., how many bright young women are in positions that allow them to pursue research? It does not matter how much investment we put into young women if they are just spewed out at the other end of the pipeline. I decided to explore where women mathematicians are ten to fifteen years after their Ph.D. degree.

Now of course academia is a complicated marketplace. Finding jobs is difficult for men, and it is difficult for women. There are pieces that often conspire to make it more complicated for women.

A high percentage of women mathematicians are part of a "two-body" problem: eighty percent of married women mathematicians have scientists as spouses.[1] Tenure time and the prime child-bearing years coincide, creating a conflict for many women. And finally, sexism is not dead.

I tracked MIT Ph.D.'s who received their degree in the period June 1980 to June 1984. This time period gives time for a post-doc or visiting position, followed by a tenure-track position and a tenure decision. Observe that hiring decisions were made during the era of Affirmative Action. The folklore has it that women are doing well. The numbers show a different story.

This data is preliminary. I was able to track only sixty-five of the eighty living graduates. For a definitive study, one would also need to understand

Susan Landau, University of Massachusetts at Amherst

	I	II	III	Other U.S.	Non-U.S. Faculty	Untenured/ Not in Academia	Information Unavailable
men	14	4	7	5	9	13	14
women	1	0	1	4	1	6	1

why those who left academia did so: was it because the grass was greener, or was it that the grass on this side was dead? Despite the preliminary nature of this data, the gap between where the men are and where the women are is striking.

Of the fifty-two men in the group, thirty-nine, or three-quarters, are tenured. Only seven of the thirteen women, or just over one-half, are. Admittedly these are small numbers. Just three more tenured women would more than even things up. So I poked a bit harder — and that is when real disparities appeared.

Not every mathematician aspires to a position in a research institution, but many of us do. Only two of thirteen women are in Group I, II or III schools — that group of universities that comprises the top one hundred and seventy-two Ph.D.-granting institutions. Twenty-five of the fifty-two men are. Fourteen men, or 26% of the men, are in Group I institutions; one woman is.

We have a problem here. These MIT Ph.D.'s finished at a time when the market was reasonable. Ph.D.'s from MIT — men and women — are smart. The men from MIT are being tenured at research institutions; the women are not. I do not know why. It may partially be self-selection; with the difficulty of two-body job situations, and combining children and tenure, some women may choose to apply for less competitive situations. But something is wrong when the data demonstrates such tremendous disparity in the job a woman Ph.D. can expect to hold ten years after her degree and the job a man can.

The problems facing women are complicated. I do not want to end on a note of pessimism. Partial solutions can have some effect. At the University of Wisconsin, the Spousal Hire Program makes available funding of one-third of an FTE for up to three years. Both Oregon State University and the University of Nebraska at Lincoln have spousal fellowship programs. Some consortiums of small colleges, including Kenyon College, the College of Wooster and Dennison College in Ohio and Bates, Colby and Bowdoin in Maine, have run joint job ads, listing all positions available at the nearby institutions.[2] Doing two-body hiring across institutions is complicated, but it can be done. Universities can also institute solutions to lessen the effect that childbearing has on tenure decisions.

The basic problems of sexism are still with us. When I look at the numbers showing where the women are, it is clear to me that there is plenty left for AWM to work on.

1. Ann Gibbons, "Key Issue: Two-Career Science Marriage," *Science*, 13 March 1992, pp. 1380–1381.

2. S. Landau, "Universities and the Two-Body Problem," AWM *Newsletter*, March 1994, pp. 12–14.

Acknowledgements: Thanks to Phyllis Ruby, Graduate Administrator, MIT Mathematics Department, and to the MIT Alumni Office, for help in compiling information regarding MIT graduates.

The Early Postdoctoral Years

On October 16–18, 1994, a workshop titled "Women in Probability" was held at Cornell University under the joint sponsorship of the Mathematical Sciences Institute at Cornell and the American Mathematical Society. Molly Hahn and I coorganized the workshop at the invitation of Rick Durrett. Many of the reasons for holding that meeting and some of the issues of concern discussed there are relevant to the question of why we need AWM now. Accordingly, I will address this latter question by drawing on my experiences at the workshop (I have described the workshop at greater length in a separate article to appear next issue).

Many of the 60 workshop attendees were women. I was particularly struck by the large proportion that were new researchers (graduate students or within five years of obtaining their Ph.D.'s). The scientific talks reflected the quality and enthusiasm of this new generation of female probabilists. However, of special concern was the fact that a good number of the new women Ph.D.'s were relatively isolated, perhaps being the only probabilist and/or the only woman in their department. I believe that organizations like AWM can play a vital role in ensuring that such women do not

Ruth Williams, University of California, San Diego

"slip through the cracks" by providing information and support for their scientific development. To illustrate this point, I will mention a few concrete things in this regard.

AWM provides a forum where women can learn and exchange essential information that might not otherwise be readily available for nurturing professional development. For instance, it is very important that one go to meetings and give talks on one's research so as to become known and to get to know others in one's field. AWM has been organizing workshops for female graduate students and new Ph.D.'s to provide visibility and encourage presentations by women at national mathematics meetings. AWM has also been making it better known that one may send in an abstract to the organizer of an AMS Special Session in one's area to be considered for possible inclusion in that session or that one can volunteer to organize a Special Session at an AMS meeting or at meetings of other relevant Societies such as SIAM or the IMS.

AWM also provides a forum for brainstorming about issues of concern and could be a repository for creative solutions to problems of common concern. There is already the AWM *Newsletter* and the AWM electronic digest, but these have a transient aspect to them. I think an additional permanent and searchable written record such as one available on a World-Wide Web home page (suggested by Susan Landau) might be a good way to keep track of suggested solutions to problems of common concern. (I would prefer that we do not each have to go and invent our own custom "wheel" to solve problems that many others have faced and resolved before.)

I will conclude with an issue of concern that arose at the workshop and which deserves immediate attention. During the workshop we had several panels and one included advice on starting one's postdoctoral career. It was mentioned that one of the ways to get to know the experts in one's field and to keep abreast of the latest developments is to attend the research institutes when they have an emphasis in one's area. Immediately there was a response from the audience that if one has small children, this can be impossible because of the lack of, or extreme difficulty in finding, reasonably priced child care. Faculty who go on sabbaticals or shorter term leaves to other institutions face a similar problem. I would like to encourage the research institutes to take a lead here and to make child care readily available for both their long and short term visitors who may need it. It should be advertised openly, not something you have to ask for. Of course, there are logistic and legal concerns to be overcome, but if the institutes are really serious about attracting more qualified women and younger researchers, this should be a priority.

Workshop

The AWM Workshop sponsored by NSF-ONR was a full-day event on January 7 in San Francisco, full of mathematical excitement and ending with several tables of us attending the AMS Banquet.

The postdocs and their talks were:

Laura Anderson, Indiana University at Bloomington
"Topology of Combinatorial Differential Manifolds"

Wendy Brunzie, Montana State University
"Stability as a Function of Continuity and Rationality"

Karen E. Clark, Trenton State University
"A Method for Determining Bounds on the Effective Properties of a Particular Composite Material"

Michele Cook, Oklahoma State University
"Generic Initial Ideals and Algebraic Geometry"

Cymra Haskell, University of Texas at Austin
"Non-uniformly Hyperbolic K-systems Are Bernoulli"

Yoshiko Hayakawa, Oklahoma State University
"Degeneration of Calabi-Yau Manifolds with Weil-Petersson metric"

Tamara J. Hummel, Dartmouth College
"Effective Versions of Ramsey's Theorem"

Victoria Pambuccian, Indiana University at Bloomington
"Proper Holomorphic Mappings"

Aurelija Trgo, Carnegie Mellon University
"On Numerical Approximation of Non-Convex Variational Problems Using Stochastic Optimization Algorithms"

Gretchen Wright, Columbia University
"The Reshetikhin-Turaev Representation of the Mapping Class Group"

The graduate students and their poster presentations were:

Julia A. Barnes, University of North Carolina at Chapel Hill
"Bernoulli Maps of the Sphere"

Joan E. Hart, University of Wisconsin, Madison
"Single Axioms for Odd Exponent Groups"

Christina He, University of California, Riverside
"Generalized Minkowski Content and the Vibrations of Fractal Drums and Strings"

Catherine Kriloff, University of Michigan
"Representations of Graded Hecke Algebras Associated to Polygons and the Icosahedron"

Sarah K. Merz, University of Colorado at Denver
"The Domination and Competition Graphs of a Tournament"

Laura Monroe, University of Illinois at Chicago
"Greedy Codes"

Helen Moore, SUNY at Stony Brook
"Minimal Submanifolds with Bounded Curvature"

Susan Morey, Rutgers University
"Equations of Blowup Algebras"

Jeanne Nielsen Clelland, Duke University
"Exterior Differential Systems and Conservation Laws for Partial Differential Equations"

Brooke E. Shipley, Massachusetts Institute of Technology
"Convergence of the Homology Spectral Sequence of a Cosimplicial Space"

Workshop Panel: Launching a Career

I was going to begin by telling you a little about my early career; really this is the way not to do it — you, by being here, are already much further ahead than I was in understanding what is needed. When I started out, I was very naive about making a career. I did my Ph.D. in Cambridge, England and was very isolated there, talking to very few people (both mathematicians and others). It never crossed my mind that I might not get a job. This saved me worry but also meant that I did nothing to shape my career like look for conferences to go to, opportunities to travel abroad, etc. Luckily, I ended up with a job, and it was only when I found out that there were only four jobs that year in Britain that I realized that I might not have succeeded. My job was at a rather small university with no one working in my field. Not the ideal place from which to build a career, but infinitely better than no job, of course, and in fact I enjoyed being there, finding it liberating after Cambridge. It was only when I was invited to spend a year at MIT as part of an affirmative action program that I began to take the initiative in planning a career, applying to the Institute in Princeton and for a Lectureship at Warwick.

I agree with Gail that it is important to get to know women in other departments in your university. Besides being a mechanism of getting support, it is a way of making friends and meeting people who are not mathematicians, which is often surprisingly hard to do after one has stopped being a student.

The other thing I wanted to talk about was how to shape your path in mathematics. To begin with, you usually rely on other's judgement about what are fruitful problems, but the time comes when you have to take over and make your own decisions about what to work on. Thesis problems by their nature tend to be rather narrowly focussed — usually that's the only way you can get a start. After finishing your Ph.D., I think you should think of developing in two ways, both building out from your thesis problem (perhaps going more deeply into it or tackling a closely related problem) and also learning something in a different though related area. For example, you might attend a course given by someone else in your department — this would also have the good effect of helping you make mathematical connections with your colleagues. It is essential to talk to people — make sure you go to the conferences where you can meet the leading people in your field, ask them questions, find out what they think are interesting (and possible) problems, tell them about your work. Especially if your work is narrowly focussed, it is important to know there are some people out there who are interested in the problems you are working on and that these problems are connected with the central questions in the field. I used to think that one could do excellent mathematics in a void (because that's how I functioned), but that's rarely so.

Should one focus narrowly or broaden one's range?

Different minds work best in different ways and at different levels of detail — some people excel at concentrated technical work, others at finding ideas

Dusa McDuff, SUNY at Stonybrook

which bridge disparate fields. So there is no magic recipe, good for everyone. But I think it is important to realize that you do have some control over your choice of problems and your mathematical development. Until you have had quite a bit of experience, there is always the fear that you cannot be creative and have new ideas, but you mustn't let this dominate you so that you just continue with what you know you can do, getting less and less interested in what you do but unable to see any way out of the rut. On a practical level, as Gail said, if you have never really gotten away from the subject of your thesis, tenure committees tend to think that you've never become really independent of your advisor who must therefore have contributed the essential part of your thesis.... Mathematics is changing and developing, and it is exciting to develop along with it. Of course, one has to keep enough focus in order to be able to be creative, and so it is a matter of balance.

Launching a Career: The Early Years

I'm currently in my third year of a tenure-track position and wow! am I happy to be finished with my doctorate and to be involved in a great first position. If I were to plot my self-esteem against time — beginning when I started graduate school — it would be a sadly decreasing function until during my last year. Once I participated in the employment register at the joint meetings and started realizing that I might be able to land a job after all, the light shone at the end of the tunnel. I'd like to discuss some of the early components to launching my career and will also share some ideas for how you can maximize your first years as an assistant professor.

The most valuable thing for me has been the continued support from my thesis advisor. He continues to phone regularly and to mentor me. We discuss all sorts of things, such as how to choose journals for submitting my papers and how to put together my first NSF grant proposals. He's a good strategist and has helped me learn how to network and create new opportunities.

I have other mentors as well. There are a few mentors at my university who teach me the politics of the place and help me deal with small issues. They also act as a sounding board for various frustrations, such as how to handle an incident of student cheating. The senior local mentors can shelter me from trouble (and from lousy committee assignments!), since they know just who to call on in a pinch.

In addition to local mentors, I actively seek global mentors, too. These are established mathematicians, frequently women, whom I may speak with only once a year. These people inspire me, help me network, remind me of the global picture, and open doors. They convince me that my ambitions are valid and that my goals are possible. Some serve as living examples of solutions to the two-body problem (my current personal nightmare) and as people who have created beautiful families as well as beautiful mathematics. Most of these people I have met at the AWM workshops and at the calculus reform activities here at the joint meetings.

One of the most important things I've done during my first three years is hardwire time for research. I set aside time each week when I'm not distracted by other things. I was also shielded from committee work during my first year, have maintained a Tuesday/Thursday teaching schedule and have had department money for books, supplies and travel. None of these "perks" is necessarily automatic. A lot of it is a function of the department chair and the philosophy of the school and department. Some of these things can be negotiated during one's initial job contract, so it is worth asking about.

Here's my advice for your first few years on the job:

1. Treat yourself! You've finished your Ph.D.! It's a major accomplishment! You have a job! You have money! Enjoy! The tensions of tenure are practically around the corner, so it is important to treat yourself now.

2. Keep a sleeping bag in your office — I took naps all the time at first.

3. Apply for a grant immediately. Even if you don't have any good research ideas yet, the experience is well worth it. The feedback you get from your first attempt will be very helpful later on once your research ideas are more fully developed.

4. Hardwire time for research — I really mean it. The rewards of teaching are immediate and wonderful; it is easy to let the research slide.

5. Attend conferences and give talks. Tie in with senior people you admire. If there is a Special Session in your research area, don't hesitate to send

Catherine A. Roberts, University of Rhode Island

a note to the organizer to introduce yourself and ask if your work may be appropriate for the session. For each meal that I eat with my graduate school buddies, I try to schedule a meal with someone more senior than me who can help me for all the reasons stated above. You can also invite yourself to give talks at nearby schools — my letter of introduction and an offer to give a talk led to several invitations from around my state.

6. There is a service component to most academic jobs — so select service that simultaneously helps your career. For example, I organized visits for several SIAM visiting lecturers (for a brochure of this program, email vlp@siam.org) to come to my university. Meeting these influential people lead to an invitation to be a judge for the Mathematical Contest in Modeling, an offer of a job, and an opportunity to collaborate with a well-respected researcher. I also volunteered to be an editor for a calculus reform project that familiarized me with many of the major components of this revolution in mathematics instruction.

7. Read. For example, in addition to research journals in your area, read AWM-Net (subscribe to awm-net-request@cs.umd.edu), the Young Mathematicians Network newsletter (subscribe to cyeomans@ms.uky.edu), UME *Trends* (317-494-1982), the *Notices*, MAA publications, etc. Read. Read. Read. Keep informed.

8. Start a folder called "promotion folder" in your filing cabinet and toss everything in it — including copies of your syllabi, all exams, every letter asking you to speak somewhere or asking you to send a reprint, every conference program, etc. You'll need all this stuff later.

9. Be willing to trumpet your own horn and to shout when there is a problem. Perhaps some may disagree, but I think it is best to make a beautiful noise even before being in a position of influence or stability.

Workshop Participant's Reaction

This is a description of the recent AWM Workshop in San Francisco from the perspective of a participant.

Many of the postdoctoral talks were outstanding. This year's workshop was held on a Saturday, during the Joint Math Meetings, which was both good and bad. On the negative side, schedule conflicts decreased the size of the audience at times. However, it was good to see a standing-room-only crowd at lunch. There was a panel discussion at lunch on the topic of "Launching a Career in Mathematics," with panelist members Catherine Roberts, Gail Ratcliff, Dusa McDuff, and Lloyd Douglas. The panel was extremely energetic and helpful. It was interesting to hear how other women had progressed in the field after receiving their Ph.D.'s and useful to hear what things had helped them in their research careers. One positive and concrete outcome that developed during the Workshop was that Wendy Brunzie, a postdoctoral participant, decided to form a Young Women Mathematicians' Network (YWMN) (to join or to get more information about this, you can contact her via email at brunzie@math.montana.edu).

One disappointment was that the prestigious research institutions with jobs did not flock to the poster sessions as I had hoped they would. In fact, most of the people who stopped by to look at my poster were people I had already met. I was also disappointed with the number of research universities interviewing during the Employment Register. Had the AWM's hard-won funds gone to waste? Was a Workshop for women mathematicians starting their careers not the project they should be running?

In examining the actual benefits to participants, I would like to share more of my personal experience. The funds the AWM awarded allowed me to attend the entire Joint Math Meetings. During the meeting and a few days afterward, a number of events that were meaningful for me occurred. Some of the high points were:

- keeping Chuu-Lian Terng up until 11:30 p.m. (and she was still on East Coast time!) talking about a paper of hers that I had read; her graceful forgiveness and continued kindness toward me.
- interrupting Joan Birman at breakfast as she enjoyed a quiet cup of coffee and a newspaper; taking in her advice to forget about the people who act in a sexist way, and just continue to take pleasure in doing math.
- Cora Sadosky's energy and enthusiasm, her adoption of me, and her mentoring of us all.

Helen Moore, Graduate Student, SUNY-Stony Brook (not yet employed by a prestigious research institution)

- having dinner and getting to talk math with Dana Mackenzie and Frank Morgan, both specialists in my field.
- meeting and talking with Lynne Butler, ostensibly for a job interview, but the job (full-time teaching) was much less interesting to me than the interview.
- meeting and getting to hang out with a woman postdoc, my roommate Gretchen Wright, who was also a Workshop participant.
- getting to meet folk hero Lee Lorch, a pioneer among men working for equality for women and people of color.
- traveling around California after the Joint Meetings, talking to researchers in my field at Stanford, UC-Berkeley, and UC-Santa Barbara.

Some of the low points were:

- having to listen to a privileged white male at the AMS dinner describe the five most important issues in the future of the AMS and feeling that he left out most of the things important to the rest of us.
- having to choose between my only chance to talk math with two researchers in my field or going to the reception for Gays, Lesbians, Bisexuals and their friends.

Returning to my question: Would the AWM's money have been better spent elsewhere? Every time I talked math with someone, I gained information or insight which advanced my work. Mathematically, I can not think of a single thing which could have been better for my research. In addition, every time I went to an AWM-sponsored event or talked with other women, I gained energy and made plans. And aren't these two areas (our careers and our personal lives) the ones in which the AWM strives to make a difference for women?

Resolution on Proposition 187

Whereas the voters of the State of California passed Proposition 187 in November 1994, removing access of undocumented aliens to many social services, including public education.

Whereas this Proposition directs in particular that teachers in the state report to the Immigration and Naturalization Service the names of any students who may be undocumented, and many California teachers at all levels have declared their willingness to risk imprisonment by defying this requirement.

Whereas this proposition encourages discriminatory and divisive behavior toward Hispanics and Asians, thereby creating a hostile environment for all and placing California teachers in a moral quandary.

Whereas the Association for Women in Mathematics (AWM) has a deep commitment to providing access to mathematics education to all.

Therefore, be it resolved that AWM opposes the denial of basic benefits such as education and health services to persons on the basis of immigration status.

Be it further resolved that, should California enforce the provisions of Proposition 187, AWM will urge the American Mathematical Society (AMS), the Mathematical Association of America (MAA), and other mathematical societies not to schedule any meetings within the state during this enforcement.

Related information from Cora Sadosky

When Colorado passed the resolution against gay rights, I contacted the Presidents of AMS, MAA and NAM, initiating an action that culminated with moving the 1995 Joint Meetings from Denver to San Francisco. After Proposition 187 was passed in California last November, I contacted them again to propose a joint statement from the organizations cosponsoring the meeting, taking exception to the barriers Proposition 187 puts in the way of freedom of access to social institutions, in particular public schools.

The resolution above was passed by the AWM Executive Committee on 1/4/95 and immediately made available to the other organizations. The last sentence urges an action from the AMS and the MAA, but the MAA Board of Governors had already met the day before. We hoped to get a reaction from the AMS Council, meeting three days later. It is regrettable that the AWM resolution was not included in the Council's agenda. As educators, the matter is of concern to all of us. We urge our sister organizations to consider its implications.

Passed January 4, 1995 by the Executive Committee of the Association for Women in Mathematics

WORKSHOP FOR WOMEN GRADUATE STUDENTS AND POSTDOCTORAL MATHEMATICIANS

Over the past four years, the Association for Women in Mathematics, with funding from the National Science Foundation and the Office of Naval Research, has held a series of workshops for women graduate students and postdoctoral mathematicians in conjunction with major mathematics meetings.

The next workshops in the series will be held in conjunction with the Society for Industrial and Applied Mathematics (SIAM) Annual Meeting in Charlotte, NC, October 22–26, 1995 and in conjunction with the annual AMS-MAA Joint Mathematics Meetings in Orlando, FL, January 9–13, 1996. The workshops will be held sometime during the given time periods; exact dates for these workshops will be announced later.

We invite graduate students to present posters on their thesis problems and postdocs to present talks on their research. AWM will offer funding for travel and subsistence for up to ten women graduate students and ten women postdocs to participate in each workshop. Participants will have the opportunity to present and discuss their research and to meet with other women mathematicians at all stages of their careers. Each workshop will also include a panel discussion on issues of career development, a luncheon, and a dinner banquet.

All mathematicians (female and male) are invited to attend the entire program whether or not they are funded. Departments are urged to help graduate students and postdocs obtain some institutional support to attend the workshop and the associated meetings.

To be eligible for funding, graduate students must have begun work on a thesis problem; postdocs must have received their Ph.D. within approximately the last five years. All non-U.S. citizens must have a current U.S. address. All applications should include a curriculum vitae and a concise description of research; graduate students should include a letter of recommendation from their thesis advisor. Nominations by other mathematicians (accompanied by the information described above) are also welcome.

Please send **five** copies of the application materials to: Workshop Selection Committee, Association for Women in Mathematics, 4114 Computer & Space Sciences Building, University of Maryland, College Park, MD 20742-2461 (applications via email or fax will not be accepted). Applications must be received by **June 1, 1995** for the Charlotte workshop and by **October 1, 1995** for the Orlando workshop. For more information contact the AWM office at (301) 405-7892 or awm@math.umd.edu.

NSF-AWM TRAVEL GRANTS FOR WOMEN

The objective of the NSF-AWM Travel Grants program is to enable women to attend research conferences in their fields, thereby providing a valuable opportunity to advance their research activities and their visibility in the research community. By having more women attend such meetings, we also increase the size of the pool from which speakers at subsequent meetings may be drawn and thus address the persistent problem of the absence of women speakers at some research conferences.

Travel Grants. These grants provide full or partial support for travel and subsistence for a meeting or conference in the applicant's field of specialization. A maximum of $1000 for domestic travel and of $2000 for foreign travel will be applied. International travel must be on U.S. flag carriers whenever possible.

Eligibility. These travel funds are provided by the Division of Mathematical Sciences of NSF, and the research conference must be in an area supported by DMS. For example, this includes certain areas of statistics, but excludes most areas of mathematics education and history of mathematics. Applicants must be women holding a doctorate (or equivalent experience) and having a work address in the U.S. (or home address, in the case of unemployed mathematicians). Anyone who has been awarded an AWM-NSF travel grant in the past two years or who has other sources of external funding, including *any* NSF grant, is ineligible. Partial support from the applicant's institution or from a non-governmental agency does not, however, make the applicant ineligible.

Applications. There will be three award periods per year, with applications due February 1, May 1 and October 1. An applicant should send *five* copies of 1) a description of her current research and of how the proposed travel would benefit her research program, 2) her curriculum vitae, 3) a budget for the proposed travel, and 4) information about all other sources of travel funding available to the applicant along with *five* copies of her cover letter to: Travel Grant Selection Committee, Association for Women in Mathematics, 4114 Computer & Space Sciences Building, University of Maryland, College Park, MD 20742-2461. For more information, contact AWM by phone (301-405-7892) or email (awm@math.umd.edu). Applications via email or fax will not be accepted.

ROSA QI HUANG (1963–1995)

Rosa Qi Huang, a rising star in the field of algebraic combinatorics, died tragically on January 9, 1995 at the age of thirty-one. At the time of her death she was an Assistant Professor of Mathematics at Virginia Tech.

After receiving her B.S. in Mathematics from Beijing University in 1985, she came to MIT, where she was a student of Gian-Carlo Rota; she was awarded the Ph.D. in 1990. After holding a two-year Assistant Professorship at Michigan, she came to Virginia Tech in 1992. This past Fall, she was nominated for a Sloan Foundation Fellowship on the strength of her research in algebraic combinatorics and classical invariant theory.

In her brief career, Rosa Huang was an extraordinarily prolific young mathematician. Outgoing and enthusiastic about her mathematical work, Rosa Huang worked both independently and in numerous productive collaborations. She had recently begun research projects with Roger Howe of Yale and I.M. Gelfand of Rutgers, and she had been actively involved in writing a book on the algebraic combinatorics of simplicial complexes and convex polytopes with Richard Stanley of MIT. This spring, she was to have held a visiting position at Yale to continue her joint work with Professor Howe.

Rosa Huang is survived by her husband, David Gao, also an Assistant Professor of Mathematics at Virginia Tech, and by her two small children, Timothy and Tanya. She is also survived by her parents and by her three brothers. Her death comes as a great loss to her family, her friends, and the entire mathematical community.

Marge Murray, Virginia Tech

AWARDS AND HONORS

One of our long-time male members is being honored. A conference on "Special Functions and Related Topics in Analysis" will be held at York University, North York, Ontario, Canada on Friday and Saturday, June 9–10, 1995. It will be dedicated to LEE LORCH on his forthcoming 80th birthday (September 20, 1995).

The meeting will follow the 50th Anniversary Meeting of the Canadian Mathematical Society to be held at the University of Toronto June 4–8 and will precede the program "Special Functions, q-Series and Related Topics," sponsored by the Fields Institute, to be held at the University of Toronto June 12–23.

The conference will be devoted to those topics in analysis (Fourier analysis, summability theory, special functions, ordinary differential equations, ...) to which Lee Lorch has made particular contributions. It will include a symposium on "Zeros and Eigenvalues." The conference will also honor his lifelong dedication to the struggle for civil rights and for equal educational opportunities for women and minority groups.

For further information, please contact: Martin Muldoon, Department of Mathematics & Statistics, York University, North York, Ontario M3J 1P3; Canada; phone: (416) 736-5250; fax: (416) 736-5757; email: muldoon@mathstat.yorku.ca.

Happy birthday, Lee!

CONGRATULATIONS to the women listed below for their meritorious achievements.

ANNELI LAX, mathematics professor emerita at New York University, was awarded the Yueh-Gin Gung and Dr. Charles Y. Hu Award for Distinguished Service to Mathematics on January 5, 1995 by the MAA. The Hu Award is the Association's most prestigious award and consists of a cash prize of $4000, a citation, and recognition by the American mathematics community.

Professor Lax has been at the center of the MAA's publication program for thirty-three years, overseeing one of the Association's most distinguished series, the New Mathematical Library (NML). She has handled every aspect of the NML from acquisition to cover design. The NML series was planned by Lax and the editorial board "to make mathematics accessible to the general reader without sacrificing technical accuracy." In addition to her successes with NML, Professor Lax has served on several committees of the MAA including the Panel on Remediation (1983–1986) and the Committee on the Award for Distinguished Service to Mathematics (1985–1987).

Professor Lax's interests in language and mathematics led her to develop a combined course of expository writing and mathematical thinking with the writer Erika Duncan. The course, taught at

NYU, was so successful that with Ford Foundation support, Professor Lax expanded the curriculum into several junior and senior high schools in New York City.

The citation for her award reads in part, "No other person in the history of the Association's book publishing effort has played a larger role in developing and nurturing a book series. Some of her admirers have suggested that the NML be retitled as ANML, Anneli's New Mathematical Library."

Responding to the award, Professor Lax wrote:

> I am overwhelmed by the unexpected honor of receiving the ... Award for Distinguished Service to Mathematics.... I have the privilege of having known all but four of the 33 previous winners of this award and am delighted to be in their company. I had always known that there were various ways of being of service to mathematics, many of which are not officially recognized.
>
> As in the case of the NML, my concern has been access to mathematics, and my efforts have been directed to making sure that our schools do not deprive students of learning how to think for themselves by developing, among other skills, one of their natural talents: looking at the world mathematically.... There have been many promising experiments of implementing this agenda: those I have been trying to promote are attention to use of language in all learning, particularly learning mathematics, and developing the art of listening (and reading) so that we can apply this art to looking at our students' emerging ideas as these are voiced in our classes and written in writing assignments we give....
>
> Let us practice what we preach, read and write carefully, avoid trendy slogans, and go beyond mathematical correctness, syntactic correctness and political correctness in serving our discipline in our individual ways.

LISA MANTINI of Oklahoma State University received a Deborah and Franklin Tepper Haimo Award for Distinguished College or University Teaching of Mathematics from the MAA. At Oklahoma State her teaching activities have ranged from the organization of a contest for high school students to the direction of an NSF-supported undergraduate research project to the supervision of master's and doctoral students. She works in representation theory of Lie groups.

SUN-YUNG ALICE CHANG, UCLA, was awarded the Ruth Lyttle Satter Prize by the AMS. She was honored for her deep contributions to the study of partial differential equations on Riemannian manifolds and in particular for her work on extremal problems in spectral geometry and the compactness of isospectral metrics within a fixed conformal class on a compact 3-manifold.

BARBARA BEECHLER, Pitzer College emeritus, Southern California Section, BARBARA T. FAIRES, Westminster College, Allegheny Mountain Section, and THERESA C. MICHNOWICZ, Jersey City State College, New Jersey Section received Certificates of Meritorious Service from the MAA.

CORA SADOSKY, our Past President, has been awarded a Research Professorship from MSRI for the academic year 1995–96.

GRACE WAHBA was awarded the first Emanuel and Carol Parzen Prize for Statistical Innovation.

CALL FOR NOMINATIONS: ALICE T. SCHAFER MATHEMATICS PRIZE

The Association for Women in Mathematics calls for nominations for the Alice T. Schafer Mathematics Prize to be awarded to an undergraduate woman for excellence in mathematics. All members of the mathematical community are invited to submit nominations for the Prize. The nominee may be at any level in her undergraduate career.

The Schafer Prize was established in 1990 by the Executive Committee of the AWM and is named for AWM former president and founding member, Alice T. Schafer, who has contributed a great deal to women in mathematics throughout her career.

The letter of nomination should include, but not be limited to, an evaluation of the nominee(s) on the following criteria: quality of performance in mathematics courses and special programs, demonstration of real interest in mathematics, ability for independent work in mathematics, and performance in mathematical competitions at the local or national level, if any.

Supporting materials (e.g., reports from summer work using math, copies of talks given by members of student chapters, transcripts) should be enclosed with the nomination(s). Send *five* complete copies of nominations for this award by **April 1, 1995** to: The Alice T. Schafer Award Selection Committee, Association for Women in Mathematics, 4114 Computer & Space Sciences Building, University of Maryland, College Park, MD 20742-2461. For more information, contact AWM by phone (301-405-7892) or email (awm@math.umd.edu). Applications via email or fax will not be accepted.

CALCULATOR USE AND GENDER ISSUES

In the spring of 1995 the College Board will require graphing calculators for the Advanced Placement exams in calculus. Will the requirement of calculators adversely affect the achievement of young women on the exams? That is the issue raised in the following statement from the November–December AWM *Newsletter*: "Young women may be placed at a disadvantage if they are less at ease with the technology than the young men" [Vol. 24, No. 6, 1994, p. 9].

The increased use of calculators in mathematics instruction *does* have gender-related implications for confidence and achievement, but those implications are not the ones suggested in the quotation above. Although it is a commonly held notion that many women and girls are less comfortable with technology than their male counterparts, research evidence supports this only with regard to computer use in mathematics. Calculators, on the other hand, seem to generate more positive feelings about mathematics, increase confidence to do mathematics for both males and females, and improve performance in a variety of areas including problem solving [8]. In fact, results from some recent studies indicate that with calculators female students perform as well as *or better than* males. Consider the following:

- In a study of high school students taking precalculus, Ruthven [9] found that among calculator users women scored higher than men on symbolization tasks (converting functions to algebraic form given their graphs) but that the reverse was true for the non-technology group. However, on graph interpretation items — for which technology did not give an advantage to the treatment group — males did better than females with or without calculators.

- Boers and Jones [2] reported that graphing calculators benefitted females more than males when technology was required in a college calculus course for mathematics/computer science majors. For the two years before calculators were required, males had averaged slightly higher than women on the final exam. After the introduction of graphing calculators, the women's scores improved so that their final averages for the next two semesters were ten and nine points higher, respectively, than the men's.

- In a study of over 200 college students enrolled in precalculus, Dunham [3] found that men showed greater achievement than women on visual items on a pretest. After ten weeks of instruction with graphing calculators, both groups showed significant gains on achievement on the posttest. However, gains for the women were greater, thereby eliminating the gender differences that had been present on the pretest.

- Gender differences have been observed as well when non-graphing models of calculators were in use. Bitter, Hatfield, and Mercer [1] reported a positive influence on both performance and attitudes for middle school students who used "fraction" calculators. Overall, students made gains of one grade level or more when using calculators on the Iowa Test of Basic Skills, but scores of the females increased to a greater extent than those of the males. The girls, who had scored lower on average than the boys without calculators, performed equal to or better than the boys when both groups were tested with calculators. Survey results indicated that the students felt more competent and better able to understand mathematics when using technology.

Motivating girls and women to study mathematics is one of the great challenges the mathematics community faces today. Many educators and organizations like the MAA, the NCTM, and the National Research Council have claimed that the use of graphing calculators will increase students' interest and motivation and remove some of the barriers to learning mathematics that have existed in the past. We are now beginning to see evidence from research that the claims have merit. Recent studies have shown that, when compared to non-technology users, students with graphing calculators engaged more willingly in problem solving and stayed with a problem longer, had more flexible approaches to problem solving, had greater overall achievement on graphing items, and better

Penny Dunham is a Visiting Assistant Professor of Mathematics at Muhlenberg College, Allentown, PA, and a College Board consultant for AP calculus. She has conducted research, written, and spoken extensively on the integration of technology with mathematics instruction. She is also on the Board of Directors of Women and Mathematics Education.

understood connections among graphical, numerical and algebraic representations. Moreover, students reported greater confidence in their ability to solve problems when calculators were available. (See the research summaries in [4] and [5] for specific studies and citations.)

But why would the use of calculators benefit young women more than young men, even to the extent of giving females an advantage over males in some cases? The answers are not clear-cut, but there are at least four plausible reasons why calculator-enhanced instruction might affect women's mathematical achievement in this fashion. These involve issues of confidence, spatial ability, algebra skills, and classroom environment.

First, confidence consistently emerges as a significant predictor of mathematical achievement for women, more so than for men [6]. Anything that raises confidence thus might have a greater benefit to women than men. Ruthven [9] has conjectured that women gain confidence because graphing calculators provide feedback on algebraic work. That reduces anxiety and may result in increased achievement. In other studies [3, 10, 11] women have reported feeling more confident in their work because the calculator provided a way to check algebraic solutions and confirm the accuracy of answers.

Second, gender differences in spatial ability have traditionally favored males, and spatial ability is sometimes a significant predictor for mathematics achievement in women. Since graphing technology requires students to reason from visually-presented information, one might suppose that women would be at a greater disadvantage with graphing calculators. In fact, it appears that using graphing calculators can actually improve spatial ability. Shoaf-Grubbs [10] used traditional measures of spatial ability with female students enrolled in college algebra. She reported that women in the graphing calculator section made greater gains in spatial visualization skills than women in a non-technology section. Despite an advantage for the control group on pretests, the treatment group scored significantly higher on the Card Rotation posttest and made larger gains on the Paper Folding test than the control group. Ruthven [9] has suggested that more exposure to graphical images via technology may have improved the females' ability to visualize functions and graphs, thereby remediating a deficiency in experience and leading to higher achievement for the women in his study. Other researchers have shown that spatial ability is amenable to training [7], so this may be a valid interpretation. Even if *ability* to visualize does not improve, the calculator provides an alternative *source* of visual images for those who cannot create their own. Having the option of approaching a problem both visually and algebraically is helpful, as this woman notes: "In my case, I can think about the problem more logically and realistically. Using the calculator has been a great learning tool in that it uses illustrations; it is more interesting." [11, p. 6]

Third, along with increased attention to visual methods of solution, graphing calculator instruction reduces attention to algebraic symbol manipulation. De-emphasizing a traditional area of strength for women could lead to lower achievement for them but, in an analysis of calculus exam responses, Boers and Jones [2] found that the opposite had occurred. Males and females did prefer different solution strategies, with men leaning more toward graphing solutions and women more toward algebraic strategies. It was the females' better performance on purely algebraic questions that gave them their "edge" as they were able to use a full range of tools, combining strength in algebra with new skills in graphical solutions.

Choice of solution method is further complicated when its interaction with confidence is considered. Dunham [3] found that when given a choice of strategies, low confidence females were the most likely group to use graphing calculators and high confidence females the least likely. Analysis of interviews revealed that women tended to use algebra wherever possible, but they were happy to have a calculator to "fall back on" when their algebra skills (or their confidence in those skills) were not adequate. Attitudes toward calculators didn't play a role in choice, in that most students expressed confidence in graphing solutions and viewed calculators as fast, efficient, reliable tools. But the high confidence females were more likely to exhibit "algebraic guilt," a feeling that they relied too much on "easy" calculator solutions and would benefit more from learning algebraic techniques. The implication was, "Algebra is hard so it must be good for you." High confidence females also mentioned that using algebra gave them a greater sense of personal accomplishment.

Finally, past research on gender issues has shown that female students achieve more in mathematics classrooms that promote cooperative learning over competitive settings [6]. Recent

studies indicate that use of graphing calculators dramatically changes the classroom climate [4, 5]. Instructors lecture less and students engage in more group work, investigation, and problem solving. Thus a curriculum that fully integrates technology may create a classroom environment that fosters and encourages female students and is more conducive to their learning.

Further research is needed to determine which, if any, of these factors account for female students' success with graphing calculators. But whatever the reason, it seems likely that young women will not be disadvantaged by the requirement of graphing calculators for the AP calculus exams. Despite common notions that girls and women are less comfortable with technology, most calculator users will agree with the female college algebra student who wrote, "It is great to have a graph in the palm of your hand and to be able to explore it and make comparisons. The graphing calculator should be introduced as soon as possible to help overcome the common fears of math." [11, p. 6]

Perhaps an even stronger testament to the power of technology is the one written by a student from the non-technology section of Shoaf-Grubbs' study: "Although I never used [a graphing calculator], I think that is should be used as a tool/device because all of my friends who took the calculator section enjoyed it very much. They also said that the calculator decreased their anxiety about math." [11, p. 7] If word-of-mouth can generate such a reputation among women who haven't even used them, think what benefits await women who do use the technology!

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RE: CHANGES IN AP CALCULUS EXAMS

For the past decade I have been making extensive use of graphics calculators in all of my high school and middle school mathematics courses. Through the 1980's I taught in a coed school, and for the past four years I have been teaching at an all-girls school. When I taught in a coed school I attempted to make use of the school computers, and most of the time I found that the "guys hogged the machines." You are no doubt aware of the research that supports what I found to be the case, and I would imagine that many other educators have had a similar experience. The attitude of young women in my classes towards technology changed dramatically when the graphics calculator was introduced in the mid 1980's. The reaction of my female students to this hand-held technology has been highly positive, and it has had a very strong impact on how

Ron Lancaster, Past-President, OAME (Ontario Association for Mathematics Education), Hamilton, Ontario

they learn mathematics. Young women tend to enjoy playing with problems over a period of time (in my opinion this is one of the reasons that very few female students do well on mathematics contests, where the time limit does not allow for this type of exploration), and a graphics calculator allows them to examine and analyze problems from a number of points of view. This technology gives them the opportunity to consider any problem from three major perspectives: numerically, graphically and algebraically. They also enjoy working collaboratively, and the model that my students have been working with (the Texas Instruments TI82) allows them to share programs, data, graphs, and even personal notes!

A great deal of the curriculum that is taught in North America is highly repetitive and boring. By using a graphics calculator I have been able to make major changes in the content of my courses. So far this year my Grade 7 students have worked on several optimization problems from the Calculus, and they have also played with a variety of problems that involve financial mathematics. It would have been computationally impossible for me to give these problems to my Grade 7 students several years ago, and yet today, the problems are within the reach of all of my students. I believe that many young women are bored with the curriculum, and they would do so much better if they saw a point to what they were studying. The graphics calculator will allow educators to make dramatic and exciting changes in the content and in the way that students learn mathematics.

For all these reasons we should be encouraging the use of a graphics calculator in *all* middle and high school mathematics courses *and on the AP Calculus Examinations*. These machines will enable young women to explore mathematics and to make their own personal discoveries. Especially at the middle-school level, they will allow students to move beyond a curriculum that is obsessed with arithmetic.

It goes without saying that teachers will need extensive training in how to use a graphics calculator. For the past six years I have taught a week-long course at The Phillips Exeter Academy Mathematics and Technology Conference, and I would highly recommend this conference to any educator interested in learning how to use a graphics calculator to enhance and enrich the learning of mathematics. The conference is held each year at the end of June in Exeter, NH; more information may be obtained by calling (603) 772-4311 X 3381.

LETTER TO THE EDITOR

To the editor:

I am a junior at Wellesley College and a member of the Association for Women in Mathematics. I am writing in response to the change in the AP calculus exams. Three years ago I took that exam, and part of what I was tested on was my ability to graph equations. I am afraid that with the change in the exams and the more widespread use of graphing calculators, students will lose the ability to graph without them. I had to learn how to graph the hard way and since have been very glad that I did. There have been many times in upper level classes where I was required to understand how an equation works and how the placement of just one variable would change the resulting graph. Had I learned to graph with the mandated crutch of a graphing calculator, I would have relied on it and not understood the "why's" of what I was doing.

Let me illustrate this with an example: my roommate this semester was taught to graph using a graphing calculator. When she realized that she didn't understand the theory behind what she was doing, she tried to teach herself how to graph manually by reading the textbook. After struggling for a while, she asked her teacher for help. That teacher told her she did not need to understand, that was what technology was for. To this day, she does not know how to graph without a calculator. I fear that my roommate's experience is not uncommon.

I do not mean to insinuate that calculators of any sort should not be used. On the contrary, they make my life much easier. However, I do mean to say that the student must understand why. Once children understand why seven times six is forty-two, let them use calculators. And once students understand why (sin x) / x looks the way it does, then let them use calculators. By requiring students to use graphing calculators on the AP exams, we are not asking them whether they understand, we are asking them if they can enter data into a mini-computer. What is that we want our students to do? Spout back what we plug into them, or understand?

Sincerely,

Anne Gaffney
Cambridge, MA
November, 1994

AWM ACTIVITIES: JANUARY 1993 TO JANUARY 1995

• Alice T. Schafer Undergraduate Prize in Mathematics. (Awarded annually since 1990.)

1993 Co-winners: Cathy O'Neil and Dana Pascovici; Runners-up: Melissa Aczon and Susan W. Goldstine; Honorable mentions: Karin Dorman, Rebecca Field, Ariel Glenn and Jennifer Slimowitz.

1994 Winner: Jing Rebecca Li; Runners-up: Patricia Hersh, Julia J. Rehmeyer and Nina Zipser; Honorable mentions: Jennifer M. Switkes and Yi Wang.

• Louise Hay Award for Contributions to Mathematics Education. (Awarded annually since 1991.)

1993: Naomi Fisher (University of Illinois at Chicago)

1994: Kaye de Ruiz (U.S. Air Force Academy)

1995: Etta Z. Falconer (Spelman College)

• Noether Lectures. (Annual series of lectures presented each January since 1980.)

1993: Linda Keen, "Hyberbolic geometry and spaces of Riemann surfaces," San Antonio, TX

1994: Lesley Sibner, "Analysis in gauge theory," Cincinnati, OH; Ol'ga Ladyzhenskaya, "On some evolutionary fully nonlinear equations of geometrical nature," Special Noether Lecture at ICM'94, Zürich, Switzerland

1995: Judith D. Sally, "Measuring Noetherian rings," San Francisco, CA

• Workshops for Women Graduate Students and Postdoctoral Mathematicians. (Supported through grants from NSF and ONR.)

12 January 1993, Joint Mathematics Meetings, San Antonio, TX. Eight postdocs and twelve graduate students. Panelists on Launching a Career in Mathematics: Lenore Blum, Carolyn Gordon and Deborah Lockhart. Presentation: alumnae of the Mills College Summer Program. Organizer and chair: Ruth Charney. Cochair: Cora Sadosky.

11 July 1993, SIAM Annual Meeting, Philadelphia, PA. Nine postdocs and thirteen graduate students. Panelists on Launching a Career in Mathematics: Margaret Cheney, Suzanne Lenhart and Virginia Torczon. Panelists on Funding Mathematics Research: Debbie Lockhart (NSF), Reza Malek-Madani (ONR) and Jagdish Chandra (ARO). Keynote dinner speaker: Barbara Keyfitz. Organizer: Suzanne Lenhart. Chair: Barbara Keyfitz.

11 January 1994, Joint Mathematics Meetings, Cincinnati, OH. Ten postdocs and eleven graduate students. Panelists on Launching a Career in Mathematics: Lynne Butler, Ruth Williams and Susan Williams. Organizer and chair: Ruth Charney. Cochair: Lenore Blum.

24 July 1994, SIAM Annual Meeting, San Diego, CA. Ten postdocs and ten graduate students. Panelists on Careers in Applied Mathematics: Ann Almgren, Mimi Celis, Deborah Levinson and Joyce MacLaughlin. Panelists on Funding Mathematics Research: Jagdish Chandra (ARO) and Deborah Lockhart (NSF). Keynote dinner speaker: Margaret Wright. Organizer and chair: Dianne O'Leary.

7 January 1995, Joint Mathematics Meetings, San Francisco, CA. Ten postdocs and ten graduate students. Panelists on Launching a Career in Mathematics: Dusa McDuff, Gail Ratcliff and Catherine Roberts. Presentation: members of the Noetherian Ring, a group of female graduate students at UC Berkeley. Organizer and chair: Ruth Charney. Cochairs: Chuu-Lian Terng, Cora Sadosky and Carol Wood.

• AWM/NSF Travel Grants for Women Mathematicians. (Supported through grants from NSF.)

1993 February: Seven grants totalling $5,900; May: Ten grants totalling $6,000; October: Eight grants totalling $8,000.

1994 February: Ten grants totalling $8,000; May: Six grants totalling $6,500; October: Seven grants totalling $6,000.

• Sonya Kovalevskaya High School Days. (Supported through grants from NSF and the Sloan Foundation.)

1994 Spring: American University, Briar Cliff College, Rivier College, St. John's University; Fall: Columbia University, Elizabeth City State University, Norfolk University, Pembroke State University, Worchester Polytechnic Institute

1995 Spring: Colorado School of Mines, Emporia State University, Rivier College, Rhode Island College, Sierra Nevada College, University of Tennessee

Cora Sadosky, January 1995

- Participation in national and international events.

Sixth Meeting of the European Women in Mathematics (EWM) Warsaw, June 1993. AWM representative: Mary Gray.

First Meeting of the Palestinian Society of Mathematical Sciences, Birzeit, June 1993. AWM representative: Mary Gray.

Joint Meetings with the Canadian Mathematical Society Vancouver, August 1993. AWM representatives: Executive Committee.

ICME Study Group on Gender in Mathematics Education, Hoor, October 1993. AWM representative: Cora Sadosky.

A Celebration of Women in Mathematics. A symposium organized by Susan Friedlander at MIT, Cambridge, March 1994. Chuu-Lian Terng (AWM President-Elect) was an invited speaker.

CBMS Workshop on U.S. Participation in International Mathematical Activities. AWM international expert: Mary Gray. Cora Sadosky (AWM President) participated as CBMS Council member.

International Mathematical Union (IMU) General Assembly, Luzern, July 1994. Chuu-Lian Terng (AWM President-Elect) was a member of the U.S. Delegation.

International Congress of Mathematicians ICM 94, Zürich, August 1994. AWM activities coordinator: Cora Sadosky.

Workshop for Women in Probability. A workshop organized by Ruth Williams and Molly Hahn, Ithaca, October 1994. AWM representative: Cora Sadosky.

- Panels at the Joint Mathematics Meetings.

August 1993, Joint Meeting with the Canadian Mathematical Society, Vancouver, Canada. "Affirmative action." Panelists: Joan Geramita, Richard Griego, Mary Gray and Joan Wick Pelletier. Moderator: Asia Ivic Weiss. Organizer: Cora Sadosky.

January 1994, Joint Mathematics Meetings, Cincinnati, OH. "Are women getting all the jobs?" Panelists: Lynne Billard, Helen Grundman, Mel Rothenberg and Mark Winstead. Moderator and organizer: Cora Sadosky.

August 1994, International Congress of Mathematicians, Zürich, Switzerland. "Discussion with women mathematicians." Panelists: Christine Bessenrodt (Germany), Mary Gray (AWM), Verena Huber-Dyson (Canada), Krystyna Kuperberg (U.S.), Lucy Moser-Jauslin (France), Marjatta Naatanen (EWM), Raman Parimala (India), Ana Maria Porto da Silva (Portugal) and Asia Ivic Weiss (CWM). Moderator and organizer: Cora Sadosky. Co-organizers: Eva Bayer and Asia Ivic Weiss.

August 1994, Mathfest, Minneapolis, MN. "Celebrating women's achievements in algebra, analysis, combinatorics and geometry: past, present, future." Panelists: Jane Gilman, Karen Saxe, Doris Schattschneider and Marie Vitulli. Moderator and organizer: Joan Hutchinson.

January 1995, Joint Mathematics Meetings, San Francisco, CA. "AWM: Why do we need it now?" Panelists: Sylvia Bozeman, Mary Gray, Susan Landau and Ruth Williams. Moderator and organizer: Cora Sadosky.

- AWM Committees and Project Directors.

Noether Committee: Karen Vogtmann (1993), Alice Chang (1993, 1994), Sylvia Wiegand (1993, 1994, 1995), Tilla Weinstein (1994, 1995, 1996)

Hay Award Committee: Sylvia Bozeman (1993), Naomi Fisher (1993, 1994), Carolyn Mahoney (1993, 1994, 1995), Deborah Tepper Haimo (1994, 1995, 1996)

Schafer Prize Committee: Jill Mesirov (1993), Phyllis Cassidy (1993, 1994), Linda Rothschild (1993, 1994, 1995), Ruth Charney (1994, 1995, 1996)

Kovalevskaya HS Days: Mary Gray (chair), Ellie Palais, Alice Schafer (1993, 1994, 1995)

Workshops Committee: Cora Sadosky, Ruth Charney, Pam Cook, (1992-94), Ruth Charney, Carolyn Gordon, Joyce MacLaughlin (1994-97)

Travel grant director: Carol Wood (1992-94), Chuu-Lian Terng (1995-97)

Representatives to JCW: Alayne Parsons, Marie Vitulli

Representatives to AAAS: Alice Schafer (Mathematics Section), Mary Gray (Statistics Section)

Long Range Planning Committee: Mary Gray, Judy Green, Linda Keen, Anne Leggett, Cora Sadosky, Chuu-Lian Terng, Carol Wood

Nominating Committee: Mary Gray, Rhonda Hughes, Carol Wood

- Resources.

Publications (partially supported by grants from NSA and the Exxon Education Foundation): The AWM *Newsletter*, Editor: Anne Leggett, Circulation 4,000; *1994 Membership Directory*, issued 3,000; Noether Lecturers booklet, issued 10,000;

Careers That Count booklet, reprinted 36,500 with partial support of CBMS.

E-mail forum: AWM-Net, Editor: Dianne O'Leary, awm-net-request@cs.umd.edu.

- New AWM Office at College Park, MD.

Through the generous hospitality of the University of Maryland, the new AWM office was established in February 1993 at College Park. A new post of Association Administrator was created, with Dawn Wheeler making AWM history in it. Ginny Reinhart was the Executive Director for 1993, succeeded by Joanna W. Schot in January 1994. Angie Beach joined us in 1994 as part-time Bookkeeper/Secretary. Part of the office's activities are financially supported by the Exxon Education Foundation grant. All its workings are supported by Judy Green, AWM Treasurer.

It is difficult to explain to anybody but those of us that have directly appealed for its assistance, what a great resource center the AWM office has become. I have asked Joanna to write a piece for the *Newsletter* on the activities of the office to give our members an idea of what their work entails.

Many more people than those mentioned in here are responsible for the activities of AWM. The work of Bettye Anne Case, AWM Meetings Coordinator, is of special significance. The Association happily recognizes the contribution of all our volunteers.

DINNER FOR WOMEN GEOMETERS

The 1995 East Coast Geometry Festival will be held at SUNY-Stony Brook, April 28–30. All women attendees of the Festival are cordially invited to attend a dinner on Friday, April 28th, which will take place on the Stony Brook campus. We will have a catered, buffet-style dinner and expect the cost to be under $10 per woman, payable at the dinner. Our invited speaker will be Dr. Dusa McDuff, Professor of Mathematics at SUNY-Stony Brook. She will talk about being a woman mathematician, after which we will have an informal question and answer session/discussion. The exact time and location will be announced at registration Friday afternoon.

We ask that women planning to attend the dinner RSVP via e-mail by April 25th, to the addresses shown in the byline. Please include in your response any dietary restrictions you may have. You may also send questions and suggestions to the same addresses. This is the second year we are holding such a dinner. The dinner at the last Geometry Festival was great fun and very well attended. We hope you will join us!

Helen Moore (helen@math.sunysb.edu);
Sarah Greenwald (sarah@math.upenn.edu)

FIRST BIRTHDAY FOR AWM-NET

AWM-Net is an electronic mail forum initiated in January, 1994, for discussing issues related to the AWM mission. In its first year, the 33 AWM-Net digests contained 62 submissions, including announcements of workshops, funding opportunities, journals, available resources, introductory messages, and requests for advice. There are now 150 members of AWM-Net.

AWM-Net can be used to update each other on our work and interests and to discuss some of the problems (joys too!) of being women in our field. It is an appropriate place for calls for papers, information about meetings, conferences etc., recruiting, questions about how to handle a job-related problem, and just about anything else where the intended audience is women in mathematics. (Job ads are ordinarily not posted.)

Membership in AWM-Net is free to all members of AWM. If you are interested in joining AWM-Net, send a mail message to awm-net-request@cs.umd.edu, including both your email and postal mail addresses. I'll respond to your message as soon as I can.

I hope that you will use AWM-Net this year to give and receive help and that this network becomes a real catalyst in building community among women in mathematics.

Dianne P. O'Leary, University of Maryland

EDUCATION COMMITTEE

Linear Algebra with Computers

Linear algebra is often a required course for mathematics majors. Also, because of its varied applications, it is often recommended for majors in engineering, the natural sciences, and some social sciences. An important goal is to establish the relationships among systems of equations, matrices, determinants, vectors, linear transformations, and eigenvalues. Students' grasp of such complicated and abstract material is often hindered by the arithmetic drudgery involved. In 1990 the Linear Algebra Curriculum Study Group was formed with the encouragement of the SIAM Activity Group in Linear Algebra and the International Linear Algebra Society. With support from NSF, the group held a workshop at the College of William and Mary in August of that year. Five recommendations were generated at the workshop, one of which is to encourage faculty to utilize technology in the first linear algebra course. This recommendation is gradually gaining support in the greater mathematics community. Many experiments have been tried; one example is the NSF sponsored project ATLAST (Augmenting the Teaching of Linear Algebra through the use of Software Tools). The project was initially conceived by the Education Committee of the International Linear Algebra Society. The Project Director is Steven J. Leon and the Assistant Director is Richard Faulkenberry; both are in the Mathematics Department of the University of Massachusetts, Dartmouth. During the summers of 1992 and 1993, the ATLAST project sponsored a series of ten faculty workshops nationwide to encourage and facilitate the use of MATLAB, a software system that operates on matrices, in the teaching of linear algebra.

MATLAB provides an interactive environment for numerical computation which uses a single object, the matrix. The MATLAB command structure resembles the way we write algebraic expressions. Most MATLAB command names closely parallel terminology from the operations and concepts of linear algebra. MATLAB is also used by professional engineers and scientists, so familiarizing students with it helps prepare them to use tools they will need in their future careers.

Last spring semester, after having attended an ATLAST workshop at the University of Maryland, I integrated a laboratory component using MINIMAT, a public domain subset of MATLAB, into my linear algebra course. Linear algebra requires less change in teaching style to incorporate computers than many other mathematics courses. The technology removes the tedium of arithmetic manipulations, thus allowing the learners to concentrate on understanding the underlying concepts.

Early in the semester I scheduled a few class meetings in a computer lab. The first few laboratory assignments introduced the students to the basic features of MINIMAT and to some elementary linear algebra concepts. After that, they were given weekly assignments with problems to solve. The main body of each assignment was a sketch of the mathematical background together with a precise description of the problem with the theorems and algorithms needed to solve it. Following the background discussion was a list of problems, some of which were tedious to solve using only paper and pencil. After seeing how quickly the software helped to solve problems, many students began to respond enthusiastically.

Our laboratory exercises are based on several paradigms to help students learn linear algebra: *learning-by-doing*, *drill-and-practice*, *"what-if" prediction*, and most importantly *real-world applications*. For example, to ensure that the students learn the mechanics of Gaussian elimination, we used a routine that requires students to specify the elementary row operations for the computer to carry out. Once they have mastered this concept, the students are allowed to use the automatic row reduction routine (RREF) to solve real problems. A key way to motivate students in introductory linear algebra is to present them with interesting ideas, problems, and particularly real-world applications. With computers doing much of the tedious work, we were able to introduce more realistic interpretations of problems than are usually found in standard text books, such as the traffic-flow problem with many streets or the bride-groom assignment problem with more than three or four couples. To help

Suda Kunyosyoing (Shepherd College) has been experimenting with the use of technology in teaching linear algebra and reviews her experiences in this report. For further information, email Suda at skunyosy@scvax.wvnet.edu.
AWM Education Committee, Sally I. Lipsey, Chair, 70 E. 10th Street, #3A, New York, NY 10003-5106

motivate the concepts of matrix multiplication, matrix inverse, and determinant functions, we assigned a project on cryptography, a real application project that appeared to be a favorite among our students.

Cryptography is the study of coding and decoding messages. Simple letter-replacement codes are, unfortunately, easy to break. One way to make a code more difficult to decipher is to divide the message into blocks of letters and multiply each block by the *ciphering matrix*. Then decoding is accomplished by using the inverse of the ciphering matrix. When the deciphering matrix is not known, the decoder must look for clues in the coded message that will give rise to the matrix.

Putting together meaningful projects and laboratory exercises has taken much time and experimentation. We are currently organizing these laboratory exercises and projects to compile a supplement for use as a laboratory manual in our department.

There are several drawbacks, however. This approach to computer-aided instruction is based on independence and requires extra time beyond three lectures per week. Initially, the students were not enthusiastic about using computers and thinking independently. I handled this by putting students in groups of three when doing an experiment or project. This encouraged discussion and dialogue among students. As a result, more students were studying with others on all their homework assignments. The course was much livelier and more fun to teach than before.

From this pleasant experience, I really recommend to other linear algebra instructors that they try using computers in their teaching. Any computer software packages that perform the algebraic manipulations of matrices and the automatic row reduction of an augmented matrix can be used. Using MINIMAT, however, helps expose students to MATLAB-like commands, easing the transition from school to real-world computing, while addressing the pedagogical objectives recommended by the Linear Algebra Curriculum Study Group.

Eleventh Annual Small College Computing Conference

Iona College will host a conference on October 20 and 21, 1995, for exchange of information about the use of computers in the academic environment. The meetings will be held in New Rochelle, NY, both on campus and at the Ramada Plaza Hotel. Conference papers will be published in the *Journal for Computing in Small Colleges*. The deadline for proposals is March 10.

The following people may be contacted for further information. ESCCC papers: Dr. Steven Andrianoff, Department of Computer Science, St. Bonaventure University, St. Bonaventure, NY 14778; andrianoff@sbu.edu; (716) 375-2053; ESCCC panels: Dr. Elizabeth S. Adams, Richard Stockton College of New Jersey, PROS, Pomona, NJ 08240; fac188@vax003.stockton.edu; (609) 652-4587. Information: Dr. Catherine Ricardo or Dr. Frances Bailie, Department of Computer and Information Sciences, Iona College, 715 North Avenue, New Rochelle, NY 10801; (914) 533-2561 or (914) 633-2335; cmrl@iona.bitnet or fkbl@iona.bitnet.

SUMMER PROGRAMS

ATLAST 1995 Linear Algebra Workshops

ATLAST, the NSF Project to Augment the Teaching of Linear Algebra through the use of Software Tools, will offer two faculty workshops on the use of software in teaching linear algebra during the summer of 1995. Workshop participants will learn about commercial linear algebra software packages and will be trained in the use of the MATLAB software package. Attendees will learn how to incorporate computer exercises and laboratories into undergraduate linear algebra courses effectively.

Participants will work with exercises from the forthcoming ATLAST book and will be expected to design additional computing exercises at a level suitable for undergraduate linear algebra. These exercises will be class tested during the school year following the workshop and then submitted to the project director for inclusion in the ATLAST database. Some of these exercises will be included in later editions of the ATLAST book or be made available to the general public through the Mathematics Archives at the University of Tennessee, Knoxville.

The project was conceived by the Education Committee of the International Linear Algebra Society (ILAS). Steven J. Leon of this Committee is the ATLAST Project Director, and the Assistant

Director is Richard Faulkenberry. Both are in the Mathematics Department of the University of Massachusetts Dartmouth. The ATLAST project is funded by an NSF Faculty Enhancement grant.

This is the fourth year of ATLAST workshops. Past workshops have been rousing successes. We are confident that those in '95 will be even better.

Summer 1995 ATLAST Workshops will be held at Seattle University, Seattle, Washington, June 21–24, 1995, Workshop Presenter: Dr. Jane Day, San Jose State University and College of William and Mary, Williamsburg, Virginia, July 19–22, 1995, Workshop Presenter: Dr. David Hill, Temple University.

All teachers of undergraduate linear algebra courses at colleges or universities in the U.S. are invited to apply for the ATLAST workshops. The deadline for applications is **March 20, 1995**. Late applications will be accepted on a space available basis. Each workshop will be limited to thirty participants. The ATLAST Project provides room and board for all participants accepted. A screening committee will review applications and notify applicants of its decisions early in April. For further information and application forms contact: Steven Leon, ATLAST Project Director, Department of Mathematics, University of Massachusetts Dartmouth, North Dartmouth, MA 02747; phone: (508) 999-8320; email: atlast@umassd.edu; fax: (508) 999-8901.

DIMACS REU Program for 1995–96

Contingent on funding from the National Science Foundation, the Center for Discrete Mathematics and Theoretical Computer Science (DIMACS) will offer a Research Experiences for Undergraduates (REU) program. DIMACS is one of 25 Science and Technology Centers funded by the NSF. Located at Rutgers University, it is a joint project of Rutgers (Computer Science, Mathematics, and Operations Research), Princeton (Computer Science), AT&T Bell Laboratories, and Bellcore.

The program begins with eight weeks of intensive work during the summer of 1995 and continues through the academic year 1995–96. Up to five undergraduates will be selected to participate, and each will have a DIMACS faculty member as a supervisor. During the summer, supervisors help students choose and begin work on suitable research problems. Past research topics have included complexity of algorithms, computational biology, computational learning theory, combinatorial optimization, and discrete geometry. The timing of the eight-week summer work period is to be arranged by the student and supervisor during June–August, 1995. The program will provide each student with a stipend, which includes summer living expenses and travel.

Applicants should be undergraduates with a major in computer science, mathematics, or a closely related field. They should currently be juniors (graduating in 1996), although sophomores with exceptionally strong backgrounds will be considered. Preference will be given to students who will continue their research projects during the academic year, under the direction of either their supervisor or a faculty member from their home institution. DIMACS is particularly interested in increasing the participation of women, minorities, and disabled students.

An application and a full announcement of the program may be obtained from Ida Castellano, REU program, DIMACS, Core 406, Busch campus, Rutgers University, Piscataway, NJ 08855-1179; email: ida@dimacs.rutgers.edu, fax: 908-445-5932, phone: 908-445-5928. Applications should be mailed to the same address; completed applications are due by **April 13, 1995**. For further information, contact the program coordinator, Deborah Franzblau, franzbla@dimacs.rutgers.edu, (908) 445-4573.

The Middle Math Project

The Middle Math Project will be held at the Department of Mathematics, 219 Austin Building, East Carolina University, Greenville, NC 27858-4354 (phone: (919) 328-4111; fax: (919) 328-4103). The Conference will be held August 2–6, 1995; a Follow-Up Conference will be held June 7–9, 1996.

The Middle Math Project will bring together a group of forty mathematicians and mathematics educators from across the country to learn about the changing nature of the middle grades curricula and to consider the implication of these changes for improving the undergraduate preparation of teachers of middle grade mathematics. Participants will work collaboratively to develop models for the mathematics component of pre-service middle grades teacher preparation programs as well as design and test new undergraduate courses that will fit into their programs. The project lasts for two

years. During the 1995 summer conference, participants will explore the NSF-funded Middle Grades Mathematics Curricula currently being developed, hear and react to the developers' perspectives on how curriculum change should affect teacher preparation, and examine curriculum materials and how manipulatives and technology are used to enhance student learning.

Participants will analyze some of the past NSF-funded Middle School Mathematics Teacher Preparation Projects (1986–1991) with their creators. Then in small groups, participants will discuss, brainstorm, and plan the changes they wish to make at their home institutions. During the 1995– 96 academic year, participants will change at least one course in their middle grades' program. Then at the follow-up conference in the summer of 1996, they will present poster sessions on these pilot classes and describe what changes they are planning to make. In working groups, they will develop refinements and modifications to their plans. Invited speakers will discuss the use of research on teaching and learning in developing the curriculum and also sources of funding for the development of the participants' projects.

The conference is designed for university, college, and community college faculty who are involved in the mathematics content and pedagogy courses for pre-service middle grades teachers. Teams consisting of mathematicians and mathematics educators from the same institution are desirable as are teams that link several institutions.

The Middle Math Project will provide per diem and a stipend of $375 for all participants in the first conference. Similar arrangements will be made for the second conference. Participants' home institutions are expected to cover the cost of travel as an in-kind contribution. Some travel funds are available in cases of special need.

The application deadline is **May 15, 1995.** Information on the project is posted on Gopher at the address ecuvax.cis.ecu.edu under the heading ECU Project and Course Information. For additional information, contact Katherine Stanley in the project office or send an inquiry by e-mail to mathmid@ecuvax.cis.ecu.edu.

The Middle Math Project is funded by the NSF (Grant #4-90481), the North Carolina Statewide Systemic Initiative, and East Carolina University. East Carolina University is a constituent institution of the University of North Carolina, an Equal Opportunity/Affirmative Action Employer.

PROJECT NEXT

Project NExT (New Experiences in Teaching) is a program for new or recent Ph.D.'s in the mathematical sciences who are interested in improving the teaching and learning of undergraduate mathematics. Faculty who are just beginning or just completing their first year of full-time teaching at the college/university level are invited to apply to become Project NExT Fellows. The first event for the 1995–1996 Fellows will be a Workshop, August 3–5, 1995, just prior to the Summer Joint Mathematics Meetings (the MATHFEST) in Burlington, VT. At this Workshop, Fellows will explore and discuss issues of special relevance to beginning faculty, including calculus and pre-calculus reform, alternative methods of teaching and assessment, technology in the classroom, lessons from pedagogical research, and the faculty member as teacher and scholar. The Fellows will also have an opportunity to meet and interact with the first group of Fellows, who began the program in August, 1994.

Invited speakers include Kenneth Ross, University of Oregon, President, MAA; Joseph Gallian, University of Minnesota–Duluth; Sharon Ross, DeKalb College; and Abdulalim Shabazz, Clark Atlanta University.

Following the Workshop, Project NExT Fellows will attend the summer Joint Mathematics Meetings (August 6–8), participating in all the opportunities of that meeting, and choose among special short courses on issues in teaching and learning collegiate mathematics, including the pedagogical uses of graphing calculators and computers. During the following year, Project NExT Fellows will participate in a network that links Project NExT Fellows with one another and with distinguished teachers of mathematics, special events at the Joint Mathematics Meetings in Orlando in January, 1996, and a Workshop in the summer of 1996.

Sixty Project NExT Fellows will be selected for the 1995–1996 year. Funding for room and board at the Workshop in Vermont and for the short courses at the 1995 MATHFEST will be provided by a grant from the Exxon Education Foundation. Institutions employing the Project NExT Fellows are expected to provide financial assistance. Limited funds are available to those institutions that are unable to afford full or partial support.

Completed applications are due on **April 28, 1995**. Applicants will be notified by June 1, 1995,

whether they have been accepted as Fellows. For application materials or additional information, contact: James R.C. Leitzel, Department of Mathematics and Statistics, University of Nebraska–Lincoln, P.O. Box 880323, Lincoln, NE 68588, (402) 472-7232, jimleitz@unlinfo.unl.edu or T. Christine Stevens, Department of Mathematics and Computer Science, Saint Louis University, 221 North Grand Boulevard, St. Louis, MO 63103, (314) 977-2444, stevnsc@sluvca.slu.edu.

BEIJING CONFERENCE

Over 30,000 women will attend the Fourth United Nations World Conference on Women: Action for Equality, Development and Peace to be held in Beijing during September, 1995. Grass roots planning is currently taking place worldwide. At the Conference, official delegates representing U.N. member states and speaking for their delegates will vote on an official document, the *Platform for Action.*

The *Platform for Action* is immensely important. It represents global consensus and sets the tone for government policies for women worldwide. By their vote on the document, countries commit themselves to goals, standards of behavior, and actions. The document becomes an organizing and leveraging tool to use with governments and institutions. Media attention educates and informs the public.

Grass roots local, regional, national and international groups have been working on a draft of the *Platform for Action.* As is usual with U.N. World Conferences, the official document is drafted by two groups working independently and together. One group is comprised of the official government representatives and the accredited Non-Governmental Organizations (NGO's), while the other is composed of groups of individuals and non-accredited organizations. The U.N. World Conference and the NGO Forum will be held simultaneously in Beijing. The NGO Forum for the Fourth World Conference on Women invites everyone, individual or group, to attend. Participants cannot view the proceedings of the government conference, but they may give input to the *Platform for Action* and provide a forum for the exchange of ideas and information with workshops, panels, film/video presentations and cultural events.

The American Association for the Advancement of Science had a special day-long symposium to discuss the manner in which science and technology is being factored into the preparations, planning and agenda for the WCW at their annual meeting in February. Dr. Gertrude Mongella, Secretary General for the WCW, was the Topic Speaker.

I want to know why mathematics is not doing the same. The mathematics organizations should also be thinking about how to contribute to the document and what sorts of activities to contribute to the WCW. The MAA and the AWM have both applied for accreditation as NGO's. All mathematicians and mathematics educators must work together to make the document reflect the concerns of women and girls in mathematics, and we need to do it now. Time is short!

Creating a presence at the Conference makes an excellent opportunity for the mathematical community to break down its stereotype of aloofness. Let's open ourselves to the youth. By the year 2000, over half of the world's population (over 60% in Asia) will be under 25 years of age. We want these young people to know that understanding mathematics can help them. I want the phrase "women and mathematics" in the conference document so that all peoples will know that mathematicians are concerned about the real-life issues that women are struggling with. I want *knowing mathematics can help save the world* on a big sign at the conference! How can we get it there? Let's get visible!!

Christine Onyango of the U.S. Network for the Conference says, "Organizations in the United States have a real role to play in shaping the language that appears in the *Platform* because our government listens to us. We have the responsibility to advocate on the behalf of those in other countries who have no clout. The more organizations and regular individuals are involved, the more accountability there is for governments who have agreed to the document at the conference."

For information on accreditation, write to the Conference Secretariat, NGO Accreditation, Fourth World Conference on Women, Two U.N. Plaza,

Frances Rosamond, National University, frosamon@nunic.nu.edu

Room 1204, NY, NY 10017; fax: (212) 963-3463. A newsletter about the Conference and preliminary meetings is free from: U.N. Secretariat of the Fourth World Conference on Women, Division for the Advancement of Women, DC 2-1234, Two U.N. Plaza, NY, NY 10017; phone: (212) 963-8385; fax: (212) 963-3463. For information on registering for the NGO Forum or to obtain a copy of the *Forum on Women '95 Bulletin*, write Executive Director, NGO Forum on Women Beijing '95, 211 E. 43rd Street, Room 1500, NY, NY 10017; phone (212) 922-9267; fax: (212) 922-9269.

Materials related to the Conference are being posted to the gopher server of the U.N. Development Program (UNDP). Open a gopher connection to gopher.undp.org, then select United Nations Conferences from the menu. Also, documents may be retrieved via an auto-answering electronic mailbox; instructions may be obtained by sending a blank email message to gopher.undp.org. The email address of the NGO Forum '95 Planning Office is ngoforum95@igc.apc.org.

BEIJING95-L

BEIJING95-L is a fully moderated international electronic forum *for women only* dedicated to the discussion of the United Nations Conference on Women which will convene in September 1995 in Beijing, China.

It is hoped that BEIJING95-L will provide a network for women where we can exchange information concerning the upcoming conference. Topics include, but are not limited to: pre-conference events (regional meetings, etc.); prior U.N. Women's Conferences (Mexico City, 1975 and Nairobi, 1985); travel and tour arrangements; job, volunteer and organizational opportunities related to the conference; caucuses; Non-Governmental Organization (NGO) information; international formal and informal reports on the current status of women; and post-regional and post conference follow-ups.

Although the origin of BEIJING95-L is the U.S. and the moderator in English-speaking, please feel free to post in any language. If there is a call, language-specific lists may be created. A digest form of the list is also in the works. If enough men are interested, a separate male-inclusive list may also be included.

BEIJING95-L is not officially sponsored by the United Nations nor any organization — it is a labor of love born of the belief that the U.N. Conference on Women, Beijing 1995 will be a catalyst for women all over the world to lead humankind into the 21st century! This list is also born of frustration over the lack of media coverage of pre-U.N. Women Conference events (and women's issues in general) plus the difficulty accessing direct information about the conference itself. It is also hoped that the information provided on this list will enable as many women as possible from every conceivable background to attend the conference. For information, input, or if you are having technical difficulties, please contact the list moderator, Jennifer Gagliardi, gagliajn@netcom.com.

Finally, BEIJING95-L is a *fully moderated* list. This means that each posting is screened, not to censor information, but mostly to protect the "women-only" cyberspace of the list, to control traffic, to promote netiquette, and to discourage flaming. Although making net friends/contact is highly encouraged, please "chat" off-list.

To subscribe to BEIJING95-L please send a message to: address: listserv@netcom.com; subject: (leave blank); text: subscribe BEIJING95-L First name & Last name (please, no initials).

Thank you for your support and efforts to make this an effective communication device for women and the world.

COMING NEXT ISSUE

"Why I Became a Scientist" by Dr. Shirley Tilghman, talk given at The Women in Science Summit at Mills College.

Report on the Workshop "Women in Probability" by Professor Ruth Williams, UCSD.

Part Two of the book review on books by Leone Burton and Valerie Walkerdine.

1994 Annual Report of the Joint Committee on Women in the Mathematical Sciences by Beth Ruskai, Chair.

More panel contributions and more photos from AWM activities in San Francisco.

AWM IN SAN FRANCISCO

Celebrating Etta Falconer's Louise Hay Award:
Teresa Edwards (Chair, Spelman College), Cora Sadosky (Howard University), Sylvia Bozeman (Spelman College)

The transfer of "the bowl":
Cora welcomes Chuu-Lian to the presidency

AWM Presidents Old and New:
Cora Sadosky (Howard University),
Chuu-Lian Terng (Northeastern University)

AWM Noether Lecture: Sylvia Wiegand (University of Nebraska), Judith D. Sally (Northwestern University)

AWM PANELS

Workshop Panel: "Launching a Career in Mathematics": Gail Ratcliff (University of Missouri, St. Louis), Dusa McDuff (SUNY at Stonybrook), Catherine Roberts (University of Rhode Island), Lloyd Douglas (NSF)

"AWM: Why Do We Need It Now?
Ruth Williams (University of California, San Diego), Susan Landau (University of Massachusetts), Mary Gray (American University), Sylvia Bozeman (Spelman College)

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ALLEGHENY COLLEGE - DEPARTMENT OF MATHEMATICS - We invite applications for a tenure-track position, commencing September 1995. Faculty are expected to demonstrate excellence in teaching and maintain professional and scholarly activity. Teaching load is six courses per year on a semester calendar. Allegheny has an extensive network of NeXT computers, and the college provides excellent support for use of computing in courses. Applicants must have a Ph.D. in mathematics by August 1995. Send a letter of application, a curriculum vitae, graduate transcripts, and three letters of recommendation (at least one should address teaching) in hard copy to: **Michael J. J. Barry, Department of Mathematics, Allegheny College, Meadville, PA 16335**. Questions should be sent to mbarry@alleg.edu. Applications received by e-mail will not be reviewed. Allegheny strongly encourages applications from women and minority candidates. We are an Equal Opportunity/Affirmative Action Employer.

ARIZONA STATE UNIVERSITY - DEPARTMENT OF MATHEMATICS - The Department of Mathematics at Arizona State University invites applications for tenure track positions at the Assistant Professor level, pending budgetary approval, beginning in the fall semester 1995 or the fall semester 1996. Applicants are required to have a Ph.D. in mathematics, or closely related area, and are expected to have a strong commitment to education on all levels and a strong research record. Outstanding candidates in all areas reinforcing existing departmental strengths will be considered. Preference will be given to candidates in the areas of applied and computational partial differential equations, geometric theory of partial differential equations and dynamical systems. Applicants must send their resume and arrange for at least three letters of recommendation be sent to: **Christian Ringhofer, Chair, Department of Mathematics, Box 871804, Arizona State University, Tempe, AZ 85287-1804.** Review of applications will begin March 1, 1995, and will continue weekly until the position is filled. AA/EOE.

BATES COLLEGE - DEPARTMENT OF MATHEMATICS - Temporary Position - The Mathematics Department at Bates College announces one full time, one-year temporary position, beginning Fall 1995. The position requires teaching six courses during the academic year: 2 courses in the fall, 3 in the winter, and 1 during the Bates five-week "short term." The courses will be primarily sections of Calculus I and II, and perhaps a junior or senior level course. Special consideration will be given to those candidates who show experience or express interest in teaching a "reformed Calculus" curriculum. For three years running, we have used the curriculum developed by the Calculus Consortium at Harvard University. We will use it or a similar one again next year; any interested applicant should mention pertinent experience in the application. The qualified applicant will have or be near completion of a Ph.D. in mathematics. We will consider applications postmarked through March 13, 1995. Located in central Maine, Bates College is a highly selective liberal arts college of 1,500 students. The mathematics department has eight faculty members, and we graduate about 15 majors per year. Department members take teaching very seriously, while supporting a wide range of professional activities including research and publishing. Bates College values a diverse college community and seeks to assure Equal Opportunity through a continuing and effective Affirmative Action program. We welcome applications from women and minorities. Interested persons should send a letter of application and current vita. Include e-mail address. Forward three letters of reference. Two letters should specifically address the candidate's teaching abilities. Submit to: **Chip Ross, Chair, Department of Mathematics, c/o Secretarial Services, 2 Andrews Road, 7 Lane Hall, Bates College, Lewiston, ME 04240.**

HUNTER COLLEGE OF THE CITY UNIVERSITY OF NEW YORK - DEPARTMENT OF MATHEMATICS AND STATISTICS - Two tenure track Assistant Professor faculty positions available September 1995. Salary Range: $29,931 - $52,213 depending on experience. Doctoral degree required. We are interested in mathematicians (all fields) and statisticians (all fields). Send curriculum vita and three letters of reference by March 17, 1995 to: **Professor Richard Churchill, Chair, Department of Mathematics and Statistics, Hunter College, 695 Park Avenue, New York, NY 10021.** Hunter College is an Equal Opportunity/Affirmative Action Employer.

KNOX COLLEGE - DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE - Tenure-track assistant professorship beginning in the Fall of 1995. Responsibilities: two courses a term for three ten week terms, departmental and college service, high level of professional activity. Candidates should have a Ph.D. in mathematics. Some preference to those who can collaborate with faculty in other disciplines. Knox College is an Affirmative Action/Equal Opportunity Employer. In keeping with the College's 150 year commitment to equal rights, Knox College particularly invites applications from women and minorities. Send curriculum vitae, graduate transcript, and three letters of recommendations to: **Kevin J. Hastings, Chair, Department of Mathematics and Computer Science, Knox College - Box 84, Galesburg, IL 61401.**

LEBANON VALLEY COLLEGE OF PENNSYLVANIA - DEPARTMENT OF MATHEMATICAL SCIENCES - Are you interested in teaching a variety of undergraduate courses in Mathematics and Statistics? Become part of a dynamic department of 6 faculty and 90 majors in Mathematics, Actuarial Science, and Computer Science. Applications are invited for a tenure-track position beginning in August 1995. Teaching load is 12 hours per semester. Ph.D. required. Salary competitive. Benefits include health and life insurance, TIAA-CREF, dependent tuition, and recreation center. Lebanon Valley College is a Liberal Arts College of 1050 full-time undergraduates and 70 faculty. Located in central Pennsylvania, LVC is within three hours of New York, Philadelphia, Baltimore and Washington, D.C. To assure consideration, application materials, to include cover letter, resume, three letters of reference, and transcripts, should be sent by January 31, 1995 to: **Bryan V. Hearsey, Chairman, Department of Mathematical Sciences, Lebanon Valley College, Annville, PA 17003-0501**, hearsey@acad.lvc.edu.

MACALESTER COLLEGE - MATHEMATICS AND COMPUTER SCIENCE DEPARTMENT - Applications are invited for a tenure track position in Computer Science at the Assistant Professor level to begin in the Fall of 1995. Candidates must have a Ph.D. in Computer Science and must be committed to teaching and research in a four-year liberal arts college. Macalester is a private coeducational college located in a pleasant residential area of Minneapolis-St. Paul, a major center of our nation's computer industry, with a rich cultural life. Its student body of 1,750, includes 11% who are international and 10% who are American minorities. Part of a strong college science program, the Math and Computer Science Department is the largest department on campus. Computer Science offerings closely adhere to the principles of model programs for Computer Science in liberal arts colleges, with an emphasis on research-based instruction. Facilities include laboratories with Macintosh computers for introductory courses and UNIX workstations for advanced work. Each faculty member has a UNIX workstation networked with the labs, the Minnesota Regional Network, and the Internet. The teaching load is 5 three-hour courses per year and supervision of independent work. Candidates must be interested in continuing development of an outstanding undergraduate Computer Science program. Salary is competitive, with good benefits and excellent support for professional work. Applicants should send a resume, a statement giving reasons for interest in a liberal arts college, and arrange for three letters of reference to be sent to: **Wayne Roberts, Mathematics and Computer Science Department, Macalester College, 1600 Grand Avenue, St. Paul, MN 55105.** For more information, send e-mail to robertsw@macalstr.edu. Evaluation of applications will begin December 15, 1994 and continue until the position is filled. Macalester is an Affirmative Action/Equal Opportunity employer and encourages applications from women and minority groups.

MOVING?--WE'D LIKE TO KNOW! - Please inform us of any changes, so we can keep our database up-to-date. Let us know if you move, get a new job, change phone numbers, etc... We want to know. We don't want loose contact with you. Because we send the newsletter by third class bulk rate, the post office will not forward mail to you or notify us of address changes. Therefore, we must rely on YOU to notify US of ANY CHANGES. Just fill out the changes using the **form on the BACK COVER** or drop us a **postcard or e-mail**, and we'll take care of it. THANKS. E-MAIL: awm@math.umd.edu ADDRESS: 4114 Computer & Space Sciences Bldg., University of Maryland, College Park, MD 20742-2461

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MARSHALL UNIVERSITY - DEPARTMENT OF MATHEMATICS - Chair - Marshall University invites applications and nominations for Chair of the Mathematics Department. Minimum qualifications include a Ph.D. in mathematics, broad mathematical interests, and a history of successful teaching and scholarly activities. Applicants should also possess effective communication and leadership skills, as well as experience in innovative program development. Demonstrated administrative abilities, success in obtaining external funds, and good interpersonal skills are highly desirable. The Chair will represent the department to the administration, provide leadership in both curricular and faculty development, and promote mathematics to the Marshall University community. Experience in curricular activities across disciplines is preferred. Qualifications should be sufficient for full professor with tenure. Salary will be commensurate with qualifications and experience. Marshall University, a comprehensive higher education institution, is located in Huntington, West Virginia, just across the Ohio River from Ohio, and thirteen miles from the Kentucky border. There are approximately 12,500 students and 600 faculty. The department has 17 regular faculty members and about 15 part-time faculty and graduate assistants. The department offers bachelor's and master's degrees in mathematics and service courses for many other degree programs. Applicants should send a letter of application, a current curriculum vita, and names, addresses, and phone numbers of three professional references. Nominations and applications should be sent to: **Dr. Herbert Tesser, Chair of Search Committee, Marshall University, Huntington, WV 25755-2580**, (304) 696-2696. Application review will begin March 27, 1995, and continue until position is filled. Anticipated starting date is Fall 1995. Women and minorities are encouraged to apply. Marshall University is an Equal Opportunity/Affirmative Action Employer.

MIAMI UNIVERSITY, HAMILTON - DEPARTMENT OF MATHEMATICS AND STATISTICS - The Hamilton Campus of Miami University invites applications for a tenure-track position in mathematics at the Assistant Professor level beginning Fall 1995. A doctorate in a mathematical science or mathematics education, with strong evidence of effective teaching ability is required; some background in statistics is desirable. Teaching load is 24 semester hours/year at the freshman and sophomore level, with service and scholarly activity appropriate for a regional campus of a major university. Women and minority candidates are encouraged to apply. Send a letter of application, a curriculum vitae, a statement on teaching philosophy, and three letters of recommendation to: **Dr. Robert Baer, Search Committee Chair, Miami University - Hamilton, 1601 Peck Blvd., Hamilton, OH 45011.** Application deadline is March 31, 1995. Phone (513) 863-8833; Fax (513) 863-1655. Miami University is an AA/EOE employer.

NORTH CAROLINA STATE UNIVERSITY - THE DEPARTMENTS OF MATHEMATICS AND PHYSICS - Mathematical Physics - - Tenure Track Faculty Position - The Departments of Mathematics and Physics invite applications for a joint tenure track faculty appointment in the intersecting area between mathematics and theoretical physics. The NCSU math/physics community is very active and consists of mathematicians who are investigating gauge field theory, classical and quantum gravity, and symplectic techniques in physics, and physicists conducting research in relativistic quantum field theory, emphasizing quantum chromodynamics for hadronic systems, and theoretical high energy astrophysics. In addition, interactions and joint seminars are conducted with nearby UNC at Chapel Hill and Duke University. Candidates are expected to demonstrate excellence, documented in part by publications, post-doctoral or equivalent research experience is desirable. Preference will be given to applicants having backgrounds in mathematical physics with expertise in the above-mentioned areas. The successful candidate, aided by start-up funds, is also expected to interact and strengthen relations between the two departments. Teaching responsibilities will be split between both departments. For full consideration, applicants should submit by March 1, 1995 a curriculum vitae, visa status, description of research interests and qualifications, to: **Search Committee, c/o Jennifer Tuten, Box 8202, North Carolina State University, Raleigh, NC 27695-8202**. NCSU is an AA/EO employer.

NORTH CAROLINA STATE UNIVERSITY - CENTER FOR RESEARCH IN SCIENTIFIC COMPUTATION - The Center for Research in Scientific Computation at North Carolina State University in collaboration with the Lord Corporation's Thomas Lord Research Center, Cary, N.C., expects to make a University/Industry Cooperative Postdoctoral Research appointment starting August 16, 1995 (availability of the position is contingent upon funding). The appointment will be in the area of applied mathematics and scientific computation. The successful candidate for this position is expected to participate in a collaborative multidisciplinary team carrying out fundamental research investigations to provide a better understanding and predictive capability of the dynamic mechanical behavior of rubber-like polymer composites (elastomers). The research efforts will involve the modeling of nonlinear dynamics viscoelastic composite materials subject to large deformations, development of computational methods for both forward and inverse problem analytic studies, and design and performance of experiments to aid in model verification and validation. Since the research efforts will require physical modeling, theoretical analysis and computational skills, candidates who are outstanding in at least one of these areas and willing and able to learn quickly in the others will be given highest priority. This position offers a unique opportunity for multidisciplinary mentored post-doctoral research on a mathematical project arising in an industrial/university collaborative effort. Applicants should send a curriculum vita and brief description of research interests and have three letters of recommendation sent to: **Professor H.T. Banks, Center for Research in Scientific Computation/Department of Mathematics, Box 8205, North Carolina State University, Raleigh, NC 27695-8205.** Applications will be considered anytime after February 15, 1995, as funding becomes available. NCSU is an AA/EOE. In its commitment to diversity and equity, NCSU and the CRSC seek applications especially from women, minorities, and people with disabilities.

NORTH CAROLINA STATE UNIVERSITY - DEPARTMENT OF MATHEMATICS - The Department of Mathematics at North Carolina State University expects to make a faculty appointment at the level of assistant professor or higher in computational fluid dynamics starting July 1, 1995 or as soon as possible thereafter. Applicants for a junior level position should have research experience beyond the Ph.D. Applicants for a senior position should have an outstanding research record and a well-established research program. The intellectual climate for applied mathematics and numerical analysis at NCSU is lively and challenging. Our group consists of over thirty faculty members (within a Department of over sixty faculty) and many graduate students and postdocs. The group has research programs in biomathematics, differential algebraic equations, integral equations, numerical linear algebra, numerical optimization/nonlinear equations, ordinary and partial differential equations, control, and parallel computing. The successful applicant will have the opportunity to interact with active groups in control of fluids, simulation of granular flow, and flow through porous media, and to become a member of the Center for Research in Scientific Computation which facilitates interaction between the faculty in the Mathematics Department and other research institutions and industry. Faculty in the NCSU Mathematics Department have access to the high performance computing and visualization facilities at the North Carolina Supercomputing Program. Applicants should send a vita and have three letters of recommendation sent to: **C.T. Kelley, Department of Mathematics, Box 8205, North Carolina State University, Raleigh, NC 27695-8205.** Phone: 919-515-7163. FAX: 919-515-3798. E-mail: Tim_Kelley@ncsu.edu. North Carolina State University is an equal opportunity and affirmative action employer. In its commitment to diversity and equity, NCSU seeks applications from women, minorities, and people with disabilities.

OAKLAND UNIVERSITY - DEPARTMENT OF MATHEMATICAL SCIENCES - Assistant Professor of Mathematical Sciences - The Department of Mathematical Sciences at Oakland University invites applications for a tenure-track position at the rank of Assistant Professor in the area of applied discrete mathematics. Responsibilities of this position include teaching, research, and contribution to the department's collaborative efforts with industry. Candidates must have a Ph.D. in mathematics or a closely related discipline (or its requirements completed) by August 15, 1995. Preference will be given to applicants with strong research potential in applied discrete mathematics and also evidence of experiences and/or ability in developing research links and student internships with industry. Areas of special interest include discrete optimization, discrete mathematical modeling, queueing theory, and symbolic computation. Please send a vita and transcripts, and arrange for three letters of reference to be sent to: **Chair of the Applied Discrete Mathematics Search Committee, Department of Mathematical Sciences, Oakland University, Rochester, Michigan 48309-4401.** Review of applications will begin on April 1, 1995. Oakland University is a public institution with approximately 13,000 students enrolled in baccalaureate, masters, and doctoral programs. It is adjacent to the recently-developed Oakland Technology Park and the Chrysler Technology Center and convenient to many social, cultural, and recreational activities in the metropolitan Detroit area. Oakland University is an Affirmative Action/Equal Opportunity Employer and especially encourages applications from women and minorities.

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SAN JOSÉ STATE UNIVERSITY - DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE - One full time temporary position in Mathematics Education for the 1995-96 academic year with potential for renewal. Candidates must have a master's degree in math, math education or related field. Preference will be given to applicants with a Ph.D. in Mathematics Education with at least one year of teaching experience in U.S. schools. Mathematics background sufficient to teach content courses for prospective elementary or secondary school teachers. Awareness of and sensitivity to the educational goals of a multicultural population, and commitment to quality teaching. Interest and experience in preservice and inservice mathematics teacher education. Application deadline is March 15, 1995. Applicants should send vita, transcripts, and three letters of recommendation to: **Dr. Eloise Hamann, Dept. of Math. & Computer Sci., San José State Univ., San José, CA 95192-0103.** EOE/AAE.

SUNY COLLEGE AT FREDONIA - DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE - The Dept. nvites applications for tenure-track positions in mathematics. A doctorate in mathematics or mathematics education is required. Candidates must have a commitment to excellence in teaching and to continued scholarly activity along with an interest in curriculum development, especially the application of technology. Candidates who can document excellence in teaching are likely to be ranked higher in our selection process. Review of applications will commence March 15, 1995 and will continue until the position is filled. Fredonia actively encourages applications from women and minority candidates and is an Affirmative Action /Equal Opportunity Employer. Send a letter of application, a curriculum vita and three letters of reference to: **Dr. Nancy Boynton, Chair, Mathematics Search Committee, Mathematics and Computer Science, SUNY College at Fredonia, Fredonia, NY 14063-1198.** masearch@cs.fredonia.edu.

UNIVERSITY OF COLORADO AT DENVER - DEPARTMENT OF MATHEMATICS - Applications are invited for an entry level tenure track position to begin August 1995. Applicants are expected to show strong potential for research and teaching and have a commitment to professional service. Applicants must have, or expect to receive by August, a Ph.D. in mathematics or a related discipline that covers at least one of: computational mathematics, discrete mathematics, engineering mathematics, operations research, probability, and statistics. We are particularly seeking someone that interfaces operations research and computational or discrete mathematics, notably in optimization. To apply, send a current vita, list of publications, a statement of research plans and goals, a statement of teaching philosophy, and arrange to have three letters of recommendation sent to: **Harvey Greenberg, Search Committee Chair, Mathematics Department - Campus Box 170, University of Colorado at Denver, P.O. Box 173364, Denver, CO 80217-3364** (fax: 303-556-8550). We shall begin screening applications January 15, 1995, and we shall continue to accept applications until the position is filled. UCD is an Equal Opportunity Employer; women, minorities, and people with disabilities are encouraged to apply.

UNIVERSITY OF MINNESOTA, DULUTH - DEPARTMENT OF MATHEMATICS AND STATISTICS - Temporary Assistant Professor/Instructors, 9/1/95-5/31/96 - Teach up to three mathematics and/or statistics courses per quarter. Full course administrative responsibilities and additional faculty duties such as advising, service, and participation in departmental curricular decisions. Competitive salary. Required: demonstrated evidence of teaching excellence and communication skills appropriate to a full-time faculty position; degree in Mathematics or Statistics by August 15, 1995 (Master's for Instructor, Doctoral for Assistant Professor); at least one year's experience teaching college/university courses. Send letter of application, resume, three letters of recommendation, and official transcript of highest degree received or in progress to: **Dr. James L. Nelson, Search Committee Chair; Math & Statistics, Heller Hall 108; University of Minnesota, Duluth; 10 University Drive; Duluth, MN 55812**; by May 15, 1995. The University of Minnesota is an Equal Opportunity Educator and Employer.

THE UNIVERSITY OF OKLAHOMA - DEPARTMENT OF MATHEMATICS - Applications are invited for two anticipated visiting positions at the Assistant Professor level for the 1995-96 academic year. Pending performance evaluation and availability of funds, either position could be extended through the 1996-97 academic year. The salary is competitive and based on prior experience. Duties consist of teaching two courses per semester and carrying out research on an interactive basis with the Department's permanent faculty. An earned doctorate, potential or demonstrated excellence in research, and prior successful undergraduate teaching experience are required. Candidates from all areas of mathematics will be given full consideration, but preference will be given to candidates whose research interests overlap with those of the permanent faculty. The Department has 30 regular faculty members and approximately 60 graduate students. Virtually all of our faculty members have active research programs, and the scholarly environment of the Department is further enhanced by a conveniently located branch library and a regular series of colloquium lectures funded by a Departmental endowment. Candidates should send a cover letter, vita, and direct three letters of reference (with at least one evaluating the candidate's teaching abilities) to: **Visitor Search Committee, Department of Mathematics, University of Oklahoma, Norman, OK 73019-0315**, Phone: 405-325-6711. Screening will begin on March 15, 1995, and continue until both positions are filled. The University of Oklahoma is an Equal Opportunity/Affirmative Action Employer. Women and minorities are encouraged to apply. OU has a policy of being responsive to the needs of dual-career couples.

UNIVERSITY OF ROCHESTER - DEPARTMENT OF MATHEMATICS - Assistant Professor - This is a three-year, non-renewable appointment for new or recent Ph.D.'s beginning in Fall 1995. Qualifications include a Ph.D. in mathematics and outstanding promise in research and teaching. Applicants in all areas of mathematics will be considered, but preference will be given to applicants whose research interests are compatible with those in the department. Evidence of interest in and experience in the teaching of undergraduates is essential. Consideration of applicants will begin on January 15, 1995. Send a letter of application, current curriculum vitae, minimum of 3 letters (at least one of which addresses teaching), and description of research to: **Joseph Neisendorfer, Chair, Department of Mathematics, University of Rochester, Rochester, NY 14627.** The University of Rochester is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF WISCONSIN, SUPERIOR - DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE - Mathematics Education - Tenure track position in mathematics beginning September 1995. Doctorate in Mathematics with interest in Math Education preferred. Doctorate in Mathematics Education with a Masters in Mathematics considered. Excellence in teaching and continuing scholarly activity expected. Teach mathematics for secondary, middle and elementary education students as well as mathematics courses such as calculus. Familiarity with NCTM Standards necessary. Computer background desirable. Rank and salary negotiable/competitive. Deadline for receipt of applications is March 15, 1995. Send letter of application, resume, transcripts, and have three letters of recommendation sent to: **Mathematics/Math Ed Search Committee, Francis G. Florey, Chairman, Department of Mathematics and Computer Science, University of Wisconsin - Superior, Superior, WI 54880.** Minorities and women are encouraged to apply. Nominees and applicants who have not requested in writing that their identity not be revealed, and names of all finalists, will be revealed upon request. Position contingent upon funding. AA/EOE.

UNIVERSITY OF WISCONSIN, SUPERIOR - DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE - Mathematics - Tenure track position in mathematics/computer science beginning September 1995. A Ph.D. in mathematics or a Ph.D. in computer science with a strong mathematics background is required. Excellence in teaching and continuing scholarly activity expected. All areas considered, preference may be given to individuals with a strong background in discrete applied mathematics and computer science. Rank and salary negotiable/ competitive. Deadline for receipt of applications is March 15, 1995. Send letter of application with AMS application cover sheet, resume, transcripts, and have three letters of recommendation sent to: **Mathematics/Computer Science Search Committee, Dr. Francis G. Florey, Chairman, Department of Mathematics and Computer Science, University of Wisconsin - Superior, Superior, WI 54880.** Minorities and women are encouraged to apply. Nominees and applicants who have not requested in writing that their identity not be revealed, and names of all finalists, will be revealed upon request. Position contingent upon funding. AA/EOE.

WAYNE STATE UNIVERSITY - DEPARTMENT OF MATHEMATICS - Applications are invited for an anticipated tenure-track position at the rank of Assistant or Associate Professor. There is also the possibility of Visiting positions for 1995-96. Ph.D. in mathematics required. Excellence in both research and teaching is expected. Applications should include a signed, detailed vita, description of current research interests, and three letters of recommendation, at least one of which addresses the applicant's teaching. Sent to: **Pao-Liu Chow, Chair, Wayne State University, Department of Mathematics, Detroit, MI 48202.** Wayne State University is an Equal Opportunity/Affirmative Action Employer and applications from female and minority candidates are particularly encouraged.

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Newsletter Volume 25, Number 2, March–April, 1995

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Printed in the U.S.A.