

FOCUS

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January-February 1990

MAA's 75th Anniversary

Gerald L. Alexanderson, Chair
Committee on the 75th Anniversary

Had one vote been cast differently, we would not be celebrating in August of 1990 the 75th anniversary of the Mathematical Association of America. There probably would have been no MAA.

THE FOUNDING OF THE MAA It all started in 1894 when Benjamin Finkel, who had taught in high school in Ohio and Tennessee, started publishing *THE AMERICAN MATHEMATICAL MONTHLY*, aimed primarily at a high school audience, but subsequently expanded to include undergraduates and their teachers. Finkel, who later taught at Drury College in Missouri, solicited for his enterprise some distinguished university faculty: G. A. Halsted of Texas, E. H. Moore of Chicago, and W. E. Byerly of Harvard. The first issue contained an article by Leonard Eugene Dickson, then a 19-year-old graduate student at Texas. Eventually he persuaded Dickson (by then at Chicago) and Herbert Ellsworth Slaught (also at Chicago) to become associate editors, along with G. B. Miller (University of Illinois). The *MONTHLY* continued to appear, though on a rather shaky financial foundation, until 1912, when additional support was obtained from a number of other colleges and universities, primarily in the Midwest.

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Benjamin Finkel, founder of THE AMERICAN MATHEMATICAL MONTHLY



Earle Raymond Hedrick, first MAA President (1916)

Contributed Papers in Columbus

Kenneth A. Ross, Secretary, MAA

This preliminary announcement of the Columbus meeting is made to encourage members' participation and to provide leadtime for organizing sessions on contributed papers. The meeting will be held August 8–11, 1990. Events include invited addresses, joint AMS-MAA addresses, minicourses, and various panel discussions. For more detailed information on the MAA's 75th Anniversary celebration in Columbus, see Gerald Alexanderson's related article in this issue of *FOCUS*, beginning on this page, opposite column, and continuing on page five.

Contributed papers are being accepted on several topics in collegiate mathematics. The topics, organizers, their affiliations, and the days they will meet are:

- **LIBERAL ARTS MATHEMATICS COURSES**—*Solomon A. Garfunkel, Consortium for Mathematics and Its Applications (COMAP, Inc.)*, Friday, 11 August 1990 (and possibly Thursday, 10 August 1990). This session will be devoted to the mathematical content and course design for liberal arts students. We are soliciting papers which address these themes in the context of long-term literacy goals as well as core undergraduate curriculum issues.
- **TOWARD EQUITY AND EXCELLENCE: Efforts to Increase the Number of Minorities and Women in the Profession**—*Carolyn R. Mahoney, California State University at San Marcos*, Friday, 11 August 1990 (and possibly Thursday, 10 August 1990). Papers are welcome discussing precollege interventions, college and graduate school seminar workshops, mentor programs, and institutional initiatives, as well as state and national efforts aimed at increasing participation of underrepresented groups.
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In an attempt to arrange for more stable and permanent support for the MONTHLY, Slaught requested assistance from the American Mathematical Society, which noted in the minutes of the council "a communication from Professor Slaught suggesting the appointment by the Council of a committee to consider the general relation of the Society to the promotion of teaching, especially in the collegiate field." Such a committee was appointed and consisted of Thomas Scott Fiske, Henry Buchard Fine, Earle Raymond Hedrick, William Fogg Osgood, and Slaught.

At the April 1915 meeting of the Council, the committee reported that, by a vote of three to two, it had decided to recommend that the American Mathematical Society "should not undertake nor become responsible for the publication of the MONTHLY," a decision in which the Council concurred. It is interesting to note, however, that the Council did adopt the following resolution: "it is deemed unwise for the American Mathematical Society to enter into the activities of the special field now covered by the AMERICAN MATHEMATICAL MONTHLY; but the Council desires to express its realization of the importance of the work in this field and its value to mathematical science, and to say that should an organization be formed to deal specifically with this work, the Society would entertain toward such an organization only feelings of hearty good will and encouragement."

So with the committee vote and the decision of the Council to accept the committee's recommendation, the stage was set for the forming of a new organization to provide a home for the MONTHLY. Slaught sent out a letter soliciting interest in a new organization and a surprising 450, representing every state in the Union, the District of Columbia, and Canada, responded by signing the call to an organizational meeting.



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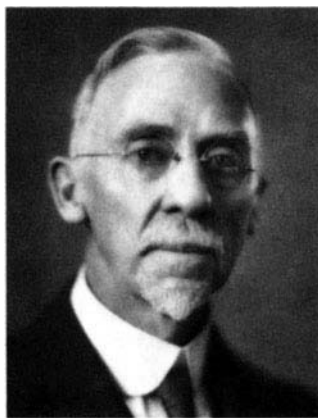
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Herbert Ellsworth Slaught, MAA President (1919), organized the Illinois Section in 1917



W. D. Cairns, first Secretary-Treasurer (1916-42); MAA President (1943-44)

The meeting was held in Room 101, Page Hall, on the campus of Ohio State University in Columbus, December 30-31, 1915. The setting was a meeting of the American Association for the Advancement of Science. Slaught delivered the opening remarks. He talked about the history of the MONTHLY and "emphasized the fact that this journal had stood consistently, since its reorganization, for advancing the interest of mathematics in the collegiate and advanced secondary fields, and expressed the hope that the new organization might carry forward these aims with still greater effectiveness, cooperating, on the one hand, with the various well-organized secondary associations, and on the other, with the American Mathematical Society in its chosen field of scientific research, but being careful to encroach upon neither of their fields."

Hedrick presided at the meeting. There were 104 people attending, among which 49 came from large universities, 43 from mainly undergraduate institutions, and 6 from high schools. W. D. Cairns of Oberlin College was the temporary secretary. All the business of organizing the Association was completed in one three-hour session, except for one very difficult issue: the choice of a name. That took a committee of three to sort through eighteen proposals. The choice of "Mathematical Association of America" was unanimous.

Hedrick was chosen first President, E. V. Huntington of Harvard and G. A. Miller of Illinois Vice Presidents, and Cairns Secretary-Treasurer. Hedrick later became the 20th President of the American Mathematical Society (1929-1930). Cairns served as Secretary-Treasurer until 1943, a record for the position, but was not a match for Finkel, who served for 19 years as Editor of the MONTHLY and another 21 years as Associate Editor. Cairns became President of the MAA in 1943.

There was no formal program for that first meeting, but L. C. Karpinski of the University of Michigan gave an illustrated lecture on "The Story of Algebra." Cairns reported that "it is not too much to say that for the space of an hour he both charmed and edified an enthusiastic audience of approximately one hundred persons."

Three sections had been organized prior to the December meeting in Columbus, those of Kansas, Missouri, and Ohio. Clearly the sectional structure of the Association was not an afterthought.

Founded at the beginning of the First World War, the Association claimed 1,100 members by the end of the war three years later. In 1920 the MAA was incorporated in the state of Illinois.

The issues before the Association in the days before and shortly after its founding do not sound much different from many of the issues today. Should a course in mathematics be required for graduation? Should calculus be taught in the freshman year? (W. F. Osgood

thought that it should be.) Should the United States go on the metric system? Should the same course be taught to future mathematicians and scientists as to other students? Should separate courses in different areas be taught, or should they be replaced by an integrated course? Committees were formed to study these questions and reports were duly submitted and distributed.

The Association has come a long way from the 3 Sections and the 104 people attending the organizational meeting in Columbus to 29 Sections with almost 28,000 members today. With the publication of three journals, a newsletter, and a number of series of books and monographs, along with national and Sectional meetings and many other activities, the Association is a widely-felt force in mathematics and mathematics education.

To celebrate the accomplishments and the growth of the Association over the past 75 years, the MAA is planning a special meeting in Columbus in August 1990. One day will be devoted entirely to the MAA, the rest of the days resembling more closely regular joint meetings of the MAA and the AMS. Even on these other days, however, the main invited talks will be to a great extent jointly sponsored by the Association and ten of the sibling organizations with which the MAA works. These are listed in order of their founding: the American Association for the Advancement of Science, the American Mathematical Society, Pi Mu Epsilon, the National Council of Teachers of Mathematics, the Canadian Mathematical Society, the Association for Computing Machinery, the Society for Industrial and Applied Mathematics, the National Association of Mathematicians, the Association for Women in Mathematics, and the American Mathematical Association for Two-Year Colleges.

On the opening day of the meetings, following an opening ceremony, there will be addresses in the morning by Judith V. Grabiner (Pitzer College), the noted historian of mathematics, and G. Bailey Price (University of Kansas), President of the MAA, 1957–59. There will also be a ceremony to dedicate two plaques, one to be placed outside Room 101, Page Hall, commemorating the first MAA meeting, and one in the building housing the Mathematics Department at Ohio State. Following lunch, there will be a series of half-hour talks by Wade Ellis, Jr. (West Valley College), Paul R. Halmos (Santa Clara University), Peter Hilton (SUNY at Binghamton), and Cathleen Morawetz (Courant Institute). An entertaining discussion and display of juggling, magic, and music will follow, featuring Ron Graham (who will also be delivering Pi Mu Epsilon's J. Sutherland Frame Lecture) and Joe Buhler, among others. That evening there will be a banquet with featured speaker, David P. Roselle, President of the University of Delaware and former Secretary of the Association.

The ten joint invited addresses alluded to earlier will be interspersed among the three remaining days of the meetings. The Earle Raymond Hedrick lectures will be given by Philip Davis of Brown University. Further, there will be minicourses, sessions for contributed papers, invited addresses of the American Mathematical Society and Pi Mu Epsilon, and special events associated with the Year of National Dialogue.

Additional events include a talk on mathematical sculpture by Helaman Ferguson on August 9, and a talk and demonstration of calculating skills by Arthur Benjamin of Harvey Mudd College. On the evening prior to the full day of MAA activities, there will be a reception for 25-year members of the Association.

Columbus is an attractive city of nearly 600,000 population and the Ohio State campus, where the meetings will be held, has the largest student population of any one campus in the United States, roughly 54,000 students. The university, approximately two miles north of the center of Columbus, is connected by frequent city bus service

to downtown and nearby areas of interest. In downtown Columbus are the State Capitol, the Center of Science and Industry, and the Columbus Museum of Art. The latter houses an outstanding collection of American art as well as good collections of other art.

Special efforts are being made to make the Columbus meetings attractive to families. Columbus offers many attractions for children: Ohio Village, the Columbus Zoo, the Wyandotte Lake amusement park, and the Center of Science and Industry mentioned above, among others. Just south of downtown Columbus is an extensive area called German Village, a part of the city settled in the 1840s and restored since the 1960s. It is a charming district filled with old brick houses and businesses on tree-lined streets, with bookstores, craft galleries, restaurants, and outdoor beer gardens. German Village is good for hours of strolling and browsing. Picnic and hiking opportunities abound in eight, large metropolitan parks which ring Columbus, and at Hocking Hills State Park, about 45 miles south of Columbus. Several pools inside the Ohio State Natatorium and large, public beaches at two reservoirs north of Columbus provide excellent swimming.

Make plans now to join the MAA in celebrating its 75th anniversary this coming August 8–11.



The Kansas Section of the MAA meeting in Lawrence, Kansas in March 1916. This group had formed and met, earlier in 1915, as an association to improve mathematics teaching in Kansas. Subsequent to the founding of the MAA on December 30, 1915, this association became the Kansas Section of the MAA. This appears to be the earliest photograph of an MAA Section. Among those present is Solomon Lefschetz. See the MONTHLY, May 1916, pages 164–165 for further details. MAA members with an interest in the history of the Association may wish to identify other members in the photograph.

Seaway Section Marks Golden Anniversary

The Seaway Section will celebrate its 50th anniversary on Friday and Saturday, April 6 and 7, at Colgate University in Hamilton, New York, where the Section was founded.

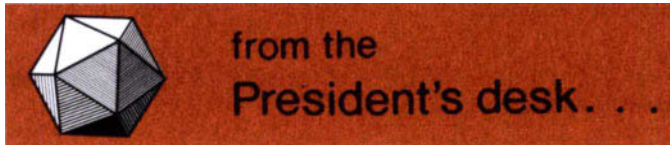
Friday evening's program will include a talk by Neil Brabois, the mathematician-President of Colgate, and a brief summary of the Section's history by Paul Schaefer of SUNY College at Geneseo. (*"Seaway's Golden Anniversary" continues on page four.*)

(*"Seaway's Golden Anniversary" continued from page three.*)

On Saturday morning, hour addresses will be presented by Leonard Gillman, MAA Past President, William Moser of McGill University, and Marshall Cohen of Cornell University. Professor Cohen, the Section's 1990 Harry M. Gehman Lecturer, will speak on "Combinatorial Group Theory: A Geometric Subject."

On Saturday afternoon, Donald Muench of Saint John Fisher College will offer the microcourse, "Teaching Mathematical Concepts with ISETL." The afternoon program will also include sessions of contributed papers.

Members of sister Sections are welcome to take part in this anniversary meeting. Programs and registration forms can be obtained from Malcolm Pownall, Mathematics Department, Colgate University, Hamilton, New York 13346.



Lida K. Barrett, Mississippi State University

The Louisville meeting completes my first year as President of the MAA. It has been a busy and rewarding year—one of change and transition. The appointment of Marcia Sward to become Executive Director in the fall was matched by the change in status for Al Willcox, who now works part-time for us, while assuming the duties of interim Director of the Office of Governmental and Public Affairs.

The changes in the MAA's Washington Headquarters are also dramatic. These changes include: a new paint job on the exterior, new windows, a new roof, and new air conditioning and heating, as well as the complete remodelling of our adjoining townhouse rental property.

The most striking development, however, is the impetus for educational change. The political, economic, intellectual, and technological climates all favor moves to improve education dramatically. Urgent messages for reform are carried by electronic mail, FAX machines, telephone conferences, and other means of prompt communication. These tools help us carry forward changes called for at the grass roots, as well as from on high. It is now simpler to move ahead quickly. Further, there is a special opportunity for us in mathematics, created by the enhanced level of awareness, interest, and activity in mathematics and in mathematics education. The presence at the National Academy of Sciences of the Board on Mathematical Sciences, the Mathematical Sciences Education Board, and the Mathematical Sciences for the Year 2000 Project has given us visibility and credibility within the national scientific community. The Mathematical Association of America, through its work with the Office of Governmental and Public Affairs of the Joint Policy Board of Mathematics, has not only contributed to these activities, but also enhanced its own programs by working in concert with them.

As President, joining the Mathematical Sciences Education Board this year, serving on the Mathematical Sciences for the Year 2000 Project from its inception, and serving on the Conference Board of Mathematical Sciences and on the Council of Scientific Society

Presidents have enabled me to relate the activities of the Mathematical Association of America to the wide spectrum of events that are affecting the future of mathematics. I am very proud that the MAA is positioned as a leader in these new developments through its Executive Director, its officers, its Sections, its committees, and its fine record of activity. The long-term work of the Committee on the Undergraduate Program of Mathematics, as well as many of our other committees, is known, recognized, and significant.

The new electronic age of communication, coupled with the mathematical and educational activity outside the professional societies, such as the Presidentially convened Governors' Conference on Education, has made it not only possible, but also necessary for our committees to increase their activity to keep pace. Through external grant support, we have been able to move key projects ahead. It is an exciting time.

Communicating Mathematics: Theme for 1990 Mathematics Awareness Week

Begin planning now for Mathematics Awareness Week, April 22–28, 1990. The theme, *Communicating Mathematics*, was selected to link with the mathematical community's 1990 Year of National Dialogue, the national vehicle for discussion of the state of American mathematics and mathematics education. The 1990 theme provides a broad base for you and your colleagues to plan a wide variety of activities.

Examples include: mathematics competitions or speakers for students in nearby schools; banners or bulletin boards proclaiming Mathematics Awareness Week; public forums for proposed changes in mathematics education; or mathematical art contests.

The cumulative impact of Mathematics Awareness Week is being felt more and more across the country every year. Please help us to make this year's observance the biggest ever. Appoint a Mathematics Awareness Week coordinator and meet with your colleagues and other MAA members to discuss ways in which your particular institution can participate.

Mark the dates now or schedule Mathematics Awareness Week activities during another week in April, if our suggested dates are during your spring break. Whatever you do, don't neglect this important week.

Write to us to tell us of successful events. To receive a Mathematics Awareness Week packet containing: **Sample Proclamation**, which you can use to work with local officials to draft a similar proclamation for your state or city; **1989 Successes**, a sampling of projects from last year which you may replicate or adapt to your situation; **Audio Visual Resources**, an updated listing of films and tapes which are good focal points for your events; **Sample News Release**, which you can adapt and mail to local media outlets; **Sample Editorial**, which you can submit to local newspapers; **Poster and Postcards**, with beautiful graphics communicating contemporary mathematics; **Pamphlets on careers in mathematics**; and **Information** on other items you can order to help you in *Communicating Mathematics*, contact: Donna Murray, Office of Governmental and Public Affairs, 1527 Eighteenth Street, NW, Washington, DC 20036.

NSF-Supported Mathematics Program Available in Boston

The Program in Mathematics for Young Scientists (PROMYS) offers 60 ambitious high school students of all ages and from all states the chance to learn creative mathematical thinking. This six-week residential program runs from July 2 to August 10, 1990. It is one of the National Science Foundation's Young Scholars Programs.

Entering students take a challenging course in number theory and may also study algebra. Returning students choose from algebra, the theory of equations, and experimental dynamical systems. The instructors are research mathematicians with extensive experience in the long-standing Ohio State Summer Program of Professor Arnold Ross. PROMYS emphasizes active problem solving, including the formulation, criticism, and modification of conjectures. Special features by outside speakers help give a broad view of mathematics and its role in the sciences. The combined presence of the busy participants and 15 career-bound, college-age counselors in the residence halls fosters an intense mathematical environment.

PROMYS is directed by Professors David Fried and Glenn Stevens. The cost to participants is \$1,150 for room and board. Financial aid is available. Application materials can be obtained by writing PROMYS, Department of Mathematics, Boston University, 111 Cummington Street, Boston, MA 02215, or by calling (617) 353-2560. Admissions will be made beginning March 1, 1990, but late applications are welcome.

East-West Scientific Exchanges

The National Academy of Sciences (NAS) invites applications from American scientists who wish to make visits to the USSR, Bulgaria, Czechoslovakia, the German Democratic Republic, Hungary, Poland, Romania, and Yugoslavia. A new program of two-week project development visits begins in April 1990. Also, twelve-month research visits during 1992 will be supported. Special emphasis on young investigators is included in each program.

Applicants will be considered who are from the US and who hold doctoral degrees or their equivalent by June 1990 in mathematics and computer science or doctoral degrees in any of several other areas of science or engineering. Projects in the economic and social sciences will be considered on a case-by-case basis. Necessary expenses will be met by the NAS and the foreign academy, including reimbursement for long-term visitors for salary lost up to a predetermined maximum and expenses for accompanying family members for visits exceeding five months.

Requests for applications should reach the National Academy of Sciences not later than February 15, 1990. Applications must be postmarked by February 28, 1990. Requests for further information or for applications should go to: The National Academy of Sciences, Office of International Affairs, Soviet and East European Affairs (HA-166), 2101 Constitution Avenue, NW, Washington, DC 20418; telephone: (202) 334-2644.

("Contributed Papers in Columbus" continued from front page.)

- THE INTERFACE BETWEEN MATHEMATICS AND OPERATIONS RESEARCH —Linn I. Sennott, Illinois State University, Normal, Wednesday, 9 August 1990 (and possibly Thursday, 10 August 1990). The session has two purposes: (1) to illustrate the contributions of mathematics to the development of operations research via

such topics as linear programming, queueing theory, etc., and (2) to acquaint mathematicians with the application of operations research models. Papers are solicited in either (or both) of these areas.

Presentations are normally limited to ten minutes, although selected contributors may be given up to twenty minutes. Individuals wishing to submit papers for any of these sessions should send the following information to the MAA Washington office (1529 Eighteenth Street, NW, Washington, DC 20036) by May 18 1990: (1) title; (2) intended session; (3) a one-paragraph abstract (for distribution at the meeting); and (4) a one-page outline of the presentation.

Rooms where sessions of contributed papers will be held are equipped with overhead projector and screen. Blackboards are not normally available. Persons having other equipment needs should contact the Secretary (Kenneth Ross, Department of Mathematics, University of Oregon, Eugene, OR 97403) as soon as possible, but in any case prior to June 1, 1990. Upon request, the following will be made available: one additional projector, 35mm slide projector, 16mm film projector, or VCR/VHS with one color monitor.



Budget Drifts; Education Takes Center Stage

... 22 November 1989, Washington, DC

By mid-November 1989, the 1990 budget had still not been enacted, even though we are already seven weeks into the fiscal year. Nevertheless, the federal agencies have delivered their 1991 budget requests to the White House and are now busy with the preparations for the 1992 planning cycle. Not much will be known about the administration's strategy until the President sends the 1991 budget request to the Congress in January. The surprising agreement between Congress and the administration to let Gramm-Rudman-Hollings kick in with its across-the-board cuts, makes it very possible that the administration will be adjusting its 1991 budget right up to the moment of its unveiling next year. It is also quite conceivable that Budget Director Darman's strategy this year actually misfired and the deal that the administration thought they had with the Congress fell apart over the President's insistence on a reduction of the capital gains tax.

The uncertainty over the final 1990 budget dominated the agenda when Erich Bloch met with the advisory panel for the Mathematical Sciences Division at NSF in early November. Now that the proposed doubling of the NSF budget has been side-tracked for the third time, Bloch seems convinced that government funded R&D is in for an extended period of belt tightening. As the amounts to be saved in the deficit reduction process become larger every year, and tax increases continue to be very unlikely, Bloch feels that *("Washington Outlook" continues on page six.)*

("Washington Outlook" continued from page five.)

the years of rapid growth for the NSF research budget have probably run their course. He made it clear to the mathematics panel that the long neglect of education requires adjustments in the balance between the support for research and for education and that the pendulum had simply swung too far in the other direction.

The emphasis on higher investments in education has a strong resonance in Congress, where both the House and the Senate have held hearings on the issue of mathematics and science education. We have reported on the hearings by the House Committee on Science, Space, and Technology which continued throughout the spring and summer (see the November-December 1989 issue of FOCUS, pages 2 and 3). On 14 November, Senator Kennedy's Committee on Labor and Human Resources held hearings on "The Crisis in American Math, Science, and Engineering Education." Witnesses included Carl Sagan (Cornell University), Shirley Malcolm (American Association for the Advancement of Science (AAAS)), Irwin Shapiro (Harvard University), Leon Lederman (Nobel laureate and Director Emeritus of Fermilab), and Lourdes Monteagudo (Deputy Mayor for Education of the City of Chicago). Besides presenting the usual statistics on the poor performance of our high school students in international science and math competitions, the witnesses were quite blunt in their calls for a national set of standards to which the 11,000 school districts should address themselves. They deplored the textbook situation and the inadequacy of teacher training. To make science attractive to the K-12 age group, they also called for better equipment, more demonstrations and less textbook learning. Rather than seeing students with increased curiosity about nature as they advance to secondary school, the witnesses found the students' lack of comprehension about our environment rather appalling. For example, less than half of our college graduates are able to explain why the summers are hot and the winters are cold, the majority of them believing that it has to do with the distance of the earth from the sun.

Better textbooks and better teacher training are desperately needed, especially in view of the demographic fact that, from now until 1995, only 15% of the net increase in the workforce will be white males, traditionally the large majority of the workforce. We must prepare women and minorities for professional careers in science, technology and mathematics. It is no secret that we are not doing it well now.

Powerful testimony came from Ms. Monteagudo who, Cuban-born, got her education in what the former Secretary of Education, William J. Bennett, has called the Nation's worst school system—the City of Chicago's. She and Lederman made a strong case for reaching down into the urban school systems to make them perform, not by "raising the level of mediocrity" but by motivating the students to take an interest in math and science on the broadest basis. Senator Kennedy deplored the lack of interest by scientists in policy matters. The Senator noted that not even a proposal to raise the salaries of medical researchers at NIH brought any mail from scientists.

On the same day as the Kennedy hearings, the American Chemical Society (ACS) used one of the big hearing rooms in the Rayburn House Office Building to release its report "Education Policies for National Survival." As others have done before, the ACS lists the "generic faults" of our educational system: (i) the lack of a national consensus in support of relevant, coherent science education, (ii) the often inadequate preparation of, and lack of continuing education opportunities for precollege science teachers, (iii) the inadequate environmental conditions under which chemistry is taught (including both facilities and equipment), (iv) the low status of teaching as a profession . . . , (v) the underrepresentation of women and minorities in any of the quantitative disciplines and its implication for science education policy

Another document issued this past year discusses the fundamental issues confronting us in undergraduate education. This one results from a workshop held by the National Advisory Group of Sigma Xi, The Scientific Research Society, at Wingspread in Racine, Wisconsin in early 1989. Their report is entitled "An Exploration of the Nature and Quality of Undergraduate Education in Science, Mathematics and Engineering." The workshop was sponsored by the NSF Directorate on Science and Engineering Education and the Johnson Foundation. Copies can be requested from Sigma Xi headquarters: 345 Whitney Avenue, New Haven, Connecticut 06511.

From time to time, the NSF Director issues so-called Important Notices to presidents of colleges and universities and other grantees. Two of these were issued in 1989 that deserve attention because they signal departures from past policy and practice. The first, IN-106, was issued in April 1989; it deals with openness of scientific communication, both with respect to timeliness of publication and that authorship accurately reflects the contributions of those involved. The notice also recommends that universities develop policies and guidelines to deal with alleged incidents of fraud and misconduct. The new policy is evidently a consequence of a highly publicized event that has drawn a great deal of Congressional attention.

A second notice, IN-107, published in September, reflects the new NSF emphasis on education and human resources. In all new proposals, starting in 1990, principal investigators will have to address the effect of their proposed research on the "infrastructure of science and engineering." This rather vague concept requires that all proposals will have to specify the relationship of the project to the education and development of human resources. IN-107 also urges reviewers to emphasize in evaluating scientific productivity the quality of published work rather than quantity. In a highly controversial change of policy, the NSF now insists on limiting the numbers of publications in a grant submission to five relevant citations. In order to avoid any appearance of conflict of interest, new proposals will have to list scientists with whom the principal investigator has had a long-term association or collaborated with over the past 4 years. In the same notice, the long-used peer review label is replaced by a new concept called merit review.

THE CHRONICLE OF HIGHER EDUCATION in its 22 November edition, published detailed numbers on foreign students in the U.S. There are now 366,354 students from abroad who are getting their education here, an increase of 2.8% over previous year. Of those, more than 238,000 are from various parts of Asia (65%). As one might expect, the largest group (19.8%) studies engineering, followed by business and management (18.9%). The third largest contingent (7.3%) is in computer science. Together with social science (5.4%) and liberal arts (3.6%), those five groups represent 55% of the total foreign student body. More than half of all foreign students can be found in six states of the Union, i.e., California, Hawaii, New York, Texas, Massachusetts, and Florida. A complete breakdown by institution, field of study, and by country of origin, can be found in the cited article in the CHRONICLE.

The Joint Policy Board for Mathematics (JPBM) welcomes comments about its "Washington Outlook" column. You can reach JPBM over the Internet communications network under the address: jpbm@athena.umd.edu; or write: JPBM, 1527 Eighteenth Street, NW, Washington, DC 20036.

Hans Oser, most recently Technical Director at SIAM, formerly at the National Bureau of Standards, is now senior associate at the Office of Governmental and Public Affairs (OGPA) for the JPBM in Washington, DC.

Teaching Programs That Work

Leonard Gillman

During the past several years, a number of innovative programs have been established for helping students succeed in mathematics, particularly minority students. I have picked out a few to talk about, but you should be aware that there are many others and their number continues to increase. The ones I have picked represent a fair mix of type of student and of type of school.

SAN ANTONIO, PREP (Pre-Freshman Engineering Program) In 1979, Professor Manuel Berriozábal of the University of Texas at San Antonio founded PREP in an effort to encourage hispanic students who are talented in mathematics and science to continue through college with majors in those fields, rather than switch in high school or college to easier courses or drop out altogether. (I suspect he calls it an engineering rather than a mathematics program because it is easier to get money that way.) What he does is to get students from grades 6–11 and teach them a lot of mathematics and science to keep them interested. PREP has been expanding across the state, but I'll talk about the main program in San Antonio.

It is an academically intensive eight-week summer program; and students may return for a second or third summer. Admission and retention standards are strict. There is an orientation session for parents, most of whom come from backgrounds without traditions in higher education. There are daily classes in logic, engineering and computer science, algebraic structures, physics, probability and statistics, technical writing, and problem solving, as well as study sessions and guest speakers; in addition, there are occasional field trips and some practice with SAT tests. The guest speakers, from universities, industry, and government, give pep talks and describe career opportunities for math majors; this is of great importance, as students are usually unaware of such opportunities, part of the reason they switch to easier programs or drop out of school. Class size is in the low twenties except for emergencies. Faculty teach three courses each day and are on campus from 9:00 to 5:00. Over 600 students completed the 1989 program; three-quarters were hispanic and one in fifteen were black; half were from low-income families and received daily lunches, bus transportation, or stipends. I visited six classes and attended a guest lecture and gave one.

Many academic people derided PREP when it was first announced, maintaining that a mathematics professor would degrade his profession by being associated with it, that you can't get young kids to study logic for eight weeks, that minority students never do well in a traditional academic setting. In fact, the 1989 class voted logic the overwhelming favorite, with an interest rating of 98%. There are now 1100 PREP graduates of college age; of the 750 who responded to the latest survey, all have finished high school (whereas only 50% of students nationwide go past the 10th grade), and 90% are actually attending college or have graduated. Only 50% of freshmen in the Texas public colleges go on to finish, with less than 20% in science or engineering; among PREP graduates, 75% of college freshmen go on to finish, with 67% in science or engineering.

ESCALANTE Everyone in this room has heard of Jaime Escalante and his incredible successes with AP calculus at Garfield High School in East Los Angeles. Probably most of you have seen the movie *Stand and Deliver*. You should also know that there is a book *Escalante* [1]. It too is somewhat romanticized, but it includes gripping details not given in the movie.

Garfield High School has 3500 students, of whom 95% are hispanic, predominantly from middle or lower income families in which neither parent has completed high school. Eighty percent of the children qualify for the federal free or reduced-cost lunch program.

Escalante arrived there in 1974. He had taught mathematics and physics in his native Bolivia, and he had ideals and standards. What he found was debris, graffiti, and gang fights; students who were surly, bored, unruly, and hostile, wedded to a life of academic failure; and teachers who didn't seem to care whether or what the kids learned. The basic mathematics text was 5th-grade level by Bolivian standards. To win students over, Escalante devised gadgets, gimmicks, and a special vocabulary, all of which he still uses as he entertains, challenges, cajoles, encourages, praises, warns, scolds, and threatens in English and Spanish and two Bolivian dialects. He plays music, sometimes soft, sometimes loud. He hands out candy, has the class chant and clap, and tells jokes. "Red light" means stop and think; "green light" means smooth sailing ahead. He squeals in ridicule of the marching band—a waste of time away from mathematics—and barks on behalf of his toy bulldog, which he asserts is 45-carat gold. (The bulldog is the school mascot.) A poster warns, "You don't do your homework, you gonna be working the rest of your life at Jack-in-the-Box."

Escalante also wins students by example. They respect a teacher who is at the school from 7:00 a.m. to 7:00 p.m. Even students not much interested in math work hard for him when they see him working so hard for them. He also challenges student athletes to handball: "You choose. I use left hand or right hand. You beat me, you get an A. I beat you, you do this homework" [1]. The student does the homework. Finally, Escalante provides personal support by accepting telephone calls at home, interceding with parents, arranging field trips, and organizing expeditions to McDonalds; even a clean-up-and-paint squad for the classroom or a money-raising car wash enhance a student's feeling of participation and self-esteem.

Now that Escalante is established, his showmanship is needed less if at all. Still, many students go for it. As one of them told me, "He's funny. He's very funny. He's creative when he teaches. He'll make an opening monologue, very fast, and he'll start telling jokes, and then all of a sudden he's hit you with a quiz—and you want to do it because you're in a good mood. He comes up with some different stuff every time you go to class: we go to class and there's some apparatus there. He gets you interested." I visited two of his classes, an algebra and a calculus. (He told the algebra class the bulldog cost him \$1000; for the calculus students, he revalued it at \$2000.) I also visited two classes of Ben Jiménez, his colleague: a trig and a calculus. The four classes averaged about 23 students. Jiménez is the exact opposite in character: quiet, undramatic, and no-nonsense. He doesn't use gadgets, nor even "red light" or "green light," but he achieves the same results. Like Escalante, he emphasizes on day one that he is a serious teacher teaching a serious course; that the students are going to have to attend class, study hard, and do a great deal of homework; and that the standards will be uncompromising. At the same time he makes clear that he is the students' friend; that he believes in them; that he is available in his classroom or adjoining office from 8:30 on, in particular during the noon hour and after school; and that he will work hard to help any student who is working hard.

Garfield students tackled AP calculus for the first time in 1979 and gained national fame in 1982. The AP was not an end in itself but a lofty, almost impossible challenge. The mere act of studying for it, whatever the result, was itself a worthwhile discipline. Those who passed acquired a strong sense of achievement for having performed something difficult as measured by a national standard. The results at Garfield started out modestly but picked up to an astounding record. In one 6-year stretch involving 250 students, the passing rate was 89%, vs. a national average of 70%. In the past few years, one quarter of all hispanic students in the country who passed calculus AP have come from Garfield High. Did you hear that right? *One quarter in the country came from Garfield.* (One may wonder what this says about the rest of the country.) (*Teaching Mathematics* continues on following page.)

("Teaching Mathematics" continued from previous page.)

What do AP students do for an encore? Fifteen of the eighteen students in the famous class of 1982 entered college and by 1987 nine had graduated—well above average for hispanics; several held professional or technical jobs. One had passed her CPA exams and another had completed her MBA. Equally notable is the way the spirit of success carried into the rest of the school: during those five years, the percentage of Garfield High School students admitted to college increased from 60% to 70%.

UC BERKELEY, PDP (Professional Development Program) The freshman class at Berkeley is 20% hispanic and 10% black. PDP is an honors program for freshmen, inaugurated in 1978 by Uri Treisman, who was concerned about the high rate at which black students with strong high school records in math were failing freshman calculus; moreover, only one in eight of those who did pass got through sophomore differential equations or pre-med organic chemistry, the prerequisites for careers in engineering and the sciences. (In a tragic twist of irony, when many of the students switched to other majors and graduated, the university counted them as successes, whereas they thought of themselves as failures.) To discover the roots of the problems, Uri made a detailed study of the backgrounds and study habits of the black students. Those from predominantly black high schools typically had less exposure to mathematics than other Berkeley students, causing them to overestimate their understanding of course concepts; those from predominantly white high schools also had trouble adjusting as they discovered to their dismay that they were not welcomed by Berkeley's white students. Uri observed that the black students tended to keep their academic and social lives separate. They almost invariably worked alone, with all the attendant frustrations that come from having no frame of reference; in one group he observed, only two of the students provided a counterexample by regularly studying with others: with each other—and at the end of the year they married and quit college. Chinese students, in contrast, studied in groups, exchanging hints and tips and offering constructive criticism of one another's work.

PDP is an intensive, demanding program for talented students, particularly minority students, who are planning a career in a mathematics-based profession. It is designed to help them excel at the university. Candidates are selected by an elaborate process that ensures an ethnic mixture, diversity of high school backgrounds, and gender balance. They are told that they are among the most promising freshmen and that the program is seeking students with a deep commitment to excellence and the desire to con-



Section instructor Duane Cooper (seated, second from left) encourages students at UC Berkeley's PDP to rethink the challenging problem before them. Professor Henry Gore (standing, fourth from left) of the Department of Mathematics at Morehouse College observes their interaction. Photograph courtesy of Jane Scherr.

tinue to graduate school and become leaders in their profession and in society. Several of Escalante's graduates have entered Berkeley and participated in the program. The program itself consists of enriched, intensive work sessions to replace the regular calculus recitations. The emphasis is on students' strengths rather than weaknesses—a student with an identified deficiency will be handed difficult problems where it will have to be met head on—the direct opposite of tutoring or other remedial programs. There are two 2-hour intensive sections per week, 15–20 students to a section. Students come in having already done the regular class homework and are handed worksheets containing challenging problems of the sort that separate A-students from B-students. They begin working the problems individually, then, when things get tough, in collaboration with one another. These experiences lead to a strong sense of community and the forging of lasting friendships.

The session is conducted by a "facilitator," a TA who guides the work but does not give out answers. An important goal is to ensure that the students will go on to excel in their sophomore and later courses without the program there to help them—to become "independent but not isolated learners," as the PDP people put it. The facilitator is a role model and peer counselor, and together with other program staff is sensitive to warning signs such as a distracted appearance or nonattendance; they act as a support group, intervening to help solve outside problems (housing, for instance) before they have become crises. (In contrast, university counseling offices usually see students only after they are already in trouble.) Activities such as pizza-parties and volleyball, as well as the informal atmosphere of the sections, provide additional social contacts that help counter possible feelings of isolation. This combining of the academic and social functions is regarded as an important feature of the program.

The proportion of black students who graduated or are still in school after six years or more is 39% for non-PDP students and 65% for PDP. There are now more than 30 satellite programs across the country. I visited the new ones at Cal Poly (San Luis Obispo) and UT Austin, as well as the main one at Berkeley, speaking with students, facilitators, administrators, and faculty, and sitting in on work sessions. The excitement of the students as they shout and argue about mathematics is a joy to behold. At Austin the Calculus 1 students in the program averaged 21 points higher than the rest of the class. Two years ago, a black female student from PDP became the first Rhodes Scholar at Berkeley in twenty-four years.

NEW MEXICO CALCULUS PROJECT New Mexico State University at Las Cruces is conducting an intriguing calculus project. About 30% of the students are hispanic, and there are satellite programs at several nearby schools, of which one is predominantly hispanic. The goal is to improve calculus teaching for all students by means of student research projects. It stems from a 1987 experiment by two young faculty members, Marcus S. Cohen and David J. Pengelley, whose aim was to get students "to discover the excitement of calculus, build their self-confidence in theoretical thinking, and thereby fundamentally alter their perception of what doing mathematics is really all about." For the formal project, they were joined by colleagues Edward D. Gaughan, Arthur Knoebel, and Douglas S. Kurtz. A research project is a calculus problem, more elaborate and challenging than a standard problem. Ten calculus sections (of the twenty in the college) use these projects, which replace the three one-hour exams. The instructors are the above five and five TAs; each TA is assigned to one of the professors and teaches a section of the same course (1st, 2nd, or 3rd-term). Help labs staffed by the TAs are open two to four hours daily during the two weeks of a project. Students are expected to turn in polished solutions, and, later, explain them in a private 15-minute interview with the professor. With two sections of 40 students, an instructor spends a lot of time reading papers, holding office hours, and interviewing. (Creating the problems in the first place is also time-consuming, but once a data bank has been established, that will no longer be a big consideration.)

A problem often involves simply fitting several concepts together, as when computing the volume cut from the first octant by a tangent plane to a given surface. Sometimes students have to consult a section of the text that the course did not cover. They may be asked to develop a topic on their own, such integration by hyperbolic substitution. Some problems are stated without numbers or variables, such as the following greenhouse problem, which causes their jaws to drop:

"Your parents are going to knock out the bottom of the entire length of the south wall of their house and turn it into a greenhouse by replacing some bottom portion of the wall by a huge sloped piece of glass (which is expensive). They have already decided they are going to spend a certain fixed amount. The triangular ends of the greenhouse will be made of various materials they already have lying around. The floor space in the greenhouse is only considered usable if they can both stand up in it, so part of it will be unusable, but they don't know how much. Of course this depends on how they configure the greenhouse. They want to choose the dimensions of the greenhouse to get the most usable floor space in it, but they are at a real loss to know what the dimensions should be and how much usable space they will get. Fortunately they know you are taking calculus. Amaze them!"

Only the better students can manage this type; so most problems proceed by a series of hints. Whatever the form, the work is intended to require reasoning over a period of days and so reward good thinkers rather than good test takers. A problem that wows the students is to show that the series $1 - 1/2 + 1/3 - 1/4 + \dots$ can be rearranged to converge to any number: their invariable reaction is that it is not possible, and (to quote the faculty) deriving the result "revolutionizes their view of mathematics."

The program has been underway for only a year and a half, but the experimenters are highly encouraged by the anecdotal evidence and preliminary data and in fact amazed by what some students can do. During a long conversation I had with them about the program, they had nothing but praise for their students—in sharp contrast to the universal pastime of ridiculing or grousing. Many students find the projects exciting, but some of the weaker ones do not enjoy the challenges, and require lots of help. In my view, if a lot of students are learning to think more mathematically and enjoy it at the same time, the program is worth while; the weaker ones can always opt for the traditional course.

SUNY POTSDAM MATHEMATICS PROGRAM The mathematics program at SUNY College at Potsdam was started in 1969 by Clarence F. Stephens, who had just joined the department as chairman. Potsdam is a liberal arts college of 4000 students, located in the upper reaches of NY State. 95% are from New York high schools, primarily from lower middle class backgrounds, often from farming communities and small villages. The mean combined SAT for mathematics majors is about 1100; for the entire college, a bit less. Practically all the students are white, but Steve (as he is known to his friends) had tested and refined his ideas during twenty-two years at Prairie View A&M in Texas and Morgan State University in Baltimore, where the students were predominantly black. The program at Potsdam soon started bearing fruit but did not become widely known until 1987, when John Poland's article appeared in the MONTHLY [2]. Steve retired the same year, and Vasily C. Cateforis, his colleague and former student, became chairman. Perhaps the best way to describe the program is to read from a letter Steve wrote me last spring:

"You may be disappointed with the description of our program. We have not used grant money to develop it, and the only innovation in the curriculum is our BA-MA program established in 1970, which provides an opportunity for able mathematics majors to earn both degrees in four years without attending summer school. Most efforts to improve undergraduate mathematics programs focus on curriculum and educational technology. While we acknowledge the

importance of these two factors in the improvement of mathematics education, we focus on the human factor of changing students' perception that mathematics is an almost impossible subject for students to learn and only the most gifted can be expected to achieve any degree of success. We simply established a humanistic academic environment for learning mathematics in which students in mathematics courses feel good about themselves and find enjoyment in the study of mathematics as a result of proper teaching strategies and a supportive environment which promote student success and academic excellence. We help our students understand the meaning of a mathematical proof and have respect for it, to learn how to learn mathematics, to read a mathematics textbook with understanding and pure enjoyment, to study independently and as a member of a group. We use many different methods of teaching undergraduate mathematics. We teach in the spirit that *Everybody Counts*."



Clarence F. Stephens, founder of the mathematics program at SUNY College at Potsdam (1969). His determination to develop a flexible mathematics program that emphasizes the "human factor" has fostered marked success—a substantial number of Potsdam's students major in mathematics and those that concentrate in the discipline compose over 40% of the College's honors students.

The major at Potsdam consists of 30 to 40 hours of mathematics (out of 120): calculus (12 hours), set theory and logic, linear algebra, modern algebra, advanced calculus, a problem seminar, and electives. Class size is 40 at the lower level, 30 to 35 at the upper, 15 in the problem seminar. The predominant spirit is the culture of success: continual encouragement, recognition of every accomplishment, successful role models—honors students, BA-MA students, graduates—enough success to develop self-esteem, enough time to develop intellectually, recognition of one's achievement, and the belief that the study is worth while. Instead of racing through a long syllabus that students are largely not going to absorb anyway, the faculty want their students to learn enough of the subject well enough to understand the essential idea and general strategy. The students solve very hard problems in small groups, teaching one another as the professor guides the effort with helpful questions. Tests are regarded as articles of learning rather than measures of ability. Grading is flexible, to allow for late bloomers. Teachers focus on developing the students' skills rather than on the transmission of knowledge. They challenge the students—but within reason, consistent with Steve's maxim: "Teach the students you have, not the students you wish you had." No one motivates by threat. No one says "I taught them, but they didn't learn it"—that would be likened to a salesperson saying, "I sold it to them, but they didn't buy it."

The faculty believe that the best basis for understanding mathematics and its wide applications is experience in classical mathematics with its emphasis on logical structure, precision, careful analysis, and clarity of expression. Consequently, there are no service courses; nor are there remedial courses, nor even placement tests. (Have faith in them: throw them in and they'll probably swim.) There are no special mathematics courses for math education. ("Teaching Mathematics" continues on following page.)

(*Teaching Mathematics* continued from previous page.)
 cation majors. There is no course titled "Calculus for two-headed football players." The only special course is honors calculus.

There is no mathematics requirement for graduation—but half the freshmen class take calculus as an elective. There is a large and flourishing Pi Mu Epsilon chapter. Although nationally, post-calculus courses account for only 10% of mathematics credits, at Potsdam the figure is 50%. While nationwide only 1% of graduating seniors are math majors, at Potsdam it is 22%. The proportion of women among all graduating seniors is 51% nationally and slightly higher, 54%, at Potsdam; but the proportion of women among graduating math majors is 46% nationally and 55% at Potsdam—although the department makes no particular effort to attract women into mathematics. As the mathematics program has prospered, it has attracted better and better students; by now, over 40% of honors graduates are math majors. Thirteen of the last 16 valedictorians were mathematics majors; 8 of the 13 were women. Did you get that? *Half the valedictorians were women mathematics majors.* I spent two-and-a-half days on campus, where I visited five classes and conferred at length with students and faculty and with the top administration—who, I am happy to report, support the mathematics program unequivocally. Again the faculty have nothing but praise for their students.

Most of the mathematics graduates go into industry, many to places like Kodak and IBM, or various insurance companies, where they prove to be able to think independently, read and write technical reports, work cooperatively with others, present and defend their work, and offer criticism constructively; many rise to high managerial positions. Others go on to do graduate work in mathematics-related fields, often at Cornell or Big Ten schools, where they find themselves well prepared for independent work despite a mathematical education that may be less broad than that of other students.

All the departmental faculty have engaged in research, all teach courses at every level, all are dedicated to the program. There are no TAs. The faculty work long hours, subordinating any research ambitions to the success of their students. The dean told me of the time he was walking across the campus late one Friday afternoon when spring had just broken out and everyone had fled home early—except that as he passed the mathematics building he happened to look up and there were the professors still at work at their desks.

Some mathematicians believe only potential researchers should major in mathematics. But this would write off a mathematically educated citizenry. I for one hope to see many more Potsdam graduates sitting in our state legislatures when university budgets next come up.

CONCLUSIONS All these programs are based on teaching strategy rather than on curriculum reform. The fundamental precepts are: challenge your students with difficult problems, demand hard work, and adhere to uncompromising standards; at the same time, constantly promote and bolster their confidence and self-esteem, assuring them that they can succeed and praising each accomplishment, and make yourself available outside of class for sympathetic help and encouragement. "Remediation" is a dirty word—in fact, a dirty concept. Classes are kept small. Where the program is part of the regular teaching assignment (Garfield, New Mexico, Potsdam), the faculty generally work long hours at their teaching.

The principle of having students working in groups is basic to the Berkeley and Potsdam programs. (I permit myself the irreverent observation that when students learn from one another they take up less of *your* time.) Berkeley maintains a support structure to help students adjust to the new environment and to help keep nonacademic problems out of the way—important for minority students just entering the university. Potsdam tenders support via its Pi Mu Epsilon chapter and other activities typical of a big happy family. Escalante provides his personal support.

I learned something about role models. I asked Escalante, "Suppose there was a teacher who was your clone except that he was anglo; would he have the same success with these students?" I expected him to say, "No, he has to be hispanic." Instead, he said, "No. I pronounce their names right," adding, in explanation, "It comes from within." He went on to say that an anglo who lived for several years in Mexico, say, and absorbed its culture, could also succeed. Then he added, "I could teach an anglo class." The story at Potsdam, with its incredible record of female math majors, is even more interesting. Professor Pat Rogers of York University recently concluded a detailed study of the department, in which she states: "Given the importance placed by some writers on providing female students in male-dominated fields with female role models, it surprised me to find that in a department of 15 faculty, only one is female [3]." The women students spoke of their male teachers as father-figures and, in fact, role models, and were unaware that females are often discouraged from taking math. The article presents an interesting discussion of power and other social or psychological factors and their relation to the nature of mathematics and concludes that apparently "in an environment which is genuinely open to and supportive of all students and in which the style of teaching is true to the nature of mathematical inquiry, women are attracted to mathematics and are just as successful as men."

Here then are five programs with success records ranging from substantial to unbelievable. I'll temper that. I have not defined success. I do not agree with every detail of every program. Some reports are skewed, as when they are limited to those who took the trouble to respond to a survey, or when they do not separate the effect of the program itself from the fact that its students were preselected high achievers. I picked up occasional infelicities on the part of lecturers, such as the statement $f(x) = x^2 - 3x = 2x - 3$, which the students dutifully copied. (What about $3x = 21 = 7$? Or $3x = 21 = 8$?) But my statement stands. The problems we face in educating our youth, especially minorities, are daunting, and it behooves us to study these programs and learn from them.

Before concluding, I wish to express my thanks to Reba Gillman, who is my wife, and Jackie McCaffrey, the coordinator of UT Austin's "Berkeley" program, for many insightful comments on earlier drafts of this talk.

There is one common feature of these programs I have not yet mentioned—perhaps the most outstanding one of all. Can you guess what it is? They were all created by dedicated, imaginative individuals, working by themselves. *MAA had nothing to do with it.* Instead, we were sitting around in committees talking about—oh, never mind!

Finally, it appears that good teaching is good teaching, whether your students are above or below average, live in poverty or in affluence, or represent any particular color or sex.

This article is Professor Gillman's Retiring Presidential Address, presented January 19, 1990 at the MAA meetings in Louisville, Kentucky.

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Photograph of UC Berkeley's Professional Development Program (PDP) on page eight courtesy of Jane Scherr, Berkeley, California.

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THE UNIVERSITY OF NEW MEXICO IS AN AA/EOE

FAIRFIELD UNIVERSITY Tenure-track Position in Mathematics

An entry level Assistant Professor is sought to start in September 1990 who must have a PhD in Mathematics and evidence of teaching ability. Normal teaching load is 3 courses per semester plus research. Salary is competitive and full consideration is given to dossiers completed by February 1, 1990.

Please send a resumé and three letters of reference to Joseph B. Dennin, Chair, Dept. of Math and Computer Science, Fairfield University, Fairfield, CT 06430-7524. Fairfield is a Jesuit University located 60 minutes from New York City. It is an Equal Opportunity/Affirmative Action Employer.

MILLS COLLEGE Oakland, California

The Department of Mathematics and Computer Science invites applications for a tenure-track position as an Assistant Professor of Mathematics, to commence in the fall of 1990 (subject to final budgetary approval). Applicants must have a PhD in mathematics and should submit evidence of exceptional teaching ability and strong research potential. Mills is a small liberal arts college for women, located in the San Francisco Bay Area, and is known for its innovative mathematics and computer science programs. Applications should include a vita and three letters of reference (addressing both teaching ability and research potential). Please have all materials sent to:

Head of the Mathematics Search Committee
Department of Mathematics
and Computer Science
Mills College
5000 MacArthur Boulevard
Oakland, California 94613

The deadline for completed applications is January 20, 1990. Mills College is an affirmative action/equal opportunity employer.

DARTMOUTH COLLEGE

John Wesley Young Research Instructorship

The John Wesley Young Research Instructorship is a two year post-doctoral appointment for promising new or recent PhD's whose research interests overlap a department member's. Current departmental interests include areas in algebra, analysis, algebraic geometry, combinatorics, computer science, differential geometry, logic and set theory, number theory, probability, and topology. Teaching duties of four ten-week courses spread over two or three quarters typically include at least one course in the instructor's speciality and include elementary, advanced, and (at instructor's option) graduate courses. Nine-month salary of \$31,000 supplemented by summer (resident) research stipend of \$6,889 (two-ninths). Send letter of application, resumé, graduate transcript, thesis abstract, description of other research activities and interests if appropriate, and 3 or preferably 4 letters of recommendation (at least one should discuss teaching) to Richard E. Williamson (Recruiting), Department of Math and CS, Bradley Hall, Hanover, NH 03755. Applications received by Jan. 15 receive first consideration; applications will be accepted until position is filled. Dartmouth College is committed to affirmative action and strongly encourages applications from minorities and women.

ASSISTANT DEAN

Engineering/Science/Math. Ocean County College seeks applicants for this 12-month position. Master's degree reqd, earned Doctorate desired. 5 yrs teaching exp in appropriate subject area at post-secondary level and demonstrated leadership in educational administration, preferably at dept level, reqd. Send resumé, transcripts, and 3 professional letters of reference to Ocean County College, Personnel Dept, CN2001, Toms River, NJ 08754 by 2/2/90. AA/EOE.

UNIVERSITY OF ILLINOIS AT CHICAGO

The Department of Mathematics, Statistics, and Computer Science invites applications for positions, effective September 1, 1990, in Mathematics and Computer Science Education.

The Department offers the stimulating environment of a highly rated Mathematics Department with a strong commitment to the improvement of pre-college education. It currently has a number of successful programs in the area of pre-college mathematics and computer education. These include undergraduate programs for the certification of elementary and secondary teachers; an MST degree program; a Doctor of Arts program; courses for gifted pre-college students; and extensive teacher in-service continuing education programs.

Applicants must have a doctorate in Mathematics, Mathematics Education, Computer Science, or related field, an outstanding research and publication record, experience in undergraduate and graduate teaching, and previous involvement with teacher education programs. Applications are also invited for visiting positions of 1 or more quarters. Send vita and direct 3 letters of reference to John Baldwin, Chairman, Search Committee, Dept. of Mathematics, Statistics, and Computer Science, Univ. of Illinois at Chicago, Box 4348, Chicago, IL 60680. To ensure full consideration materials must be received by January 15, 1990. AA/EOE.

HEAD

Department of Mathematics and Computer Science Western Carolina University

Nominations and applications are invited for the position of Head, Department of Mathematics and Computer Science. The department has eighteen full-time faculty members and offers programs leading to the BS, BS Ed, MS, and MA Ed degrees with majors in mathematics, and the BS degree with a major in computer science. Western Carolina University has an enrollment of 6,200 and is a member of the University of North Carolina system. The successful candidate should have a terminal degree, a sustained record of quality teaching, research, and service, and an interest in both undergraduate and graduate program development, as well as administrative experience and/or potential.

Applicants should send a resumé, graduate transcripts, and three letters of reference to: Dr. James H. Horton, Chair, Mathematics and Computer Science Search Committee, School of Arts and Sciences, Western Carolina University, Cullowhee, NC 28723. WCU is an Equal Opportunity/Affirmative Action Employer. Closing date for receipt of applications is March 1, 1990.

HOLLINS COLLEGE

Mathematics and Statistics

Applications are invited for one tenure-track position with duties beginning September, 1990. The position requires the teaching of six freshman- to senior-level courses per year—training in statistics is highly desirable. Excellent teaching skills are essential and professional activity is encouraged. The PhD is required for an assistant professorship; a master's degree and "ABD" are required for an instructorship. The salary is competitive. Applications will be accepted until January 31, 1990, or until the position is filled. EOE. A letter of application, resumé, and three letters of reference should be sent to Dr. Caren L. Diefenderfer, PO Box 9562, Hollins College, Roanoke, VA 24020.

THE COLLEGE OF WOOSTER

Mathematical Sciences Dept. Wooster, Ohio 44691

Assistant Professor of Mathematics: Multi-year visiting position beginning Aug. 25, 1990. To teach elementary and advanced courses in mathematics, direct senior independent study, and participate in interdisciplinary courses. Breadth of interest in mathematics desired; PhD required. Salary competitive. Review of applications will begin January 25, 1990 and continue until the position is filled. Send vita, transcripts, and 3 letters of recommendation to Charles R. Hampton at the address above. The College of Wooster is an Equal Opportunity, Affirmative Action Employer.

MATHEMATICS DEPARTMENT

University of North Dakota Box 8162 University Station Grand Forks, ND 58202

Applications are invited for several tenure-track positions at the assistant and associate professor levels starting August 16, 1990. Consideration will be given to all areas of mathematics, as well as statistics and math education. Must possess a strong commitment to teaching and research and have completed PhD requirements by starting date. Teaching loads are three courses/semester. US citizenship or permanent residency status preferred. Salary and fringes competitive. Open until filled. Send resumé, copy of transcripts, and three letters of reference to Selection Committee. UND is an AA/EOE.

LOYOLA COLLEGE IN MARYLAND

Master's Level Position Mathematical Sciences

A full-time, continuing, non-tenure-track position available in the Mathematical Sciences Department of a medium-sized selective liberal arts college in Fall '90. Primary duty is teaching freshman and sophomore level courses, especially elementary statistics. Teaching load is 4 courses per semester. A master's degree and some background in statistics is required, with exposure to instructional uses of computing desirable. Excellence in teaching a must. Please send resumé and three letters of reference to: Dr. George Mackiw, Chair, Department of Mathematical Sciences, LOYOLA COLLEGE, 4501 N. Charles Street, Baltimore, MD 21210-2699. EOE.

GOUCHER COLLEGE

Mathematics and Computer Science Department

Applications are invited for two tenure-track positions at the Assistant Professor level beginning August, 1990. Qualifications include a PhD in mathematics or computer science and a strong commitment to and demonstrated excellence in undergraduate teaching. Responsibilities include a teaching load of 9–10 hrs/wk and continuing scholarly activity. Goucher is a select, private, coeducational, liberal arts college located eight miles north of Baltimore and is convenient to Washington, DC. The selection process will begin Jan., 1990. Goucher is an EOE. Send vita and three letters of recommendation to:

Dr. Joan S. Morrison
Chair of the Mathematics and
Computer Science Department
Towson, MD 21204

MATHEMATICS DEPARTMENT

Kennesaw State College
P.O. Box 444, Marietta, GA 30061

At least one tenure-track position in Mathematics at the level of Assistant Professor beginning in September, 1990. A PhD is required with a strong commitment to undergraduate education as well as an interest in scholarly activities. Preference will be given to degrees in Combinatorial Group Theory, Combinatorics, or Statistics. Salary and rank are competitive and commensurate with credentials and experience. The College is located in Northwest Metro Atlanta, and enrolls over 9,000 day and evening students in undergraduate and graduate programs. The Department of Mathematics has 18 full-time faculty and shares 6 others with the Department of Computer Science. Send resumé and a list of three references to Dr. Nancy E. Zumoff, Chair, Search Committee. Application deadline is March 1, 1990, or until filled. EOE/AA.

NORTHERN ARIZONA UNIVERSITY

Flagstaff, Arizona

ORDINARY DIFFERENTIAL EQUATIONS: Tenure-track Associate Professor with specialty in the geometric theory of dynamical systems. In addition to this authorized position, several appointments at the assistant professor rank are anticipated this year and next year as we seek to develop an existing strength into a clear focus. Current research of the department in this area concentrates mainly but not exclusively on planar systems with polynomial right-hand sides.

ALGEBRA/COMBINATORICS: Tenure-track Assistant Professor position in algebra or combinatorics, especially combinatorial areas of algebra or geometry. Several current faculty have related research interests.

MATHEMATICS EDUCATION: Three tenure-track positions, one Associate Professor and two Assistant Professor. Candidates must have experience in teacher preparation programs. The appointees will share the activities of our mathematics education program, including secondary teacher preparation, instruction of mathematics and methods courses for educators and others, development of a vibrant research group and design of collaborative programs with schools, including those with high minority enrollments. We intend to appoint a group of mathematics educators who will develop a clear research concentration in either technology in mathematics instruction or access and participation of minority populations.

STATISTICS: Tenure-track Assistant Professor in statistics. Preference will be given to applicants with a strong theoretical background, interest in applied statistics and intramural consulting, and the ability to contribute to the development of an interactive research group in statistics. The department has four statisticians, including the advertised position.

For all positions, qualifications include a doctorate in the advertised specialty, substantial evidence of high quality teaching and demonstrated potential for a productive, quality research program. Positions at the associate rank require a sustained program of high quality research in the advertised specialty.

NAU has an on-campus enrollment of approximately 14,000. The department of 34 faculty offers bachelor's and master's degree programs with emphases including mathematics, mathematics education, statistics, and actuarial science. Flagstaff is located at an altitude of 7,000 feet in the cool pine forests of Northern Arizona near high mountains, the Grand Canyon, and numerous other natural attractions.

Send letter of application and vita, and direct three letters of reference to: Screening Committee, Department of Mathematics, PO Box 5717, Flagstaff, AZ 86011. The searches will remain open until the positions are filled; however, the Screening Committees will begin reviewing applications on December 1, 1989.

NAU is an Equal Opportunity/Affirmative Action Institution. Women and minorities are encouraged to apply.

WASHINGTON AND LEE UNIVERSITY

Department of Mathematics
Lexington, Virginia 24450

One tenure-track position at Asst./Assoc. Prof. level beginning 1990-91 AY. PhD in mathematics required; training in numerical analysis highly desirable. We hope to fill the position with an individual who will interact with colleagues in the physical sciences and engineering in both research and program development. W&L is a privately endowed, undergraduate college with a highly selected student body, small classes, and a commitment to excellence in teaching. Competitive salary and excellent fringe benefit package. Send resumé, graduate transcript (unofficial), three letters of reference (at least one about teaching) to Search Committee at the address above. Consideration of applications will begin Jan. 2 and will continue until position is filled. EQUAL OPPORTUNITY EMPLOYER.

OLD DOMINION UNIVERSITY

Department of Mathematics and Statistics

The Department of Mathematics and Statistics of Old Dominion University invites applications for one or more tenure-track positions in applied mathematics at the assistant professor level beginning August 1990.

The department currently has 21 faculty members active in research. The non-statistics research faculty are devoted to the study of applied mathematics. Topics of current interest are: mathematical combustion, elasticity, magnetohydrodynamics, gas solids mechanics, numerical analysis, approximation theory, integral equations, and mathematical biology. The successful candidate will have a doctorate degree and have demonstrated strong research potential in one of the above mentioned areas or a related field of applied mathematics.

The department has an active graduate program and offers a Doctor of Philosophy degree in applied mathematics and statistics. Also offered are Bachelor of Science and Master of Science degrees in both fields.

The deadline for applications is February 15, 1990. Applicants should send a curriculum vitae; three letters of recommendation, one of which should come from a thesis advisor, and any available pre-prints of research articles to: Professor D. Glenn Lasseigne, Dept. of Mathematics and Statistics, Old Dominion University, Norfolk, VA 23529-0077.

Old Dominion University is an affirmative action, equal opportunity institution and requires compliance with the Immigration Reform and Control Act of 1986.

SAINT OLAF COLLEGE

Northfield, Minnesota 55057

One two-year postdoctoral position, partially funded by the Fund for the Improvement of Post-Secondary Education. This position is half-time teaching (three courses/year) and half-time research. Unlike most postdoctoral positions, there will be a strong emphasis upon developing the teaching aspect of an academic career through a mentored internship. This position is allotted generous research and professional travel budgets. Salary: \$31,500. For new or recent PhD's only. Write to Professor Paul D. Humke, Mathematics Department, St. Olaf College, Northfield, MN 55057. St. Olaf is an Equal Opportunity/Affirmative Action Employer.

FURMAN UNIVERSITY

Greenville, South Carolina 29613

The Department of Mathematics at Furman University, an undergraduate, liberal arts college, invites applications for a tenure-track Assistant Professorship beginning September 1, 1990. A PhD in a mathematical science is required. All areas of specialization are acceptable. Excellence in teaching and continued scholarly activity are expected of all faculty. A vita, graduate and undergraduate transcripts, and three letters of recommendation should be sent to Robert Fray, Department of Mathematics. Application deadline: February 1, 1990. EOE/AEE.



EMBRY-RIDDLE
AERONAUTICAL UNIVERSITY

Department of Mathematics
and Physical Science

Mathematics: Tenure-track entry-level positions beginning Spring and Fall 1990. A commitment to teaching excellence and scholarly activities is essential. PhD in Applied Mathematics required. The department offers a BS degree in Engineering Physics and provides support courses for other Programs throughout the campus. We offer a comprehensive compensation/benefits package. Send a letter of interest, resumé, and three letters of reference to: Chair, MA / PS (EIMS) Department, c/o Office of Human Resources, Embry-Riddle Aeronautical University, Daytona Beach, FL 32114-3900. EOE.

MATHEMATICS EDUCATION

Wright State University
Department of Mathematics and Statistics
Dayton, Ohio 45435

One or two tenure-track positions in mathematics education anticipated for Fall 1990. Preference will be given to applicants who qualify for appointment at the rank of full professor but all qualified applicants will receive consideration. Excellent research record or potential and commitment to quality teaching required. Applicants should expect to complete all requirements for the PhD or EdD by September 15, 1990. Competitive salary and excellent fringe benefits. Two-course teaching load. Department has 30+ PhD faculty and offers a masters degree. Please send vita, graduate transcript(s) and three letters of reference to Mathematics Education Search Committee. Closing date: November 15, 1989, then every two weeks until selection or until July 1, 1990. WSU is an AA/EOE.

INSTRUCTOR

Wright State University
Department of Mathematics and Statistics
Dayton, Ohio 45435

One or more instructorships are anticipated for Fall 1990. These are one-year non-tenure-track positions which may be renewed annually for up to five years. These positions offer competitive salaries and excellent benefits. The teaching load is 12-16 contact hours per quarter, mainly inservice courses. Masters degree in mathematics or statistics required. Previous full-time teaching experience preferred. Please send resumé, graduate transcript(s) and three letters of reference to: Faculty Search Committee. Closing date: February 15, 1990, then every two weeks until selection or August 1, 1990. WSU is an AA/EOE.

UNIVERSITY OF WYOMING

Department of Mathematics

Invites applications for the following positions:

One tenure-track position at the assistant professor level in the area of functional analysis, numerical linear algebra, dynamical systems theory, and algebraic/computational combinatorics. Send resumé and direct three letters of recommendation to:

Professor W. Bridges, Chairman
 Mathematics Department
 P.O. Box 3036 University Station
 University of Wyoming
 Laramie, WY 82071-3036
 (307) 766-4222

Applications completed by January 31, 1990 will be given first consideration. The University of Wyoming is an Equal Opportunity/Affirmative Action Employer.

QUEENS COLLEGE

C H A R L O T T E

Faculty Positions

Queens College in Charlotte, North Carolina invites applications for the following faculty positions for 1990-91. We are looking for faculty committed to liberal arts education and dedicated to fine teaching. Applicants should also demonstrate ability and interest in participating in an interdisciplinary core curriculum and/or international study tour program. We are especially eager to receive applications from women, minorities, and all others who wish to work in a diverse community. Please send a letter of application, vita, and names of references to the individual listed below:

Mathematics and Computer Science: Two positions in mathematics: tenure-track assistant or associate professor and two-year visiting appointment. Applicants must have strong commitment to quality teaching and a demonstrated ability to teach a variety of undergraduate courses in mathematics. PhD required. Ability to teach lower-level computer science courses desirable.

Queens College
 1900 Selwyn Avenue
 Charlotte, NC 28274

Applications to: Professor Robert Vogel, Chair, Department of Mathematics and Computer Science. Closing date: February 9, 1990.

Queens College is a four-year residential and co-educational liberal arts college founded in 1857. The College also includes an evening baccalaureate program for working adults and a small graduate program offering the MEd, MBA, EMBA, and MN. Queens is located in a pleasant residential area of Charlotte, a major and growing urban center.

SAINT PETER'S COLLEGE

The Department of Mathematics invites applications for a tenure-track position to begin Fall 1990. PhD (for Assistant Professor) or Master's with significant current progress toward PhD (for Instructor) required. Applicants must have strong interest in teaching service and major courses for undergraduates in an urban setting. Please send resumé, transcripts, and three current letters of reference to B.M. Kiernan, Mathematics Department, Saint Peter's College, Jersey City, NJ 07306 by March 1, 1990. SPC is an AA/EOE.

ARMSTRONG STATE COLLEGE

The Department of Mathematics and Computer Science invites applications for a tenure-track position as an Assistant Professor of Mathematics beginning in Fall, 1990 (dependent on final budgetary approval). PhD in mathematics or a mathematical science is required. Course work and interest in statistics is preferred, but any specialty will be considered. The successful candidate will show potential for excellence in teaching and enthusiasm for continued scholarly activity. A letter of interest, resumé, transcripts, and at least three letters of reference should be sent to Ed Wheeler, Mathematics and Computer Science, Armstrong State College, Savannah, Georgia 31419-1997. Screening will begin January 31 and continue until search is successful. ASC is an Equal Opportunity, Affirmative Action Employer.

DUTCHESS COMMUNITY COLLEGE

Instructor/Assistant Professor: Tenure-track available September 1, 1990. The position requires a Master's degree in mathematics or a related field with appropriate coursework in mathematics. The person will be expected to teach a wide variety of courses from remedial mathematics to differential equations. Send letter of application and resumé to: Mr. Paul Higgins, Personnel Administrator, Dutchess Community College, 53 Pendell Road, Poughkeepsie, NY 12601-1595. Qualified women and minorities are encouraged to apply. AA/EOE.

HEAD

Mathematics and Computer Science
University of Northern Iowa

The Department of Mathematics and Computer Science is seeking a department head to facilitate the development of leadership in: mathematics, computer science, and mathematics education; teaching and scholarly activity by all faculty; professional activity; and curriculum development. Responsibilities include budgeting and faculty assignment, evaluation, and development. Appointment effective August, 1990. Salary is competitive and commensurate with experience and qualifications. Closing date is February 16, 1990. Contact:

Philip East, Chair, Head Search Committee
 Mathematics and Computer Science, UNI
 Cedar Falls, IA 50614
 (319) 273-2631

UNI is an equal opportunity educator and employer with a comprehensive plan for affirmative action.

MILLSAPS COLLEGE

Department of Mathematics

A tenure-track position in mathematics is available beginning Fall, 1990. Candidates should have the PhD in mathematics and some teaching experience. Ability to teach numerical analysis and/or statistics is desired, but candidates in all areas will be considered. Salary and fringe benefits are competitive. Rank is open.

Applicants should send resumé, transcripts, and three letters of recommendation to Dr. Robert H. King, Dean, c/o Mathematics Search, Millsaps College, Jackson, MS 39210. Applications from women and minorities are strongly encouraged. Applications will be considered until the position is filled. AA/EOE

ALLEGHENY COLLEGE

Mathematics Department
Meadville, PA 16335

Receiving applications for a tenure-track position beginning September 1990. Applicants should have a PhD in mathematics, strong commitments to the teaching of undergraduate students and to continued professional development. Rank and salary are competitive and commensurate with qualifications and experience. Fringe benefits include TIAA-CREF, health and life insurance, full tuition benefits for family, and personal computers in faculty offices. Screening of applicants will begin January 4 and continue until the position is filled. Send application, vita, graduate transcripts, and three letters of recommendation to Dr. Ronald Harrell, Search Committee Chairman. Early applicants should also indicate whether they plan to attend the Joint Mathematics Meetings in Louisville, KY. Allegheny College is an Equal Opportunity Employer.

**UNIVERSITY OF WISCONSIN
WHITEWATER**

Tenure-track position open Aug. 1990. PhD or ABD in a math science, Master's or equivalent in statistics, knowledge of statistical software, ability to teach/develop undergraduate courses required. PhD or ABD in statistics and professional statistical experience preferred. Responsibilities include teaching 12 undergrad statistics/math credits/semester. By February 15, send letter of application, resumé, three letters of recommendation, and all undergrad and grad transcripts: David Stoneman; Dept. of Math/CS; Univ. of Wisc-Whitewater; Whitewater, WI 53190; (414)472-1313. AA/EOE.

**FIORIELLO H. LAGUARDIA
COMMUNITY COLLEGE**

Math Instructor or Assistant Professors
Two Sub Lines

Duties: One person to teach in the Math Dept. on a full-time day schedule and one for a full-time evening schedule. Qualifications: Master's degree (for Instructor line), or doctorate (for Assistant Professor line) and teaching experience are required; knowledge of actuarial science or engineering a plus. Salary: \$26,260-33,297 (Instructor); \$28,630-37,018 (Asst. Prof); commensurate with qualifications and experience. **Send letter and resumé by 1/2/90 to: Anthony Giangrosso, Fiorello H. LaGuardia Community College, The City University of New York, 31-10 Thomson Avenue, Long Island City, NY 11101.**

SAINT BONAVENTURE UNIVERSITY

St. Bonaventure, New York 14778

Two tenure track positions in mathematics to begin 9/90. PhD required. Rank and salary open. Teaching load: 12 hours per semester. Open until filled. Excellence in teaching and scholarly activity expected. Send letter, resumé, copy of graduate transcript, and at least 3 letters of recommendation to:

Dr. Harry Sedinger, Chair
Department of Mathematics
and Computer Science
St. Bonaventure University
St. Bonaventure, New York 14778

St. Bonaventure University is an AAEO employer.

DEPARTMENT HEAD

Mathematics and Statistics
Louisiana Tech University

Louisiana Tech University invites applications for Head, Department of Mathematics and Statistics. The Departments of Chemistry, Mathematics and Statistics, and Physics make up the School of Science within the College of Arts and Sciences. The Department Head has responsibility for all facets of departmental activity, which include curriculum development, budgeting, departmental activity, scheduling, and faculty evaluation. As the Department's chief administrative officer, he/she will report to the Dean of the College through the Director of the School. The Department is comprised of approximately twenty-five full-time faculty members. Salary is commensurate with qualifications. The position will be available on/after July 1, 1990.

Applicants must hold a PhD in Mathematics or Statistics, have an established record of research and scholarly activity, and be able to provide strong academic leadership.

Although applications will be accepted until the position is filled, evaluation of applicants will begin immediately following the joint meetings in Louisville (a representative will be registered at the meeting). Please submit application, resumé, and three letters of reference to:

Dean
College of Arts and Sciences
Louisiana Tech University
Ruston, LA 71272

An Affirmative Action/Equal Opportunity Employer

LOUISIANA TECH UNIVERSITY

The Mathematics and Statistics Department anticipates having three tenure-track positions open at the Assistant Professor level for academic year 1990-91. Candidates must have a doctorate in mathematics or statistics, a commitment to teaching and a research record or potential. The specialty areas considered are statistics, modeling theory, and differential equations. The salary is competitive. Send vita, three letters of reference, and transcripts by February 15, 1990 to: (Applications will be considered until the positions are filled).

John E. Maxfield, Interim Head
Department of Mathematics and Statistics
Louisiana Tech University
P.O. Box 3189 T.S.
Ruston, LA 71272

Louisiana Tech University is an Affirmative Action/Equal Opportunity Employer.

**THE UNIVERSITY OF PITTSBURGH
AT BRADFORD**

Department of Mathematics

The University of Pittsburgh at Bradford has available two Assistant Professor level positions with September, 1990 starting dates:

(1) PhD required, and applicants should have teaching interests in probability, statistics, discrete math, and calculus.

(2) PhD preferred, but M.S. with experience considered, and applicants should have teaching interests in algebra and precalculus.

Please specify which position you are applying for (or both) in your letter of application, and send a copy of your vita with three letters of reference by February 1, 1990, to: Dr. Richard F. Melka, Chairman, Mathematics Search Committee, University of Pittsburgh at Bradford, Bradford, PA 16701-2898. Pitt-Bradford is an affirmative action/equal opportunity employer.

ECKERD COLLEGE

Applications are invited for a tenure-track position in mathematics to begin September 1990. Candidates should have a PhD in mathematics with the field open but an applied course background is preferred. We are seeking a person with a desire to teach in a liberal arts college where good teaching and professional productivity, and periodic participation in an interdisciplinary general education with at least one junior or senior level course, and a one month winter term project. Other duties are in advising, curriculum development, and some general committee work. Eckerd College's 1350 students enjoy a 280 acre campus fronting Boca Ciega Bay in a city of 240,000. We are an equal opportunity employer and women and minorities are encouraged to apply. Applicants should send a resumé, transcripts of all college work, and three reference letters to Prof. George Lofquist, Eckerd College, P.O. Box 12560, St. Petersburg, Florida 33733, by February 10, 1990, for full consideration.

WHITTIER COLLEGE

The Department of Mathematics and Computer Science invites applications for a tenure-track position, at the level of Asst. Prof. beginning Fall 1990. The five members of the department teach a wide range of undergraduate courses in Mathematics and Computer Science. PhD in Mathematics is expected, but no particular field is required. Participation in the teaching of college-wide courses such as College Writing and interdepartmental courses such as Quantitative Management courses is most welcome. Candidates should send a vita, a statement of teaching philosophy, and three letters of recommendations to Chairman, Department of Mathematics and Computer Science, Whittier College, Whittier, CA 90608. The processing of applications will begin on Feb. 15, 1990. However, applications will be accepted until the position is filled.

OCCIDENTAL COLLEGE

Department of Mathematics
1600 Campus Road
Los Angeles, California 90041

Regular appointment beginning September 1990. PhD and expertise in statistics required. Two courses (8 hours per week) per quarter except for first year when only five courses. Excellence in teaching and quality research expected. Candidate expected to interact with social science departments. Occidental actively supports affirmative action; applications from ethnic minorities and women are strongly encouraged. Interviews will be held at the AMS January Meeting. Send resumé and three letters of reference (one about teaching) to Statistics Search Committee, Math Dept. by 15 Feb. 1990.

MOORHEAD STATE UNIVERSITY

Mathematics Department
Moorhead, MN 56560

Tenure-track position at rank of assistant or associate professor to begin September 1990. A PhD in mathematics, statistics, or mathematics education is required. Candidates in all fields of mathematics are encouraged to apply, however, preference will be given to applicants who are qualified through coursework or experience to teach mathematics content and methods courses for elementary and secondary education majors. Successful college teaching experience is desirable. Duties include teaching undergraduate courses in mathematics and statistics, advising students, university and departmental committee work and other professional activities as appropriate. First screening of applications on February 15, 1990. Applications accepted until filled. Apply to Milton Legg, Chair, Mathematics Department. Moorhead State University is an equal opportunity/affirmative action employer. Women and minority persons are encouraged to apply.

MOORHEAD STATE UNIVERSITY

Mathematics Department
Moorhead, MN 56560

Tenure-track position at rank of assistant professor to begin September 1990. A PhD in mathematics or statistics is required. Candidates must be qualified to teach courses in mathematical statistics and/or applied mathematics. Preference given to candidates with successful college teaching experience. Duties include teaching undergraduate courses in mathematics and statistics, advising students, university and departmental committee work and other professional activities as appropriate. First screening of applications on February 1, 1990. Applications accepted until filled. Apply to Milton Legg, Chair, Mathematics Department. Moorhead State University is an equal opportunity/affirmative action employer. Women and minority persons are encouraged to apply.

ALBION COLLEGE

Albion, Michigan

Tenure-track position at the assistant professor level in mathematics department. Starts August, 1990. Salary competitive; excellent fringe benefits. PhD in mathematics or statistics with strong emphasis in applied statistics. Evidence of excellence in teaching required. Albion College encourages applications from minority candidates and women. Direct inquiries to R. C. Fryxell, Chairman, Mathematics Department, Albion College, Albion, MI 49224, (517) 629-0287. (BITnet address: RFRYX-ELL@ALBION) Albion College is an equal opportunity employer.

HUMBOLDT STATE UNIVERSITY (HSU)

Applications are invited for two tenure track assistant or associate professor positions for Fall 1990. HSU, located on the California north coast, has an active mathematics faculty and a strong undergraduate major with options in applied mathematics, computer science, and teacher preparation, as well as a master's program in mathematical modeling of environmental systems. Candidates must have a doctorate in a mathematical science or mathematics education. All qualified applicants with a commitment to teaching excellence and scholarly activities will be considered. Preference will be given to applicants who can help meet programmatic needs in mathematics education, statistics, or general undergraduate mathematics. Women and minorities

are especially encouraged to apply. Applicants should send vita and the names of three references to: Search Committee, Department of Mathematics, Humboldt State University, Arcata, CA 95521 by February 15 for full consideration. HSU is an Equal Opportunity/Affirmative Action Employer.

WOFFORD COLLEGE

Spartanburg, South Carolina

Wofford College invites applications for a tenure-track position in mathematics to begin Aug. 29, 1990. Rank and salary will depend on qualifications. The PhD in mathematics is preferred, but candidates with a strong Master's degree in mathematics will be considered. Applicants should be committed to undergraduate teaching and to a program of scholarship that sustains professional vigor. The usual teaching load is 9–12 hours per week.

Wofford College, founded in 1854, is a private, four-year, coeducational college of 1100 students. It is committed to high quality, undergraduate, liberal learning, and it is related to the United Methodist Church. Wofford is pleasantly situated in the foothills of the Appalachian Mountains in a community of about 110,000 people.

Inquiries and applications should be sent by February 15 to Prof. Richard L. Robinson, Chairman, Mathematics Department, Wofford College, Spartanburg, SC 29303-3840. AA/EEO employer.

SAINT MARY'S COLLEGE OF CALIFORNIA

Mathematical Sciences

One tenure-track assistant professorship, beginning fall 1990. A PhD and commitment to both liberal arts education and continued research are expected of candidate to join a young, growing department. Computer science expertise is desirable. St. Mary's is a coeducational college of over 3800 students, located 10 miles east of Berkeley. Current salary range is \$28,786–\$34,259. Send resumé and 3 letters of recommendation, at least 1 of which discusses teaching ability, to Charles Hamaker, Chair, Dept. of Mathematical Sciences, P.O. Box 3517, St. Mary's College, Moraga, CA 94575. Evaluation of candidates will begin February 12, 1990, and continue until the position is filled. Interviews will be held at the AMS meeting in Louisville, KY, January 1990. An EOE/AA employer.

GREENSBORO COLLEGE

Mathematics/Computer Science. Full-time position beginning August, 1990. Masters level or higher. Rank and salary commensurate with credentials and experience. Must be committed to teaching wide variety of undergraduate mathematics and computer science courses in liberal arts setting. Interviewing at MAA in Atlanta in January. Greensboro College, four-year, liberal arts institution affiliated with the United Methodist Church. Chartered in 1838 and located in community of 200,000 with six colleges and universities. Send full credentials to Dr. Mary Dowlen, Chair, Mathematics Search Committee, Greensboro College, 815 West Market Street, Greensboro, NC 27401-1875. AA/EEO

CALIFORNIA STATE UNIVERSITY CHICO

Department of Mathematics and Statistics Assistant Professor of Mathematics Lecturer in Mathematics

The Department is offering a tenure-track position at the Assistant Professor level, and one or more one-year full-time temporary positions, for the 1990-91 academic year. A PhD in mathematics or statistics and evidence of teaching excellence are required. Candidates in mathematical statistics are particularly encouraged to apply, but candidates in all areas will be considered. Faculty teach 12 hours (units) per semester and are expected to strive for excellence in teaching, be actively engaged in scholarly activities, including research, and contribute to the governance of the department. The salary range is \$28,884–\$39,924 for Assistant Professor and \$28,884–\$55,452 for a Lecturer.

California State University, Chico enrolls 16,000 students, with thirty full-time faculty in mathematics and statistics. Chico, a community of 60,000, is 90 miles north of Sacramento.

Qualified candidates should submit a resumé, graduate transcripts, supporting documents, and at least three letters of recommendation, prior to the closing date of February 1, 1990, to:

Thomas A. McCreedy, Chair
Department of Mathematics and Statistics
California State University, Chico
Chico, CA 95929-0525

CSU, Chico is an EO/AA/IRCA employer.

UNIVERSITY OF DELAWARE

Preparatory Mathematics Specialists

Professional 12 month position available 7/1/90 with one year renewable contracts. Duties involve teaching/tutoring and curriculum/materials development for intermediate algebra, pre-calculus and calculus courses. Requires BA in math or math ed (Master's preferred) and teaching experience with strong commitment to student development. Send resumé, transcripts and 3 letters of reference before March 15, 1990 to Dr. J. Bergman, Chair, PMS Search Committee, Dept. Mathematical Sciences, University of Delaware, Newark, DE 19716.

The University of Delaware is an Equal Opportunity Employer which encourages applications from qualified minority groups and women.

MATHEMATICS POSITION

Qualified applicants are invited to apply for a tenure-track position in mathematics which is available September 16, 1990. The successful candidate will be committed to teaching a wide range of undergraduate mathematics courses. An interest and background in analysis and/or applied mathematics is preferred. Send resumé and three recent (1987–89) letters of recommendation to: Professor Robert Brandon, Mathematics Search, Badgley Hall of Science, Eastern Oregon State College, La Grande, OR 97850. Application closing date is February 15, 1990, or until filled. Eastern Oregon State College is an Equal Opportunity/Affirmative Action Employer.

TRINITY COLLEGE

Hartford, CT

The Department of Mathematics at Trinity College invites applications for one tenure-track position and for one or more visiting positions, which will begin in the academic year 1990–91. The normal teaching load is five semester courses per year ("3/2"). Rank and salary are open, and dependent on qualifications. Specialization is also open. Requirements for the positions: PhD in mathematics, evidence of teaching excellence at the undergraduate level, and (for the tenure-track job) indications of promise in research.

Applicants should send a c.v., three letters of reference (at least one of which speaks directly to teaching experience), and a statement of teaching and research interests to:

Search Committee Chair
Dept. of Mathematics
Trinity College
Hartford, CT 06106

by February 1, 1990.

Representatives of the department will attend the Employment Register at the Joint Annual Meetings in Louisville in January, 1990.

Applicants will be considered for both the tenure-track and visiting positions unless they specify otherwise.

Trinity College is an Equal Opportunity/Affirmative Action Employer. Women and members of minority groups are especially encouraged to apply.

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

Alma College

invites applications for a tenure-track position beginning Fall, 1990. Candidates should enjoy teaching a variety of undergraduate mathematics courses in a liberal arts environment and working with students on independent projects. A PhD in mathematics is required, excellence in teaching is paramount, and the ability to teach some computer science is preferred.

Located in the center of lower Michigan, Alma College is a selective, private college known for the quality of its programs in the sciences and the liberal arts. Alma is a member of the Undergraduate Science Group, a consortium of 50 liberal arts colleges with exceptionally strong science programs. The Department of Mathematics and Computer Science comprises 8 full-time faculty and graduates 10 to 20 majors each year. The normal teaching load is 6 courses per year; faculty development is encouraged. Salaries are competitive and fringe benefits are excellent.

Applications from women and minorities are especially encouraged. Please send a cover letter addressing scholarly interests, resumé, graduate transcript, and three letters of recommendation including evaluation of teaching ability to:

John Putz
Department of Mathematics
and Computer Science
Alma College
Alma, MI 48801

by February 2, 1990. Alma College is an AA/EEO employer.

ROOSEVELT UNIVERSITY

**Department of Mathematical Sciences
Chicago, Illinois**

There is a tenure-track opening for a person with a PhD in computer science or in mathematics with credentials or experience in computing. The position involves teaching bachelor's and master's level courses at both the Downtown campus and at the branch in Arlington Heights. Roosevelt is an Equal Opportunity Employer.

Please direct vita, transcripts, and at least 3 letters of reference by February 1, 1990 to Jimmie Lee Johnson, Chair, Search Committee, Department of Mathematical Sciences, Roosevelt University, 430 S. Michigan Ave., Chicago, IL 60605-1390.

FORT LEWIS COLLEGE

Fort Lewis College, Math Department anticipates a tenure-track position for 1990-1991. Terminal degree or near completion is required. 12 hours of undergraduate teaching, CS and/or Math. FLC is a state-supported liberal arts college of 4,000 in SW Colorado. Send letter of application, resumé, statement of professional intent, transcripts, 3 current letters of recommendation, including one that clearly addresses teaching to: H.C. Rosenberg, Math Dept., Fort Lewis College, Durango, CO 81301. Deadline is February 5, 1990. FLC is an AA/EEO employer.

GRAND VALLEY STATE UNIVERSITY

Allendale, Michigan

Four tenure-track positions are open in the Department of Mathematics and Computer Science beginning Fall, 1990. Preferred specialties are: mathematics education, statistics, computer science and information systems. Earned doctorate and strong teaching recommendations are required.

For each position, duties include teaching undergraduate and/or graduate courses, student advising and professional development. GVSU is located in greater Grand Rapids, the second largest metropolitan area in Michigan and offers numerous cultural and recreational opportunities. Cost of living is moderate and quality of life is high. Send resumé and three letters of recommendation to: Faculty Search Committee, Math and CS Dept., GVSU, Allendale, MI 49401. An EO/AA Institution.

ELMIRA COLLEGE

Elmira College invites applications for a tenure-track position in mathematics at the Assistant Professor level. Doctorate required. Responsibilities include teaching in the full spectrum of undergraduate mathematics courses. Salary range in the mid 20's. Background and willingness to teach in the areas of applied statistics or mathematics education are desirable, as is an interest in interdisciplinary teaching or teaching outside the discipline of mathematics. Special three-term calendar provides significant opportunity for innovative teaching and development of new courses.

Elmira College is a liberal arts college located just south of the Finger Lakes region of New York near Corning, Ithaca, and Watkins Glen. Send cover letter, current vita, and three letters of recommendation (at least one of which speaks to teaching ability) to Dr. Leonard Simons, Chair, Division of Mathematics and Natural Sciences, Elmira College, Elmira, NY 14901. Search committee will begin reviewing applications on January 30, 1990 and the search will continue until the position is filled. Women and minorities are especially encouraged to apply.

UNIVERSITY OF CINCINNATI

**OMI College of Applied Science
Math/Physics/Computing Technology
Department Head**

The OMI College of Applied Science is a four-year engineering technology college of the University of Cincinnati. Current day and evening enrollment is 1600. The Math/Physics/Computing Technology department head provides academic and administrative leadership for a seven member department providing instruction for day and evening associate and baccalaureate degree programs. The primary academic courses include: Collegiate Mathematics through Integral Calculus, Differential Equations, Advanced Applied Mathematics, Linear Algebra, Vector Analysis, Probability and Statistics, College Physics and major computer languages. Minimum qualifications: MS/MA in math, physics or computer science with background in other two fields; evidence of excellence in college-level teaching; demonstrated administrative ability. Availability: Tenure-track appointment available September 1, 1990. Nominations and applications, including three references, should be forwarded by March 23, 1990 to: Jo Diamantes, Sr. Admin. Asst., OMI College of Applied Science; 2220 Victory Parkway; Cincinnati, OH 45206-2822.

**WOMEN AND MINORITIES
ENCOURAGED TO APPLY
AN AA/EEO EMPLOYER**

MANKATO STATE COLLEGE

**College of Natural Science
Mathematics and Home Economics**

POSITION: Mankato State University invites applications and nominations for the position of DEAN of the COLLEGE OF NATURAL SCIENCES, MATHEMATICS and HOME ECONOMICS. Persons in this position provide leadership to the College whose disciplines include Astronomy, the Biological Sciences, Chemistry, Computer Science, Geology, Home Economics, Mathematics, and Statistics. The College consists of five departments, 105 FTE faculty, and 10 FTE classified employees, and offers 25 undergraduate and 9 graduate programs.

QUALIFICATIONS: Doctoral degree in an appropriate academic field, proven effectiveness in teaching and research, and demonstrated administrative ability are required. Additional qualifications include active participation in curricular and professional issues and a commitment to provide leadership in the areas of scholarship, research, development, external relations, and equal opportunity and affirmative action.

COMPENSATION: This is a 12-month administrative position. Salary is competitive and will be commensurate with qualifications and experience.

APPLICATION: Applications must include a resumé and the names and addresses of three current references. Applications or nominations to:

Dr. Richard A. Crofts
Vice President for Academic Affairs
Mankato State University, MSU Box 43
Mankato, MN 56002-8400
(507) 389-1333

Review of applications will begin February 19, 1990. Date of appointment will be as soon after July 1, 1990 as possible.

Mankato State is an Equal Opportunity, Affirmative Action University and encourages applications from women and minorities.

OHIO WESLEYAN UNIVERSITY

Computer Science/Mathematics: Tenure-track position beginning fall 1990. Teaching load of three courses per semester, at least two in computer science. PhD in computer science or in a closely related area. Seek person interested in planning and developing of a modern curriculum in computer science. Scholarly activity expected. Computing facilities include two VAX 11/750's connected to BITNET. Also IBM 4341 and a microcomputer laboratory. Applications close February 28, 1990. Send cover letter, resumé, official graduate transcript, and three letters of reference to: Professor Jeffrey Nunemacher, Department of Mathematical Sciences, Ohio Wesleyan University, Delaware, Ohio 43015. OWU strongly encourages applications from qualified female and minority candidates. An Equal Opportunity/Affirmative Action Employer.

**SOUTHWEST MISSOURI
STATE UNIVERSITY**

Department of Mathematics

Several tenure-track positions and possibly some visiting positions in Mathematics and Statistics are available beginning August 20, 1990. Rank and salary will be commensurate with qualifications. Applicants must have a PhD in mathematics or statistics, evidence of excellence in teaching, and a commitment to continued research. For all positions preference will be given to applicants with research interests compatible with those of the current faculty and for at least one position preference will be given to applicants with research interest in algebra. Duties include teaching, research, and service. Applications will be reviewed as received and will be accepted until the positions are filled or until April 1, 1990—the final deadline for all application materials. Send application (resumé, three letters of reference, graduate transcripts, and a letter of interest) to: Dr. M. Michael Awad, Head, Department of Mathematics, Southwest Missouri State University, Springfield, MO 65804-0094. AA/EOE.

DENISON UNIVERSITY

Three positions, preferably at the Assistant Professor level, in the Department of Mathematical Sciences. The first position is non-tenurable and starts in January 1990. A Master's degree in mathematics or computer science is required; preference will be given to those having a background in computer science or holding the PhD. Applicants for this position can (if they choose) simultaneously be candidates for one of the tenurable positions.

The second position is in computer science and is tenurable with a starting date of Fall 1990. It requires a PhD (in hand or to be attained shortly following employment) in computer science or in a related field. The third position, also tenurable, is in mathematics (any speciality) and requires a PhD (in hand or to be attained shortly following employment) in mathematics. It also starts in the Fall of 1990. Teaching loads are 5 and 6 courses per year for computer science and mathematics respectively.

The primary responsibility of both positions is teaching; a commitment to quality instruction is essential. Some research is expected of those in tenurable positions. Denison University is a liberal arts college of 2,100 students located in a village of 4,000, seven miles from Newark (population 50,000) and twenty-five miles east of Columbus. The Department of Mathematical Sciences offers B.A. and B.S. degrees in mathematics and computer science as well as a mathematics-economics joint B.A. degree. The department consists of 10 full-time and two part-time faculty members. Four members of the department have advanced degrees in computer science.

Every faculty office is equipped with a DOS/UNIX workstation connected to larger computers over a departmental network. The Department operates a classroom/laboratory facility with 21 IBM-PC equivalents connected to a 3B2/400 via a StarLAN network and it uses a symbolic computation facility consisting of two 3B2/1000 systems and a SUN Microsystems 4/280 computer. The University computing facilities consist of a VAX 11/6210, and a VAX 11/785.

Send resumé and transcripts of graduate work to Professor Zaven A. Karian, Chairman, Department of Mathematical Sciences, Denison University, Granville, OH 43023. Also ask three persons who know you well to send reference letters in support of your application (at least one letter should address your teaching). For the non-tenurable position, applications will be reviewed as they are received. Applications for the tenurable positions should be made by February 5, 1990; applications beyond this date will be considered until the positions are filled. Denison is an Affirmative Action/Equal Opportunity Employer; women and minorities are encouraged to apply.

MATHEMATICS EDUCATION Western Carolina University Cullowhee, NC 28723

Western Carolina University's Department of Mathematics and Computer Science is currently accepting applications for a tenure-track assistant professor in mathematics education beginning August 1990. Required: PhD or EdD in mathematics education or related area, and evidence of ability to engage in research/creative activities. Preferred: Some secondary teaching experience. WCU, a comprehensive university, is one of the sixteen senior institutions of the University of North Carolina with an enrollment in excess of 6,000 and offers undergraduate degrees in mathematics and computer science and graduate degrees in mathematics. The university is located in a valley between the Blue Ridge and Great Smoky Mountains 50 miles southwest of Asheville, NC. Candidates should submit vita, official transcripts, and three letters of reference to: Professor Ron Marshall, Mathematics and Computer Science Department, Western Carolina University, Cullowhee, NC 28723. Closing date: March 15, 1990, or until position is filled. Western Carolina University is an equal opportunity/affirmative action employer and encourages applications from women and minority candidates.

KALAMAZOO COLLEGE Kalamazoo, Michigan

The Department of Mathematics and Computer Science invites applications for a tenure-track position as an Assistant Professor of Mathematics to commence in the fall of 1990. Applicants must have a PhD in mathematics or statistics and a wide range of mathematical interests. Teaching load is two courses per ten-week term, three terms per year. Kalamazoo College is a highly selective, private, four-year liberal arts college known for its innovative program and its strong tradition in the sciences. Competitive salary, good benefits, in a pleasant urban residential setting.

Applicants should supply resumé and three references to:

Professor J.B. Fink
Department of Mathematics
and Computer Science
Kalamazoo College
Kalamazoo, MI 49007

Applications received until position is filled.

Kalamazoo College is an equal opportunity, affirmative action employer. Women and minorities are especially encouraged to apply.

THE VIRGINIA MILITARY INSTITUTE Mathematics/Computer Science

A tenure-track position beginning August, 1990. Applicant should have a strong interest in teaching. VMI's hardware includes a Data General MV/7800, a Burroughs A9, and 200 IBM PC's.

Preference given to an applicant with a PhD in a computer-related field such as computer science, mathematics, or MIS. Significant education or experience in CS required. Duties include teaching computer science and mathematics. Salary and rank commensurate with qualifications.

VMI is a quality undergraduate military college of engineering, liberal arts, and science, located in an attractive college town. Faculty wear uniforms but have no other assigned military duties. Deadline for applications is March 1, 1990. Send resumé with at least three references to Thomas C. Lominac, Department of Mathematics and Computer Science, Virginia Military Institute, Lexington, Virginia 24450. AA/EEO Employer

UNIVERSITY OF HARTFORD Mathematics and Computer Science Department

Applications are invited for a full-time tenure-track position beginning September 1990 at the rank of Associate or Assistant Professor depending on qualifications and experience. Candidates must have a PhD in mathematics and a strong commitment to excellence in undergraduate teaching and scholarship/professional development. Opportunities exist to teach in an interdisciplinary general education curriculum. Review of applications will begin Feb. 1 and continue until the position is filled. Send resumé and three letters of recommendation to:

Dr. Joel Kagan, Chair
Department of Mathematics
and Computer Science
University of Hartford
West Hartford, CT 06117

The University of Hartford is an equal opportunity, affirmative action employer and specifically encourages applications from women and minorities.

HUNTINGTON COLLEGE Department of Mathematical Sciences

Huntington College invites applications for a position in computer information science and mathematics open for Fall 1990. Minimum MA in computer science or related area; doctorate preferred. Huntington is an evangelical, church-related liberal arts college. Initial screening by February 1 but position open until filled. Resumé and credentials should be mailed to Dr. Gerald D. Smith, Vice President and Dean of the College, Huntington College, Huntington, Indiana 46750. Equal Opportunity Employer.

ASSISTANT/ASSOCIATE PROFESSOR Mathematics Education

The Division of Education, University of California, Davis invites applications for a tenure-track faculty position in the area of mathematics education. Candidates must have a PhD or equivalent and a promising record of empirical research in mathematics education. Preference will be given to applicants with demonstrated interest in culturally and linguistically diverse student populations, K-12 teaching experience, demonstrated interest in research aimed at improving mathematics learning and instruction in elementary and secondary schools. Responsibilities include teaching in the undergraduate,

graduate, and teacher education programs; supervising graduate students in research; participating in research and development programs with elementary and secondary schools. Effective July 1, 1990. Submit a current vitae, and the names, addresses, and telephone numbers of four references to: Dr. Barbara Goldman, Mathematics Education Search, Division of Education, University of California, Davis, CA 95616. Screening will begin January 15, 1990; applications will be accepted until a suitable candidate is selected. EEO/AA Employer.

MATHEMATICS

USC Coastal Carolina College is seeking a person committed to excellence in classroom instruction, sensitivity to student needs and curriculum development. Tenure-track position at rank of Assistant or Associate Professor available Fall, 1990. Qualifications: PhD in mathematics; teaching experience. Statistical background preferred. Salary negotiable and competitive. USC Coastal Carolina College, the fastest growing 4-year regional campus of the University of South Carolina, is located 9 miles west of Myrtle Beach. All applicants should submit letter of application, curriculum vitae, and names and addresses of references to: Dr. Janis W. Chesson, Assistant Chancellor for Human Resources and Affirmative Action, USC Coastal Carolina College, PO Box 1954, Conway, SC 29526. Screening of applications will begin February 1, 1990, and will continue until position is filled. Applications from women and minorities are encouraged. USC Coastal Carolina College is an EOE/AA Employer.

MATHEMATICS POSITIONS

One full-time temporary position, one half-time temporary position, in the mathematical sciences for 1990-91. Masters degree required, doctorate preferred. One tenure-track position for which expertise in statistics is preferred. A doctorate is required for tenure. Appointment at the rank of instructor or assistant professor (\$21,000 to \$34,000 per academic year). Emphasis on undergraduate teaching. Full-time load is 12 hours teaching per week. A complete application consists of letter of application, vita, transcripts and three letters of recommendation. Send application materials to Search Committee, Dept. of Mathematics and Computer Science, Bloomsburg University, Bloomsburg, PA 17815. Complete applications will be reviewed beginning February 16, 1990. Applications received after this date may be considered. Bloomsburg University is an equal opportunity and affirmative action employer. Women and all other protected class persons are encouraged to apply.

LAKE SUPERIOR STATE UNIVERSITY Sault Ste. Marie, Michigan 49783

Department of Computer and Mathematical Sciences invites applications from qualified candidates for a tenure-track position at the instructor or assistant professor level beginning September, 1990. Duties include teaching undergraduate courses in mathematics and/or computer science, advising, and committee work. A masters degree in computer science, mathematics, mathematics education, or statistics is required. Doctorate is preferred. Teaching duties will normally span the level of remedial to advanced upper level. Selection will be based on the potential and demonstration of excellence in teaching undergraduate mathematics and/or computer science. Application begins with letter, vita, undergraduate and graduate transcripts (student copies will suffice initially), one letter of reference addressing teaching experience. Consideration of applications shall begin January 22, 1990, and continue until the position is filled. Submit these to the Office of Employee Relations, LSSU.

UNIVERSITY OF MINNESOTA MORRIS

The University of Minnesota, Morris invites applications for a tenure-track assistant professor position to begin September 1990. Candidates must have/expect a PhD degree in statistics or a closely related field by September 1990 and must be able to demonstrate an excellence or promise of excellence in teaching. Candidates must also show promise of being able to establish a research program suitable to a liberal arts college. The major responsibility of the successful candidate will be teaching undergraduate statistics courses. Other responsibilities include sharing the administration of the Mathematics Discipline, serving the wider activities of the college with other faculty, and advising students. Special consideration will be given to women and minority candidates. Candidates should submit complete resumés and three letters of reference by February 16, 1990 to Dr. James M. Olson, Chair, Division of Science and Mathematics, University of Minnesota, Morris, Morris, MN 56267. The University of Minnesota is an equal opportunity educator and employer and specifically invites and encourages applications from women and minorities.

PHILLIPS UNIVERSITY Mathematics

The Department of Mathematics is accepting applications for a tenure-track position beginning in August 1990. Doctorate required. Ability to teach undergraduate Real Analysis and Modern Algebra is particularly desirable. Three person department, Phillips is a church-related liberal arts college with an enrollment of 1000 students and a BS in Mathematics, Mathematics Education, Applied Mathematics and Computer Science. Phillips University is a private, church-related institution and is the only institution in Oklahoma to rate in the top ten percent or "best" colleges of the west in categories of independent rating publications. An AA/EOE employer. Send vitae including transcripts to Dr. Beth Murphy, Chairperson, Division of Natural and Mathematical Sciences, Phillips University, P.O. Box 2000, University Station, Enid, Oklahoma 73701.

SUNY FREDONIA

Mathematics: Applications are invited for a one-year position in mathematics for the 1990-91 academic year. A PhD in mathematics is preferred. A successful candidate must exhibit a strong commitment to teaching excellence and an interest in scholarly work. The teaching load consists of three or four courses (9-12 hours) per semester, taken from undergraduate mathematics and first-year computer science. Candidates should arrange to have a resumé and three letters of reference sent to: Dr. Albert D. Polimeni, Department of Mathematics and Computer Science, SUNY College at Fredonia, Fredonia, New York 14063. The deadline for application is May 15, 1990. (EOE/AA) Women and minorities encouraged to apply.

DEPARTMENT OF MATHEMATICAL SCIENCES University of Montana Missoula, Montana 59812

The Department of Mathematical Sciences at the University of Montana has openings for two Assistant Professorships beginning Fall 1990. One position is a 3-year appointment (with tenure possible) in statistics. A PhD in statistics or mathematics (with dissertation in Statistics) is required. The other is a tenure-track position in abstract algebra. A doctorate with a strong background in mathematics is required. Teaching and research experience for both

positions are necessary. The department offers BA, MA, and PhD degrees in mathematics. Applications including resumé, graduate transcript and three letters of recommendation should be sent to: Professor William Derrick, Chair, Department of Mathematical Sciences, University of Montana, Missoula, MT 59812. Phone: (406) 243-5311. Application closing date is February 20, 1990. AA/EOE.

UNIVERSITY OF TENNESSEE AT MARTIN

Martin, Tennessee

Assistant/Associate Professor of Mathematics, tenure track. PhD in mathematics, statistics, or closely related area is required, experience is expected. Duties will be teaching 12 hours of undergraduate courses, advising, professional development, and scholarly inquiry. Salary dependent on experience.

UT Martin, a primary campus in the University of Tennessee system, has an enrollment of 5,000 students. The department has 5 computer science and 16 mathematics faculty. Martin is a friendly town of 9,000 in northwest Tennessee.

Send resumé, transcripts, names and addresses of three references to Dr. Bill Austin, Chair, Dept. of Mathematics and Computer Science, The University of Tennessee at Martin, Martin, TN 38238-5049. Screening of applicants will begin Feb. 1, 1990. Applications will be accepted until the position is filled. UTM is an equal opportunity, affirmative action employer.

VISITING PROFESSOR

United States Air Force Academy Department of Mathematical Sciences

The Department of Mathematical Sciences of the United States Air Force Academy invites nominations and applications for a Visiting Professor Position. We seek a Professor with extensive experience teaching undergraduate mathematics, statistics or operations research and a strong record of scholarly activity. Duties will include reviewing our academic programs, teaching undergraduate courses, and promoting our research programs. Applicants should have a demonstrated commitment to undergraduate research and education. The appointment is usually for one year and will begin in July 1991. Inquiries are welcome for Visiting Professor positions for subsequent years. Salary is commensurate with qualifications. To apply, please send nominations (to include resumé and references) by 1 May 1990 to: Chairman, Department of Mathematical Sciences, United States Air Force Academy, CO 80840-5701.

UNIVERSITY OF SOUTHERN COLORADO Department of Mathematics Pueblo, CO 81001-4901

Applications are invited for several tenure-track assistant professor positions for Fall 1990. Doctorate in mathematics required. Evidence of commitment to teaching excellence necessary. Active research desirable. Send letter of application, resumé, graduate transcripts, and three letters of reference to Search and Screen Committee. Evaluation of applications will begin 7 February 1990 and continue until positions are filled. USC is an AA/EO employer.

MISSOURI WESTERN STATE COLLEGE

Computer Science, Mathematics, and Physics: Assistant Professor or Instructor. Two tenure-track positions to teach 24 load hours per academic year in one or more disciplines of computer science, computer information systems, mathematics, or physics. PhD preferred in computer science, computer information systems, mathematics, or physics. Candidates with Master's degree(s) are encouraged to apply. Preference will be given to candidates with credentials or experience in more than one of the disciplines to extent departmental needs are addressed. Salary dependent upon qualifications and experience. Submit letter of application, resumé, transcripts, and at least three letters of reference with addresses and telephone numbers to: Dr. Don Mahaffey, Missouri Western State College, 4525 Downs Drive, St. Joseph, MO 64507. Applications deadline February 19, 1990 or until position is filled. Position available August 13, 1990. An Equal Opportunity Employer.

CALIFORNIA STATE POLYTECHNIC UNIVERSITY POMONA

Two tenure-track teaching positions: one in mathematics education, salary dependent upon qualifications, doctorate in mathematics education or mathematics; one in applied mathematics at the assistant professor level, salary dependent upon qualifications, doctorate in applied mathematics or mathematics. Evidence of potential for excellent teaching and scholarly research required. Application, resumé, copy of transcripts, and three references to be postmarked by 2/16/90. For additional information or to apply, contact: Search Committee, Mathematics Department, California State Polytechnic University, 3801 W. Temple Ave., Pomona, CA 91768-4033; (714) 869-3467. EOE/AA.

WALSH COLLEGE

The Department of Mathematics and Computer Science at Walsh College has two tenure-track positions at instructor or assistant professor level, starting September 1990. Applicants must have at least master's degree in computer science or mathematics. Successful candidate is expected to teach some computer science and some mathematics courses. Deadline for applications: 15 February 1990. Send vita to: Dr. Laurence Bove, Academic Dean, Walsh College, North Canton, OH 44720. Affirmative Action/Equal Opportunity Employer.

DEPARTMENT OF MATHEMATICS University of Wisconsin-La Crosse

One or more tenure-track assistant/associate professor positions in undergraduate department. Responsibilities: teaching 12 hours per semester in wide range of mathematics courses, continuing scholarly activities, university and department service. Women, minorities encouraged to apply. Requires PhD in mathematics, statistics, or math education. Begin August 1990. Send application letter, resumé, and transcripts, three letters of reference, all postmarked by Feb. 15, to Dr. Jack Scheidt, Chair, Mathematics Department, University of Wisconsin-La Crosse, La Crosse, WI 54601. AA/EOE.

TRANSYLVANIA UNIVERSITY
Lexington, KY 40508

The Mathematics Program invites applications for a tenure-track position commencing in the fall of 1990. Transylvania University is a private, liberal arts college with a strong commitment to academic excellence. Applicants must have a PhD in mathematics and a commitment to undergraduate teaching. Salary and rank will depend on qualifications and experience. Exceptionally well qualified candidates may be considered for a Bingham Excellence in Teaching Award which supplements a faculty member's salary by up to 50%. Send letter of application, resumé, undergraduate and graduate transcripts, and three letters of reference to David L. Shannon, Mathematics Program Director, Transylvania University, Lexington, KY 40508. The search will remain open until the position is filled. Transylvania University is an Equal Opportunity Employer.

SWEET BRIAR COLLEGE

Applications are invited for one and possibly two temporary one year positions starting in Fall 1990 at the assistant professor or instructor level. A strong commitment to teaching undergraduate mathematics and/or computer science is required. PhD preferred. Three course load per semester. Review of applications will begin on March 20 and continue until the positions are filled. Send curriculum vita and three letters of recommendation to:

Dr. J. R. Kirkwood, Chairman
Department of Mathematical Science
Sweet Briar College
Sweet Briar, VA 24595

Equal Opportunity, Affirmative Action Employer.

**THE CLARE BOOTHE LUCE
FACULTY CHAIR
AT CREIGHTON UNIVERSITY**
in Mathematics/Computer Science

Creighton University invites applications from outstanding women candidates for appointment to the Clare Boothe Luce Faculty Chair in the Mathematics/Computer Science Department.

Candidates are expected to be excellent scholar / teachers who will serve as mentors and role models for undergraduate women interested in careers in scientific research. The Department will consider candidates in mathematics, statistics, or computer science. Candidates are expected to be interdisciplinary in approach and committed to a productive research program. The successful candidate will be expected to teach in the general mathematics/computer science/statistics program and in her area of specialization, and to develop an active research program involving undergraduate and graduate students. The initial appointment, at the Assistant Professor level, is renewable annually up to a total of five years. Salary is commensurate with the capabilities of an outstanding scholar/teacher.

Interested women should send a letter of intent, a *curriculum vitae*, official transcripts, three letters of reference, a statement of current research interests and achievements, and information on teaching experience and success. Materials should be mailed to meet a 15 February 1990 deadline. Please address applications and inquiries to: The Search Committee, Dean's Office, College of Arts and Sciences, Creighton University, California at 24th Street, Omaha, NE 68178.

Creighton University is an equal opportunity, affirmative action employer.

WILLIAMS COLLEGE
Department of Mathematics
Williamstown, Massachusetts 01267

Three anticipated positions, probably at the rank of assistant professor, for Fall 1990. Strong commitment to both teaching and scholarship is essential.

Please have a vita and three letters of recommendation on teaching and research sent to Frank Morgan, Chair. Evaluation of applications will continue until positions are filled.

**ILLINOIS MATHEMATICS
AND SCIENCE ACADEMY**

The Illinois Mathematics and Science Academy seeks applications for faculty and staff positions for the 1990–91 school year. Applicants must have a proven record of exemplary performance.

The Illinois Mathematics and Science Academy was created in 1986 as a three-year public, residential school for Illinois students gifted in mathematics and science. The 1990–91 student population will total nearly 600. First year students must have completed the equivalent of ninth grade and enter the Academy to engage in a comprehensive, integrative program that is unique, challenging, and rigorous.

The Academy provides an environment in which faculty, administrators, and staff are enabled to become academic entrepreneurs and students are nurtured and challenged as they fulfill roles as apprentice investigators. Teachers are expected to be exemplary in their discipline and teaching skills, committed to interdisciplinary approaches and innovative. A minimum of a **Master's Degree** is required for faculty and administration. Anticipated opening:

Mathematics

Precalculus sequences of courses drawn from algebra, trigonometry, college algebra, and analytic geometry, and calculus. Advanced courses in differential equations, discrete mathematics, data analysis, number theory, advanced geometry, and problem-solving.

Applications will be reviewed in the Spring with interviewing and hiring anticipated in June and July.

Applications available from:

Connie Jo Hatcher
Assistant to the Director
Illinois Mathematics and Science Academy
1500 West Sullivan Road
Aurora, Illinois 60506

An Equal Opportunity Employer

DEAN
School of Natural Science
and Mathematics
California State University–Fullerton

The University (CSUF) invites nominations and applications for Dean of the School of Natural Science and Mathematics. Comprised of the departments of Biology, Chemistry and Biochemistry, Geological Sciences, Mathematics, Physics, and the Science Education Program, the School has approximately 120 faculty and enrolls some 1,250 undergraduate and 150 master's level students. The current science facility will be expanded by a \$23 million addition. CSUF has 25,000 students and seven schools.

The Dean provides administrative and intellectual leadership, and represents the School, and interacts with the community. Qualifications include a PhD, academic credentials for appointments at the rank of full professor in one of the departments, five years of successful collegiate teaching, a record of scholarly/creative activity, and three or more years

of related professional administrative experience involving responsibility for a major organization. A proven record of success in securing private and governmental support is required. Strong interpersonal communicative skills are required. A demonstrated commitment to affirmative action is essential. The Dean is expected to promote excellence in teaching and research, and foster ongoing outreach programs in science and mathematics education and in-service training programs for K–12 science and mathematics teachers.

The effective date of appointment is preferably June 25, 1990, but not later than August 1, 1990. Excellent salary and benefits.

Deadline for applications and nominations is March 1, 1990, or until the position is filled. Letters of interest with statements of qualifications, resumé, and names/addresses/telephone numbers of five references should be sent to:

Dr. Maria C. Linder, Chair
Search Committee for Dean of the
School of Natural Science and Mathematics
Office of the Vice President
Academic Affairs MH-133
California State University, Fullerton
PO Box 34080
Fullerton, California 92634-9480

CSUF is an Affirmative Action/Equal Opportunity Title IX Employer.

FERRIS STATE UNIVERSITY
Teacher of Mathematics

The Department of Mathematics at Ferris State University has available one-year teaching positions, contingent on funding. Applicants should have a Master's degree in Mathematics or Mathematics Education with demonstrated excellence in college teaching. An Education Master's degree with emphasis in developmental mathematics is welcomed. Responsibilities include teaching in the area of the first two years of undergraduate mathematics. Send resumé, transcripts, and three letters of reference by February 15, 1990 to: Dr. Robert Kosanovich, Department of Mathematics, Ferris State University, Big Rapids, MI 49307.

AN EQUAL OPPORTUNITY/
AFFIRMATIVE ACTION EMPLOYER.

**OHIO
NORTHERN UNIVERSITY**
Mathematics and Computer Science

Faculty position beginning September, 1990. Rank and salary open. Candidates with a PhD in any area of the mathematical sciences will be considered, but preference may be given to candidates in statistics, analysis, CS, or applied mathematics. Evidence of excellence in teaching required.

ONU is a private University related to the United Methodist Church with Colleges of A&S, Business, Engineering, Pharmacy, and Law. The University has 2,600 students and is located in a rural area of NW Ohio.

A complete application consists of a letter of application, vita, transcripts, and three letters of recommendation. Consideration will begin in late winter, but the search will continue until the position is filled. Please have all materials sent to:

Robert A. Hovis, Chair
Mathematics and Computer Science
Ohio Northern University
Ada, Oh 45810

ONU is an Equal Opportunity/Affirmative Action Employer. Women, minorities, and handicapped persons are encouraged to apply.

DEPARTMENT HEAD

The University of Tennessee at Chattanooga invites applications for Head, Department of Mathematics. PhD in mathematical sciences with previous administrative experience desired. The Head should provide leadership in curriculum development and support for teaching and scholarship. The Department has 22 faculty members including a Chair of Excellence in applied mathematics. In this primarily undergraduate institution, the faculty is expected to exhibit excellence in teaching while maintaining a strong commitment to research and public service. UTC has 7,800 students in a very scenic metropolitan area of 400,000. Send applications with vita and 3 letters of reference to: Dr. Paul L. Gaston, Dean, College of Arts and Science, 119 Holt Hall, UTC, Chattanooga, TN 37403. Those received before March 1, 1990 will be given preference. Women and minorities are encouraged to apply. UTC is an Equal Opportunity Employment/Affirmative Action/Title IX/Section 504 Institution.

UNIVERSITY OF NORTH FLORIDA

Department of Mathematics and Statistics

Applications are invited for a possible visiting position for the academic year 1990-91. Candidates must have the PhD in mathematics or the MS in mathematics with strong coursework. All candidates must have an excellent teaching record; candidates with the PhD must have a record of continuing scholarly activity. Teaching duties will depend on the qualifications of the individual; the Department offers service, major, and graduate courses. The Department offers the BA and BS in mathematics and statistics and the MA with tracks in mathematics, statistics, and computing. The regular faculty of 14 members is active in a growing institution in the State University System of Florida; more than 7,500 students are currently enrolled. Send resumé, 3 letters of recommendation, and transcript by March 20, 1990, to Leonard J. Lipkin, Chairperson, Department of Mathematics and Statistics, University of North Florida, 4567 St. Johns Bluff Road South, Jacksonville, FL 32216. The University is an affirmative action/equal opportunity employer and encourages applications from women and minorities.

WESTMINSTER COLLEGE

Potential tenure-track position in Mathematics and Computer Science Department starting late August, 1990. Rank and salary based on qualifications. PhD in mathematics is required. Computer versatility desirable for combined department. Send letter of application, resumé, graduate transcript, and three letters of recommendation to: Dr. Warren D. Hickman, Chair, Department of Mathematics and Computer Science, Westminster College, New Wilmington, PA 16172. Telephone: (412) 946-7285. Applicant review will begin February 1, 1990 and will continue until the position is filled. Affirmative Action, Equal Opportunity Employer.

PACIFIC UNIVERSITY

Forest Grove, Oregon Mathematics Department

Pacific University is a selective, private liberal arts college with graduate programs in the health sciences. Pacific University is located in an appealing and varied geographic area—marine, alpine, and desert environments all within three hours' driving. The electronics industry is the predominant employer in the Portland metropolitan area—which city is just 25 miles away. Moderate climate and living costs.

Applications are invited for a tenure-track position at the Assistant or Associate Professor level, beginning in August 1990. Qualifications include a PhD in mathematics and a strong commitment to and demonstrated excellence in undergraduate teaching. In addition, the candidate will preferably have an interest in applied analysis. The successful candidate will be able to develop upper division courses consistent with his/her interests and be interested in all aspects of the undergraduate mathematics curriculum.

Please send a letter of application, a resumé, the names of three references, and unofficial transcripts to Dr. Mike Clock, Chair, Department of Mathematics, Pacific University, Forest Grove, OR 97116. Review of applications will begin February 15th and continue until the position is filled. Pacific University is an affirmative action/equal opportunity employer.

CLAYTON STATE COLLEGE

Instructor or Assistant Professor of mathematics for September, 1990, at developing senior college in metropolitan Atlanta. Duties include teaching 15 credit hours per quarter at the lower division level and working with other faculty in course development. Rank and salary depend on qualifications. Master's degree and teaching experience required. The ability and desire to teach introductory computer science courses will strengthen the application. Apply to Catherine Aust, Mathematics Coordinator, School of Arts and Sciences, PO Box 285, Morrow, GA 30206. Screening begins Mar. 5, 1990, and will continue until the position is filled. AA/EEOI.

CLINCH VALLEY COLLEGE OF THE UNIVERSITY OF VIRGINIA

Applications are invited for a tenure-track position in mathematics to begin Fall 1990. A PhD in mathematics or statistics required. Graduate work in computer science preferred. Candidates who expect to complete degree requirements by January 1991 will be considered. The normal teaching load is 12 semester hours per semester and faculty are expected to advise students and serve on committees. Salary and rank commensurate with experience and qualifications. Founded in 1954, Clinch Valley College is an undergraduate branch of the University of Virginia located in the highlands of rural Southwest Virginia. The college enrolls 1,200 students on-campus and 400 off-campus. Send resumé, official transcripts, and three letters of recommendation to Dr. G. E. Culbertson, Office of the Vice Chancellor, Clinch Valley College, Wise, VA 24293. The review process will begin February, 1990 and applications will be accepted until the position is filled. Clinch Valley College is an AA/EEO employer.

RHODE ISLAND COLLEGE

Providence, RI Math-Education Faculty Position

Tenure-line position beginning Fall 1990. To teach mathematics, and mathematics or computer science education, engage in scholarly work, participate in the math-education responsibilities of the department, curriculum development, student advisement, and other departmental and college committee work. Requires doctorate in mathematics education with at least a master's level background in mathematics, and the ability to teach a variety of mathematics and math education courses. College teaching experience and demonstrated interest

in computers or computer science education preferred. Rank: Assistant Professor. Salary competitive. Attractive fringe benefits. Summer employment available. Rhode Island College is an institutional member of the MAA, ACM, AWM, and is committed to high quality teaching, research, and program development. APPLICATIONS MUST BE RECEIVED BY Monday, March 12, 1990. SEND RESUMÉ, TRANSCRIPT, AND THREE LETTERS OF REFERENCE TO: PERSONNEL OFFICE, RHODE ISLAND COLLEGE, PROVIDENCE, RI 02908. ATTN: CHAIR, MATH/CS DEPT. AN AFFIRMATIVE ACTION/EQUAL OPPORTUNITY EMPLOYER.

RHODE ISLAND COLLEGE

Providence, RI Math-CS Faculty Position

Three year term position beginning Fall 1990. To teach appropriate mathematics and computer science undergraduate courses that serve majors or nonmajors, participate in departmental and college committee work, curriculum development, and student advisement; engage in scholarly work. Requires PhD in Mathematics or Master's in Computer Science, with ability to teach upper division courses in the area of the degree and lower division courses in the other. College teaching experience preferred. Doctorate required for rank of Assistant Professor, otherwise rank of Instructor. Salary competitive. Attractive fringe benefits. Summer employment available. Rhode Island College is an institutional member of the MAA, ACM, AWM, and is committed to high quality teaching, research, and program development. APPLICATIONS MUST BE RECEIVED BY Monday, March 12, 1990. SEND RESUMÉ, TRANSCRIPT, AND THREE LETTERS OF REFERENCE TO: PERSONNEL OFFICE, RHODE ISLAND COLLEGE, PROVIDENCE, RI 02908. ATTN: CHAIR, MATH/CS DEPT. AN AFFIRMATIVE ACTION/EQUAL OPPORTUNITY EMPLOYER.

WINONA STATE UNIVERSITY

Applications are invited for three probable tenure-track (rank and salary dependent on qualifications) positions—one each in statistics, mathematics, and mathematics education to begin September, 1990. Minimum requirement is ABD (PhD must be completed by 1993). We also anticipate three temporary one-year positions because of sabbaticals and a leave. Minimum requirement is a master's degree. All positions (both tenure-track and temporary) require an average teaching load of 3 courses (12 credits) per quarter and may include off-campus teaching assignments. Send cover letter (indicate which position applying for), resumé, transcripts, and three letters of reference to: Department of Mathematics and Statistics Searches, c/o Office of Human Resources, Winona State University, Winona, MN 55987. All positions are open until filled. Winona State is an Affirmative Action/Title IX/Equal Opportunity University. Women, minorities, and disabled individuals are encouraged to apply.

POSITION ANNOUNCEMENT

Qualified persons are invited to apply for a tenure-track position at the Assistant/Associate Professor level in a PhD granting department of mathematics. A PhD in mathematics and previous publication record are required. Applicant must be able to join a team conducting research in mathematical analysis, graph theory, and combinatorics. Salary is \$30,963 per nine months. Applicants should submit resumé, graduate transcript, reprints, dissertation abstract, and at least three letters of recommendation to:

Mississippi Employment Service/EEO
PO Box 469
Oxford, Mississippi 38655

Deadline for applications: February 5, 1990.
Job Service Office Identification Number:
MS 2350984

SOUTHERN CONNECTICUT STATE UNIVERSITY

Mathematics Department
501 Crescent Street, New Haven, CT 06515

Tenure-track position at asst/assoc rank beginning 8/27/90 to teach ungrad/grad math, including stat. and appl. math. (12 hrs). Qualifications: doctorate in math, evidence of quality teaching, expertise in stat. or appl. math, potential for scholarly growth. Send application, vita, transcripts, references to Dr. Helen Bass, Chair. Full consideration given to applications received by 1/31/90. (AA/EOE)

SOUTHERN CONNECTICUT STATE UNIVERSITY

Mathematics Department
501 Crescent Street, New Haven, CT 06515

Tenure-track position at asst/assoc rank beginning 8/27/90 to teach ungrad/grad math, and math ed., supervise secondary student teachers (12 hrs). Qualifications: doctorate in math, or math ed, evidence of quality teaching, experience in teacher ed. programs, potential for scholarly growth. Send application, vita, transcripts, references to Dr. Helen Bass, Chair. Full consideration given to applications received by 1/31/90. (AA/EOE)

UNIVERSITY OF GUAM

The University of Guam invites applications for three (3) nontenure- and tenure-track positions in mathematics. The appointments will be made at the ranks of instructor (nontenure-track), assistant and associate professor (tenure-track). A master's degree in one of the mathematical sciences and an ability to teach a variety of undergraduate courses is required for instructor level. A doctorate in one of the mathematical sciences and/or a background in computer science is required for assistant and associate professor levels. Closing date is February 1, 1990, but applications will be accepted until all positions are filled. Send letters of inquiry to Chairperson, Math Search Committee, c/o University Personnel Office, UOG Station, Mangilao, Guam 96923.

FACULTY VACANCIES IN MATHEMATICS AND STATISTICS

Two anticipated Assistant Professor positions available for 1990–1991.

One tenure-track position in mathematics. PhD in mathematics and evidence of strong scholarship required.

Tenure-track position in statistics with preferred areas being experimental design or statistical computing. PhD in statistics with evidence of strong scholarship and an interest in applied statistics required.

Responsibilities include undergraduate and graduate teaching, advising, scholarship, and University service.

Competitive salary, commensurate with qualifications and experience. Positions subject to final budgetary approval. Send c.v. and names of three references. Preference given to applications received by March 1, 1990.

Professor Basil P. Korin
Department of Mathematics and Statistics
The American University
4400 Massachusetts Avenue, NW
Washington, DC 20016

An EOE/AA University; minorities and women candidates are encouraged to apply.

DEPARTMENT OF MATHEMATICS AND STATISTICS

Applications are invited for a tenure-track Assistant Professor position starting Fall 1990. PhD in mathematics is required with interest in applied mathematics, operations research, or optimization preferred, but other areas will be considered. Primary duties are undergraduate and graduate teaching. Some research and curriculum development are expected. Salary commensurate with qualifications. Send resumé, transcripts, and three letters of reference to: Dr. Daniel B. McCallum, Department of Mathematics and Statistics, University of Arkansas at Little Rock, 2801 S. University Avenue, Little Rock, AR 72204. Applications received before March 1, 1990 will receive full consideration.

Applications will be subject to inspection under the Arkansas Freedom of Information Act.

The University of Arkansas at Little Rock is an affirmative action, equal opportunity employer and actively seeks the candidacy of minorities and women.

CARTHAGE COLLEGE

Carthage will make a tenure-track appointment to a generalist in mathematics who has an emphasis in statistics or analysis, and whose primary commitment is undergraduate teaching. The College also encourages, and will support, research and active engagement in professional activities.

Carthage is experiencing growing enrollments and rising test scores in the entering classes. The College will need to make a number of new faculty appointments in the near future. Carthage seeks someone willing to participate imaginatively in developing the curriculum and in shaping the future of mathematics and the natural sciences at the College.

Located on the shores of Lake Michigan between Chicago and Milwaukee, Carthage offers easy access to major urban areas. Totalling almost 2,000 full and part-time students, the student body is drawn primarily from the Midwest but includes students from more than twenty states and a variety of foreign countries.

Salary and benefits are competitive, based on academic credentials and experience; we will be interviewing at the Louisville meetings. Please send nominations and applications, with current curriculum vitae, to Charlotte J. Chell, Chair, Department of Mathematics, Carthage College, Kenosha, WI 53140-1994.

THE UNIVERSITY OF WEST FLORIDA

Applications are invited for three tenure-track positions beginning Fall 1990. Two positions are at the assistant professor rank, one will be at the associate or assistant professor rank. The PhD is required for all positions. Areas of specialization needed are applied mathematics (computations mathematics and applications and/or operations research) and statistics (applied statistics, statistical quality control and/or operations research). One position is reserved for a candidate with expertise in operations research. A record of excellent teaching and research is required for the associate professor rank. Applications from minorities and women are especially encouraged. Duties normally consist of teaching three courses per semester (9–10 hours), advising, research, and service. Persons interested in applying for one of these positions should send a vita and arrange for three letters of reference to be sent to: Dr. Shawky E. Shamma, Chairman, Search Committee, Department of Mathematics and Statistics, The University of West Florida, Pensacola, FL 32514. Screening begins February 1, 1990.

An affirmative action/equal opportunity employer.

UNIVERSITY OF NORTHERN COLORADO

Senior Position

The Department of Mathematics and Applied Statistics is making mathematics education reform a major emphasis. In this direction we have recently received approval for a PhD degree in educational mathematics. This program assumes that mathematical content is the pre-eminent concern in developing education strategies necessary for the improvement of mathematics education.

The University is seeking an individual at the Associate/Full Professor level to help provide leadership in obtaining grants for the reform of teaching of mathematics. This individual would be expected to participate in the continuing development of the new PhD in educational mathematics and to carry on an active scholarly program. Teaching assignment is negotiable.

Applicants should possess a PhD in mathematics or a closely related field, a history of funded grants especially for research in the teaching of mathematics, and a solid record of publications. Send a letter of application, a candidate statement of US citizenship or eligibility for US employment, curriculum vitae, and three letters of recommendation to: Dr. Don Elliott, Search Committee Chair, Department of Mathematics and Applied Statistics, University of Northern Colorado, Greeley, CO 80639.

Initial screening will begin February 15, 1990. Applications will be considered until the position is filled. UNC is an AA/EO Employer. This tenured/tenure-track position is contingent upon State funding.

COMMUNITY COLLEGE OF PHILADELPHIA

MATHEMATICS—The Mathematics Dept. invites applications for a possible 1990 tenure-track position. Candidates must have at least a master's degree in mathematics, a commitment to quality teaching, both remedial and college level students and a serious interest in curriculum development. The department is actively engaged in developing new mathematics courses. It has recently received grants from NSF and CASSET. Outstanding benefits. Send curriculum vitae and 3 letters of recommendation to: Dept. of Mathematics Chair, COMMUNITY COLLEGE OF PHILADELPHIA, 1700 Spring Garden St., Phila., PA 19130. Women and minorities are encouraged to apply. AA/EOE.

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

Two tenure-track positions at the rank of Assistant Professor, commencing fall semester, 1990. Duties of one position include teaching undergraduate courses in mathematics, especially probability and statistics, and introductory computer science. Duties of the other position include teaching a combination of upper and lower level undergraduate courses in mathematics and computer science. Candidates should possess a doctorate and strong research ability with a firm commitment to teaching.

Send resumé by February 1, 1990, to Prof. Francis B. Taylor, Chairman of the Search Committee, Department of Mathematics and Computer Science.

MANHATTAN COLLEGE
Riverdale, NY 10471
AA/EO Employer M/F
Women and Minorities are encouraged to apply.

CLARION UNIVERSITY

Clarion, Pennsylvania

Applications are invited for a tenure-track position in mathematics at the Assistant/Associate Professor level, beginning Fall 1990. PhD in the mathematical sciences and evidence of successful mathematics teaching are required. While all candidates are encouraged to apply, additional background in statistics or computer science will receive preference. Faculty load is 12 hours per semester. Salary and benefits are highly competitive. Located in northwestern Pennsylvania and adjacent to Interstate 80, Clarion University is one of fourteen institutions in the State System of Higher Education. With 6,000 students, it offers the bachelor's degree in mathematics, with options in applied mathematics, actuarial science, and computer science, and in mathematics education. Send letter of application, personal vita, transcripts, and three current letters of reference to: Main Campus Search Committee, Department of Mathematics, Clarion University, Clarion, PA 16214. Deadline is February 15, 1990. Clarion University actively seeks minorities and women applicants and is an affirmative action/equal opportunity employer.

SIMPSON COLLEGE

Applications are invited for a full-time tenure-track position at the Assistant Professor/Instructor level beginning in late August 1990. The Master's degree is a minimum requirement; preference will be given to candidates who have a PhD or ABD in mathematics or statistics and successful teaching experience. A strong commitment to quality undergraduate education in a liberal arts environment is essential. Send letter of application, vita, and three letters of recommendation to: Dr. William C. Dunning, Chair, Mathematics Department, Simpson College, 701 North C. Street, Indianola, Iowa 50125. Applications will be accepted until the position is filled, but the review process will begin February 12. Simpson is an Equal Opportunity/Affirmative Action Employer. Women and minorities are particularly encouraged to apply.

**ANNOUNCEMENT OF POSITIONS
IN COMPUTER SCIENCE**DePaul University
Chicago, Illinois

DePaul University invites applications for a tenure-track position in Computer Science at any level. The starting date is September, 1990. Any area of specialization will be considered. Any applicant should hold a PhD in Computer Science or be a candidate for such a degree. Consideration will also be given to holders of PhD degrees in mathematics or related fields who have an interest in changing fields to Computer Science. Duties include a six-hour teaching load and research. Tenure details and salary are negotiable. Benefits include TIAA and standard health insurance. US citizenship is not required.

The Department of Computer Science and Information Systems has 500 undergraduate majors and over 800 graduate students. Facilities include two VAX 11/780s, a VAX 11/750, an IBM 4341, and an IBM 4381, a Harris HCX9, and AT&T 3B15, and a Harris 800. Each faculty office is provided with a high performance workstation connected to the Department's Ethernet. In addition the Department has an Artificial Intelligence Laboratory equipped with four Hewlett-Packard AI workstations—two 350s, two 370s, two Symbolics 3600s and 5 PERQs; and a Computer Vision Laboratory equipped with an AT&T 3B2-1000, 8 AT&T 6386 WGS Model E workstations, 15 AT&T 630 multi-tasking graphics terminals, two frame grabbers, and dedicated vision processor. There are also numerous PC Laboratories.

Faculty interests include artificial intelligence, computer vision, natural languages, applied statistics, applied graph theory, computer graphics, computer security, information systems, compiler design, semantics of programming languages, and computer architecture.

Applications will be received until positions are filled. To apply, send a resumé and at least three letters of reference to: Helmut Epp, Chairman, Department of Computer Science and Information Systems, DePaul University, 243 S. Wabash, Chicago, IL 60604.

DePaul University is an equal opportunity employer.

TRENTON STATE COLLEGE**Department of Mathematics and Statistics
Anticipated Faculty Vacancies
for Fall 1990**

Assistant Professor of Mathematics. Tenure-track position. Req'd: PhD (or within one year of completion); demonstrated commitment to quality teaching and strong research potential. Both pure and applied mathematics will be considered.

Assistant Professor of Statistics. Tenure-track position. Req'd: PhD in Statistics (or within one year of completion); demonstrated commitment to quality teaching and strong research potential. Both theoretical and applied statisticians will be considered.

Assistant Professor of Mathematics Education. Tenure-track position. Req'd: PhD or EdD in Mathematics Education (or within one year of completion); demonstrated commitment to quality teaching, and ability to teach both undergraduate and graduate mathematics courses, as well as supervise field experience; strong research potential.

Send vita and three letters of recommendation to: Dr. Aigli Papantonopoulou, Chair, Search Committee, Department of Mathematics and Statistics, Trenton State College, Hillwood Lakes CN4700, Trenton, NJ 08650-4700.

Application deadline is March 1, 1990, or until positions are filled. Non US citizens must include statement of current visa status.

The department enrolls every year an average of forty liberal arts majors in mathematics who have the option to concentrate in statistics or in mathematics education. A graduate program offers a Master's degree in mathematics.

Trenton State College has earned national recognition as a highly competitive undergraduate institution. TSC is located on 224 acres in Ewing Township, within seven miles of Central New Jersey's research corridor.

To enrich education through diversity, TSC is an AA/EEO.

CHAIR**Department of Mathematics
and Computer Science
Augusta College**

Augusta College is a senior unit of the University System of Georgia with more than 5,000 students. The Department has fifteen active members, offers baccalaureate degrees in both mathematics and computer science as well as a master's degree in mathematics education, and produces about 40 graduates per year.

A doctorate is required with a PhD in mathematics preferred. The ability to teach in both fields is desirable and previous administrative experience will enhance the application. Salary will depend on qualifications and rank and will be competitive.

Formal screening of candidates will begin in mid-January and will continue until the position is filled.

Applicants should send letter of application, three letters of recommendation and two additional names of reference to: Dr. Gerald Thompson, Department of Mathematics and Computer Science, Augusta College, Augusta, GA 30910.

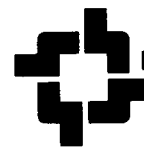
Augusta College is an Affirmative Action/Equal Opportunity Institution.

EMPORIA STATE UNIVERSITY

The Division of Mathematics and Computer Science at **Emporia State University** seeks a maximum of three candidates for positions at the instructor/assistant professor rank beginning in the Fall 1990. Successful candidates must have a commitment to quality teaching and an interest in research. A doctoral degree in Mathematics, Computer Science, Statistics, or Education/Mathematics is required for tenure. Salary is commensurate with qualifications. Screening will begin January 15 and will continue until all positions are filled. Send resumé, transcripts, and three letters of recommendation to: William F. Simpson, Chair, Search Committee, Division of Mathematics and Computer Science, Emporia State University, Emporia, KS 66801. **ESU is an affirmative action/equal opportunity employer. We encourage applications from members of protected classes.**

UNIVERSITY OF RIO GRANDE

Rio Grande University is expanding its math department by adding three new full-time tenure-track positions beginning 8/90 at the assistant/associate professor level in the College of Math and Science. Doctorate required. Preference will be given to individuals with experience and background in teaching a wide range of mathematics courses at the undergraduate level. The review process will begin January 22, 1990 and continue until the positions are filled. Rio Grande University combines a private four year University with a state-supported community college in a single institution serving rural southeastern Ohio. Send letter, resumé, the names, addresses and telephone numbers of three references, and a copy of most recent transcripts to: Phyllis Mason, Personnel Officer, Rio Grande University, PO Box 969, Rio Grande, OH 45674. AA/EEO employer.



**harrisburg area
community college**
3300 CAMERON STREET ROAD
HARRISBURG, PENNSYLVANIA 17110-2999
TELEPHONE (717) 780-2300

MATHEMATICS INSTRUCTORS

Performs classroom instruction and participates in student recruitment, program advising, and departmental/division activities. Master's degree in mathematics required (or near completion); teaching experience highly desirable. Three tenure-track openings will be available in mid-August, 1990. Salary for these 9-1/2 month positions based upon education and experience. Candidates will be contacted for interview in February, but applications will be accepted until the positions are filled. Submit resumé and unofficial transcripts to the Personnel Office, Harrisburg Area Community College, 3300 Cameron Street Road, Harrisburg, PA 17110.

**AFFIRMATIVE ACTION/
EQUAL OPPORTUNITY EMPLOYER**

Calendar

National MAA Meetings

August 8–11, 1990 66th Summer Meeting, Columbus, OH (Board of Governors, August 7, 1990)

January 16–19, 1991 74th Annual Meeting, San Francisco, CA (Board of Governors, January 15, 1991)

Sectional MAA Meetings

Allegheny Mountain Pennsylvania State University at Dubois, April 6–8, 1990

Eastern Pennsylvania-Delaware Swarthmore College, Swarthmore, PA, April 7, 1990

Florida Valencia Community College (West Campus), Orlando, March 2–3, 1990

Illinois Millikin University, Decatur, April 27–28, 1990

Intermountain Southern Utah State College, Cedar City, April 6–7, 1990

Iowa Iowa State University, Ames, April 6–7, 1990

Kansas Kansas State University, Manhattan, March 30–31, 1990

Kentucky Berea College, Berea, April 6–7, 1990

Louisiana-Mississippi McNeese State University, Lake Charles, LA, February 23–24, 1990

Maryland-District of Columbia-Virginia Frostburg State University, Frostburg, MD, April 28, 1990

Metropolitan New York New York City Technical College–CUNY, Brooklyn, May 6, 1990

Michigan University of Michigan, Flint, May 11–12, 1990

Missouri School of the Ozarks, Point Lookout, April 6–7, 1990

Nebraska University of Nebraska–Omaha, April 6–7, 1990

New Jersey Princeton University, Princeton, April 28, 1990

North Central St. Cloud State University, St. Cloud, MN, April 20–21, 1990

Northeastern Roger Williams College, Bristol, RI, June 8–9, 1990; Framingham State College, Framingham, MA, November 16–17, 1990

Northern California The Naval Postgraduate School, Monterey, February 24, 1990

Ohio University of Cincinnati, April 27–28, 1990; Marietta College, Marietta, October 19–20, 1990

Oklahoma-Arkansas John Brown University, Siloam Springs, AR, March 30–31, 1990

Pacific Northwest Portland State University, Portland, OR, June 14–16, 1990

Rocky Mountain University of Wyoming, Laramie, April 6–7, 1990

Seaway Colgate University, Hamilton, NY, April 6–7, 1990

Southeastern Davidson College, Davidson, NC, April 6–7, 1990

Southern California Whittier College, Whittier

Southwestern Arizona State University, Tempe, Spring 1990

Texas North Texas State University, Denton, April 5–7, 1990

Wisconsin University of Wisconsin–Richland, April 20–21, 1990

Other Meetings

January 22–24 ACM/SIAM Symposium on Discrete Algorithms, Cathedral Hill Hotel, San Francisco, CA. Organizers: Fan R. K. Chung, Bell Communications Research, Inc., and David Johnson, AT&T Bell Laboratories. For information, contact: SIAM Conference Coordinator, 3600 University City Science Center, Philadelphia, PA 19104-2688; (215) 382-9800. FAX: 1-215-386-7999.

January 25–26 The Bard Center's Annual Conference for High School and College Educators: "Solve for X: Practical Solutions to Teaching Math and Science in American Schools and Colleges." For information, contact: Amie McEvoy, Bard College, Annandale-on-Hudson, New York 12504; (914) 758-6822.

March 1–4 Mathematics and Education Reform (MER) Network Workshop, Ohio State University, Columbus. Presentations by mathematicians who have developed "exemplary projects," especially at the elementary and high school level. Participation limited to 40 people. Grant funds will cover accommodations, meals, and materials for 30 participants. Limited travel grants also available. For information, contact: Naomi Fisher, Associate Director, MER Network, University of Illinois at Chicago, Office of Mathematics and Computer Education (M/C 249), Box 4348, Chicago, IL 60680; (312) 996-2439; bitnet U37158@UICVM.

March 5–7 SIAM Conference on Applied Probability in Science and Engineering, Clarion Hotel, New Orleans, LA. Organizers: Bernard Matkowsky, Northwestern University, and James McKenna, AT&T Bell Laboratories. For information, contact SIAM at address above (January 22–24).

March 29–31 The Mathematical Sciences Institute (MSI) Conference on "Modern Perspectives of Mathematics: Mathematics as a Consumer Good, Mathematics in Academia," Statler Hotel, Cornell University. The conference will address how to develop mathematics education and research to encourage the interplay of mathematics and its applications in business, industry, and government. For information, contact: Diana Drake, MSI, Cornell University, 201 Caldwell Hall, Ithaca, NY 14853-2602; (607) 255-7740.

March 30–31 Pi Mu Epsilon Student Conference, St. John's University, Collegeville, MN 56321. Open to all mathematicians and mathematics students, as well as Pi Mu Epsilon members. Area colleges are invited to send at least one student to conference, which will provide a forum for independent study or research projects. For information, contact: Philip Byrne at (612) 363-5293; Shoba Gulati at (612) 363-3087; or Mike Zielinski at (612) 363-3094.

April 20–21 Sixth Annual Conference on Applied Mathematics, Central State University (CSU), Edmond, OK 73034. For information, contact: G. Kay Owens at CSU; (405) 341-2980.

April 20–22 New York State Mathematics Association of Two-Year Colleges (NYSMATYC) 1990 Annual Meeting, Holiday Inn Arena, Binghamton. For information, contact: Sadie Bragg, Department of Mathematics, Borough of Manhattan Community College, 199 Chambers Street, New York, NY 10007.

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