

Association for Women in Mathematics

Volume 10, Number 1

NEWSLETTER

Jan.-Feb. 1980

AWM ELECTION RESULTS

President-elect: Bhamu Srinivasan

Members-at-large: Louise Hay, Rhonda Hughes, Joan Hutchinson
(A very close election!)

By-laws: Approved

PRESIDENT'S REPORT

San Antonio. Our annual meeting for 1980 is at the Joint Mathematics Meetings in San Antonio. AWM events include:

The Emmy Noether Lecture. Speaker: Jessie MacWilliams
2 p.m., Friday, January 4.

Executive Committee Meeting. 3 p.m., Friday, January 4.

Invited Lecture. "Ada, Lady Lovelace." Speaker: Dana Angluin.
11 a.m., Saturday, January 5.

Business Meeting. 5 p.m., January 5.

Party. 8 p.m., January 5. See AWM table for location.

New officers will be introduced at the business meeting. There will be an AWM table throughout the meetings which needs volunteers to staff it. Come on by and say hello.

ICME. Yes, Virginia, there will be people talking about teaching math to girls and women at the International Congress on Mathematical Education, held in Berkeley, August 10 to 16 1980. The official organizing committee had arranged a panel and one of the panel members, Dora Skypek of Emory University in Atlanta, realized that one panel was not enough. So she has mobilized women's organizations to help her get together a more

inclusive program which would hopefully lead to an international network. We are cosponsoring this program. Events and times will be announced in future newsletters.

Editorial. The by-laws are rewritten, committee work goes forward, there are few announcements, and there is time to take stock of what we're doing. A lot is being done in math education. The math community has generally been opened up - just look at the current officers of the AMS, MAA, SIAM, and NCTM, or see who's been invited to speak in the past couple of years at their meetings. AWM works behind the scenes on such issues as increasing the number of women who are journal editors. We speak out publicly on ERA and blind refereeing.

But a recent spate of letters in response to the executive committee's endorsements of AMS candidates shows that there is some feeling that, as one writer put it, "the AWM does not speak often enough to or for the women mathematicians who believe that doing mathematics is the primary way to increase the role of women in mathematics."

There are two levels here. On the surface is the question of AWM endorsements. While I too was disturbed by the majority vote of the executive committee, I think that there is no longer any need to support a woman for office simply because she is a woman, and we can expect disagreement and dissent of the support of almost any particular woman. That is a sign of our strength.

More important is the question: are we doing anything for women researchers? Taken literally, of course we are. But we are not doing nearly enough. The problems are broad and subtle. We have tended to work on small pieces that we can solve.

The big issues are seldom talked about. Many of our members might even deny that they exist. It was heartening to see how many of these issues were mentioned in the statements of candidates for AWM office. How does professional isolation affect our self-esteem and hence our work? How do we strengthen each other to survive the many small ways in which even the best of us are belittled by our colleagues? How do we recognize a detrimental environment and deal with it? How do we keep our perspective? How do we work with people who, because of our sex, may be uncomfortable working with us?

Those of us who do research live in a predominantly male environment. It is our environment as well, and it is difficult to acknowledge its problems without seeming to betray our colleagues. Even when we see something wrong, there is often no one who will listen to us - our opinion makes us out of step. When we become successful, it is easy to feel that our success makes us immune. But no one is immune: there was the eminent woman who asked a journal editor in her field why there were no women editors on the journal, only to be told that no woman was good enough. There was the discussion group at a AAAS/NSF conference on women in scientific research in which sexual harrasment was discussed and it turned out that not only had nearly every woman present experienced it, but several well-established women were facing it right then.

It is easier to talk about how young women are discouraged in high school than to look around us and see how we are being discouraged right now.

At this stage of our mutual liberation we have gotten past the questions of how to organize the housework so we have time to work. We have made women visible in the mathematical community. But we still don't know how to help good women who are denied tenure or a raise, and we have not even begun to figure out how to improve the atmosphere so that those of us who do research mathematics no longer waste our energies on psychological battles we are often scarcely aware we are fighting.

That's the next step.

Judy Roitman
Math Department
University of Kansas
Lawrence, KS 66045

LETTER TO THE EDITOR

In the Sept.-Oct. 1979 edition of the AWM Newsletter there appears an endorsement for some candidates for AMS offices. While there is a remark at the bottom saying that these candidates have been endorsed by half of the AWM Executive Committee, because of the positioning and prominence of the endorsement it could very well seem to be the endorsement by the AWM of these candidates.

At the bottom of page 2 of this same Newsletter there is an endorsement by a few people of the candidacy of Lee Lorch. By its nature, and by the lack of a statement to the contrary, I can assume that this endorsement is not a paid ad.

I protest the printing of these items in our newsletter. I do not believe this publication of ours should be the vehicle for a tiny, albeit vociferous, minority of our membership for an expression of their, and theirs alone, view on these matters. If they want to plug for some candidates let them take out paid ads in our newsletter, and let these ads indicate that they are paid ads. I don't want a minuscule percentage of the members to be given this opportunity to seem to speak for all of us.

Sincerely, I. N. Herstein, University of Chicago

Ed. reply: All endorsements make it quite clear who is doing the endorsing. Similar endorsements have been made in the Newsletter for years. I suspect you do not agree with all of this year's; neither do I. But I feel that making such endorsements is neither inappropriate nor misleading.

TEACHING AND LEARNING RESEARCH GRANTS

The National Institute of Education announces a competition for grants to support research on teaching and learning, to be administered by the NIE program on Teaching and Learning. One of the five selected areas is Mathematics Learning. Priority will be given to the topics 1) development of mathematical concepts in children and adults, 2) analyses of mathematical tasks, and 3) the nature of and development of mathematical problem-solving and reasoning abilities. (Program officer contact: Edward Esty, 202/254-6572 .) It is estimated that with the funds available, 60 to 70 grants can be awarded ranging in size from small grants of \$15,000 or less to larger grants with budgets averaging about \$50,000 annually. Deadline date for receipt of proposals by NIE is 4:30 p.m., January 21, 1980.

WOMEN IN ENGINEERING INFORMATION & EDUCATION PROJECT

communiqué from group of this name, New York, New York

The engineering profession remains nearly an all-male occupation today. Women have been excluded from engineering by arbitrary and obsolete qualification requirements, lack of role models and encouragement, and outright discrimination. For a number of reasons, women did not enroll in engineering, and today a shortage of engineers exists. At the same time, there exists a surplus of women chemists, biologists, mathematicians, and technologists. [Ed. note: surplus? Some of us are unemployed, anyway.]

For the most part, these women are not allowed to enter engineering training programs in industry and government, when they could successfully be trained as engineers.

State registration boards rely on unfair written tests, which are not job-related, to give certification as an engineer-in-training in lieu of an engineering degree. Registration boards also rely on age and length of experience, rather than quality and potential, when determining whom to register. Some even require a person to be age 50.

It is no wonder there are no female "Registered Professional Engineers". Please write to the State Board of Registration of Professional Engineers at the State House in your state, and ask that archaic requirements (unfair tests, age and longevity) be dropped so that women scientists and mathematicians may be allowed to become engineers-in-training.

Federal Civil Service qualifications also exclude women scientists, mathematicians, and technologists from being hired by Federal agencies in civil service engineer training programs. Please write also to Alan K. Campbell, Director, U.S. Office of Personnel Management, 1900 E St., N.W., Wash., D.C. 20415, and ask that engineer qualification standards be changed to allow women scientists, mathematicians and technologists to be hired as engineer trainees.

If you help, results can be obtained this year, while there is a shortage of engineers. Encourage others to write to Federal and state officials. Start a political action group. Opportunities for women in the all-male engineering world can be a reality.

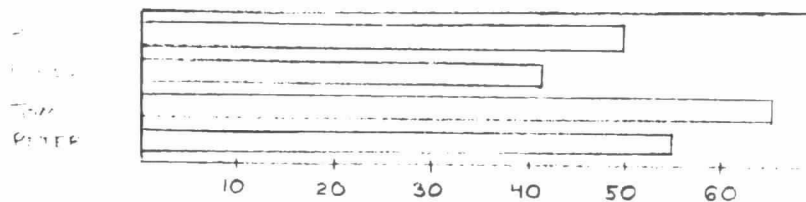
MATH EDUCATION: A FEMINIST PERSPECTIVE

presentation by Prof. Diane Resek, Dept. of Math., San Francisco State Univ.
panel at joint summer meeting, Duluth, Minn., August 23, 1979

There are a number of problems related to women and mathematics, but the one I am concerned with is that many women avoid math-related careers and thus end up in low-paying unsatisfying jobs. Although sex-difference studies often contradict each other, a number of studies have shown that already in some junior high schools there are important differences which might explain this later avoidance. First, on attitude surveys girls are less likely than boys to see the relevance of math to their future. Secondly, girls do not see themselves as having careers (although most women work in our society), and those who do imagine themselves in low-paying, traditionally feminine careers. Lastly, girls perform differently than boys on math achievement tests.

I would like to expand on the third point. The recent California State Assessment looked at sex differences for the first time. The State surveyed by a sample all California 6th and 12th graders in math skills in 1977 and 1978. In each year and in each grade they found the same pattern: on every computation or routine one-step word problem the average scores for girls was a tiny bit higher than the boy's average. On every problem that was slightly novel or that was a two-step word problem, the boy's average was decidedly higher than the girls.

Let me give an example which shows how requiring a small bit of thought can make a big difference. The students were shown the following graph and asked "Who weighs the most?" 97.5% of the girls and 96.7% of the boys answered correctly. Then they were asked "Who weighs closest to 50 pounds?" 79.9% of the boys got it correct and 72.6% of the girls.



The cause of this pattern of difference on every problem in every grade in both years is open to interpretation. My feeling is that girls are just not thinking. They tend to perform well on questions they've been programmed to answer. However, on even slightly non-routine problems they tend not to have the confidence (i.e., "we didn't learn about this type of problem, so I can't do it"), the interest, or the tenacity to try to get an answer.

There are a number of programs in the San Francisco Bay Area and elsewhere which are aimed at giving elementary school girls a new attitude toward problem-solving:

- a. you can do it;
- b. many adult women do it and enjoy doing it; and
- c. you don't have to rely on memory to solve problems, just hang in there and try.

I want to describe and give references for some programs for elementary school girls in the Bay Area which try to show them the relevance of math to their future lives, try to expand their career considerations, and try to change their attitude toward problem-solving.

The first program is the Equals Program of the Lawrence Hall of Science. This program works with teachers (4th grade through 12th grade) and counselors. Each participant does a research project to assess whether sex-differences exist in math in their school district. They are provided with other research data and activities to promote awareness among students of these differences. They share awareness activities they've used in the classroom with each other. Secondly, they are given and they give each other activities to show the usefulness of math in careers, and the wide range of careers open to women. In this area they meet women role models from traditionally non-feminine careers and compile a list of role models to invite to their class. Lastly, time is spent on math activities which stress problem-solving and methods are discussed for helping all students to improve their problem-solving skills. A handbook on the Equals Program (cost is \$5) is available from Nancy Kreinberg, Director, Equals, Lawrence Hall of Science, University of California, Berkeley, CA 94720.

Another Lawrence Hall of Science program is "Math for Girls". This program stresses that math is fun. It tries to develop confidence and competence at solving non-routine problems, and it relates problem-solving skills to school work. For more information, contact Diane Downie, Lawrence Hall of Science, University of California, Berkeley, CA 94720.

A third activity in the Bay Area is one-day conferences on math and science for junior and senior high school girls. If the reader is interested in starting a program, the conferences are easiest to do. They involve only getting together a willing group of workers (junior high and high school teachers are essential ingredients for such a group), buying a handbook, and doing it. The conferences feature an inspirational panel of successful women, hands-on workshops in math and science, and career workshops with women in a wide variety of fields. For the conference handbook, send \$3.00 for an evaluation copy to Joann Koltnow, Coordinator, Math Science Resource Center, Mills College, Oakland, CA 94613.

Let me conclude by giving you an example of a math activity for building problem-solving skills used in these programs. (The programs build on Polya's heuristics, W.W. Sawyer's use of visualization, and Robert Davis' Madison Project materials. An Equals Bibliography lists sources of materials and problems.) The example given here uses an In-Out machine which accepts certain objects, and gives back another object by following a rule. It is the student's job to guess the rule. Here's three sample tables of ins and corresponding outs:

<u>In</u>	<u>Out</u>	<u>In</u>	<u>Out</u>	<u>In</u>	<u>Out</u>
3	5				
6	11	this	u	george	f
10	19	student	t	cute	d
18	35	has	i	elephant	h
5	9	elephant	f	cover	e
25	49	alphabet	b	triangle	h
		someone	t	divide	f
		silly	t	math	d

The students generate the tables by giving an appropriate "in" and guessing its "out". They even guess at the first one, while there is no way for them to have any idea about

the rule. In this way they are drawn away from memorizing and toward risk taking, even if it's only risk taking by guessing in the dark. The first machine leads toward a method of introducing variables: x goes in and $2x-1$ comes out. This method can be extended to solving algebraic word problems first by guessing and using in-out machines to get an equation. Since in-out machines are functions, their use can be extended to work exploring functions. They can also be used to generate formulas inductively in all sorts of mathematical situations (e.g., win strategies for 2-person games, Euler's formula for solids, counting problems in probability, etc.). The in-out activities and many others are described in detail in the Equals handbook, and the Equals Bibliography lists many good sources for activities.

NEWS FROM AWM MEMBERS

Barbara Smith-Thomas: She is a new AWM Council Member representing the South. Her address is Dept. of Math., University of Alabama at Birmingham, Birmingham, Ala., 35294, where she is an associate professor. Statement: I hate writing statements for Newsletters. It's simply time for me to give more than my \$10.00 per annum dues. AWM needs more than my money if it's going to keep giving me, and others, the kind of encouragement and support that I have found so valuable over the past 6 years.

Dora Helen Skypek, Division of Educational Studies, Emory University: As chair of the NCTM Task Force on Problems in the Mathematics Education of Girls and Young Women, I would welcome correspondence with regard to related problems and their possible solutions.

As a speaker at the Seattle meeting, April 1980, of NCTM on the topic of sex equity in elementary school mathematics, I would like to hear about inequities in curriculum, achievement, or classroom practices. Also, I want to cite projects throughout the United States and Canada that inform elementary school teachers and students about inequities and some of the successful intervention activities that encourage girls to develop fully their abilities in mathematics and mathematics-related fields and to keep their career options open.

EVGENIYA ALEKSANDROVNA BREDIKHINA: 1922-1974

by B. M. Levitan, D.E. Men'shov, S. B. Stechkin, P. L. Ul'yanov
Russian Math. Surveys 30: 3(1975), 129-133 from Uspekhi Mat. Nauk 30: 3(1975),
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Thanks to Lee Lorch for bringing this article to our attention.

Evgeniya Aleksandrovna Bredikhina, Doctor of Mathematical and Physical Sciences, died on 6 October 1974 after a long and severe illness. E. A. Bredikhina (nee Kitaeva) was born on 2 January 1922 in the village of Chistovok in the Kuibyshev region. Her father Aleksander Fomich Kitaev was a doctor, her mother Anna Sergeevna a teacher.

In 1939 she left the middle school in the town of Kuibyshev with honours and entered the Mathematical-Physical Faculty of the University of Kazan. In 1940 she transferred to the Faculty of Mathematics and Mechanics of the University of Leningrad, where she attended the lectures of D. K. Faddeev, I. P. Natanson etc. Whilst still a student, she showed interest in research in the theory of functions.

From the outbreak of war she worked on the construction of fortifications near Leningrad, and then in a Leningrad hospital. In April 1942 she moved to Kuibyshev and in 1945 she graduated with honours from the Faculty of Mathematics and Mechanics of the Kuibyshev Pedagogical Institute. In the same year she started work at the Kuibyshev Polytechnic and after a year she moved to the Kuibyshev Institute of Aviation, where she worked for 28

years as an Assistant, as a Senior lecturer, as a Reader and finally as titular Head of the Department of Higher Mathematics.

She was an external research student of the University of Leningrad, where she worked under the supervision of Professor I. P. Natanson. In 1955 she defended her Ph.D. thesis entitled: "Some problems of the best approximation of almost periodic functions" (see [1]-[3]). Further development of this subject led to a great number of papers, which formed the basis of her D.Sc. dissertation: "The theory of approximation and almost periodic functions", which she defended in 1972 at the University of L'vov.

Mrs. Bredikhina's research was on the theory of almost periodic functions. In all, she published 35 papers, in which she studied the following questions: the uniform and absolute convergence of Fourier series of almost periodic functions; Fourier gap series of almost periodic functions; the best approximation to almost periodic functions by entire almost periodic functions of finite degree, bounded on the real axis; the connection of the best approximation with the uniform and absolute convergence of Fourier series of almost periodic functions; questions of simultaneous approximations of almost periodic functions and their derivatives by finite trigonometrical sums and entire functions of finite degree.

[2] deals with a class of gap almost periodic functions

$$f(x) = \sum_k a_k e^{i\lambda_k x}, \quad \lambda_{-k} = -\lambda_k, \quad \lambda_k > 0, \quad \lambda_k \rightarrow \infty, \quad \lambda_{k+1}/\lambda_k \geq \theta > 1$$

and it is proved that there is a constant $C=C(\theta)$ such that

$$\sum_k |a_k| \leq C(\theta) \sup |f(x)|.$$

This is a generalization of Sidon's well-known theorem. Later Mrs. Bredikhina generalized this result to almost periodic functions whose Fourier exponents are finite sums of gap sequences.

In her papers on the best approximations she made a further study and gave a refinement of direct and converse theorems on the best approximations for various classes of almost periodic functions. She then applied these results to questions of absolute and uniform convergence of Fourier series of almost periodic functions.

Of great interest are those of her papers which show that certain tests for the convergence of Fourier series of almost periodic functions cannot be improved upon. Here is one of her results: let

$$f(x) = \sum_k a_k e^{i\lambda_k x}, \quad \lambda_{-k} = -\lambda_k, \quad \lambda_k > 0, \quad \lambda_k \rightarrow \infty$$

be a continuous almost periodic function satisfying the Lipschitz condition

$$|f(x'') - f(x')| < C|x'' - x'|^a \quad (0 < a \leq 1). \quad \text{A well-known theorem of Bochner states: if}$$

$$\lambda_k^a \ln \frac{\lambda_{k+1} + \lambda_k}{\lambda_{k+1} - \lambda_k} = o(1),$$

then the Fourier series of $f(x)$ converges uniformly. In [25] Mrs. Bredikhina gives an example of an almost periodic function satisfying a Lipschitz condition of order a for which

$$\lambda_k^a \ln \frac{\lambda_{k+1} + \lambda_k}{\lambda_{k+1} - \lambda_k} = 0(1)$$

and whose Fourier series diverges at $x = 0$. This result was improved in [34].

Mrs. Bredikhina took part in the work of the Third All-Union Mathematical Congress in Moscow in 1957; her main papers were reported and discussed at the Fourth All-Union Mathematical Congress in Leningrad in 1961 and at the International Congress of Mathematicians in Moscow in 1966.

Her ability as a teacher was outstanding. Her lectures were remarkable for the depth and ease of the exposition. Many of her former pupils bear witness to her aim of providing solid knowledge. As an examiner, she was both fair and kind.

She was decorated with the medals "For distinguished work" and "For valiant labour in honour of the centenary of V. I. Lenin".

She was a beautiful woman, a loving mother and grandmother. In everything she always displayed strictness combined with warmth. Her memory will long be cherished in our hearts.

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REMEDIAL MATHEMATICS AND THE WOMEN'S COLLEGE

by Betty Mayfield and Elizabeth Chang, Hood College

Hood College is a small liberal arts women's college in Frederick, Maryland. Increasingly, we find that many of our entering students lack the basic mathematical skills necessary for college-level work. Since this problem is certainly not unique to Hood, we would like to share with you our efforts and experiences in trying to find a solution; we are also interested in hearing about some of your efforts.

LARC

Through an Advanced Institutional Development Program grant, Hood College set up a Learning Assessment and Resource Center on campus last year. LARC is the center for all of the non-traditional educational programs on campus. In addition to a full-time director, we have a half-time math skills coordinator, a half-time writing skills coordinator, and a full-time counselor who works with reading and study skills, academic-related

anxiety, and test administration and evaluation. LARC is involved in granting college credit through examination for prior learning and experience. It is also the home for all of the college's videotaping equipment. We offer workshops for students, faculty, and staff in areas as diverse as Preparing for GRE's, Grading Essay Tests, and Understanding the Metric System.

The LARC Mathematics Program

At present, almost all work done in mathematics in LARC is self-paced. Students use individualized printed and audio-tutorial materials and tutorial computer programs to learn new skills or review old ones. Our materials cover subjects ranging from arithmetic with whole numbers to functions and relations. In addition, we have a set of workbooks dealing with science-oriented mathematics, chiefly for use by students enrolled in chemistry and physics classes.

A student may come in and plan an extensive review program in algebra or drop in when she encounters a problem with decimal numbers in a course. A faculty member who finds that a student has weak math skills may refer her to LARC for extra work. The math skills coordinator then keeps the faculty member informed of the student's progress.

LARC also sponsors a Basic Math workshop for students, faculty, and staff. This semester we are using Shirley Hockett's book, Basic Mathematics: What Every College Student Should Know. The workshop meets one evening a week for ten weeks, but students do much of the work on their own during the week.

Math 001

Beginning in the fall of 1980, LARC will offer a more structured mathematics program in addition to our present informal, drop-in program. A new course, Math 001, will be a 1-credit remedial course offered through LARC in consultation with the Department of Mathematics. Every new student will take a math placement test upon entering the college. Students who need remedial work will then be required to take Math 001 before registering for any other college math course. The course will consist of two parts: Unit A (arithmetic and elementary algebra) and Unit B (advanced algebra and other selected topics). Credit for Math 001 will be granted only upon successful completion of Unit B. Students will use self-paced materials; grading will be on a Satisfactory/Unsatisfactory basis.

Remedial Mathematics and the Math Department

While many liberal arts colleges have remedial programs or math anxiety clinics or both, we feel that our program is unique because it is so firmly tied to the Department of Mathematics. LARC is not a "step-child" of the department or the college. The department helped in the planning of LARC; the faculty played a big role in choosing the LARC math coordinator; and the coordinator is a half-time member of the mathematics department. The new course in remedial mathematics will be offered through the joint efforts of LARC and the Department of Mathematics.

ON CAMPUS WITH WOMEN

reprinted from On Campus With Women, a publication of the Project on the Status and Education of Women, Association of American Colleges, 1818 R St., Washington, DC 20009

Women Faculty Still Trail Along Tenure Track: Salaries Also Lag

Women faculty at all institutions continue to receive tenure less frequently than their male counterparts according to recent data from the National Center for Education Statistics. The number of tenured women faculty at all ranks increased .5 percent

between 1977-78 and 1978-79 while the number of tenured male faculty rose at twice that rate during the same period. The rate at which tenure was granted to all faculty at public institutions was slightly higher than at private institutions. However, at public institutions, the rate at which tenure was granted remained substantially lower for women than for men. At private institutions the percentage of tenured women faculty dropped .4 percent from 1977-78 to 1978-79 compared to an increase of .8 percent for tenured male faculty.

Salary increases for women also remained smaller than those for men. Although the average salary for faculty members with nine-month contracts in the 1978-79 academic year increased 6.2 percent over the preceding year, women faculty (all ranks combined) on nine-month contracts received an average increase of 5.6 percent while men faculty salaries increased 6.4 percent.

Women Administrators: Low on the Ladder

Women comprise 21 percent of the administrators at 106 universities in the National Association of State Universities and Land-Grant Colleges (NASULGC). In 1970-71, 60 percent of the institutions had no women administrators. In 1977-78, every institution had at least one. However, the study also indicated that 58.1 percent of the women administrators held positions "categorized as associate or assistant director", the lowest administrative category in the survey. The report is available, free, from NASULGC, Office of Communications and Services, One Dupont Circle, NW, Suite 710, Wash., DC 20036.

Paternity Leave vs. Pregnancy: To Have and Have Not

A federal district court has ruled that paternity leave without comparable maternity leave is unlawful sex discrimination. In Wisconsin, a school district gave male, but not female, teachers a paid day of leave to attend the birth or adoption of a child. The rationale was that female teachers were already given unpaid leaves of absence for childbearing purposes. However, it was school policy to deny paid leave time to employees already on unpaid leave, so the effect of the practice was to give the male teachers a benefit that female teachers could never enjoy. Female employees who challenged this policy were awarded one day's pay as a remedy for the sex discrimination. The case is *Byrd v. Unified School District No. 1*, 453 F. Supp. 621 (Dist. Ct. Wis., 1978).

Publications of Interest

Discrimination Against Minorities and Women in Pensions and Health, Life, and Disability Insurance, 1288-page two-volume set, free from the U.S. Commission on Civil Rights Publications Unit, 1121 Vermont Ave., NW, Wash., DC 20425.

The Pension Game: The American Pension System from the Viewpoint of the Average Woman available for \$2.50 from the U.S. Government Printing Office, Wash., DC 20402. Stock #027-000-00752-0.

"Women in Higher Education: A New Renaissance?", the Spring 1979 issues of the College Board Review, includes 11 articles looking at various aspects of the issue and highlighting the accomplishments of women leaders in academe. Copies of this special issue #111 are available at bulk order rates of \$2 per copy for five or more copies or \$2.50 for a single copy from Department EW/The College Board, 888 7th Ave., NY, NY 10019. Checks payable to The College Board, or an institutional purchase order, must accompany orders.

Women in Academe: Steps to Greater Equality, written by Judith M. Gappa and Barbara S. Uehling, extensively reviews current research and literature about women as students, faculty and administrators. The report also surveys legislation and enforcement efforts, and includes recommendations to increase equity. Copies of the 89-page monograph are available for \$4 from the American Association for Higher Education, One Dupont Circle, #780, Washington, DC 20036.

Collected Papers: Educational Equity Issues in Community Colleges is a 66-page booklet published by the Northwest Women Studies Resource Bank of Washington State College edited by Carol J. Gross. Copies are available prepaid at \$1.50 plus 20 percent for handling from Education Development Center, 39 Chapel St., Newton, MA 02160.

The White House is now publishing a newsletter on women. Prepared by the Interdepartment Task Force on Women, White House News on Women contains information about government actions and programs affecting women. It will be issued periodically with occasional additional publications providing descriptions of federal activities. Copies are available by writing Susan McCullough or Frances Selnow, c/o Sarah Weddington's Office, The White House, Washington, DC 20500.

CLIMBING THE ACADEMIC LADDER: DOCTORAL WOMEN SCIENTISTS IN ACADEME: part one

a report to the Office of Science and Technology Policy from the Committee on the Education and Employment of Women in Science and Engineering
Commission on Human Resources, National Research Council
published by National Academy of Sciences, Wash., DC 1979

Preface

This report focuses on the status of women scientists in academic institutions, the major employer of doctoral scientists. It also examines their current situation in postdoctoral training and their role in national science advisory bodies, entities that draw their membership primarily from academe. A future report of this Committee will analyze the employment of women scientists and engineers in government and industry.

The Committee on the Education and Employment of Women in Science and Engineering was established by the Commission on Human Resources of the National Research Council in December 1974. Its charge was to analyze the social and institutional constraints that limit the participation of women in science and engineering and to examine the problems of sex discrimination in their education and employment.

Since its inception, the Committee has been chaired by Lilli S. Hornig, Executive Director of Higher Education Resource Services of New England. She has led the Committee through the processes of formulating specific tasks, obtaining funds and staff, and completing their report.

Preparation of the report began in the summer of 1977 when the Committee undertook the task of preparing studies of the education and employment of women scientists and engineers for the Office of Science and Technology Policy (OSTP) in order to illuminate national policy issues in these areas. Since September 15, 1977, the work of the Committee has been conducted pursuant to Task Order No. 365 (OSTP 77-9) of National Science Foundation Contract C310, under OSTP's first contract in the area of human resources. Gilbert S. Omenn, Associate Director for Human Resources and Social and Economic Services, OSTP, has provided technical liaison for this report.

In fulfilling its assignment, the Committee has been primarily concerned with the analysis of the trends of the last few years in the education and employment of women scientists. It has sought to assess the effectiveness of existing remedial practices and to indicate additional measures that would contribute to more balanced faculties and advisory committees.

Data for the report were obtained from surveys of the Commission on Human Resources; the files on advisory committee members of the Alcohol, Drug Abuse, and Mental Health Administration, the National Institutes of Health, the National Research Council, and the National Science Foundation; and published sources.

Summary of Findings

- * The majority of women scientists under discussion in this report received their undergraduate education and were admitted to graduate school well before the advent of equal opportunity mandates in higher education.
- * Women scientists receive their graduate education in the same institutions as men but in much smaller numbers. Similar proportions of men and women are trained in the highest-rated departments.
- * On the average, as measured by college grades and high school test scores, women scientists at receipt of the doctorate show evidence of higher academic ability than men and, in recent years, have completed their Ph.D.'s as fast as or faster than men. This finding supports the inference that women may have been more highly selected. Comparisons of research ability cannot be made unambiguously at this stage since no reliable measures are applicable.
- * Of the new Ph.D.'s who were seeking postdoctoral appointments, the men were in general more likely to receive early awards.
- * The universities ranked highest by R&D expenditures, which have traditionally employed the fewest women, have made the greatest relative gains in appointing new women faculty at all ranks, in spite of the fact that this group of institutions sustained the lowest growth rates in the sciences in recent years.
- * Women science faculties increased about three times faster than total faculty growth between 1973 and 1977.
- * Science faculties at ladder ranks in all institutions increased by 22,000 between 1973 and 1977; women's share of that increase was 21 percent, somewhat larger than their share of doctorates since 1970. This finding suggests that some women faculty were recruited from among long-term postdoctorals and research staffs.
- * Women account for all of the net growth in science faculty at the assistant professor rank in the top 50 universities (by R&D expenditures) and for nearly half of the increase in all other institutions.
- * At full professorial rank, women account for 19 percent of the net growth between 1973 and 1977 in the top 50 universities, but only 6 percent in the remaining institutions. The respective percentages for associate professors are 69 and 16 percent.
- * For all science and engineering fields combined, women's share of faculty appointments (excluding instructor/lecturer) grew from 12 to 19 percent in the second 25 institutions and from 12 to 18 percent in all others between 1973 and 1977.
- * Women's distribution among faculty ranks is a mirror image of men's; women are most likely to be assistant professors but men are most likely to be full professors. In the top 25 institutions, women are more than seven times more likely than men to be at the rank of instructor/lecturer; in 1977 they held 46 percent of these positions compared to 27 percent in 1973.
- * Rank for rank, women faculty continued to be tenured less often than men; for all ranks, 72 percent of the men but only 46 percent of the women hold tenure appointments. This disparity is increasing.
- * Sex differences in salaries remains a serious problem. Median salary differentials between women and men in 1977 varied by fields, ranging as high as 28 percent for full professors of chemistry.
- * In relation to the pools of new women Ph.D.'s in the various fields, chemistry and mathematics employ far lower proportions of women faculty than do other fields.
- * Wide field variations in rank, salary, and tenure distribution for women faculty compared to men suggest that an assumed lack of mobility of married women is at most a contributory rather than a primary reason for women's evident disadvantage.
- * Research productivity cannot be used yet as an overall comparative measure of male and female academic scientists' performance. In most fields in research universities, there are not yet enough women faculty to have held professional positions with the necessary prerequisites long enough to make such comparisons meaningful.
- * The Alcohol, Drug Abuse, and Mental Health Administration, the National Institutes of Health, and the National Science Foundation have shown marked gains in the percentages of women appointed to advisory committees, while the National Research Council has not yet matched the representation of women in the appropriate doctoral pool.

- * In the past few years women have been 6 to 8 percent of newly elected NAS members, more than twice their share of full professorships in high-ranking research universities.
- * The number of women scientists in tenure-track positions in research universities and in policy advisory functions is slowly increasing as a result of affirmative action. Sex differences in salaries and awarding of tenure persist.

INTRODUCTION

Overview

Why are there so few women scientists? Why do we so rarely hear of their work? What happens to the over two thousand women who annually earn doctorates in science? What jobs do they get? Do they get jobs? Dead end jobs, or those with a future? Do they get equal pay for equal work? Have equal opportunity mandates changed their situation? Do they benefit as men do from public awareness of their work? Do they have similar opportunities to serve in policy advisory bodies? What is the outlook for their future?

We chose to focus this first report on academic employment, primarily in faculty positions, both because existing data are more extensive than for other sectors and because educational institutions are the prime employers of doctoral scientists. In addition, the hierarchy of ranks and institutions is well-defined and makes it possible to compare how men and women fare in professional terms to a degree that is not readily matched in industry, for example. Beyond these pragmatic considerations, however, faculty status represents the quintessential scientific career. Ideally it provides total freedom of inquiry, insured by a degree of personal security unmatched in any other walk of life except the Civil Service. In practice, freedom of inquiry may be somewhat curbed by the availability of money and more recently by certain external regulations. Still, to many young scientists a tenured faculty post in a research university remains the most desirable career goal. How many women reach it?

Scientific manpower has been the subject of many analyses since World War II; scientific womanpower--about one-tenth of the scientific doctoral labor force--has received little attention until recently, when equal opportunity legislation required employers to perform utilization analyses of their labor force. Data on doctorate production by sex and field have been published since 1920, but detailed employment information on a national sample of all science and engineering Ph.D.'s has been available only since 1973. While some analyses of women scientists' employment for individual disciplines have appeared in the last few years, no systematic studies encompassing all science fields have been done.

This Committee owes its existence to the pressures arising from the women's movement, specifically in academe, during the late sixties. A small conference was convened by the National Academy of Sciences in 1972 to begin exploration of women's status in science, followed by a research conference in 1974. Subsequently, this Committee was appointed. Concurrently, demands from employers, particularly academic institutions, for better information regarding women scientists arose in relation to their affirmative action obligations.

Scope of the Study

To assess whether and to what extent earlier patterns of faculty appointments have changed since the advent of affirmative action regulations, we will be examining extensive trend data on the production and employment of men and women doctorates. We hoped that it would be possible also to derive some insights that transcend statistical comparisons. The flow of scientists through graduate and postdoctoral training and into jobs, in academe or elsewhere, is subject to various influences not usually considered in affirmative action discussions. Training opportunities at both pre- and postdoctoral levels are highly dependent on research funding, which has been changing in the last decade, declining in real dollars and fluctuating widely among fields. The effects of the

Vietnam War and the draft on science doctorates are almost impossible to assess. To what extent, if at all, did they reduce the numbers of new male doctorates or affect their quality? We have no data on this and can draw no conclusions. The decreasing enrollments in higher education are reducing the number of available appointments; some departments are contracting, and almost all are postponing tenure decisions as long as possible. Against such a background, what kind of hiring and promotion rates for women scientists can reasonably be expected? How do we interpret the changes we find? If no expansion is possible, what might the "good will efforts" which the law is willing to accept in lieu of actual numerical improvement encompass?

What of the problems of obsolescence which are specific to science and not to other academic disciplines? A first-rate woman scientist trained a decade ago and unlikely to be considered at that time for a faculty post in a research university may have spent the intervening years teaching in a small college. Her ten-year-old qualifications do not fit her now for the position she should have had then. Can anything be done for her? Should something be done? Could her excellent capabilities, maturity, and experience in a different sector of academic science be used to advantage in advisory functions? How many others like her are there? Is this a national problem?

What are the restrictions faced by women who decide to interrupt or slow down their careers in order to have children? Are there employment options available that would utilize their talent on a rigorous but less than full-time basis? There is a continuing search by today's young men and women for ways to reconcile conflicting demands of their parental and career roles. While academic institutions cannot be charged with responsibility for either the problems or solutions that women face in this connection, they should avoid compounding the problem and should share responsibility for exploring the development of solutions within the academic framework that would help meet the conflicts. For example, a quarter of a century ago New York Medical College took the pioneering step of offering part-time psychiatric residency for women physicians with young families.

We have also been mindful of the compounded difficulties faced by minority women scientists; their problems are discussed fully in a conference report issued by the American Association for the Advancement of Science (1977). It is interesting to note here that minority women report more discrimination based on sex than on race. For the purposes of this report, we found minority women scientists to be too widely scattered through fields and departments to enable us to draw any general conclusions other than to deplore their absence.

At the end of this report we consider the possible modifications or policy initiatives which could correct or ameliorate existing inequities. Among these are the creation of additional research opportunities, more innovative institutional contributions to solving dual-career problems, and expanded opportunities for service by women scientists in advisory functions. It is notoriously difficult, however, to devise remedial policies which do not in turn create some measure of disadvantage for innocent bystanders.

Implicit in these questions is our assumption that men and women scientists are of comparable quality. Some scientists do not believe that assumption is justified, Lester (1974) among them. We explore that problem in Chapter 2, insofar as the usual proxy measures of ability can be applied. None of them really tells us much about research potential, or how we foretell the excellent from the merely very good.

It is often assumed that women's careers must necessarily take a different path from men's because of their different family responsibilities and constraints on mobility. If that is true, and given similar ratios of qualified candidates, unmarried women's career opportunities should be just like men's, and there should be no systematic differences in relative employment of women among fields unless some fields somehow impose greater demands on their practitioners than do others.

As we begin this exploration, it must be stressed again that our concern is with the status of women scientists, rather than the situation of all women doctorates. Excellence in science, at least at advanced levels, can be fostered only in certain circumstances. It is far more dependent than other fields on concentrations of facilities and equipment and the presence of other workers in the same or related disciplines. The place where a potentially outstanding scientist finds employment, and the conditions of such employment, will therefore influence the eventual realization of that potential in significant ways.

On the other hand, science demands aptitudes and preparation possibly more specialized or exacting than other disciplines so that we must examine the capacities of men and women scientists as they enter their professional careers. For this purpose, a comparison of all women doctorates with all men doctorates is inappropriate. Numerous comparisons of this type have yielded negative results for women with respect to measures of educational quality. In fact, these distinctions reflect the different field distributions of the two sexes. The fact that women doctorates as a group take longer than men to complete their degree, for example, simply indexes the greater concentration of women in nonscience fields where both sexes customarily obtain their degrees after longer time periods.

Our analysis, therefore, is limited to a comparison of men and women Ph.D.'s in the natural sciences, the social sciences, and engineering. It excludes those with doctorates in other fields as well as those with professional degrees in fields such as medicine but does include Ph.D.'s employed in medical or other professional schools.

Equal Opportunity in Higher Education

In 1968, Executive Order 11246 extended the clause of the 1964 Civil Rights Act prohibiting discrimination in employment (Title VII) to cover institutions of higher education, which were previously excluded, and four years later the Office of Civil Rights issued its Guidelines for Affirmative Action in Higher Education to implement Title VII. Also in 1972, Title IX of the Higher Education Amendments specifically addressed the provision for educational equity at all levels. Equal opportunity for study and employment in higher education regardless of sex is therefore a clearly stated goal of national policy; the explicit controversies surrounding the issue have dealt not with the desirability of achieving that equality but with the means for doing so. Since affirmative action guidelines require utilization analyses based on appropriate statistical information, there has been a natural tendency, for purposes of both general discussion and the establishment of legal evidence, to argue for or against the existence of discrimination on statistical grounds. Any discrepancy between the percentage of women or minorities qualified by training and experience to hold a given type of position and the percentage actually employed has been taken as legal evidence of discrimination, purposeful or not.

Several assumptions and issues are buried in the foregoing paragraph. The fact that equal opportunity laws came into being strongly suggests that equal opportunity had not existed previously. Was this a valid assumption? We think so. Until a decade ago, women were not admitted as undergraduates, and in some cases not as graduate students, to several highly selective universities which set the pace for academic science. Women who were admitted to graduate and professional schools sometimes had to meet higher standards. Numerous instances of more stringent criteria for the admission of women to selective graduate departments were cited by Harris (Harris, 1970). An illustrative case is that of the School of Veterinary Science, University of Pennsylvania, which until recently required a 3.6 GPA of women applicants and 2.6 of men (Davies, 1978).

Major universities rarely appointed women to their science faculties (although the pool of pre-1950 Ph.D.'s included about ten percent women). Women were more likely to be employed by colleges and non-research universities and to be concentrated in the lower ranks or as research staff. Moreover, they were not paid as much as similarly trained men at the same rank. For example, in 1973, a woman full professor was typically paid 15 to 20 percent less than a man in three major fields--chemistry, biology, and social sciences.

Was all this a result of discrimination? Some spokesmen for the universities have argued otherwise, suggesting that women preferred less demanding occupations in order to fulfill their family obligations, that restricted mobility made a normal academic career almost impossible for them, and that they were paid all they were worth. (See Lester, 1974, for an extended exposition of this point of view.)

These arguments in turn rest on assumptions about the nature of academic careers and the relative abilities of women and men, and the likely responses of the two groups to

potential conflicts between professional demands and family obligations. The commitment in time, energy, and dedication required of a tenured faculty member is large, and may in fact conflict with many other desired activities for men as well as women. The degree of flexibility a tenured appointment permits is also very high, however, and this might be more important in accommodating other obligations than the high total level of effort. In any case, these considerations are speculative; very little is known about how scientists make career choices at this level, or how they assess personal costs against potential professional benefits. Instances of either male or female scientists refusing academic appointments solely because they are too demanding appear to be rare at best. The inference that women commonly do so while men do not is unsupported.

Restrictions on geographic mobility for career development pose a different sort of problem. Under present social circumstances, most women with families are probably in fact less mobile than men, although "commuter couples" are increasingly common in academe. A parallel flexibility on the part of universities in creating joint employment for such couples exists in a few cases but is not widespread. In any case we know little about the professional benefits--or costs--of high mobility, or indeed about its incidence among scientists. A year or two devoted to rebuilding a research group and reorganizing facilities following a professional move may represent a long-term loss of research productivity which actually overshadows the gains in professional opportunity or other benefits. Whether women faculty members are less likely than men to move for better opportunity, or whether they are less likely to have the opportunity to move, remain unresolved questions.

Legal Definitions

Regardless of the basis for limitations on the status of women in academe, equal opportunity laws do not distinguish intent from historical accident; they deal only with end results. If women or other "affected groups" appear in a given employee category in proportions lower than their representation in the appropriate availability pool they are assumed to be victims of discrimination in the first instance. At this writing, the burden of proving otherwise legally rests with the employer.

Affirmative action policies, their execution, and the controversy surrounding them deserve further comment here. As the regulations apply to faculty employment, they require equal opportunity to be considered for a job and selection on merit criteria only, with the choice between two equally matched candidates to favor a woman or minority candidate. To ascertain whether their choices are indeed bias free, institutions are required to perform periodic utilization analyses and set goals and timetables for rectifying imbalances. However, relatively few universities have affirmative action plans which actually contain numerical goals, and they have enjoyed considerable latitude in setting those goals on the basis of their own internal staffing projections. More important, the penalties provided by law--the withholding of federal monies until an institution is in compliance--have only been imposed on a token basis, i.e., for a period of a week or two until the institution agreed to come into compliance at some future time. The most important sanction which the law provides is a pre-award compliance review conducted on site for grants and contracts exceeding \$1 million; after six years, it was applied for the first time in the last few months. At this writing, most of these reviews are incomplete and it is too early to judge their general effect.

Any conclusions regarding the effectiveness of affirmative action policies unfortunately will be clouded by the widely acknowledged capriciousness of enforcement efforts, the sometimes highly localized interpretations of regulations by enforcement officers, and the frequent problems which have been generated by these actions.

Unresolved Issues

The questions we have posed, and addressed throughout this report, deal with the opportunities afforded to individual women scientists (although they must be framed in terms of groups of individuals). Another set of issues concerns the universities and the fabric of science itself. Can it be argued that the major universities have impoverished themselves by virtually excluding women from their faculties? Are science

departments of lower quality than they would be had they hired more women? Will they be better if and when they do? Would there be more women science students if there were more women science faculty? Would that provide a welcome source of additional talent, or merely flood already overpopulated fields?

Answers to such questions would remain speculative at best, and none are suggested, but readers should bear these issues in mind.

Data Sources

The tools at our disposal for examining these issues are the extensive and detailed data collected by the National Research Council in its Surveys of Earned Doctorates and Comprehensive Surveys of Doctorate Recipients. These are the only available longitudinal data that encompass Ph.D.'s in all science and engineering fields.

The Survey of Earned Doctorates, an annual survey containing responses of virtually all new Ph.D.'s in the United States, provides data on background characteristics, educational patterns, and post-degree plans at the time the degree is obtained. The present report relies heavily on this source for data on the 1977 doctorates and, for information on earlier cohorts, on the accumulated data from these surveys, referred to as the Doctorate Records File. In some instances, tabulations of these data by field and sex reveal very few cases in specific cells, e.g., women in physical sciences, but it should be stressed that these numbers reflect the entire population, rather than a sample, of the Ph.D.'s in a given category. Sampling error is not a consideration here.

In contrast, the biennial Survey of Doctorate Recipients is administered to a sample. The sample of 65,000 doctoral scientists and engineers is drawn primarily from the Doctorate Records File but also includes some individuals who earned their doctorates at foreign institutions. Data in this report on employment status, sector, activity, rank, and salary are from this source. The numbers in the tables from the Survey of Doctorate Recipients represent the sample weighted to yield an estimate of the doctoral population in the national labor force.

In addition to these two major sources of statistical data, numerous individual studies and reports have been reviewed, and reference is made to these throughout the report.

Limitations of the Data

In tabulations from the Survey of Doctorate Recipients, small estimates may reflect even smaller numbers of sample cases. When the number of sample individuals in a cell is fewer than three, no figures or percentages are presented. For other cells containing small numbers for the estimated population, the reader is urged to exercise great caution in the interpretation of percentages.

On other grounds, statistical findings must be applied with caution to determinations of sex discrimination; group differences in quality or mobility would produce entirely legitimate statistical biases, for example. In addition, each academic hiring decision is in some sense unique and will involve personal assessments which, no matter how sincerely performed, may be swayed by one prejudice or another. In the absence of systematic sex discrimination in academic appointments, however, the sum of such individual decisions as reflected in aggregate statistics should not show bias but reflect the sex distribution of the available scientists of comparable quality.

A further limitation in examining statistical data, however disaggregated, is that they cannot tell us much about the flow of individuals through the various professional levels. For example, we cannot tell whether the increase seen in numbers of women at senior ranks in some fields represents an upgrading of in-house candidates or recruitment from other institutions. Nor do the data allow us to distinguish between those junior research faculty members who move up and those who are forced to move out.

Organization of the Report

The first chapter of the report examines some of the obstacles that women must overcome to become professional scientists. The following chapter assesses the characteristics, educational patterns, and supply of women doctorates in the sciences. Chapter 3 examines sex differences in postdoctoral training patterns. The fourth chapter presents recent developments in the academic employment of men and women scientists. Chapter 5 reviews the participation of women in three major groups within the national science advisory apparatus. The sixth chapter provides an overview of the current prospects of women scientists in academe as well as recommendations for improving these prospects.

References

1. American Association for the Advancement of Science, Conference on Women in Scientific Research, October 17-20, 1977, Washington, D.C.
2. Lester, R. A., Antibias Regulation of Universities: Faculty Problems and Their Solution, Part 3, Carnegie Commission on Higher Education, McGraw-Hill, New York, 1974.
3. Harris, Ann Sutherland, "The Second Sex in Academe," AAUP Bulletin, Vol. 56, No. 3, 1970, pp. 283-295.
4. Davies, Robert, "Expanding the Role of Women in Science," paper presented at New York Academy of Sciences Conference, March 1978.

OF POSSIBLE INTEREST

COMMENT: A Research/Action Report on Wo/Men contains highlights of conferences, abstracts of research, summaries of discussions, primary source data, etc. There are 3 8-page issues per year. Write to COMMENT, Office of Women in Higher Education, ACE, One Dupont Circle, Washington, D.C. 20036

A 1980 World Conference of the United Nations Decade for Women: Equality, Development and Peace will take place July 14-30, 1980 in Copenhagen. The objective is to measure the progress women have made since 1975 and to chart a course for the rest of the decade. Further information may be obtained from Ms. Lucille M. Nair, Secretary-General, 1980 World Conference of the Decade for Women, United Nations, New York, NY 10017.

Alice Siegel, 11 Broadmoor Road, Scarsdale, NY 10683 and Margo McLoone Basta, 511 East 80th St., NY, NY 10021 are working on a book entitled Kids' Firsts: Facts and Feats. They are looking for data on firsts, youngests, record breakers, and exceptional feats of youths 18 and under.

Covert Discrimination and Women in the Sciences, edited by Judith A. Ramaley, in the AAAS Selected Symposia Series, may be ordered from Westview Press, 5500 Central Avenue, Boulder, CO 80301 for \$13.50.

The Sept., 1979 issue of Good Housekeeping has a useful article "Where to find the best college scholarships" on page 233.

Bryn Mawr recently received an \$8 million grant to be used for the maintenance and renovation of existing buildings. The grant from the Pew Memorial Trust is unusual; most building grants go for new buildings and fancy plaques. With the current financial crunch at universities, building maintenance is becoming a severe problem.

Women's Studies and women's issues books:

Dabor Services, Inc., 140 Gazza Blvd., Farmingdale, NY 11735
Lexington Books, D.C. Heath and Company, 125 Spring St., Lexington, MA 02173
Yale University Press, 92A Yale Station, New Haven, CT 06520
Indiana University Press, 10th & Morton Streets, Bloomington, IN 47405
The Haworth Press, Inc., 149 Fifth Ave., NY, NY 10010.

Women's Agenda is a bimonthly magazine reporting on the programs, events, and issues of women's groups in the U.S. Cost is \$10/yr. individual, \$20/yr. institutional.

Make checks payable to: Women's Action Alliance, Inc., Dept. WO, 370 Lexington Ave., NY, NY 10017.

The Federal Resources Advisory Service, a project of the Association of American Colleges, provides information on federal funding for activities related to education, including opportunities for women. Contact FRAS, 1818 R St., NW, Wash., DC 20009. 202/387-3760.

DEADLINES: Jan. 24 for Mar.-April, Mar. 24 for May-June, May 24 for July-Aug.

ADDRESSES: Send all newsletter material except ads to Anne Leggett, Math. Dept., Western Illinois University, Macomb, IL 61455. Send everything else to AWM, Women's Research Center, Room 204, Wellesley College, 828 Washington St., Wellesley, MA 02181.

JOB ADS

Institutional members of AWM receive two free ads per year. All other ads are \$10.00 apiece and must be prepaid. The vacancies listed below appear in alphabetical order by state. All institutions advertising below are Affirmative Action/Equal Opportunity employers.

University of Alabama, Huntsville. Dept. of Mathematics. Assistant Professor (tenure-track). Beginning 9/1/80. Required: Ph.D in Mathematics, evidence of strong potential in research & active interest in quality teaching. 9-11 contact hours per week. Usual fringe benefits. By 2/1/80 send application, graduate transcripts & 3 letters of reference to F. L. Cook, Chmn., Dept. of Mathematics, University of Alabama, Huntsville, AL 35807.

University of Alabama, University. Dept. of Mathematics. Possible tenure-track positions probably at Assistant Professor level. Demonstrated ability in research and teaching essential. Ph.D. required. Current research interests in Dept. include algebra, analysis & applications, and topology. Candidate should have interests which complement those of people in Dept. Write to C. Hobby, P. O. Box 1416, University, AL 35486.

California State University, Fullerton. Dept. of Mathematics. Tenure-track position for Fall, 1980 for applied mathematician. Ph.D required. Prefer applicants with outstanding teaching qualifications, computation experience, and backgrounds in modeling, combinatorics, numerical analysis, applied statistics or optimization. Rank and salary determined by experience & qualifications. Send vita to Chair, Selection Committee, Dept. of Mathematics, CA State University, Fullerton, CA 92634.

California State University, Long Beach. Dept. of Mathematics. Following positions for Fall 1980: 6 lectureships (2-yr. appt.); 5 to teach lower-div. courses in Math, Ph.D in Math reqd., and 1 to teach Math to prospective teachers; Ph.D in Math Educ. & at least M.A. in Math reqd. Salary range \$16,368-\$19,680/academic yr. Send resume, transcripts, & 3 letters of reference by 2/15/80 to: A. Gittleman, Chair, Math Dept., Calif. State Univ., Long Beach, 1250 Bellflower Blvd., Long Beach, CA 90840.

California State University, Northridge. Dept. of Mechanics, Civil & Industrial Engineering. Full, associate and assistant professorships & lectureships. 9 month salary range \$16,368 - \$31,416. Required: Ph.D in Engineering or equivalent relevant industrial experience. Must teach engineering graphics & design, basic materials science, strength of materials & statics etc. Application deadline: Jan. 1, 1980 or until position is filled. Send 2 copies of resume & names of 3 references to Search & Screen Committee, c/o Dr. R. M. Di Julio, MCI Engineering, CA State Univ., Northridge, CA 91330.

Univ. of California, Berkeley. Dept. of Mathematics. R. Hartshorne, Vice-Chairman for Faculty Appointments. Several 2-year lecturer positions beginning 9/1980, for new and recent Ph.D.s (1978-80), regardless of age. Send by 1/31/80 resume, reprints, preprints, and/or thesis abstract. Ask three people to send letters of recommendation to the above person, at U. of C., Berkeley, CA 94720.

Univ. of California, Berkeley. Dept. of Math, Berkeley, CA 94720. R. Hartshorne, Vice-Chairman for Faculty Appointments. At least one tenure-track faculty position anticipated pending budgetary approval, for fall 1980 at Asst. or Assoc. Prof. level, with rank to be determined by qualifications, in the areas of algebra, analysis, applied mathematics, foundations or geometry. Demonstrated potential in research & teaching is needed. By 1/15/80 send vitae, list of publications, and names of three referees to person listed above.

University of California, Berkeley. Dept. of Statistics. Anticipate, pending budget approval, 2 tenure positions at Associate or full Professor level, to start Fall, 1980. Must teach graduate & undergraduate courses in statistics and continue programs of research. Novel contributions to statistical methodology, applied probability or applied statistics are especially valued. Contact D. Brillinger, Chair, Dept. of Statistics, Univ. of CA, Berkeley, CA 94720.

Loyola Marymount University. Mathematics Dept. Tenure-track position at beginning Assistant Professor level starting in Sept., 1980. Special consideration given to applicants with knowledge of computing/programming techniques. Ph.D. in Mathematics required. Send resume to Professor Michael Grady, Mathematics Dept., Loyola Marymount University, Loyola Blvd. at W. 80th St., Los Angeles, CA 90045.

Trinity College. Dept. of Mathematics. Asst. or Assoc. Professorship available Sept., 1980. Ph.D. in Mathematical Sciences required; demonstrated excellence in teaching especially at first & second year level & continuing research interests. Seeking applicants with knowledge of numerical analysis & combinatorics, and applications of mathematics or statistics. Please submit curriculum vitae, academic record & names of 3 references by 2/15/80 to D. A. Robbins, Chmn., Dept. of Mathematics, Trinity College, Hartford, CT 06106.

University of Delaware. Dept. of Computer & Information Sciences. 3 junior (one tenure-track) and 2 senior positions beginning 2/1980 in architecture, computer systems area, data base systems & languages, graphics or symbolic computation. Required: Ph.D. and excellence in teaching and research. Salary & rank depend on qualifications. Send vita & names of at least 2 references to Hatem M. Khalil, Dept. of Computer & Information Services, University of Delaware, Newark, Delaware 19711.

American University. Dept. of Mathematics, Statistics & Computer Science. Associate Professorship or Professorship beginning 1/1980 or 9/1980. Candidates must be able to contribute to graduate program in Computer Science. Ph.D. required. Salary & rank depend on experience. Send resumes & references to Dr. Judith Sunley, Chair, Dept. of Math, Stat & Comp. Science, American Univ., Washington, D. C. 20016.

Purdue University. Dept. of Mathematics. Possibly 3 two or three year visiting appointments at Asst. Professor level beginning Aug., 1980. Exceptional research promise & excellence in teaching required. Prefer research interest compatible with those of Dept. By 1/15/80 contact Leonard D. Berkovitz, Head, Dept. of Math, Purdue University, West Lafayette, IN 47907.

Purdue University. Dept. of Mathematics. Possibly 2 or 3 Asst. Professorships and one Assoc. Professorship open for Aug., 1980. Exceptional research promise & excellence in teaching required. By 1/15/80, send vitae & names of 3 references to Leonard D. Berkovitz, Head, Dept. of Mathematics, Purdue Univ., West Lafayette, IN 47907.

Northeastern Illinois University. Dept. of Mathematics. Tenure-track Asst. or Assoc. Professorship to begin Sept., 1980. Ph.D. in Math with specialization in Statistics required. Promise of excellence in teaching & interest in program development are important. Applied statistics & computing experience & long range research capacity are desirable. By Mar. 1, 1980 send applications to Prof. Tony Patricelli, Chmn., Dept. of Mathematics, Northeastern IL Univ., 5500 N. St. Louis Ave., Chicago, IL 60625. Interviewers will be available at AMS meeting in San Antonio, Tx.

Southern Illinois University, Carbondale. Dept. of Mathematics. Assistant Professorship (tenure-track) in Algebra, starting 8/16/80. Ph.D. required; candidate must have demonstrated evidence of excellence in research especially in an area of algebra; broad background & interest in several areas of algebra is desired. Evidence of teaching excellence is preferred. By 1/16/80 send applications & 3 letters of recommendation to Algebra Position, c/o Alphonse Baartmans, Chmn., Dept. of Math, Southern IL Univ., Carbondale, IL 62901.

Southern Illinois University, Carbondale. Dept. of Mathematics. Asst. Professorship (tenure-track) in Analysis starting 8/16/80. Ph.D. required; candidates must have demonstrated evidence of excellence in research (in any area of analysis); broad background & interest in several areas of analysis is desired. Evidence of teaching excellence is preferred. By 1/16/80 send applications & 3 letters of recommendation to Analysis Position, c/o Alphonse Baartmans, Chmn., Dept. of Math, Southern IL University, Carbondale, IL 62901.

Southern Illinois University, Carbondale. Dept. of Mathematics. Looking for junior level numerical analyst to fill tenure-track asst. professorship starting 8/16/80. Ph.D. preferred. Individuals completing Ph.D. by 8/16/80 will be considered. Candidates will be evaluated on their potential for superior teaching at graduate & undergraduate levels as well as their ability to develop research credentials expected of a tenured faculty member in a Ph.D. granting dept. Salary competitive. Send applications to Numerical Analysis Position, c/o Alphonse Baartmans, Chmn., Dept. of Math, Southern IL Univ., Carbondale, IL 62901.

Southern Illinois University, Carbondale. Dept. of Mathematics. Tenure-track position in Statistics starting 8/16/80. Ph.D. required with strong background in mathematical statistics & broad interests in applied statistics. Rank & salary depend on qualifications. By Jan. 16, 1980 send applications & 3 letters of recommendation to Statistics Position, c/o Alphonse Baartmans, Chmn., Dept. of Mathematics, Southern IL Univ., Carbondale, IL 62901.

Western Illinois University. Dept. of Mathematics. 3 tenure-track positions, fall of 1980; Asst. Professor entry level. Required: Ph.D; primary interest in operations research, computer science, systems analysis, numerical analysis, partial differential equations, or other areas of applied analysis. Salary & rank commensurate with experience. By 2/15/80 send vita, description of current research & have 3 letters of recommendation sent to Larry Morley, Acting Chmn., Dept. of Math, Western IL Univ., Macomb, IL 61455.

University of Illinois, Chicago Circle. Dept. of Mathematics. Head of Dept. of Mathematics. Preferred starting date is 9/1/80, but appointment as late as 9/1/81 may be considered. Candidates should present a distinguished record of scholarly achievement in mathematics, commensurate with rank of Professor in this university. Candidates must be committed to excellence in research & teaching at all levels. Evidence of administrative experience is required. Salary negotiable. By 2/15/80 send curriculum vitae & names of four references to Prof. A. K. Bousfield, Chmn., Search Committee, Dept. of Math, Univ. of IL, Chicago Circle, Box 4348, Chicago, IL 60680.

University of Maryland. Dept. of Mathematics (College Park). Positions for August, 1980. Positions in mathematics and statistics at assistant professor level (tenure-track). Strong research potential required. Senior level tenured position in statistics. Possibility of senior level tenured position in mathematics. Send vita and three letters of recommendation to Prof. W. E. Kirwan, Chairman, Dept. of Mathematics, University of Maryland, College Park, MD 20742.

College of the Holy Cross. Dept. of Mathematics. Tenure-track opening for Fall, 1980. No special area of mathematics required, but slight preference for active interest in an applied area such as numerical analysis, numerical solutions to partial differential equations, optimization, operations research, etc. Fringe benefits - TIAA-CREF, medical-life insurance plan, etc. Salary competitive. Send vitae & 3 letters of recommendation to Melvin C. Tews, Chmn., Dept. of Mathematics, Holy Cross College, Worcester, MA 01610.

Mass. Institute of Technology, Cambridge, MA 02139. Dept. of Statistics. Possibility of one opening for Instructor of Asst. Professor for Fall, 1980. Ph.D. in Statistics preferred. Write to H. Chernoff for application forms & information.

Mass. Institute of Technology, Cambridge, MA 02139. Dept. of Mathematics. 1 or 2 asst. professors will be appointed if sufficiently strong candidates can be found. Criteria are (1) superior ability as a research mathematician (2) demonstrated effectiveness as a teacher (3) 2 years or more of postdoctoral experience.

Mass. Institute of Technology, Cambridge, MA 02139. Dept. of Mathematics. Limited number of postdoctoral instructorships in field of applied mathematics. 2 year appointments will be made on basis of superior research potential. Final decisions will be made by 4/1/80. Write to Comm. on Applied Math, Room 2-345.

Mass. Institute of Technology, Cambridge, MA 02139. Dept. of Mathematics. C.L.E. Moore Instructorships in Math are open to postdoctoral mathematicians who show definite promise in research. Salary \$17,000. Teaching loads are 6 hrs. per week one semester, 3 hrs. per week the other. Appts. are for 1 year, renewable for 1 additional year. Applications should be filed by 1/1/80. Referees should return reference forms directly to M.I.T. by 1/15/80. For further information write to Pure Math Committee, Room 2-263.

Mount Holyoke College. Dept. of Mathematics. Asst. Professor to teach all levels of undergraduate mathematics, 3 year appointment; Ph.D. required. Starting 9/1980. Research field open. By 2/1/80 contact Robert Weaver, Chmn., Dept. of Mathematics, Clapp Laboratory, Mt. Holyoke College, South Hadley, MA 01075.

Worcester Polytechnic Institute. Dept. of Mathematical Sciences. Asst. Professor, tenure-track. Applied mathematician, supporting emphasis in major program in numerical methods or having research interests paralleling current work in dept. (applied analysis, differential equations, mathematical physics, mathematical statistics, applied probability, mathematics of communication). Strong commitment to teaching & an interest in interacting with faculty & students from other disciplines. Send resume to P. W. Davis, Dept. of Mathematical Sciences, W.P.I., Worcester, MA 01609.

Ferris State College. Dept. of Mathematics. Teacher of mathematics, to start as early as 3/4/80 but no later than 9/2/80. Appointee will share teaching responsibilities at all levels through advanced calculus; will help with (1) advising students in science-oriented curricula, (2) developing an existing B.S. degree program in applied mathematics, (3) computer-oriented instruction & (4) instructional/research development. Doctorate preferred. Rank & salary open depending on background & experience. Send resume & other supportive information (as soon after 1/1/80 as possible) to Dr. Robert J. Kosanovich, Head, Dept. of Math, Ferris State College, Big Rapids, MI 49307.

Michigan State University. Dept. of Mathematics. Several openings at Asst. Prof. level (full-time, tenure-track) beginning 9/1/80. Ph.D. in Math with interest in research & teaching. Send resumes and have 3 letters of recommendation sent to Prof. J. E. Adney, Chmn., Dept. of Mathematics, East Lansing, MI 48824.

Michigan Technological University, Houghton, Michigan. Head, Dept. of Mathematical & Computer Sciences. Dept. has faculty of 40 members; it offers a B.S. in Computer Science & M.S. degree program in Computer Science. Ph.D. required in math or comp. science; also broad understanding of research, academic and administrative requirements of both disciplines & have active commitment to research & quality teaching. Salary competitive. By 1/15/80 send inquiries, nominations and applications to MACS Search Committee, c/o William J. Powers, Dean, College of Sciences & Arts, Mich. Tech. University, Houghton, MI 49931.

University of Michigan, Dearborn. Dept. of Mathematics. Asst. or Assoc. Professorship, tenure-track, starting 9/1980. Prefer Ph.D. in Computer Science with specialization in operating systems, programming languages, graphics or compiler design. Rank & salary dependent on qualifications. Send resumes to Ms. Huettman, College of Arts, Sciences & Letters, 4901 Evergreen Rd., Dearborn, MI 48128.

Wayne State University. Dept. of Mathematics. Tenure-track position available starting 9/1980. Ph.D. required. Excellence in research & teaching expected. Salary & rank negotiable. Send resume & 3 references to B. J. Eisenstadt, Chmn., Dept. of Math, Wayne St. University, Detroit, MI 48202.

University of Minnesota. School of Mathematics. Two or 3 junior positions for persons with expertise in following areas: algebra, combinatorics, dynamical systems, functional analysis, geometry, logic. (Other fields also considered). Strong research & teaching abilities required. Salary competitive. Teaching load: 5 one-quarter courses per academic year. By 1/14/80 send curriculum vitae & 3 letters of recommendation to Prof. Willard Miller, Jr., Head, School of Math, 206 Church St., S.E. (127VH) Univ. of MN, Minneapolis, MN 55455.

Dartmouth College. Dept. of Mathematics. Two John Wesley Young Instructorships. Two-year, non-renewable, postdoctoral appointments for Ph.D.s with strong interest in research & teaching. Teaching duties 6 hrs/week. Salary \$15,000 per academic year plus resident research fellowship of \$2500. By 1/15/80 write to Donald L. Kreider, Chmn., Dept. of Math, Dartmouth College, Hanover, N.H. 03755.

Dartmouth College. Computer Science, Asst. Professor. Initial 3 yr. appointment (tenure possibility). Qualifications include demonstrated research in comp. science & ability & interest in teaching undergrad courses in comp. science & math. Ph.D. required. Write to Donald L. Krieder, Chmn., Dept. of Math, Dartmouth College, Hanover, N.H. 03755.

Dartmouth College. Asst. Professor, Algebra. Initial 3 year appointment (possible tenure). Ph.D. required. Must have demonstrated ability for mathematical scholarship & evidence of strong interest & excellence in teaching. Write to Prof. Donald L. Kreider, Chmn., Math Dept., Dartmouth College, Hanover, N.H.03755.

Rutgers University. Statistics Dept. Three Asst. Professorships. Ph.D. required by 12/31/80. Salary \$15,994. 3 year appointments, starting 9/1/80. Duties: teaching undergraduate & graduate statistics courses, doing research in applied and/or mathematical statistics. As one of positions requires substantial amount of consulting, less research & teaching are demanded. Send resume to Dr. William E. Strawderman, Chmn., Dept. of Statistics, Hill Center, Rutgers University, New Brunswick, N. J. 08903.

Colgate University. Dept. of Mathematics. Opening for Asst. Professor tenure-track position starting 9/1/80. Responsibilities include teaching numerical analysis and applications to physical sciences. Ph.D. or future Ph.D. required. Send vitae & 3 letters of recommendation to William E. Mastrocola, Chmn., Dept. of Mathematics, Colgate University, Hamilton, N. Y. 13346.

Cornell University. Dept. of Mathematics. H. C. Wang asst. professorships -- 3 year, non-renewable, fall, 1980. Teaching load, 2 courses one semester & one course the other semester in first year; 2 courses a semester thereafter. Salary at least \$17,000. Ph.D. required. Also possible tenure-track or tenure position of open rank, starting fall, 1980. By 1/15/80 send vita, research summary & 3 references to S. Lichtenbaum, Chmn., Dept. of Math, Cornell Univ., Ithaca, N. Y. 14853.

Rensselaer Polytechnic Institute. Dept. of Mathematical Sciences.
Tenure-track opening at Asst. (possibly Associate) Professor level, starting 9/1980. Strong research potential required. Prefer interests in Applied Math, and/or Numerical Analysis - Scientific Computing. Teaching 6 to 7 hours/week per semester. Also anticipate 2 or 3 Visiting Appointments - all levels. Send resume to Prof. R. C. Di Prima, Dept. of Math Sciences, R. P. I., Troy, N. Y. 12181.

Skidmore College. Dept. of Mathematics. Asst. Professorship (tenure-track) starting 9/1980. Preferred areas are analysis with some knowledge of computer programming. Required: Ph.D., demonstrated excellence in teaching & interest in research. Salary range \$14,000 - \$18,000. Send resume to Richard Speers, Chmn., Dept. of Math, Skidmore College, Saratoga Springs, N. Y. 12866.

State University of New York, Buffalo. Dept. of Mathematics. Asst. Professorship for 2 year term starting 9/1980. Salary competitive. Will consider applicants in all fields of mathematics, but prefer those with interests in algebraic or differential topology and applied mathematics including combinatorics. We seek applicants with high research potential & strong commitment to teaching. By Jan. 15, 1980 send resume and have 4 letters of recommendation sent to Dr. William Zame, Search Comm. Chmn., Dept. of Math, SUNY/Buffalo, 106 Diefendorf Hall, Buffalo, N.Y. 14214.

State University of New York, Buffalo. Dept. of Computer Science. Opening for Chairman and Professor. Applicants must have outstanding record of academic achievement in computer science & have ability to attract new faculty & develop research programs. By 1/31/80 send nominations or resume to Prof. M. A. Piech, Co-chairman Search Committee, Dept. of Math, SUNY/Buffalo, Buffalo, N. Y. 14214.

Syracuse University. Dept. of Mathematics. Visiting position; possibly one tenure-track, and possibly one or more one-year temporary positions. Ph.D. required for all positions. Research potential & compatibility with research activity in Dept. are most important. By Jan. 15, 1980 send vita & 3 letters of reference to Jack E. Graver, Chmn., Dept. of Math, Syracuse University, Syracuse, N. Y. 13210.

Case Western Reserve University. Dept. of Mathematics & Statistics, Cleveland, OH 44106.

1. Tenure-track position for Asst. or Assoc. Professor in contemporary numerical analysis. Strong research potential a must.
2. Tenure-track position for Asst. Professor of Mathematics. Strong research potential a must. Post-doctoral experience desirable, but not essential.
3. Tenure-track position for Asst. Professor of Statistics, Applied Probability. Strong research potential a must. Post-doctoral experience desirable, but not essential. For above 3 positions write G. S. Young, Chmn., at address above enclosing vita, bibliography, names of references, etc.

Ohio State University. Dept. of Mathematics, 231 W. 18th Ave., Columbus, Ohio 43210.

1. Six anticipated lecturer positions beginning 9/1980. These positions are not tenure-track, but may be renewed up to a maximum of three years.
2. Four anticipated positions on regional campuses: Lima, Mansfield, Marion and Newark. Appointments would be at Asst. Professor level & would require Ph.D. As these are tenure-track, continuing research and excellent teaching are expected.
3. Anticipated Professorship. Applicants should be distinguished researchers and able to assume leadership roles within Dept. For all 3 positions above, send vita & have letters of recommendation sent to Dijen K. Ray-Chaudhuri, Chmn., at above address.

Bucknell University. Dept. of Mathematics. One position may open for 9/1980. Required: Ph.D. (or nearly so), strong commitment to teaching and high potential for research. Preferred specialty is statistics with broad training in both math and statistics. (Potential tenure-track). Write to David S. Ray, Head, Dept. of Math, Bucknell University, Lewisburg, PA 17837.

University of Pennsylvania. Dept. of Mathematics. Tenure-track position starting 9/1980. Candidates in area of Algebra preferred. Contact Prof. D. Rim, Chmn., Personnel Committee, Dept. of Math, Univ. of PA, Philadelphia, PA 19104.

University of Pennsylvania. Limited number of positions in combinatorics & numerical analysis. Ph.D. in Math required at time of appointment. Starting 7/1/80. By 1/15/80 send resume & 3 letters of reference to Prof. D. Rim, Chmn., Personnel Committee, Dept. of Math, Univ. of PA, Philadelphia, PA 19104.

Vanderbilt University. Dept. of Mathematics. Tenured position. Impressive research accomplishments and evidence of effective teaching required. Should have specialization in some area of classical analysis or applied mathematics. Have vita and at least four letters of recommendation sent to Prof. R. R. Goldberg, Chmn., Dept. of Math, Vanderbilt Univ., Nashville, TN 37235.

University of Tennessee. Lida K. Barrett, Head, Dept. of Math, Knoxville, TN 37916.

1. Probability & Statistics - Tenure-track Asst. or Assoc. Professorships. Strong research & teaching qualifications. Prefer candidates with interest to support current university programs, e.g. stochastic equations, modeling, ecological statistics, biostatistics.
2. Statistics - Tenure-track Asst. or possibly Assoc. Professorships. Would be expected to teach math statistics in Math Dept. and be liaison person with Statistics Dept. Possibly a joint appt. with Dept. of Statistics in College of Business. Contacts: Balram Rajput or Thomas Hallam. Must have strong research & teaching qualifications. Preference for research area which intersects with active areas in Dept; Applied Math, contact Max Gunzberger; Numerical analysis, contact Steve Serbin; Analysis, contact William Wade; Algebra, contact David Dobbs.
3. Visitors - one or more quarters. Duties, research & teaching; qualifications, research recognition; area, related to our program.
4. Sabbatical Year Visitors - Support could be office, library, opportunity to participate in seminars in courses only (or additional part-time teaching with modest stipend).

University of Texas, Austin. Dept. of Mathematics. Two tenure-track asst. professorships and four terminal instructorships (each lasting 2 or 3 years), starting Fall, 1980. For information contact H. E. Lacey, Chmn., Recruiting Committee, Dept. of Mathematics, University of Texas, Austin, TX 78712.

University of Utah. Dept. of Mathematics. (1) Two 3 year instructorships. Persons of any age receiving Ph.D. in 1979 or 80 are eligible. Teaching & research ability important. Salary \$15,000. (2) One tentative visiting position in 1 year or less. (3) One position in professorial rank may be awarded on basis of excellence in teaching & outstanding research achievement in Applied Mathematics being developed at University of Utah. (4) In addition, a position in Pure Mathematics may develop in the professorial ranks. For all of above, send by 3/1/80 curriculum vita, bibliography & references to Ms. Sylvia Morris, Committee on Staffing, Dept. of Mathematics, University of Utah, Salt Lake City, Utah, 84112.

James Madison University. Dept. of Mathematics & Computer Science. (1) Asst./Assoc. Professorship, tenure-track, Fall, 1980. Ph.D. or ABD in computer science preferred, but applicants who hold Ph.D. in computer engineering, graph theory, numerical analysis or operations research will also be considered. Apply by 3/1/80 to person listed below. (2) Asst. Professorship, tenure-track, Fall, 1980. Ph.D. in applied mathematics, differential equations, analysis or related area with background in applied mathematics or in industry. Interests must be compatible with curricular needs of Dept. Strong commitment to teaching and research. Apply by 2/10/80 to person listed below. (3) Asst. Professorship, tenure-track, Fall, 1980. Ph.D. in statistics, probability or related area. Interests must be compatible with curricular needs of Dept. Strong commitment to teaching & research. Apply by 2/10/80. For all 3 positions listed above have vitae, transcripts & 3 letters of recommendation sent to Dr. Diane Spresser, Head, Dept. of Math & Computer Science, James Madison University, Harrisonburg, VA 22807.

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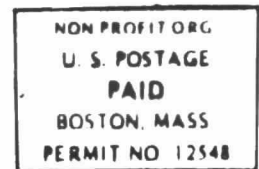
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January-February, 1980

H K NICKERSON
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