

## ASSOCIATION FOR WOMEN IN MATHEMATICS

## NEWSLETTER

Volume 6, number 1

January 1976

## REPORT FROM THE PRESIDENT

AMS Elections

Congratulations to Mary W. Gray who has been elected vice-president of the AMS. Mary's dynamism and broad experience and perspective will be a boost both to the AMS and the advancement of women in mathematics. Congratulations also to Phyllis Cassidy and Chandler Davis who were elected to the AMS Nominating Committee.

January Meeting in San Antonio

The following AWM events are planned for the Winter Joint Mathematics Meeting in San Antonio:

- An Open Executive Committee Meeting will be held on Thursday, January 22, 7-8 p.m., in room 32 of the Convention Center. This will be a working session; all members who wish to be involved in shaping policy and/or initiating and sponsoring AWM activities are urged to attend.

- A Panel, "Women Mathematicians in Business, Industry and Government," followed by a short Business Meeting, will be held on Friday, January 23, 12:30-noon, in the Corte Real Room of the Hilton Palacio del Rio Hotel. (Please check the final program published by the AMS and the MAA for possible room changes). We are very pleased to have as panelists: Leila Bram, Office of Naval Research; F. Jessie MacWilliams, Bell Laboratories; Lillian H. Rice, The Lane Co., Inc.; Marjorie L. Stein, U.S. Postal Service; Mary F. Wheeler, Rice University. I am moderating the panel and am looking forward to what promises to be an extremely informative and exciting session.

The AWM table will be located in the Convention Center between the AMS registration desk and the Banquet Hall (where the exhibits will be located). We will need volunteers at the tables to distribute AWM information including Newsletters and membership forms. Please drop by to sign up for a couple of hours (or just to say hello).

The AMS informs us that there will be some inexpensive accommodations for mathematicians attending the meetings, e.g. for women, the YWCA in downtown San Antonio is available at \$3/person/night. Arrangements can be made through the AMS if one pre-registers no later than January 16; pre-registration is \$2 for students or unemployed members of the AMS or MAA. After that date get in touch with the YWCA directly.

AWM Membership

You may be interested to find out, as I was, that according to our Fall 1975 membership list, AWM now has over 1100 members representing 49 states (the one exception is South Dakota), Puerto Rico, Washington, D.C., and 15 foreign countries: Australia, Brazil, Canada, England, France, Germany, India, Iran, Israel, Mexico, Saudi Arabia, Scotland, Switzerland, Turkey, and the USSR.

In order to further increase AWM membership and hence our effectiveness in the mathematical community at large, we are sending letters to various business, industrial, government and educational institutions describing AWM and our activities and encouraging women staff and students to apply. A copy of this letter is included in the Newsletter. I would greatly appreciate it if you would post this copy in an appropriate location in your institution.

Sectional Meetings

AWM sectional meetings have provided an opportunity for women mathematicians to get together to discuss common interests and concerns. If you are interested in arranging a sectional meeting, contact Alice Schafer at the Wellesley office who will supply a list of AWM members in your area. Good times for such meetings are in conjunction with other mathematics sessions. For times and locations of meetings, see the Notices of the AMS and the American Mathematical Monthly. Announcements of AWM meetings can be made in these publications, as well as in the AWM Newsletter, if sufficient advance notice is given.

Speakers Bureau

Requests for speakers are coming from various organizations. If you would like to join the Speakers Bureau, please submit you name, topics for talks and audiences for which suitable to the Wellesley office. Also, please encourage your own institutions to use the Bureau. A complete listing of speakers is available on request.

Update on AWM's application to CBMS

AWM's application for affiliate membership in the Conference Board of the Mathematical Sciences ("the society of mathematical societies") is still pending the MAA's affirmative vote. All other constituent members of the CBMS (i.e. the AMS, ASL, IMS, NCTM and SIAM) have by now voted for AWM's membership. AWM meets the CBMS criteria decided upon last summer in Kalamazoo. We have written to the MAA Board of Governors urging that they vote at their January meeting to assure AWM's membership in the CBMS without further delay.

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 Again, I would appreciate any comments and suggestions on AWM endeavors and directions. I hope to see you in San Antonio.

Lenore Blum  
 Department of Mathematics and  
 Computer Science  
 Mills College  
 Oakland, CA 94613

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 Editor's note: The letter for recruiting new members can be found on the back page. We appreciate your posting this. Thank you.  
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SECOND ANNUAL REPORT OF EMPLOYMENT OF WOMEN IN MATHEMATICS DEPARTMENTS

by Judy Green, AWM Employment Officer

Again this year I have used the figures of the AMS annual survey of faculty salaries (October 1975 Notices) to compare for two consecutive years, the percentages of women on faculties of departments in mathematical sciences. While the percentages no longer seem to be uniformly declining (see AWM newsletter April 1975 for the first report), neither are they increasing substantially. For example, at four year colleges and universities, for women with Ph.D.'s, the only increase of more than 0.3% occurred in the most prestigious mathematics departments where the addition of 8 women assistant professors in 20 departments pushed the percentage up from 2.6% to 3.4%.

This year I am also including information about the employment rate of new Ph.D.'s, using figures taken from the October 1974 and the October 1975 Notices. Note however that the figures for employment by type of department come only from this year's survey and therefore differ from those given in last year's report.

The doctorate granting departments are again divided as follows:

- I: the 27 most prestigious mathematics departments in the US
- II: the 38 next best mathematics departments in the US
- III: the rest of the mathematics departments in the US
- IV: statistics, biostatistics and biometric departments in the US
- V: departments in the mathematical sciences in the US not included above
- VI: Canadian departments in the mathematical sciences.

	<u>percentage of women on faculty</u>		<u>percentage of women on tenured faculty</u>	
	1974-75	1975-76	1974-75	1975-76
<b>Doctorate granting</b>				
I without doctorate	66.7	50.0	100.0	100.0
with doctorate	2.6	3.4	2.0	1.9
total	2.8	3.5	2.3	2.1

II without doctorate	32.4	32.4	11.1	11.1
with doctorate	4.2	4.3	2.9	3.4
total	5.1	5.3	3.0	3.5
III without doctorate	25.5	26.9	24.9	24.8
with doctorate	4.6	4.5	3.8	3.5
total	7.3	7.2	6.7	6.2
combined I, II & III without doctorate	26.8	27.8	25.0	24.6
with doctorate	4.0	4.2	3.1	3.1
total	5.6	5.8	4.6	4.5
IV without doctorate	38.2	40.0	45.4	38.4
with doctorate	4.6	4.9	2.9	2.9
total	7.1	7.3	4.6	4.5
V without doctorate	4.3	5.3	0.0	0.0
with doctorate	4.4	4.2	2.0	2.7
total	4.4	4.3	1.9	2.6
VI without doctorate	17.5	21.6	17.2	17.9
with doctorate	2.2	1.9	1.3	1.2
total	3.5	3.4	2.7	2.5

	percentage of women on faculty		percentage of women on tenured faculty	
	1974-75	1975-76	1974-75	1975-76
Masters granting				
without doctorate	26.1	25.3	19.9	19.2
with doctorate	8.4	8.5	8.2	7.5
total	13.5	13.1	11.7	10.9
Bachelor granting				
without doctorate	21.7	21.7	15.9	15.6
with doctorate	10.0	9.8	10.3	8.9
total	14.8	14.3	12.7	11.6
Combined doctorate, masters and bachelor granting				
without doctorate	24.2	24.2	19.2	18.7
with doctorate	5.8	5.9	4.9	4.7
total	9.4	9.2	7.7	7.2
Two year colleges				
without doctorate	17.5	18.9	15.6	17.0
with doctorate	12.1	19.6	12.4	10.4
total	16.9	19.0	15.3	16.5

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	1974	1975
percentage of women among new Ph.D.'s	9.1	10.1
unemployed new Ph.D.'s	11.1	15.0
underemployed new Ph.D.'s	#	12.5

	percentage among new Ph.D.'s of unemployed new Ph.D.'s		percentage among new Ph.D.'s of underemployed new Ph.D.'s	
	1974	1975	1974	1975
men and women	4.5	6.0	#	9.3
men	4.5	5.7	#	9.1
women	4.9	8.1	#	10.5

# no information is reported about part time employment in the October 1974 Notices.  
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MATH FOR GIRLS AT THE LAWRENCE HALL OF SCIENCE

Two hundred girls, ages 6 to 14, have participated in eight-week courses called 'Math for Girls' at the Lawrence Hall of Science, a public science center on the Berkeley campus of the University of California.

For many who enroll in this tuition course, math is a subject that either scares, mystifies, or bores them. Our intention is to introduce girls to 'hands-on' experiences in logical thinking and problem solving that stimulate their curiosity and interest in mathematics. Puzzles, games, and computer activities show a side of mathematics that can be as fun as it is challenging.

The need for such a class became apparent after we surveyed the enrollment of the Hall's classes in physical and life science, computer science, and mathematics. Female students comprised only 26% of the total number of students enrolled. Since Spring 1974, not only have 200 females taken Math for Girls, but the total number of females enrolled in other Lawrence Hall classes has doubled, increasing the total female enrollment to 34% of the student population.

Math for Girls is taught by women students at the University of California, Berkeley, who are majoring in mathematics, mathematics education, or computer science. The women are selected and trained on the basis of their interest and ability in mathematics, and their desire to act as role models of women in mathematics for their students. Throughout the eight weeks, time is set aside for discussion of girls' competency and interest in science and mathematics, and the stereotypic attitudes that can result in limited career expectations for women. The importance of electing science and mathematics courses in high school is stressed, since avoidance of such courses severely restricts an individual's choice of college major.

Activities in the eight-week sessions are selected to help students focus on fundamental concepts and relationships in mathematics: looking for numerical and geometric patterns; understanding variables and functions; strategically organizing information; classifying into sets; using coordinate systems and graphing; recognizing spatial relationships; estimating; and using logic to solve problems systematically. A discovery-oriented approach is generally used--students are encouraged to generate a variety of ideas and to concentrate on those that are most useful. Among the manipulative activities are included materials available from the Lawrence Hall of Science (towers of hanoi, topological puzzles, geoboards, and computer-controlled devices) and commercially available materials such as pattern blocks, attribute blocks, and geoblocks.

The program is experimental and the objectives are changing. Funding is being sought to bring Math for Girls to the larger Bay Area community by providing after school workshops in selected areas. We also expect to build into our future plans an evaluation component that will help determine the effectiveness of such an intervention program.

Interested people are encouraged to contact us to share information and resources. Call or write: Nancy Kreinberg, Lawrence Hall of Science, University of California, Berkeley, CA 94720 (415) 642-4193. Nancy Kreinberg

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LETTER

Professor P. Kochina, a member of the Academy of Sciences of the U.S.S.R. and a distinguished scholar specializing in theoretical mechanics, has published her autobiographical reminiscences (Moscow 1974), enlivened by her own drawings. So far this is available only in Russian.

Her brief biography of Sophia Kovalevskaya was published in an English translation by the Foreign Languages Publishing House, Moscow, 1957. The conclusion she reached twenty years ago remains relevant today:

"No one is now surprised at women professors and at women receiving degrees and prizes. But Sophia Kovalevskaya will always be distinguished among women scholars not only for her scientific achievements, but for the prominent part she played in blazing the trail for women in all fields of endeavour. This popularity is enhanced by her personal qualities, her integrity of character, her versatility, and her literary talent."

Lee Lorch

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AWM Events at the Joint Mathematics Meetings in San Antonio, January 1976

Executive Committee-Open Meeting, Thursday, January 22, 7-8 pm  
Room 32, Convention Center \*

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Panel: Women Mathematicians in Business, Industry and Government

Moderator: Lenore Blum, President, AWM

Panelists:

Leila Bram, Office of Naval Research  
F. Jessie MacWilliams, Bell Laboratories  
Alice Peters, Springer-Verlag  
Lillian H. Rice, The Lane Co., Inc.  
Marjorie L. Stein, U.S. Postal Service  
Mary F. Wheeler, Rice University

(and Business Meeting)

Friday, January 23, 10:30-noon  
Corte Real Room, Hilton Palacio del Rio  
Hotel \*

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The AWM table will be located in the Convention Center between the AMS registration desk and the Banquet Hall (where the exhibits will be located).

\* Check with the final program published by the AMS-MAA for possible room changes.

LADY LOVELACE AND THE ANALYTICAL ENGINE  
by Dana Angluin

In 1843, about a century before the earliest digital computers were built, a paper was

published in "Taylor's Scientific Memoirs" which described in some detail the design of a general-purpose digital computer, and gave several examples of programs for it. The design proposed is not very different from today's garden-variety digital computer, and demonstrates a rather sophisticated grasp of the concepts and problems of computing. It would seem that one of the ideas from the package marked "Twentieth Century" went astray, and proceeded to germinate, grow, and flower in the uncongenial soil of the nineteenth century.

One of the principal characters in the story of this development was an English countess, Augusta Ada Lovelace (née Byron), daughter of the poet Byron. Lady Lovelace has been called "the first computer programmer." The remainder of the present paper will be devoted to an account of her life and work. The account will appear in three parts, the first two in this issue.

- I. Ada's birth, childhood, and youth
- II. Babbage's calculating engines
- III. The collaboration and sequel

#### I. Lady Lovelace: Birth, Childhood, and Youth

Lady Lovelace's father was the English poet Lord Byron. Byron's life was and is the subject of passionate controversy and numerous biographies. It is now generally acknowledged that among a variety of other liaisons, he had an affair with his half-sister Augusta Leigh. The hints, rumours, and concealments of this "crime of incest" were no small part of the Byronic controversy, and were woven into his poetry.

Sometime after the affair with Augusta, Byron proposed marriage to Annabella Milbanke, a somewhat spoiled and very moralistic young woman. His proposal may have been motivated by the hope that Annabella might govern him and protect him from the temptation of relapsing into incest, and perhaps also by pique that she was one of the few women in London unmoved by his charms. Pecuniary considerations there were as well, since Byron, though propertied, was short of ready cash.

Annabella refused his offer. Gradually, though, she succumbed to the fascination of this famous, dissolute, young poet, and to the challenge of "saving his soul". She came to regret her refusal, and began to badger him with sermons on the reformation of his character. The courtship was re-opened. One of Byron's nicknames for her during that period was "The Princess of Parallelograms". She was studying plane geometry, but the name is suggestive of her Rectitude as well.

Byron proposed again, and Annabella accepted. He then began to have second thoughts. After much haggling of lawyers over the property-agreements, and some hesitation on Byron's part, the two finally were married in 1814. The couple frequently saw Byron's half-sister Augusta; Annabella only then began to suspect the incest, much to her horror and Byron's apparent relish. Far from governing him, Annabella grew increasingly terrified of Byron's cruel and capricious behaviour.

On December 10, 1815 a daughter was born to Annabella and named Augusta Ada Byron. About a month later, Byron wrote a note to his wife asking her to go for an indefinite stay with her parents, taking the infant Ada. She complied. Once she was home, Annabella and her parents decided to sue for a separation, and the attorneys got underway again.

Meanwhile, Byron got off a good, grieving poem entitled "Fare Thee Well", ending with the lines:

Fare thee well! thus disunited,  
Torn from every nearer tie,  
Sear'd in heart, and lone, and blighted,  
More than this I scarce can die.

Once the "deed of separation" was signed, in April of 1816, Byron left for the Continent, never to see England, his wife, or his daughter Ada again.

Annabella was also writing verses on her sorrow, begging Ada's forgiveness for "the heart withheld from thee". Annabella soon left her parents' and rented for a time a house in a Suffolk village, where she had difficulty keeping herself, the child, and four servants on the five hundred pounds a year allowed her by the terms of the marriage and separation. She



filled her time there with long walks, sailing, visiting the families of poor fishermen in the village, and writing endless letters to and about Byron's half-sister Augusta, on whom her Reforming tendencies had settled in Byron's absence. Soon they moved again, and spent most of Ada's childhood shifting restlessly about, staying with Annabella's parents, or with friends, or in rented houses.

On the Continent, Byron added a third canto to his narrative poem "Childe Harold" which began with the lines:

Is thy face like thy mother's, my fair child!  
Ada! sole daughter of my house and heart?  
When last I saw thy young blue eyes they smiled,  
And then we parted, -- not as we now part,  
But with a hope.

and ended, a hundred-and-some-odd stanzas of Harold's adventures later, with a blessing for Ada and his conviction that:

Yet, though dull Hate as duty should be taught,  
I know that thou wilt love me.

When Ada was about five years old, Byron sent some of his hair in a locket for the child to wear, and received a miniature of her from her mother. (Communication between Byron and Annabella was through Byron's half-sister Augusta; direct communication would have nullified the separation.) Also at about that age, Ada asked whether a Papa was the same thing as a Grandpapa, and whether God be a man or a lady.

In 1823 Byron went to Greece to join the battle for Greek independence. From Greece he wrote to his half-sister Augusta asking that Annabella send "some account of Ada's disposition, habits, studies, moral tendencies, and temper, as well as her personal appearance...I hope the Gods have made her anything save poetical -- it is enough to have one such fool in the family." In reply her mother sent a description of the eight year old Ada: "Her prevailing characteristic is cheerfulness and good temper. Observation. Not devoid of imagination, but it is chiefly exercised in connection with her mechanical ingenuity -- the manufacture of ships, boats, etc....Tall and robust." and enclosed a profile of the child.

In 1824 Byron died in Greece of a fever, with an unfinished letter on his desk addressed to Augusta, asking her to thank Annabella for the description. Apparently the child was immediately told of her father's death, for her mother writes: "Ada shed large tears ... It is a great comfort to me that I have never had to give her a painful impression of her father."

Ada's education was not neglected. She and her mother spent a year on the Continent after Byron's death. When Ada was fourteen her mother engaged a tutor at three hundred pounds a year to teach her mathematics. (The death of Lady Milbanke had increased Annabella's income to several thousand a year in the intervening time.) Annabella described Ada to the Tutor: "There are no weeds in her mind; it has to be planted. Her greatest defect is want of order, which mathematics will remedy. She has taught herself part of Paisley's Geometry, which she likes particularly." Ada also studied music. There is an anecdote to the effect that she took to walking round and round the billiard table while she practiced the violin, because her constant practicing had deprived her of necessary physical exercise.

As was the convention, Ada was presented at Court when she was seventeen, and participated in two London "seasons", going to balls, parties, dinners, the opera, the theatre. It was about this time that Ada went to one of Charles Babbage's Saturday evening parties with Sophia De Morgan, wife of the English mathematician Augustus De Morgan. Charles Babbage had invented a calculating machine which he called the Difference Engine. He kept a small model of it in his house and exhibited it to guests.

Sophia De Morgan writes of seeing the Difference Engine: "While other visitors gazed at the working of this beautiful instrument with the sort of expression, and I dare say the sort of feeling, that some savages are said to have shown on first seeing a looking glass or hearing a gun ... Miss Byron, young as she was, understood its workings, and saw the great beauty of the invention." In 1834 Ada was delighted to go to the Mechanics' Institute to hear Dr. Dionysius Lardner's lectures on Babbage's Difference Engine. She paid frequent visits to

Babbage's house in the company of Mrs. De Morgan or of Mrs. Somerville, who was a famous mathematician in her own right.

Meanwhile, Ada's foray into the marriage-market had succeeded; she was married to William, eighth Baron King, later Lord Lovelace, when she was nineteen. Her marriage and the bearing of three children put a temporary stop to Ada's active interest in Babbage's work, though she and her husband had Babbage to visit as often as they could tear him from his work.

## II. Babbage's Calculating Engines

Charles Babbage was born in 1792, and so was nearly of an age with Ada's father, Lord Byron. Babbage studied mathematics at Cambridge. In 1820 he and his lifelong friend John Herschel were appointed to carry out some calculations for the Royal Astronomical Society. During the tedious process of verifying the error-ridden calculations of the (human) computers they had engaged for the numerical work, Babbage exclaimed: "I wish to God these calculations had been executed by steam!" to which Herschel replied: "It is quite possible". Babbage became excited about the idea of making a machine to calculate mathematical tables by the method of differences. He designed and constructed a small model, and eventually got a model with six figures and two orders of differences to calculate a few simple mathematical tables.

The mathematical principle involved had long been known to the makers of mathematical tables. Suppose we take a polynomial, say  $x^2$ , and begin to tabulate its values for a stretch, say from 17 on. So we have:

x	17	18	19	20
$x^2$	289	324	361	400

One obvious way to go about extending this table is to add one to the last value of  $x$ , getting 21 in this case, and then to multiply this value by itself, getting 441 as the next value of  $x^2$  in this case.

However, if we look at the table we have constructed a little more closely, we might be prompted to "take differences", that is, to write down by how much each value of  $x^2$  exceeds its predecessor.

x	17	18	19	20
$x^2$	289	324	361	400
$\Delta x^2$		35	37	39

These numbers in turn seem to be increasing by 2 at each step, so we might conjecture that the next value of  $\Delta x^2$  is 41, and, in order for that to be true, the next value of  $x^2$  must be 441, which is the value we previously found for  $(21)^2$ . This is not fortuitous; it is in fact one instance of a general theorem on polynomials, that the  $n^{\text{th}}$  difference of a polynomial sequence of degree  $n$  is a constant sequence. This gives us a method of extending our table indefinitely at a cost of two additions per new entry.

Mechanical calculating machines capable of at least addition and subtraction, sometimes multiplication and division, had been built previous to Babbage's time -- the mathematicians Pascal and Leibnitz had each built one in the seventeenth century. What Babbage saw was how to combine the mechanisms used in these adding machines with the principle of constant differences in the tabulations of polynomials. As an example, we might use three sets of four discs each, where each disc may independently have one of ten positions (representing the digits 0 to 9). These are used to hold the three values that we need to calculate the next value of  $x^2$ :

A:	0 4 4 1	$\Rightarrow$	0 4 4 1	$\Rightarrow$	0 4 8 4
B:	0 0 4 1	$\Rightarrow$	0 0 4 3	$\Rightarrow$	0 0 4 3
C:	0 0 0 2	$\Rightarrow$	0 0 0 2	$\Rightarrow$	0 0 0 2

These are to be connected by adding machinery and sequencing mechanisms so that at the turning of a crank (say), the number recorded in register C above would be added to that in



register B. When that action is complete, another similar mechanism might come into play, adding the contents of register B to register A. At this point, the operator writes down the number represented in register A, and the whole mechanism is ready to produce the next value of  $x^2$  at another turn of the crank. (Babbage actually arranged for the machine to print the result and begin the next cycle automatically.)

In 1822, at the age of thirty, Babbage read a paper to the Royal Astronomical Society describing his idea and the experiments he had made. The government decided to advance him money for the construction of the machine, a full-scale version of it, to be called the Difference Engine. The construction of the machine was a formidable task. Less than half a century before, the art of boring holes in metal had advanced to the stage where a reasonably efficient steam engine could be built; Babbage required thousands of identical, precisely machined parts in the construction of his machine. To make matters worse, Babbage constantly scrapped parts of the machine, as he devised even simpler and more elegant ways to implement its various functions. His chief engineer eventually quit over a pay dispute, and could not be induced to return. The government began to doubt that the machine would ever be completed, and, encouraged in its doubts by Babbage's rather powerful scientific enemies, finally withdrew its support about twenty years after Babbage's first paper on the idea.

Even as work on the Difference Engine was coming to a halt, Babbage began to conceive of a generalization of his original idea. The new machine, which he called the Analytical Engine, would not merely tabulate polynomials of some fixed maximum degree, but would be able to execute any analytical calculation.

Already in 1822 he had considered the possibility of allowing the result-register to affect the contents of the difference-registers, thereby producing a sequence with no constant order of differences. As an example, he considered a sequence developed according to the rule:  $\Delta^2 u_n = \text{last digit } u_{n+1}$  namely:

$u$	2	0	2	4	6	10	6	16	12	28	20	48	28	76	34	110
$\Delta u$		2	2	4	6	10	6	16	12	28	20	48	28	76	34	110
$\Delta^2 u$			2	4	6	10	6	16	12	28	20	48	28	76	34	110

This sequence may be tabulated by our earlier cascade of three registers, provided that after the result is formed by addition in register A, some mechanism then transfers the last digit of the result to be stored in register C in preparation for the next cycle. This cyclical action of the registers Babbage called "the Engine eating its own tail."

This idea gave way to one of much greater generality and simplicity. The Analytical Engine was to be divided into a collection of registers, called the "Store", and a separate mechanism, called the "Mill", capable of adding, subtracting, multiplying, or dividing two numbers to produce a third. An addressing mechanism was to be provided, which would connect the inputs and output of the Mill with any of the registers in the Store, under external control, enabling the machine to combine the contents of any two registers in the Store, and to deposit the result in any third such register.

The means adopted for directing the successive steps of the machine -- for giving directions like "add the contents of registers 3 and 4 and place the result in register 10; now multiply the contents of registers 5 and 10 and place the result in register 11; etc." -- was a sequence of punched pasteboard cards. Such sequences of punched cards had already been used with great success (around 1800) in the Jacquard loom, to control which warp threads were to be lifted for each passage of the woof thread.

Babbage had incorporated into the Difference Engine the feature that it could be made to stop and ring a bell whenever the contents of the result-register were found to be zero, i.e., whenever it found a zero of the function being tabulated. In the Analytical Engine, this was expanded to the idea of a full conditional -- alternative sets of controlling cards which were to come into play depending on the outcome of a test ordered by the cards of whether some result was zero or not. The necessity of repeating some block of cards over and over, the number of repetitions being dependent upon some calculated values, led to the idea of a "for-loop", that is, a block of instructions to be repeated under the control of a program-variable.

The English government scorned the new idea. However, Babbage was invited to Italy to present his idea on the Analytical Engine before a group of distinguished mathematicians in

Turin. One of them, a man named L. F. Menabrea, who was to become Prime Minister of Italy after the unification, published "a lucid and admirable description" of Babbage's ideas in the Bibliothèque Universelle de Genève in October of 1842. Lady Lovelace's annotated translation of Menabrea's memoir on the Analytical Engine was to be her first, and last, published work.

(TO BE CONTINUED)

A very brief annotated bibliography:

"Charles Babbage and his Calculating Engines", edited and with an introduction by Philip and Emily Morrison, Dover ppb., 1961, contains the Menabrea/Lovelace paper on the Analytical Engine, Dr. Dionysius Lardner's description of the Difference Engine, selections from Babbage's autobiography, and some other writings of Babbage and his son.

"Passages From the Life of a Philosopher" by Charles Babbage, is his autobiography.

"Irascible Genius, the Life of Charles Babbage" by Maboth Moseley, Hutchinson and Co. (an English publisher), is the only published biography of Charles Babbage, to my knowledge. A fifth of it is devoted to Lady Lovelace, and was the source of a lot of the material in this note.

"The Life of Lady Byron" by Ethel Colburn Mayne, 1929, is a biography of Lady Lovelace's mother. It has material on Ada's childhood, and De Morgan's letter.

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OF POSSIBLE INTEREST

Inexpensive accommodations for the San Antonio meeting are available. Preregistration and housing reservation forms are available from the Mathematics Meetings Housing Bureau, P.O. Box 6887, Providence, Rhode Island 02940, and must be returned by January 16, 1976.

The Society of Women Engineers is receiving nominations for the SWE Achievement Award. Nominees need not be members of the Society and need not be formally trained as engineers. Applications for nominations are available from SWE, United Engineering Center, 345 East 47 Street, New York, N.Y. 10017.

The Association for Women in Science exists, ranges over the physical, biological and social sciences, has an interesting newsletter (with interviews, and, for example, in the May/June issue, a reprinting of the Seneca Falls declaration of 1848), and an employment registry with a tri-weekly job bulletin. They can be contacted at the AWIS National Office, Suite 1122, 1346 Connecticut Ave. NW, Washington, D.C. 20036.

The First Women's Bank also exists at 111 East 57 St., New York, N.Y. 10022. They are soliciting accounts, especially business accounts, and their primary purpose is to make loans available to women on a non-discriminatory basis. They also have a library and consumer information center which is soliciting material from organizations.

Also existing is the Women's Resource and Development Center at 316 Harvard Street, Grand Forks, North Dakota 58201. They are developing a Women's Information Collective, offer counseling, and have a Speaker's Bureau.

NOW publishes something called Peer Perspective, concerned with equal education rights. This is a project of the NOW Legal Defense and Education Fund, which monitors enforcement of anti-discrimination laws in education. They can be reached at 1029 Vermont Ave. NW, Suite 800, Washington, D.C. 20005.

On February 18, 1976, at 3 p.m. the American Association for the Advancement of Science is holding a session on women and mathematics. It looks to be exciting and will be at the Sheraton-Boston

Hotel, in Boston, Massachusetts. The AAAS also has a Mass Media Intern Program for graduate students in science to increase communication between the scientific and non-scientific communities. Applications are available from them at 1776 Massachusetts Ave. NW, Washington, D.C. 20036.

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JR

## JOBS

The vacancies listed below appear in alphabetical order in an alphabetical listing of states, followed by Canadian listings.

U. of California, Davis. Dept. of Mathematics. One year appointment, Visiting Assistant Professor, for 1976-77 academic year; up to five quarter courses a year plus seminar. Applicant should be able to collaborate in research with one or more members of the department and should have an excellent publication record. Complete files should be submitted by 2-15-76. D. G. Mead, Chairman, Department of Mathematics, U. of California, Davis, CA 95616.

Teledyne Systems Co. Sr. Test Engineer. Prefer Associate or Bachelor Electrical Engineering degree, military or technical school education. Minimum 8 yrs. experience in computer/analog converter electronics desired. Duties will include DCU and RMU System Integration, Acceptance Testing and Troubleshooting. Generate troubleshooting test plans for failure verification and resolution per FRAS Procedure. Send resumes to Personnel Office, Teledyne Systems Company, 19601 Nordhoff St., Northridge, CA 91324.

California State Polytechnic U. Dept. of Math. invites inquiries, applications and nominations for the positions described below. Assistant Professor level. Start Fall Quarter. Will lead to tenured appointments. Deadline 3-1-76. Position in Computer Science. Ph.D. required. Overall responsibility for program of computer science major, will work to develop internship programs with industries & governmental agencies. May have to teach some general math courses. Position in Statistics. Ph.D. required. Some training in computer science desirable. In addition to teaching will have the responsibility of expanding and strengthening the undergraduate program in statistics, will work to develop a consulting role for statistics on Campus. May have to teach some general math courses. Send curriculum vita, and have three letters of references sent to Search Committee, Math Dept., California State Polytechnic U., 3801 West Temple Ave., Pomona, CA 91768.

San Francisco State U. Position open in Dept. of Mathematics effective Feb. 1, 1976. Assist in development of advanced undergraduate Computer Science curriculum and teach some elementary math. 12 hr. load. Ph.D. in Computer Science or equivalent and some teaching experience necessary. Industry software experience desirable. Salary & level dependent on qualifications. Address applications to: Dr. James T. Smith, Chairman, Math. Dept., San Francisco State U., San Francisco, CA 94132.

Iowa State U. Assistant Professor of Math. Start 9-1-76. Requirements: Earned doctorate, strength in teaching & research, demonstrable interest in applications of mathematics, 1 - 3 years of post-Ph.D. experience desirable. Send resume and have three letters of reference sent to Prof. Wilfred E. Barnes, Head, Department of Mathematics, 400 Carver Hall, Iowa State U., Ames, IA 50011. Deadline 1-15-76.

Iowa State U. Dept. of Statistics. Assistant Professor. Start 7/1/76. Responsibility for planning, sample design, data collection and analysis for on-going sample survey projects within the survey section. Requirements: Ph.D. in statistics and substantive course work and/or experience in survey sampling. Send vitae, three references, academic transcript to Roy D. Hickman, Dept. of Statistics, Snedecor Hall, Iowa State U., Ames, IA 50011. Deadline. 2/15/76.

Kansas State U. Department of Mathematics. Assistant Professor, 6-10 contact hours per week. Report, August 15, 1976. Deadline for applications 2/1/76. Require an active interest in both teaching and research. Prefer areas of physical science oriented applied mathematics or point set topology with emphasis on partially ordered structures. Applicants should have experience and interest in mathematics education. Strong consideration will be given to teaching experience and publications. Ph.D. required. Contact: John E. Maxfield, Head, Department of Math., Cardwell Hall, Kansas State U., Manhattan, KS 66506.

Booz-Allen Applied Research. Systems Analyst. Five or more years experience with O.S. systems and large scale systems development with knowledge of the following software languages - Fortran

COBOL, ASSEMBLY, PL/1, ALGOL, or APL. B.S./M.S. preferred-Computer Science/Operations Research. Contact: Mr. Calvin McDowell, 4733 Bethesda Ave., Bethesda, MD 20014. (301) 656-2200. (For other openings also contact Mr. McDowell.)

U. of Missouri - St. Louis. Director - Center of Community & Metropolitan Studies. Responsibilities: provide leadership to research center; interact with campus scholars, urban community, and various governmental bodies. Requirements: scholarly background and administrative ability. Start 9/1/76. Deadline for nominations or applications with supporting material 1/15/76. Contact Dr. Alan F. Berndt, Chairman of Search Committee, 324 Benton Hall, U. of Missouri - St. Louis, 8001 Natural Bridge Road, St. Louis, MO 63121.

U. of Montana. Dean, School of Education. Start 7/1/76. Earned doctoral degree preferred. Salary range \$25,500 to \$30,000. Contact: Professor Walter R. Berard, Chairman, Search Committee, School of Education, U. of Montana, Missoula, MT 59801. Closing date 1/15/76.

State University of New York at Buffalo. Dept. of Mathematics is awarding George William Hill and Emmy Noether Research Instructorships to recent Ph.D.'s in Mathematics. All Ph.D. requirements must be completed by Sept. 1, 1976. One Research Instructorship in Applied Mathematics and one in Pure Mathematics for 1976-78. 12-month stipend, beginning Sept. 1976 is \$16,200 with staff benefits. The teaching load will total two one semester courses during 12-month period. After two year Instructorship, consideration for two-year appointment as assist. professor will be given. Application forms available. Forms, supporting letters, and educational background to: Chairman, Dept. of Mathematics, SUNY at Buffalo, 4246 Ridge Lea Road, Amherst, NY 14226 by January 20, 1976. No one holding academic rank at SUNY Buffalo is eligible.

SUNY, Geneseo. College of Arts and Science, Lecturer Computer Science Dept. Required to teach COBOL and Business Applications. Two year Term appointment beginning Fall 1976. Master's Degree in related field required. Salary: \$12,000-\$13,000. Send letter of application, vita and transcript to: State University College, Box J, Room 219 Erwin, Geneseo, NY 14454.

Wake Forest U. Babcock Graduate School of Management. Three openings. 1. Assistant Professor/Professor of Management. Teaching & research in area of Organizational Behavior. Special knowledge in relation to small groups and the field of organization development is desired. 2. Assistant Professor/Professor of Management. Specialization in Money and Banking Financial Models, and International Finance is desired. 3. Assistant Professor/Professor of Management. Involves teaching and research in Management Information Systems. Requirements all positions: DBA or Ph.D. or in final stage of completing doctoral degree. Strong interest, experience, and skills in teaching desired--research and writing skills also involved. Start 8-76. Submit resume to: Robert W. Shively, Coordinator for Faculty Recruiting, Babcock Graduate School of Management, Wake Forest U., Winston-Salem, NC 27109.

Kent State U. Dept. of Mathematics solicits nominations and applications for Chairperson. Qualified candidates in all fields encouraged to apply. Candidates in applied mathematics, numerical analysis, and computer science preferred. Start 9/15/76. Deadline for resumes and letters of recommendations 1/31/76. Contact: Professor Richard K. Brown, Secretary, Chairman Search Committee, Department of Mathematics, Kent State U., Kent, OH 44242.

U. of Oklahoma. Provost, Norman Campus. Requirements: solid record of academic accomplishment both as teacher and scholar; substantial administrative experience, sensitivity to varied components of a university campus, commitment to the basic university purpose, ability to articulate and represent goals of University, ability to manage successfully the total University resources, sensitivity and commitment to the Affirmative Action obligations of University and ability to work with and extend leadership provided by President. Earned doctorate degree or equivalent terminal degree. Applications with names and addresses of five references should be sent to Dr. Gwenn Davis, Chair, Provost Search Committee 401 W. Brooks, Rm. 43, Norman OK 73069. (405 325-5291).

Oklahoma State U. Chairman Dept. of Computing and Information Sciences. Associate Professor level. Required: Ph.D. in Computer Science; research interests in one or more of the areas: programming languages, operating systems, data structures, data base systems, computer organization, numerical computation, optimization; demonstrated ability to obtain research grants; interests in developing both graduate and undergraduate academic programs in computer science. Deadline 2-27-76. Contact: Chairman, Search Committee, Computing & Information Sciences Dept. Oklahoma State U., Stillwater, OK 74074.

U. of Oregon. Vice President for Academic Affairs and Provost. Chief academic officer of the University, responsible directly to the President for all matters pertaining to faculty and for the conduct of all undergraduate and graduate programs. Contact: William B. Boyd,



President, U. of Oregon, Eugene, OR 97403.

George Mason U. Three probable Assistant Professorships in the Mathematics Department. Initial appointments are for two years. Ph.D. required. Areas of interest: Algebra, Topology and Mathematical Programming. Two possible one year appointments in the Mathematics Department.

Areas of interest: Same as above. E.O.E./A.A. Send resumes to: John A. Oppelt, Chairman, Mathematics Department, George Mason U., 4400 University Drive, Fairfax, VA 22030.

Western Washington State College. Dean of Graduate School. Nominations and applications sought. Start July 1, 1976. Requirements: earned doctorate and experience in college and university teaching, proven administrative ability. Letters of recommendation directed specifically to this position required. Deadline for applications and resumes 2/15/76. Contact Dr. Robert Lawyer, Chairman, Search Committee for Dean of the Graduate School, Western Washington State College, Bellingham, WA 98225.

The fee for each regular advertisement to appear in the Newsletter is \$5 per issue. With our low dues structure and the high cost of publication, this is the minimum fee we can charge in order to break even. On the other hand, if a college, university or organization cannot afford the fee, then we will publish the advertisement without charge.

Advertisements to appear in the Newsletter should be sent to:

Editors, AWM Newsletter  
c/o Department of Mathematics  
Wellesley College  
Wellesley, MA 02181

Due Dates for ads for the Newsletter:

January Newsletter	copy by December 15
February Newsletter	copy by January 15
March Newsletter	copy by February 15
April Newsletter	copy by March 15
May-June Newsletter	copy by May 15
July-August Newsletter	copy by July 15
Sept.-Oct. Newsletter	copy by September 15
Nov.-Dec. Newsletter	copy by November 15

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The AWM job register is changing its method of operation. The job announcements we will now be sending out are those that will eventually appear in the Newsletter. However they will be mailed first class by the page rather than in a bulk mailing every month or so as the Newsletter comes out.

In order to receive these listings, please send several stamped self-addressed envelopes to:

AWM Job Register  
Department of Mathematics  
Wellesley College  
Wellesley, MA 02181

Address any question about the register to:

Judy Green  
10106 Leder Road  
Silver Springs, MD 20902

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We are sending the letter on the following page to many organizations not reached by our membership, and would appreciate it if our members post this page where possible future members might read it.

Thanks.

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- 15 -  
PLEASE POST

## ASSOCIATION FOR WOMEN IN MATHEMATICS

### Executive Committee

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Mills College, Oakland, CA 94613

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Wellesley College, Wellesley, MA 02181

H. Christine B. Stokes, *Representative from the South*  
University of Mississippi, University, MS 38677

December, 1975

Dear colleague,

This letter is to tell you about the Association for Women in Mathematics, in the hopes that you will inform your students, faculty, and/or staff about us.

The AWM is a national association of over 1000 professional mathematicians, both women and men, concerned with improving the position of women in mathematics and encouraging women to study and enter careers in mathematics and related fields. Our services include a Speakers Bureau, a Job Register, a Newsletter which includes informative articles and job advertisements, and investigations of charges of discrimination which come to our attention. At the national level, AWM sponsors panels at both the Summer and Winter Joint Mathematics Meetings (e.g. a panel, "Women Mathematicians in Business, Industry and Government," will be held on January 23, 1976 in San Antonio, Texas). Locally, AWM members are involved in a variety of programs such as "Math for Girls" and "Women in Science" aimed at encouraging young women to study mathematics.

Perhaps most important, the AWM is both a way in which women mathematicians, who in the normal course of events see few female colleagues, can communicate with each other, and a way in which all mathematicians can discuss ways of reducing sexism in the mathematical community.

The AWM was founded at a national meeting of the American Mathematical Society five years ago, and because of this history, the majority of our most active members have tended to have an orientation towards research within the academic world and strong ties with the AMS. The mathematical community is far broader, however, and the problems that women face within it cut across institutional lines. Therefore, we are contacting business, industrial, government, and educational institutions in order to tell people who might not have heard of us that we exist, that we are here to serve the interests of all women in mathematics and related fields, and that we are eager for new members from every part of the mathematical community.

Our present membership fees are: \$5 (individual), \$6 (family), \$2 (student, unemployed, retired), \$10 (institutional). Ads are \$5 each. (After February 1, 1976, these fees will increase to: \$8, \$10, \$3, \$20 (including two free ads), respectively). Anyone interested in joining should send their name, address, and check to:  
AWM, c/o Department of Mathematics, Wellesley College, Wellesley, MA 02181.

Sincerely,

*Lenore Blum*

Lenore Blum, President, AWM

ASSOCIATION FOR WOMEN IN MATHEMATICS  
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Institutional affiliation, if any \_\_\_\_\_

Position \_\_\_\_\_

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Wellesley College  
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Contributions are tax  
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AWM  
Department of Mathematics  
Wellesley College  
Wellesley, MA 02181

January - 1976

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