Association for Women in Mathematics

Please see last item on page 17.

Volume 17, Number 2 NEWSLETTER March-April 1987

A lot of women still have not sent in the questionnaire for the *Directory of Women in the Mathematical Sciences*. There were about 900 entries in the 1981 *Directory*. At this time, only about 430 forms have been received. If you wish to be listed in the *Directory*, please send your questionnaire to Ruth Rebekka Struik, Department of Mathematics, Campus Box 426, University of Colorado, Boulder, CO 80309. If you have mislaid your questionnaire, she will be glad to send you another.

PRESIDENT'S REPORT

It was with great pleasure that I began my term as AWM President in San Antonio. Linda Keen has been a vigorous leader, involving AWM in a number of important initiatives; I shall make every effort to continue her good work. I am most grateful to her, and to Bettye Anne Case, our Meetings Coordinator, for easing me into my new role. Without them, the details would have been overwhelming. To all of you who have offered help and encouragement, thank you.

San Antonio. The AWM panel, "Responses to the David Report: Initiatives for Women and Minorities," moderated by Lida Barrett, was well-attended and generated considerable audience response. Panelists Fern Hunt, John Polking, Louise Raphael and Barry Simon discussed the problem of renewing mathematics in the face of limited federal support. We learned of several new NSF programs aimed at encouraging students to enter mathematics, were told that still further programs were needed, and that the base of participation must be broadened to include students from diverse backgrounds. The observation was made that the best minority students seem to be going into fields other than mathematics. Details of the discussion will appear in the next issue of the *Newsletter*. Your comments and suggestions will be most welcome.

Emmy Noether Lecture. Professor Joan Birman of Columbia University and Barnard College delivered the Emmy Noether Lecture. Her lively talk, "Studying links via braids," described the excitement of being involved in Vaughan Jones' work on polynomial invariants of knots. Thanks to Professor Birman for a superb lecture.

Business meeting. A motion was passed calling on the Executive Committee to urge the AMS Council to rescind a resolution passed at their last meeting that would prohibit an individual from being nominated by petition more than twice in any ten-year period. The Executive Committee will act on this before the next AMS Council meeting.

AWM Party. The AWM party was a rousing success, attended by around 225 persons. To my surprise, entertainment was provided free of charge, so we were serenaded as well.

Committees. To all who have volunteered for various AWM Committees, you will hear from me in the coming weeks. Linda Keen has passed on to me the forms you sent her, and I am in the process of organizing them.

Child Care. Perhaps because I had two children in tow, a number of people expressed to me the need for child care at meetings; a list of local babysitters is really quite inadequate. You may remember that at the Emmy Noether Symposium, we had a room set aside with cribs and toys, supervised by a sitter from a local agency. Although we had only a few customers, the gesture was made. I shall contact

appropriate committees of the AMS and MAA to see what can be done for the summer meetings in Salt Lake City. [Ed. note: Sylvia Wiegand, University of Nebraska, is AWM contact person for help; from experience, she knows how to find out what is available. She has devised a babysitting questionnaire, which through deadline problems has never made it into the *Newsletter* before.]

Of Possible Interest. "Marriage, Motherhood and Research Performance in Science" by Jonathan R. Cole and Harriet Zuckerman, *Scientific American*, Feb. 1987 v. 256 no. 2, pp. 119-125.

Finally, let me remind you that I am enjoying a well-earned sabbatical at the University of Pennsylvania this semester. Please write to me there.

Rhonda Hughes
Department of Mathematics
University of Pennsylvania
Philadelphia, PA 19104

BABYSITTING QUESTIONNAIRE

for your information
if you have any good ideas, please get in touch

Your name:
Address and phone
How soon do you need to know if arrangements can be made?

1. Name, age, sex, grade (if in school) of child.

Please give a brief description of child's personality, abilities, needs while being cared for (diapers changed? bottles? frequency, etc.). Please indicate if your child has unusual medical, physical, or personal problems.

2. Times (estimate) that care would be needed.
Probable total number of hours necessary.

3. Kind of care desired (check any that would be acceptable)

---Private babysitter for your child only.
---Private sitter for your child and one or two others
---Group care (ages matched as much as possible)
---Coop care (share sitting with others - match children's ages as much as possible)
---Daycamp activities for school-age children (such as sightseeing, crafts, games)
---Mathematically oriented activities (films, talks by mathematicians)

Qualities you look for in sitter (include what age would be acceptable and price range)

4. Miscellaneous questions

a. Are you willing to assist with arrangements?
b. Will you have a car to transport your child at the meeting?
c. Would your child like to visit a school in the area?
d. Do you know of mature teenagers or other people who will be at or near the meeting who might like to do some babysitting? If so, please give us some information about them.
e. Apparently previous attempts to provide childcare have been stymied by restrictive laws about who can provide care. Choosing licensed approved caregivers may be prohibitively expensive. Do you feel the licensing is necessary?
f. Comments, suggestions?

REPORT OF THE TREASURER December, 1986

Accounting for the period June 1, 1986 to November 30, 1986

Balance as of June 1, 1986		$43,532.56
Total Assets, June 1, 1986		$43,644.44

Note: The figure $43,644.44 represents $43,532.56 cash-on-hand plus 5 shares of Washington Water Power valued at $111.88 as of 5/31/79.

RECEIPTS

Dues- Individuals	$10,522.65	
Families	740.00	
Institutional	4,580.00	
Pfizer Grant for AWM	1,000.00	
Raytheon Grant	5,000.00	
Interest	1,146.51	
Contributions	1,085.00	
Advertising Fees	200.00	
Miscellaneous	204.20	
TOTAL RECEIPTS		$24,478.36

EXPENSES

Wages & FICA (1)	$4,347.00	
Newsletter (2)	2,717.21	
Dues & Fees (3)	133.50	
Operating Expenses (4)	1,106.73	
Speakers' Bureau (5)	219.00	
Raytheon Grants (6)	3,458.56	
AWM National Meetings	1,432.06	
Bulk Mail Deposits	251.79	
IBM Personal Computer	4,593.40	
Research Component of Kovalevsky Symposium	15.03	
Massachusetts Income Tax	136.89	
TOTAL EXPENSES		$18,411.17

BALANCE as of November 30, 1986 . . . . . $49,599.75

(1) Part-time Administrative Assistant
(2) Typing, postage and printing
(3) Conference Board of the Mathematical Sciences, Massachusetts Incorporation Fee, Bulk Mail Permit
(4) Postage, phone, supplies, duplicating
(5) Travel, and accommodations for speakers
(6) Grants to women high school teachers to learn Pascal and/or data structures

Membership Statistics: Our membership currently totals 1609. The breakdown of this membership into membership categories is as follows: 1189 individual women, 125 individual men, 52 family-women, 52 family-men, 191 institutional. Of the total individual members, 69 are foreign, and of the institutional members, 9 are foreign.

We have used up the entire Sloan Grant for the Speakers' Bureau. Therefore, until we obtain another grant for the Speakers' Bureau, there will be no honorarium given. Speakers' travel and accommodations will continue to be covered according to the guidelines, as they have been in the past. We had only 6 speakers this past half year.

Respectfully submitted,
Lynnell E. Stern, Treasurer of AWM,
Bolt Beranek & Newman Communications Corporation

AWARDS AND HONORS

Congratulations to Ruth Williams of the University of California, San Diego! She has just been named a Young Presidential Investigator, an award created to encourage brilliant young scientists to remain in academics rather than move into industry. The award provides a $25,000 budget for each of five consecutive years. Williams is a probabilist who received her Ph.D. from Stanford in 1982.

AWM member Professor R.O. Wells, Jr., of Rice University has recently been elected a Fellow of the AAAS (American Association for the Advancement of Science). Congratulations!

WHY DID CHARLOTTE SCOTT SUCCEED?

by Pat Kenschaft, Montclair State College
a slightly modified version of her contributed paper delivered at the International Congress of Mathematicians

Charlotte Angas Scott (1858-1931) apparently was the first non-Russian woman to receive a Ph.D. in mathematics. She did so in 1885 under the supervision of Arthur Cayley at Cambridge University, although the University of London granted the degree. That same year Bryn Mawr College was opened in Pennsylvania, and Scott became its first mathematician. She was its department head for thirty-nine years and supervised seven successful doctoral students there. Co-editor of the *American Journal of Mathematics* for twenty-six years, she was also on the original Council of the A.M.S. and its vice president in 1905. She helped start the College Entrance Examination Board and was its Chief Examiner in Mathematics in 1902 and 1903. She published numerous research papers in American, British, and continental journals in analytic geometry and wrote a landmark book that was used for decades as both a text and a scholarly reference. She belonged to several mathematical societies and was one of the few U.S. delegates to the first International Congresses.

How was a woman born in 1858 able to achieve so much? Obviously, she was gifted and diligent. However, there were environmental reasons why she was able to overcome the nineteenth-century customs that oppressed most women. Only a generation earlier Florence Nightingale had said, "A British home is like a prison," and only the Crimean War had sprung her from that prison.

Charlotte Scott was much more fortunate. Both her father and his father were Congregational ministers, and the Congregational Church supported many reforms, including more rights for women. Her grandfather, Walter Scott (too easily confused with his contemporary, Sir Walter Scott) aggressively championed education for the working classes. As the ultimate working class, women undoubtedly benefited from his efforts.

When Charlotte was seven, her father, Caleb Scott, became the president of a college that prepared Congregational ministers. He encouraged intellectual pursuits in his home and was able to provide good tutors for his offspring. This was essential for his daughters' education because during Charlotte's childhood there were only two secondary schools in all England open to girls and neither was near their home.

Typically, I have not been able to learn anything about Charlotte Scott's mother, Eliza Exley Scott, except from Caleb's obituary, which says that their marriage was a source of "profound happiness" to him. There is not even an obituary of her in a local paper! In those days marriage meant that "the two became one," and I am sure that the credit I am heaping upon Caleb should be shared with Eliza.

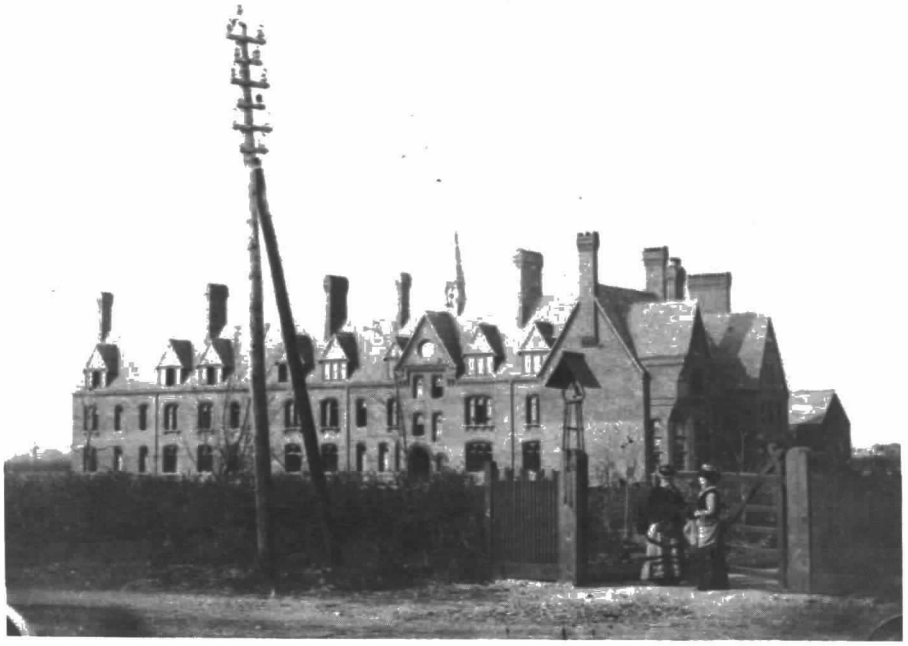
When Charlotte Scott was growing up in England, Vassar and Oberlin provided collegiate education for a few lucky American women, but there was no college in England open to women. Early in the 1860's Emily Davies, a suffragette, decided that women would not get the vote until they were better educated, and she began gathering support for a college for women. She was often criticized for her unpleasant personality, but she wrote poignantly about the "hair shirt" of constantly having to ask people to do things that they didn't want to do with no power to "make any return for the good nature... I am afraid that I feel very vindictive generally. It is the fierceness of fear. If I felt more confident, I might perhaps be more amiable."

Charlotte Angas Scott
in the 1890's

Caleb Scott, Charlotte's father,
during her childhood

Emily Davies,
founder of Girton College

A feminist on a new-fangled bicycle is hung in effigy during a demonstration against women's efforts in 1892 to obtain the right to earn degrees from Cambridge University.



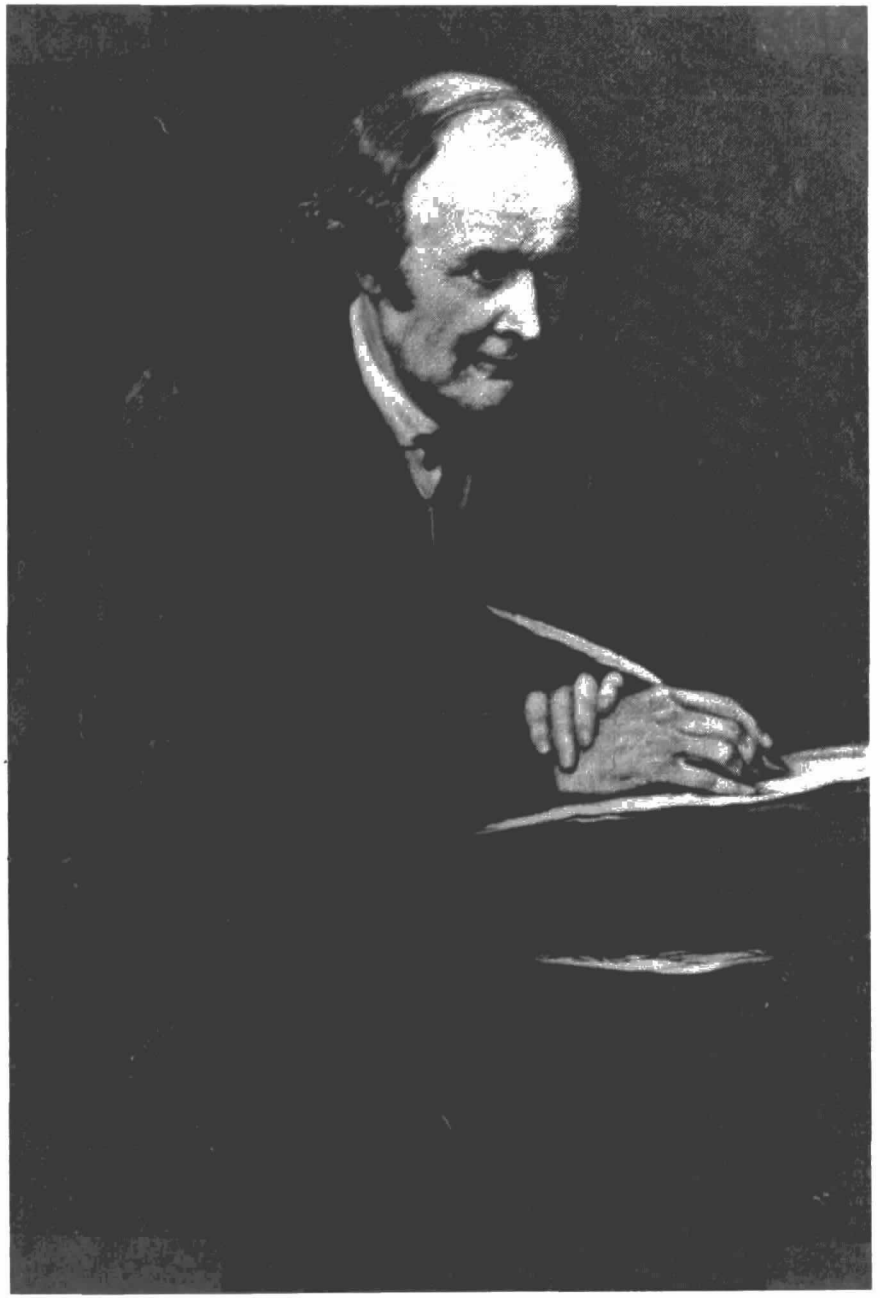
Girton College when Scott was an undergraduate. Emily Davies said the lack of landscaping emphasized the College's desperate need for money.

In 1869 she succeeded in opening a college with five women as students, and in 1873 that college moved to Girton, a chaste three miles from Cambridge. This was close enough so that idealistic young professors could peddle out to Girton College on newly-invented bicycles but far enough from campus so that Girton students would be unlikely to be thrown into the Spinning House. The Spinning House was a building on the Cambridge campus into which any unchaperoned female was summarily thrown as a "suspected prostitute," her life thereby ruined. The Girton students remained very near their own building.

Inside they did not have ideal living or learning conditions. Money was very scarce, rooms and food were Spartan, and the science labs were minimally furnished. Their fumes wafted up into the living quarters. When the three "survivors" of the first five students took the all-Cambridge honors exams, they all passed, although not by much. Since none had attended secondary school, this was a considerable feat. Throughout the seventies their praise was sung—literally—on the Girton campus:

Whenever we go forward
A hard exam to try,
Their banner goes before us
To raise our courage high.
They made old Cambridge wonder;
Then let us give three cheers
For Woodhead, Cook, and Lumsden,
The Girton Pioneers.

And when the goal is won, girls,
And women get degrees,
We'll cry, "Long live the three girls
Who showed the way to these!"
Who showed the way we follow,
Who knew no doubts or fears—
Our Woodhead, Cook and Lumsden,
The Girton Pioneers.



Arthur Cayley, Scott's mentor

M. Carey Thomas after coming home in 1883 as the first American woman to receive a doctorate. She later became the second president of Bryn Mawr College and as such was Scott's immediate supervisor.

Charlotte Scott received a scholarship to Girton in 1876 strictly on the basis of home tutoring. The college was growing; there were eleven students in her entering class. It was growing in more than size, and when she took the honors exams in 1880, she placed eighth in the entire university. And in mathematics! Because she was female, she could not be present at the conferring ceremony, nor could her name be officially mentioned. But when the name of the man who was credited with eighth was read, the students (all male) screamed "Scott of Girton!" so loudly that his name could not be heard.

As one result, a petition was publicly circulated that collected over 10,000 names urging that resident women students at Cambridge could take the honors exams by right and their name would be ranked and posted with the men's. A few Cambridge faculty led the fight for this, and the proposals were adopted only a year later. One of these faculty leaders was Arthur Cayley, who at the same time began supervising Scott's mathematical education. Women sat behind a screen in any classroom so as not to distract the men in those days (and still at Harvard in the 1920's), but Cayley probably gave Scott copies of his notes. In his obituary she said she had been the recipient of his kindness for sixteen years. Such personal kindness was indispensable for a nineteenth-century woman. As a university, Cambridge would not grant degrees to women until 1948.

Meanwhile, the first American women to receive a doctorate did so in 1882. Martha Carey Thomas earned hers *summa cum laude* in linguistics from the University of Leipzig. On her way home in 1883 she visited Girton College. In 1884 she received a stipend from the Bryn Mawr College Board of Trustees to lead its search for the initial faculty the following year, and Scott received an offer to become its first mathematical department head. This was incredibly good luck. In 1882 Sofia Kovalevskaia became the first nineteenth-century woman to hold a European university position, but it brought no money. Scott, the daughter of a minister, needed an income in order to live independently, and there were no academic opportunities for women in Europe. Thus she crossed the Atlantic Ocean alone at a time when most young women never left their parents' home without a chaperone.

As we contemplate the obstacles faced by Charlotte Scott, we can better understand why only a century later there are so few women at this Congress. We are all the products not only of our own effort and talent, but also of the people around us. Most women (like members of some other groups) do not receive as much mathematical nourishment as their brothers. However, Caleb Scott, Emily Davis, Arthur Cayley, and Carey Thomas provided Scott a pre-college education, a college education, a graduate education, and a job. Without any of these, she could not have become the super-achiever that she was. It is sad to consider how many people with comparable genius have not had similar good fortune.

PROJECT TO INCREASE MASTERY OF MATHEMATICS AND SCIENCE

PIMMS, based at Wesleyan University, is intended to make a significant positive impact on the teaching and learning of math and the sciences in Connecticut schools. Many activities are held, including Multiply Your Options Conferences and Junior Science and Humanities Symposia. The Conferences, co-sponsored with WAM (Woman and Mathematics Program of the Mathematical Association of America), are one-day meetings for women students in grades 8-12, their parents, teachers, and guidance counselors.

The organization is involved in clearing-house services and a fellowship program. Elementary Math and Science Fellows are trained to serve as resource personnel in mathematics for other teachers in their own and neighboring schools. Typical requests for service focused on curricular assessment and revision, integration of the use of computers into instruction, and advice on pedagogical techniques and processes. Vanguard Fellows do writing projects and field work of various kinds. For example, a booklet entitled "Ten Computer-Assisted Lessons in Secondary School Mathematics" has been designed to introduce algebra and geometry students to the computer while at the same time enlarging their understanding of concepts basic to these courses. New programs were introduced in 1986 for upper elementary and middle school, and for the urban high school.

Fellows are paid honoraria for their school visits, and schools are reimbursed for the costs of hiring their substitutes. United Technologies Corporation and the General Electric Foundation have provided much financial support, along with other corporations.

For more information, write PIMMS/Math Dept., Wesleyan University, Middletown, CT 06457.

THE STAR WARS COMPUTER SYSTEM: Part 2 of 2

by Greg Nelson and David Redell
Greg Nelson received a Ph.D. in Computer Science from Stanford University. A former lecturer in Computer Science at Princeton and researcher at Xerox PARC, he is presently employed at the Digital Equipment Corp. Systems Research Center.
David Redell received a Ph.D. in Computer Science from U.C. Berkeley. A former professor in Computer Science at MIT and software manager in Xerox's Office Systems Division, he is presently employed at the Digital Equipment Corp. Systems Research Center.
Published by Computer Professionals for Social Responsibility, P.O. Box 717, Palo Alto, CA 94301.

The possibility of unanticipated activation. It is an old aphorism of radar engineers that probability of detection is meaningless without probability of false alarm. Similarly, there is an inherent tradeoff between ensuring that the SDI computer system will respond to a missile attack and ensuring that it will not activate itself in unanticipated circumstances.

The existing early warning system depends heavily on human judgment to identify false alarms and pull in the reins of the systems and procedures that would otherwise unleash our strategic nuclear arsenal. According to a Senate report on false alerts,[13a] thousands of "missile display conferences" were held during the years 1979 and 1980 to evaluate ambiguous data picked up by warning sensors or false alarms caused by faulty hardware, unanticipated natural events, or human error. If a missile display conference cannot discount a warning, the next step is to convene a threat assessment conference, which "brings more senior people into the evaluation, such as the Chairman of the Joint Chiefs of Staff".[13b] Four threat assessment conferences were held in 1979 and 1980, for the following reasons:[13c] On October 3, 1979, the radar reflection of a rocket body in low orbit generated a false alarm. On November 9, 1979, a technician accidentally directed missile attack simulation data from a test tape into the early warning system. On March 15, 1980, a Soviet SLBM test launch was misclassified as threatening. On June 3, 1980, and again on June 6, a faulty chip in a communications multiplexor began setting bits randomly in the message data field containing the count of the incoming missiles detected by early warning radars. (Note that we can infer from this accident that the elementary precaution of parity checking was omitted from the communication protocol. This revelation should have provoked an outcry; its quiet reception is evidence of a lack of mature discipline in the computing profession.) In short, the complexity of the early warning system and its constantly changing environment produce a stream of false alarms, most of them minor.

A similar stream of false alarms can be expected from the SDI computer system, since it too would be complicated and deployed in an unpredictable environment. But the time limit for identifying a false alarm would be drastically reduced, because the boost phase currently lasts less than five minutes, and fast burn boosters could reduce it to less than one minute. Technicians cannot be expected to identify, in so short a time, the causes of anomalies in the behavior of a ten million line program running on a system distributed in space and over much of the earth. Threat assessment requires the evaluation of the ambiguous, the uncertain, and the unexpected, and therefore is unsuited for automation. Automatic systems are reliable only in circumstances that have been foreseen by their designers; this fundamental fact holds for expert systems as well as for other systems.

Unfortunately, the SDI plans involve increasing the level of automation in threat assessment, both by delegating to automatic systems functions previously performed by humans, and by streamlining the functions that are left to humans. Weapons release will also be automated, although whether this automation will be confined to defensive weapons release or extend to offensive nuclear weapons is not addressed explicitly by the Fletcher Report. The Report does conclude that "the battle management system must provide for a high degree of automation to support the accomplishment of the weapons release function".[10i] The 1985 report to Congress on the SDI states that studies are being made "on the speed and accuracy with which human test subjects can assess situations and make decisions. Performance is being compared as a function of the format and content of the data displayed, in situations that realistically represent possible battle scenarios".[23] The Fletcher Report states that the SDI system would be programmed so that human operators could "define thresholds or contingencies within which release of weapons is delegated to the automated system. Examples are release nuclear weapons for defense of own resources, release hit-to-kill weapons if more than ten boosters are in track, and release all nuclear weapons if more than 100 boosters are in track".[10j]

The dangers of automating threat assessment and weapons release are increased by the feedback between our C³I system and its Soviet counterpart. Paul Bracken writes in *Command and Control of Nuclear Forces*:

> A threatening Soviet military action or alert can be detected almost immediately by American warning and intelligence systems and conveyed to force commanders. The detected action may not have a clear meaning, but because of its possible consequences protective measures must be taken against it. The action-reaction process does not necessarily stop after only two moves, however... The possibility exists that each side's warning and intelligence systems could interact with the other's in unusual or complicated ways that are unanticipated, to produce a mutually reinforcing alert. Unfortunately, this last possibility is not a totally new phenomenon; it is precisely what happened in Europe in 1914. What *is* new is the technology, and the speed with which it could happen.[2]

It is important to remember that the SDI battle management system would be incorporated into the overall C³I system, which also drives the decision process for release and launch of nuclear missiles. Already, in fact, "the Joint Chiefs of Staff have begun discussions of ... a nuclear war plan and command structure that would integrate offensive nuclear forces with the projected anti-missile shield".[18] Thus, the highly automated SDI threat assessment and weapons release functions would become factors in the feedback cycle described by Bracken. The automatic release of the ABM weapons in response to a perceived Soviet threat would in turn be perceived by the Soviets as a provocation.

Such feedback effects could occur between the battle management software of opposing ABM systems, if both sides deployed them. The short reaction times and resulting absence of human damping could lead the systems to initiate preemptive attacks on each other. This fear is consistent with experience with other complex systems, which can fail in surprising ways because of unanticipated ripple effects. Power grid failures and other examples show that complicated automated systems can exhibit global behavior that was neither intended nor anticipated by their designers.

Detailed scenarios for the outbreak of nuclear war are inherently speculative, but the danger from increased automation is clear. An accidental war is not likely to be caused because an isolated hardware or software failure activates a weapon on an otherwise normal day. The danger is that the warning and response system as a whole—hardware, software, and standing orders that direct human beings to play their individual roles—is sufficiently complicated that its behavior in a crisis is unpredictable. It will interact in unexpected ways with itself and with its Soviet counterpart. In a crisis, the safety catches on the triggers would be removed, and procedures would be activated that had only been simulation-tested before. Flaws in the system would surface, possibly with disastrous consequences. This danger exists today, but it would grow in proportion to the level of automation in the process of threat assessment and weapons release.

Strategic Implications

When a large project is launched with unrealistic aspirations, the usual result is for the original goals to be quietly abandoned as the project is channeled in unforeseen directions by insurmountable technical barriers. The final result can be dramatically different from the original vision. For example, Dijkstra has pointed out that the original goal of the COBOL project was to make the professional programmer superfluous, but its result was to provide the language now used by three out of four professional programmers.

The SDI has already shown this kind of metamorphosis, as its original goal of freeing us from the need for deterrence is replaced by the goal of "enhancing deterrence". President Reagan underscored his original goal by suggesting that we would eventually share our ABM technology with the Soviet Union, as a prelude to disarmament. One of the many objections to this suggestion is that it is not feasible for the computer software, both because the Soviet Union would have no protection against "Trojan horses" in the programs, and because the constantly evolving battle management software would contain extensive details of our assessment of Soviet strategic plans and our intended responses to them, as well as potential loopholes in our defenses that could be discovered and exploited.

The technical uncertainty about the outcome of the SDI is compounded by the strategic uncertainty created by the dynamic and adversarial relationship between offensive and defensive weapons systems. As General Herres, head of C³I for the Joint Chiefs of Staff puts it: "Every time you think you've got one threat whipped, then somebody thinks up another one. It's a never-ending cycle. I rail at the guys who think one of these days ... everything will be all right. It'll never be all

right".[11b] It is difficult to predict the effects of weapons projects on this never-ending cycle, even if they are technically straightforward. For example, the original justification for MIRVs was to provide insurance against the possibility of Soviet ABM systems. The ABM treaty removed this justification, but the MIRVs remained. Today they are widely regarded as destabilizing, because one MIRVed missile can threaten many of an opponent's missiles, and therefore they make a first strike more tempting.

The SDI could backfire in the same way. The current rationale is that the ABM system would enhance deterrence, since its tendency to blunt a first strike would make reprisal more certain. Unfortunately, for technical reasons it is more likely to undermine deterrence, since its tendency to blunt a reprisal could make a first strike more attractive. During a period of international crisis, each side's hesitancy to launch its missiles would be gradually eroded by its mounting fear that the other side might attack first. In this scenario, the important consideration is the disadvantage of a second strike relative to a first strike. Any change that increases the relative advantage of striking first will tend to make the crisis unstable. The deployment of an imperfect ABM system would be just such a change, since the leakage of the system would be due, in large part, to saturation and overload of the computer system and other resources. Even with increases in computation speeds, tasks with computational time or space requirements that are more than proportional to the problem size, such as the task of tracking a cloud of objects, could easily become vulnerable to saturation. Because of saturation, the leakage of the system is likely to be much greater during a massive first strike than during a weakened second strike.

In short, it is impossible to predict the final outcome of so ambitious a project as the SDI, because of both technical and strategic uncertainties. Its goals will continue to be redefined as technical barriers are encountered and strategic theory changes. The gamble that something good will come out of it should be weighed against the foreseeable dangers, discussed in the references,[4, 8, 19] which include the possibility of Soviet countermeasures and the loss of the ABM treaty. This treaty prohibits not only the deployment, but also the development and testing of ABM systems; therefore proceeding with the SDI effort would violate the treaty long before we could know what the final outcome of the effort would be.

Conclusions

The computer system required by the Strategic Defense Initiative is the most complicated integrated computer system ever proposed. We have surveyed some of the difficulties in building such a system. The problems of software and system integration are far more serious than the problem of achieving the required radiation hardness and high computation rates. Flaws in any system of its size are inevitable. An attempt to build the system would not necessarily succeed, and if it did succeed, uncertainties would remain about its reliability. It is impossible to test the system under operational conditions, yet component testing and system simulation are totally inadequate substitutes. It would be folly to rely on such a system in the absence of full-scale operational testing.

Because of the time constraints for attacking boosters, the proposed system is required to activate itself within seconds of a warning. This would require increasing the level of automation in threat assessment and weapons release. But automatic systems are unsuited for coping with the ambiguity, uncertainty, and unexpected events that are likely in a military crisis. Increasing the degree of automation in the handling of crises would increase the risk of nuclear war.

As the state of the art improves, it becomes possible to build reliable systems that are larger and larger. An optimist might expect that, except for the fundamental impossibility of operationally testing the system, the difficulties outlined in this paper might be solved in a couple of decades. But if history is any guide, what we will have in a couple of decades is an unreliable and destabilizing ABM system along the lines of the one described in the Fletcher Report, together with a grandiose plan to build another even bigger system, intended to solve all the old problems and new ones besides.

The fundamental attitude at work here is what Bundy *et al.*[4] refer to as "technological hubris"—a chronic tendency to overestimate our technical capabilities and underestimate the difficulty of the problems we undertake to solve. The result of this attitude is the recurring phenomenon of extravagant aspirations that lead so many large computer projects to failure. The general responsibility of the computing profession to restrain the unrealistic aspirations of its clients becomes a vital obligation in the case of projects, like the Star Wars system, that introduce automation into the procedures that would determine the outcome of a nuclear crisis.

References

1. Hans A. Bethe, Richard L. Garwin, Kurt Gottfried and Henry W. Kendall. Space-based ballistic-missile defense. *Scientific American*, v. 251 no. 4, October 1984.
2. Paul Bracken. *The Command and Control of Nuclear Forces*. Yale University Press, 1983. p. 59.
3. N.H. Brown, M.P. Fabish, and C.J. Rifenberg. Safeguard data-processing system: introduction and overview. *Bell System Technical Journal*. v. 54 Special Supplement, 1975.
4. McGeorge Bundy, George F. Kennan, Robert S. McNamara and Gerard Smith. The President's choice: Star Wars or arms control. *Foreign Affairs*, v. 65 no. 2, Winter, 1984/85.
5. Matthew Bunn and Kosta Tsipis. The uncertainties of a preemptive nuclear attack. *Scientific American*, v. 249 no. 5, November 1983.
6. Ashton B. Carter. Directed energy missile defense in space—a background paper. U.S. Congress Office of Technology Assessment, OTA-BP-ISC-26, Washington, D.C. April 1984.
7. Frank C. Conahan. Adequacy of Department of Defense operational test and evaluation. GAO Senate testimony, Washington, D.C. 23 June 1983.
8. Sidney D. Drell, Philip J. Farley, and David Holloway. *The Reagan Strategic Defense Initiative: A Technical, Political, and Arms Control Assessment*. Center for International Security and Arms Control, Stanford University, July, 1984.
9. James Fallows. *National Defense*. Vintage Books, New York, 1982. p. 52.
10. James Fletcher, Study Chairman; Brockway McMillan, Panel Chairman. Report of the study on eliminating the threat posed by nuclear ballistic missiles (u). Volume V: Battle management, communications, and data processing (u). U.S. Department of Defense. February 1984. a: p. 31. b: p. 32. c: p. 4. d: p. 23. e: p. 45. f: p. 45. g: p. 7. h: p. 46. i: p. 8. j: p. 26.
11. Daniel Ford. *The Button*. Simon and Schuster, 1985. a: p. 190. b: p. 63.
12. Joseph Fox. *Software and its Development*. Prentice Hall, 1982. pp. 87-88. Cited by Lin[16].
13. Gary Hart and Barry Goldwater. Recent false alerts from the nation's missile attack warning system. Report to the Committee on Armed Services, U.S. Senate, 9 October 1980. a: p. 4. b: p. 5. c: p. 5.
14. C.A.R. Hoare. Turing Award lecture. *Communications of the ACM*. v. 24 no. 2, February 1981.
15. Fred S. Hoffman, Study Director. Ballistic Missile Defenses and U.S. National Security. U.S. Department of Defense. October 1983.
16. Herb Lin. Military software and BMD: an insoluble problem? M.I.T. Center for International Studies (to appear)
17. Daniel McCracken. Why the ABM computer system won't work. (speech given at U.S. Air Force Academy, 10 February 1971)
18. New York Times. U.S. devising an integrated nuclear plan. (reprinted in *San Francisco Chronicle*, 29 May 1985)
19. Stephen Shenfiel. Soviets may not imitate Star Wars. *Bulletin of the Atomic Scientists*. v. 41 no. 6, June/July 1985.
20. U.S. Department of Defense. The Strategic Defense Initiative; Defensive Technology Study. March 1984. (Unclassified summary of all volumes of Fletcher Report)
21. U.S. Department of Defense. Defense against ballistic missiles: an assessment of technologies and policy implications. 6 March 84. (Based on the Fletcher[10,20] and Hoffman[15] Reports)
22. U.S. Department of Defense. Report of the Defense Science Board Task Force on Military Applications of New-Generation Computing Technologies. December 1984. (See esp. Appendices G and L)
23. U.S. Department of Defense. Report to the Congress on the Strategic Defense Initiative. 1985. p. 63.

ON CAMPUS WITH WOMEN

reprinted from the publication of the same name published by the Project on the Status and Education of Women, Assn. of American Colleges, 1818 R St., NW, Washington, DC 20009

Winter 1986

2070 Will Be a Good Year for Women College Presidents

The number of women heading colleges and universities has increased by 93 percent in the past decade so that one in ten higher education institutions has a female chief executive, according to a new study by the American Council on Education (ACE). Between 1975 and 1984 the number of women presidents increased from 148 to 286, an average net gain of nearly 14 positions per year. "At the current rate, assuming no increase in number of institutions, there will not be an equal number of women and men presidents in U.S. colleges and universities until 2070," noted Judy Touchton, associate director of ACE's Office of Women in Higher Education which conducted the study.

Most women still head small institutions, although the percentages of women heading larger institutions have increased during the last decade: in 1975, three percent of women presidents led larger institutions; in 1984, 27 percent filled the top position at larger institutions. The study also found that currently 42 percent of women presidents head two-year institutions. For more information, contact The Office of Women in Higher Education, ACE, One Dupont Circle NW, Suite 829, Washington, DC 20036.

Economic Textbooks: Biased Against Women?

The Committee on the Status of Women in the Economics Profession of the American Economic Association has begun a textbook project which has two goals:

* to assess the extent of sexual bias in the curricular materials now in use; and
* to persuade textbook publishers to begin to consider the extent to which various texts are, or are not, gender balanced.

To date, the committee has studied 21 major introductory economic texts and found that not only is the quantity of coverage of gender-related topics inadequate, but when authors make reference to gender they often do so in ways which conform to negative stereotypes of women and "women's work." For example, one text illustrated a point by using men in the roles of playwright, general, lawyer and gambler. The only woman referred to had no particular job and hid her money in a mattress. For further information on the study, contact Susan Feiner, Department of Economics, Virginia Commonwealth University, 1015 Floyd Ave., Richmond, VA 23284.

More Women Role Models Needed at Yale

Yale University is aiming to double the number of tenured women on its arts and sciences faculty by 1990. Currently, only 17 (5.3 percent) of the 320 tenured arts and sciences faculty are women. The announced hiring goal was a response to a 1984 committee report on the education of women which said that it is crucial for Yale to find and attract qualified women scholars in sufficient numbers to act as role models for Yale women students.

Report Reviews Ten-Year Employment Gains of Women

Women's gains in the job marketplace can best be measured in sheer numbers, in the work they are hired to do, and in their educational attainment, according to the U.S. Department of Labor publication that documents the employment progress of women over the past ten years. The report, prepared by the Women's Bureau for the World Conference in Nairobi, notes that increasingly women are moving into nontraditional areas, particularly management, law, engineering, police work, and the skilled trades. And more women are becoming entrepreneurs, opening their own businesses.

Remarking on the increase in education noted in the report, Lenora Cole Alexander, director of the Women's Bureau said, "Fewer women are dropping out of school before obtaining a high school diploma, and greater proportions not only graduate from high school but go on to college. Women now account for more than half of the enrollments in institutions of higher learning, and more women are pursuing advanced degrees. Today we also see more high school girls studying math, chemistry, and related courses that will equip them for better-paying jobs. We view these developments as very positive signs, because women's employment status is affected greatly by their educational attainment," she noted.

The publication reports on the labor force status of women, characteristics of women workers, and groups such as women apprentices, farm women, and labor union women. One chapter discusses government activity that impacts on women in such areas as job training, retirement income, and occupational health and safety. Other sections deal with programs of the Women's Bureau and nongovernmental organizations during the decade, and with prospects for women in the labor force of the future. The 155-page report, "The United Nations Decade for Women, 1976-1985: Employment in the United States," provides charts and graphs, key provisions of federal legislation and regulations affecting women during the period covered, and a selected bibliography. Single copies are available free from the Women's Bureau, U.S. Department of Labor, 200 Constitution Ave., NW, Washington, DC 20210. A self-addressed mailing label enclosed with orders will expedite handling.

Computer Anxiety on the Wane but Women Still Trail Behind the Men

In 1984, over half of all entering freshmen had completed a high school course in computer science—65 percent of the men and 53 percent of the women. According to the Carnegie Foundation for the Advancement of Teaching, this interest in computers persists once students have enrolled in college. The percentage of women students who had written a computer program in their freshman year increased from 22 percent in 1982 to 44 percent in 1984; during that same time period the percentage of men students who had written a computer program in their freshman year went from 33 percent to 57 percent.

Who Says Women and Blacks Are Not Good at Math?

White female and Black high school seniors did as well as white male seniors on math examinations if they were equally skilled as sophomores and if they had taken the same number of math courses, according to a recent study of almost 10,000 high school students nationwide. The research suggests that differences in mathematics test scores could be reduced further if not eliminated by encouraging all females and Black males to study math, according to Lyle V. Jones of the University of North Carolina at Chapel Hill, who conducted the study.

Help for Evaluating Math and Science Programs Available

Are your math and science programs doing everything they can to encourage women to pursue a career in the field? Are they dealing with the issue of women's low achievement in math and science? A new book is available to show how teachers, counselors, directors and administrators can assess and evaluate their math and science programs. *Evaluating Intervention Programs* by Barbara Gross Davis and Sheila Humphreys offers easily understandable guidelines for conducting an evaluation, and case studies that highlight the requirements of evaluating special programs. They explain how to design an evaluation, prepare questionnaires and conduct interviews and tests, and then give suggestions on how to make sense of the information gathered, how to share what is learned, how to work with consultants, and how to plan the cost of an evaluation.

The book is available for $15.95 plus $1.50 postage and handling from Teachers College Press. Institutions should mail their orders to: Teachers College Press, c/o Harper and Row, Keystone Industrial Park, Scranton, PA 18512. Personal orders should be addressed to: Teachers College Press, P.O. Box 1540, Hagerstown, MD 21741.

Women's Spatial Ability

Many of the studies quoted to show that men have greater spatial ability than women are in fact statistically flawed, according to researchers at the Ontario Institute for Studies in Education. Writing in the July 1985 issues of *American Psychologist*, Paula J. Caplan, Gael M. MacPherson, and Patricia Tobin note that even the term "spatial ability" has never really been satisfactorily defined and is used inconsistently from one study to another.

Women Science and Math Majors: High Grades, Low Self-Esteem

Women science and math majors in college are less satisfied academically than other women in college, according to a recent study. Norma C. Ware of Radcliffe College and Valerie Lee of the Educational Testing Service also found that on a measure of self-esteem, women generally scored lower than men with women science majors scoring lowest among women.

The nationally representative study of male and female college sophomores of above-average ability showed that only 14 percent of the women, as opposed to 40 percent of the men, chose a scientific major and that women students who place a high priority on future family and personal life were less likely to major in the sciences. The study also indicated that those most likely to major in science or math are hardworking students with ambitious educational goals, good grades and academically-oriented friends.

Spring 1986

Women in Nontraditional Careers: A Discouraging Word

Women are discouraged by sex discrimination and sex-role stereotyping from considering careers in science and engineering, according to a report from the U.S. Congress' Office of Technology Assessment (OTA). Women who do become scientists and engineers face differential treatment such as less pay and fewer promotions than men. The OTA report also indicates that "women's attrition rates from scientific and engineering careers are 50 percent higher than men's and their unemployment rates are more than double." In academia, "men are far more likely than women to hold tenure-track positions, to be promoted to tenure and to achieve full professorships."

According to the report, "The differential treatment of women in the work force directly violates the principle of equality of opportunity because it affects people who have established, by virtue of

obtaining an advanced degree, the right to pursue a scientific or engineering career based solely on the quality of their work. ...It also has a significant discouraging effect on female students in the educational pipeline, who see the future benefits of their investment in science and engineering education eroded by potential unemployment and underutilization in the work force." For a free copy of "Demographic Trends and the Scientific and Engineering Work Force," contact the Office of Technology Assessment, Washington, DC 20510.

Survey Finds Men and Women Still Like to Play Together

A recent survey of *Women's Sport and Fitness* readers found that almost 70 percent of the respondents believe women's and men's sports should be kept separate. Yet because 79 percent prefer to play sports with others of the same skill level, regardless of gender, 52 percent of the women wind up playing with men.

Eighty percent of the respondents believe that men feel threatened by losing to women, and while 94 percent felt participation in sports does not "diminish a woman's femininity," 58 percent said that women are often forced to choose between being feminine and being athletes. Thus their disapproval of coed sports may be because they feel women are better off not being subjected to rigid sex roles and definitions of femininity on the playing field.

Some of the other findings of the survey were:

- Parents exert little direct influence on female sport participation but playmates are a strong factor. Women who played mostly with girls are much less likely to be sport participants than those who played mostly with boys or in coed groups.
- Girls who played mostly with girls as children are least likely to view their bodies positively in adolescence.
- There is a strong correlation between participation in high school and college varsity sports and participation in sports later in life.
- The support of men friends toward sport participation related directly with one's degree of interest.
- Women believe that participation in racially mixed sports groups reduces prejudice.

A summary of the "Miller Lite Report on Women in Sports" is available for $4.00 from the Women's Sports Foundation, 195 Moulton St., San Francisco, CA 94123.

What Effect Does Faculty Gender Have on Students' Participation in Class?

A study done at Harvard University shows that the professor's gender has an impact on classroom discussions and who participates in them. In reviewing videotapes of 24 instructors and their classes at Harvard, Catherine G. Krupnick found that male students dominated class discussions when the teacher was a man and most of the students were men. Male students, in that setting, talked two and a half times as long as female students. In contrast, Krupnick, a lecturer in psychology and social relations, found that in the presence of female instructors female students talked three times as long as when men were teaching. Despite this, her research also shows that the female students never talked as much as the men in the classes.

Krupnick's research is described in the first issue of *On Teaching and Learning*, a new journal published by the Harvard-Danforth Center for Teaching and Learning, and includes recommendations on how teachers can promote equality by closer monitoring of their classes. *On Teaching and Learning* is available for $3.50 plus 65 cents postage, from Margaret Gullette, Editor, Harvard-Danford Center for Teaching and Learning, 11 University Hall, Harvard University, Cambridge, MA 02138.

Some Things Haven't Changed

Back in 1968 psychologists did a study and found that an article was judged superior when it was supposedly written by a man but not so when it was supposedly written by a woman. The bad news is that times haven't changed much.

Two Kent State University psychologists asked 300 men and women to evaluate an article that was supposedly written by John T. or Joan T. or Chris T. or by an anonymous author. Whether the articles were on masculine, feminine or neutral topics they found that those supposedly written by a man were rated as more insightful, better written and higher in overall quality.

Commenting on the obvious pro-male bias, researchers Michele A. Paludi and Lisa A. Strayer note that the role of the male is more highly valued by males and females in the North American culture, so even when the behavior is identical men's behavior is rated higher than women's. The study appeared in *Sex Roles*, Vol. 12, No. 3/4, 1985. Reprints of the article are available free while supplies last from Michele A. Paludi, Dept. of Psychology, Kent State University, Kent, OH 44242.

How Many Women Receive First Professional Degrees?

From 1972-73 to 1982-83 the number of women who received first professional degrees increased 518 percent, form 3,529 to 21,826. According to the American Council on Education, women made significant gains in all professional fields, with their proportion of law degrees increasing from one percent to 36 percent and their proportion of medical degrees increasing from nine percent to 27 percent. Sixty percent of women's first professional degrees were in law.

Want a Hard Worker? Hire a Woman

Researchers at the University of California, Santa Barbara, in a study of men's and women's working patterns, have found that women work harder than men, at home and at their jobs. William and Denise Bielby's study of 1,515 workers showed that 65 to 70 percent of women give more time and attention to their jobs than men despite the fact that women also spend more than twice as much time on household tasks.

The study challenges the popular belief that women allocate less effort to outside employment because of their household and family responsibilities and therefore seek less demanding jobs with lower pay. Quite the contrary, say the researchers; in fact, other studies have suggested that women tend to underestimate the value of their work, so "our estimates may actually understate the sex difference in allocation of effort." Results of the study were presented at the 1985 annual meeting of the American Sociological Association.

DEADLINES:	Mar. 24 for May-June, May 24 for July-Aug., July 24 for Sept.-Oct.
AD DEADLINES:	Apr. 5 for May-June, June 5 for July-Aug., Aug. 5 for Sept.-Oct.
ADDRESSES:	Send all Newsletter material **except ads** to Anne Leggett, Dept. of Math. Sci., Loyola University, 6525 N. Sheridan Rd., Chicago, IL 60626. Send everything else, **including ads**, to AWM, Box 178, Wellesley College, Wellesley, MA 02181.

AWM Election for 1988

Your Nominating Committee would appreciate suggestions for President Elect and Treasurer. Please contact a member of the Committee.

Tilla Milnor
Linda Rothschild, Chair
Bhama Srinivasan

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 Arizona. Dept of Math, Tucson, AZ 85721. Tenured or tenure track position, Fall, 1987. Qualifications: ability to contribute to teacher preparation program & enhancement of math teaching at precollege level. Send letter, resume & at least 3 references to Head of Math Dept by 4/1/87, or later if position remains unfilled.

CA State University, Los Angeles. Dept of Math & Comp Science, Los Angeles, CA 90032. Tenure track position, any rank. Required: PhD in math, math educ or in comp sci with strong background in math. Strong comp sci background desirable & ABD toward PhD in comp sci will be considered for one year temporary. One year visiting position also available in math with PhD & strong record. Starting date 9/1987. Salary: $28,300 - $53,500 with add'l summer employment possibilities. By 2/1/87 contact Wayne Bishop, Chair, at above address.

Connecticut College. Math Dept, Box 1566, New London, CT 06320. E. C. Schlesinger, Acting Chairperson. Asst professorship in math & comp sci Aug 1987. Two year renewable appt. PhD required. Teaching comprises introductory & advanced courses in math & comp sci (3 courses per semester). Send resume & 3 letters of recommendation to Acting Chairperson.

Univ of Connecticut. Dept of Math, 196 Auditorium Rd, U-9, Storrs, CT 06268. Prof J. Tollefson, Head. Tenure track position at Stamford Regional Campus. Required: PhD in math & some teaching experience. Seeking individuals qualified to develop & offer introductory graduate courses in applied math. Screening starts 3/1/87 & will continue until position is filled. Send vita & have 3 reference letters sent to Head.

University of New Haven. Dept of Math, 300 Orange Ave, West Haven, CT 06516. Dr. Baldev K. Sachdeva, Chmn. Full time tenure track asst/assoc professorship 9/1/87. Qualifications include PhD in math with specialization in applied math preferred; demonstrated excellence in teaching and potential for research. Teaching load is 24 credit hours per academic year. Position offers opportunities to participate in the development of courses, programs & research activity. Salary & rank commensurate with qualifications. By 3/31/87 send resume & arrange for transcripts & 3 letters of reference to be sent to Chmn.

DePaul University. Dept of Math, Chicago, IL 60614. Three tenure track asst professorships 9/1987. Assoc professors may also apply. PhD in math required. Candidates should show potential for continuing mathematical research & have strong commitment to good teaching. Official teaching load is 9 quarter courses/year, but a reduction to seven quarter courses/year for sustained research is typical. Summer teaching is often available. Send vita & 3-4 letters of recommendation at least one of which comments on teaching ability to: Hiring Committee, Dept of Math, 2323 N. Seminary, Chicago, IL

60614.

Sangamon State Univ. Comp Sci & Management Information Systems, Springfield, IL 62708. Tenure track faculty positions one comp sci, two MIS, beginning 8/15/87. Rank/salary commensurate qualifications & experience. Qualifications Computer Science: Comp Sci PhD preferred; Comp Sci Master's or PhD in related field with experience required. Qualifications MIS: PhD or DBA in MIS or PhD in Operations Research/Industrial Engineering preferred. PhD other areas with teaching/industrial experience in MIS will be considered. Search will continue until positions are filled. Submit resume with references, graduate transcripts & 3 letters of recommendation to Dr. Rassule Hadidi at above address.

Purdue University. Dept of Math, W. Lafayette, IN 47907. M. S. Baouendi, Head. (1) Several regular or research professorships 8/1987. Required: Exceptional research promise & excellence in teaching. (2) Possibly one position at the assoc prof/prof level 8/1987. Excellent research credentials required. For all positions send resume & 3 letters of recommendation.

Iowa State Univ. Dept of Math, Ames, IA 50011. K. A. Heimes, Chmn. One or more asst professorships (or above) 8/21/87. Preferred specialty: numerical analysis & discrete math. Other areas of interest are control theory, math educ. & partial differential equations. Required: PhD or equivalent, strength in teaching & research, good communication skills, & ability to direct research in a graduate program. Send application, resume & 3 reference letters to Chmn.

University of Louisville. Dept of Engineering, Math & Comp Sci, Speed Scientific School of Engineering, Louisville, KY 40292. Tenure track asst/assoc professorships, 12 mos. 1987-88. Required: PhD in Engineering Math, Applied Math, Comp Sci & Engineering. Candidates should have teaching & research interests in engineering/applied math, comp. applications of math, A.I., computer control/automation, image processing, and/or computer communications. Duties: research & teaching of graduate & undergraduate courses. Applications accepted until positions are filled. Contact Dr. Arthur M. Riehl at above address.

University of Maine, Farmington. Learning Center, 112 Main St, Farmington, ME 04938. Dr. Peter Williams, Chmn of Search Committee. Two tenure track positions. (1) Teach math & comp sci courses depending upon candidate's background. (2 Teach undergraduate courses in math for elementary & secondary majors and math for liberal arts & business majors. Prefer PhD in math or math education (by 9/1987). Positions available 9/1/87. Salary $24,000 - $26,000. Normal teaching load 12 hrs per semester. Screening begins 3/1/87. Send vita & 3 reference letters to Dr. Williams at above address.

University of Maine, Machias. Science Math Division, 9 Machias Ave, Machias, ME 04654. Dr. Charles D. Duncan, Chair. Tenure track position teaching a variety of math service courses to environmental science, biology, business, education & liberal arts students. Particular sensitivity to the needs of non-traditional & underprepared students is necessary. Minimum qualifications include a masters degree in math. Interest in environmental studies & in contributing to this major program is also desirable. Starting date: 9/1987.

By 3/23/87 send application, detailed curriculum vitae & 3 letters of reference to Chair.

Holy Cross College. Dept of Math, Worcester, MA 01610. Thomas E. Cecil, Chmn. (1) One tenure track position 9/1987 for mathematician interested in teaching at an undergraduate liberal arts inst. PhD required. Teaching load 3 courses each semester.(2) One tenure track position in dept which is developing a concentration in computing. Required: PhD in C.S. or in math with strong interest & background in comp sci. Rank & salary open. Special funds available to assist computer scientist in forming ties with appropriate private corporation. Send resume, undergraduate & graduate transcripts & 3 letters of reference to Chmn.

MIT Sloan School of Management. E53-383, Cambridge, MA 02139. Tenure track position (asst or untenured assoc prof) in Statistics Group of Sloan School of Management. Required: potential for excellence in research & ability to teach in our Master's & Doctoral programs. Seeking statistician with interests in theory applications & computing who could interact successfully with Sloan School faculty in areas such as finance, marketing & information systems. Required: PhD or prospects of its early completion. Send resume & 3 letters of reference & sample of research to Prof. Roy E. Welsch at above address.

Smith College. Dept of Math, Northampton, MA 01063. Non tenure track instructorship 1987-88. Teaching load is 3-2 with one course each semester at junior/senior level. Send vitae & at least 3 letters of reference to Kathy Bartus at above address.

Northern Michigan University. Dept of Math & Comp Sci, Marquette, MI 49855. Dr. Terrance Seethoff, Head. Two tenure track positions. (1) Comp. Sci. Prefer PhD (or nearly completed one) in comp sci or related field. (2) Math education. Required: PhD or EdD in math education. Our Glenn T. Seaborg Center offers many opportunities for growth & professional involvement in math education. Commitment to teaching essential for either position. Scholarship & professional activity are both encouraged & supported. Send transcripts, resume & 3 letters of recommendation to Head.

University of Michigan, Dearborn. Dept of Math & Stat, 4901 Evergreen Rd, Dearborn, MI 48128. Ronald Morash, Chmn, Search Committee. (1) Tenure track asst professorship 9/1987. Required: PhD in math with res. interest in an applied area. Teaching capability in applied area is desirable. (2) Possible assoc professorship in comp sci. PhD in math acceptable. Research interest in comp sci is preferred for this position; some teaching capability in math is required. Teaching load 9 credit hrs per term. Send resume & have 3 letters of recommendation sent to Chmn, Search Committee.

Wayne State University. Dept of Math, Detroit, MI 48202. Clarence W. Wilkerson, Jr., Chmn. Several tenure track positions, Fall, 1987. PhD required. Higher rank or tenure possible for those extremely qualified with established res. records & national or international reputation. May be a few lectureships or visiting positions. Duties: undergraduate & graduate teaching & research. Current areas of interest: statistics, algebra, combinatorics, functional analysis, geometry, analysis & topology. Salary & rank to be negotiated. Send resume & have 3 letters of reference sent to

Chmn.

Mankato State University. Dept of Math, Astronomy & Stat, Mankato, MN 56001. F. T. Hannick, Chairperson. Tenure track position in math. Rank/salary depend on qualifications. Required: PhD in math. Special interest: algebra, analysis, applied math, math educ & stat. Strong interest in teaching at freshman thru graduate levels & evidence of successful teaching at postsecondary level. Teaching load 36 quarter hours per 9 mo. academic year. Appointee will teach math, advise students, serve on dept committees & do research. Open until filled. Send application, vita, res. & teaching interests & 3 letters of reference to Chairperson.

Moorhead State University. Math Dept, Moorhead, MN 56560. Milton Legg, Chair. Tenure track asst/assoc professorship 9/1987. PhD in math. Prefer those with successful college teaching experience. Duties: teach undergraduate math, advise students & do university & dept committee work. Screening applications begins 3/15/87 & will continue until position is filled. Apply to Chair.

Southwest Missouri Univ. Dept of Math, Springfield, MO 65804-0094. (1) Two asst/assoc professorships 8/19/87. (2) Three newly created asst professorships or higher. Required for all positions: PhD or research credentials equivalent to a PhD & commitment to teaching. For assoc/prof & prof appts established res. & teaching records are required. Salary dependent on qualifications. Prefer candidates in algebra, applied math & analysis. Screening starts at once & will continue until positions are filled. Send curriculum vitae & have 3 letters of recommendation sent to Simon J. Bernau at above address.

University of New Hampshire. Dept of Math, Durham, NH 03824. Tenure track position in math education 9/1987. Rank & salary open. Duties: teach undergraduate & graduate courses in math educ & undergraduate courses in math; engage in research, proposal writing & scholarly activity; supervise student teachers & interns at all precollege levels; advise students in math educ & direct PhD dissertations in math educ; participate in outreach activities with New Hampshire schools. Qualifications: PhD or EdD in math educ or equivalent by 8/1987. Strong background (preferably master's level) in math. Commitment to quality teaching (precollege teaching experience preferred). For appts above asst prof level record of published research in math educ is required. By 3/30/87 send vita, official transcripts & 3 letters of recommendation to Math Educ Search Committee at above address.

Trenton State College. Dept of Math & Stat, Trenton, NJ 08650-4700. Two tenure track asst professorships. (1) Statistics. Prefer PhD. Required: background in stat or probability. Duties: teaching, research & developing expertise in one or two applied areas of stat. (2) Mathematics. Required: PhD (or nearly so). Duties: teaching broad range of undergraduate & graduate math courses. Applications received until 3/16/87 or until position is filled. Apply to George J. Pawlikowski, Chmn of Search Committee , at above address.

Hamilton College. Dept of Math & Comp Sci, Clinton, NY 13323. Larry Knop, Chair. Two year tenure track position. PhD required. 3 years teaching

experience desirable. Duties: teach 6 courses per year. Required: excellence in teaching & continued scholarly research. Send curriculum vitae & 3 reference letters (one about teaching) to Chair. (315) 859 4783.

Hofstra University. Dept of Math, Hempstead, NY 11550. Harold M. Hastings, Chair. Two faculty positions expected Fall 1987. Duties: teaching (10-12 hours) and research. Prefer algebraist for one position; no preference for second position. All well qualified applicants considered. Rank dependent upon qualifications and experience. Appt to Asst Prof requires PhD by 9/1987; Instructorship requires completion of all PhD course work and some progress on dissertation. Salary competitive. Send application, vita & 3 letters of reference to Chair.

New York State College at Buffalo. 1300 Elmwood Ave, Buffalo, NY 14222. Two anticipated openings: Asst Prof tenure track. Earned doctorate in Math, Math Ed. or computer science related. Must be interested in students and teaching. Math Ed will have responsibility for Teacher Ed. programs for sec. school teaching. C.S. will be involved in new program in math sciences & must be familiakr with computational mathematics & programming. Experience is not necessary, professional growth is expected, research desirable. Salary competitive & negotiable depending on experience. Send application, resume, transcripts & 3 letters of reference to Dr. Ruth Heintz, Chair of Math Dept. Applications accepted until position is filled.

Rensselaer Polytechnic Inst. Dept of Math Sciences, Troy, NY 12180. J. G. Ecker, Chmn. Seek high quality applicants for several tenure track openings at all levels in areas of applied math, including mathematical programming, 9/1987 or earlier. PhD & very strong research potential required for junior-level appts & demonstrated outstanding record for senior-level appts. Also anticipate 2 or 3 Visiting & Postdoctoral appts at all levels.

SUNY - Buffalo. Dept of Math, 106 Diefendorf Hall, Buffalo, NY 14214. Dr. Jonathan Bell, Search Committee Chairman. Tenured assoc prof/professorship 9/1/87. Salary competitive. Seeking applicants with outstanding research in areas of applied math, applied analysis & numerical analysis. By 3/15/87 send curriculum vitae & other supporting information to Dr. Bell.

SUNY College at Plattsburgh. Dept of Math, Plattsburgh, NY 12901. Tenure track positions 9/1987. Appts possible at all levels. Duties: undergraduate teaching, research & service to the College. Required: PhD in math, stat or math education. Screening starts 3/1/87 & will continue until positions are filled. Contact Dr. Robert Hofer, Chairman, Search Committee , at above address.

Oregon State University. Dept of Comp Sci, Corvallis, OR 97331-4602. Walter G. Rudd, Chmn. (1) Dept of Comp Sci at OR State Univ & Tektronix, Inc. are sponsoring 2 new graduate fellowships in Comp Sci, beginning fall quarter, 1987. Stipend of $10,000 per year. Recipients will be chosen on basis of undergraduate performance, scores on graduate record exam & references. Expect recipients to enroll in PhD program in Comp Sci. Contact Chmn. (2) Graduate assistantships in comp sci 9/16/87. Candidates must be admitted to Graduate School, should have good undergraduate background in comp sci, or closely related field, should have an interest in teaching or research, and be

able to communicate well with professional peers. Please send detailed personal vitae to Graduate Advisor, Dept of Comp Sci: brief letter explaining your background, educational goals and qualifications; degrees obtained, colleges & univs attended, and official transcripts; professional experiences, achievements, and positions held, including areas of res. or classroom or laboratory instruction; area of technical interest in comp sci; publications and/or associated res. documents; professional society memberships, offices, service; honors, citations, or other recognition; GRE aptitude scores & TOEFL for foreign students; 3 professional references.

PA State University at Harrisburg. The Capital College, Middletown, PA 17057. Computer Science faculty. Tenure track position in Comp Sci 9/1987. Rank & salary dependent on qualifications. Prefer PhD in comp sci. Will consider those holding PhD in math or related field. Teach undergraduate & graduate students & do research. Please indicate your visa status when applying to: Dr. William Welsh, Jr., Head, Division of Science, Engineering & Technology, c/o Robert H. Hamill, Business Office, Box AWM, The PA State University at Harrisburg, The Capital College, Middletown, PA 17057. Position open until filled.

Washington State University. Pure & Applied Math, Pullman, WA 99164-2930. Prof. Duane W. DeTemple, Chmn, Search Committee. Two openings, one tenure track & one temporary 8/1987. Tenure track position requires PhD with active research interests in computational math, numerical analysis or operations research/combinatorial optimization. Area of research is more open for temporary position. By 2/15/87 send vitae & 3 letters of reference to Chmn.

Marshall University. Dept of Math, Huntington, WV 25701. Instructor/Assistant/Associate Professor. Tenure track and/or one-year temporary positions. To be considered for tenure track, applicant must receive doctorate in mathematics or related area no later than 9/1/87; for temporary, minimum degree is Master's in mathematics. Application deadline: 3/15/87 or until positions are filled. For complete position descriptions, contact Dr. Steven Hatfield, Search Committee Chairman, at above address.

Association for Women in Mathematics
Box 178, Wellesley College, Wellesley, MA 02181
617-235-0320 Ext 2643

Application Blank

The AWM membership year is Oct 1 to Oct 1

Individual $15 _____
Family $20 _____
Contributing Member $20 or more in addition to regular dues _____
Retired, Student, Unemployed $5 _____
New Member Rate:(Individual) (Applicable only to those who are joining AWM for the first time.) For each of 1st 2 years $10_____
Foreign members please remit $8.00 additional for postage.
Institutional (2 free advertisements per year in Newsletter)
Sponsoring, Category I $65 _____
(Includes nomination of 10 students for free membership for 1 year)
Sponsoring, Category II $45 _____
(Includes nomination of 5 students for free membership for 1 year)
Regular $25 _____

Name _____

Address _____

Institutional Affiliation, if any _____

Association for Women in Mathematics
Box 178, Wellesley College
Wellesley, MA 02181
March - April, 1987

Marie A. Vitulli
Univ of Oregon
Dept of Math
Eugene OR 97403