

FOCUS

THE NEWSLETTER OF THE MATHEMATICAL ASSOCIATION OF AMERICA

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JUNE 1981

The First Year at a Special School

Steve Davis and Phyllis Frothingham

At a time when reports of Soviet expansion of school mathematics and science programs coincide with reports of large federal cutbacks in funding for training in science and mathematics in the United States, one state is making a giant effort to retain and reaffirm educational excellence in those disciplines. The people of North Carolina have established the North Carolina School of Science and Mathematics. The School, created in 1978 by the North Carolina General Assembly at the suggestion of Governor James B. Hunt, Jr., is located in Durham. It is a statewide, residential, coeducational public high school which provides a challenging education for eleventh and twelfth graders in science and mathematics.

One hundred fifty juniors, now completing their first year, are looking forward to welcoming a new junior class in September 1981. Thereafter, enrollment is scheduled to increase by approximately 150 annually to a maximum of 900 students. As this first year of operation draws to a close, memories of last September's inconveniences of cold showers and partially renovated rooms are fading as the realities of a quality academic program, established by a dedicated founding faculty, are becoming apparent.

The School is located on the site of the former Watts Hospital and School of Nursing in a residential area on the west side of Durham. The \$8 million campus was a gift of Durham County. It consists of 27 acres and 15 buildings; however only a few campus buildings are being used during the first year of operation.

Competition for admission to the School is intense. There were 900 applications for the 150 openings last September and 672 applications have been received for next year's junior class. Every attempt is made to enroll a cross section of the eleventh grade population of the State of North Carolina. Family income is not a consideration since tuition and room and board are provided. However, potential for achievement



Watts Hall, the most historic building on campus, is the future home of the Mathematics Department and Computer Center.

in science and mathematics is a consideration, the primary one.

Students pursue an interdisciplinary academic program, an approach the faculty believes is most effective for the teaching and learning of talented young people. Student interests in science and mathematics combined with the determination of the faculty to develop those in-

terests have resulted in rich offerings in science and mathematics. The four members of next year's Mathematics Department, two of whom have doctorates in the field, will offer twelve different levels of mathematics ranging from Algebra/Trig to Ordinary Differential Equations. While pure acceleration is not the primary goal of the program, courses are offered which enable a student to cover two years of a traditional program in one year. The emphasis of the mathematics program is on problem-solving and breadth of mathematical experience. Students learn quickly that mathematics is not a spectator sport. A program of independent study is considered a necessity, and the faculty is committed to providing the resources essential for successful independent learning.

Special emphasis is placed on integrating the use of the microcomputer into the total school curriculum, and today, the mathematics, science, and music programs are using the microcomputer as a tool to help the student learn. The science and mathematics faculty is designing software to help students use the microcomputer in the science laboratory as a tool for acquiring and processing experimental data. Microcomputers are also used to augment topics covered in the mathematics classroom, especially those where graphics can aid a student in understanding difficult material.

To provide the essential bridge between the sciences and all of human affairs, the School also provides a strong program in English, foreign languages, the arts, and social
(continued on page 8)

Anderson Urges Restoration of Science Education Funds

The following testimony was presented to the NSF Authorization Hearing of the Senate Committee on Labor and Human Resources on April 7, 1981 by R. D. Anderson in response to the proposal from the Reagan Administration that the NSF Science Education Directorate be effectively terminated in FY 1982. Anderson is President of the MAA and Chairman of the Committee on Science Education of the Council of Scientific Society Presidents (CSSP).

"This testimony is to amplify the following position adopted by the Executive Board of the Council of Scientific Society Presidents.

The Executive Board of the Council of Scientific Society Presidents strongly supports President Reagan's position that increased productivity is the essential ingredient to control inflation and to make the economy healthy. To achieve increased productivity we not only need a high level of scientific and technological innovation but a work force at all levels able to use and exploit current and future technological advances.

A major crisis is developing in pre-college education for science and technology. There has been a pronounced long-term deterioration in average student performance as measured by tests and judged by faculties. There are serious shortages of qualified teachers in science and mathematics. And these are occurring while there is much greater need for technologically and quantitatively-oriented people. Other countries such as Germany, Japan, and the Soviet Union appear to be rapidly outstripping us in pre-college education in this technological age.

Only the federal government can give the needed impetus to a national commitment for excellence and specifically for a rethinking of priorities in education for science and technology to achieve this excellence. The Administration's proposal for a nearly total elimination of the Science and Engineering Education budget of the National Science Foundation, together with the abolition of the NSF Directorate for Science and Engineering Education, are counter-productive and totally against our national interest. Rather, there should be refocused NSF and other federal efforts to identify and address the serious problems facing education for science and technology. For example, upgrading the scientific, mathematical, and technological competencies of teachers at the pre-college level needs to command a high priority. Not only is much overall education effort needed to achieve desired productivity increases but it is also very much needed to address the current and prospectively more serious future military manpower problems. A key example is that of recruiting personnel capable of being trained to maintain and operate increasingly sophisticated military equipment.

We urge the Congress to restore funding to Science and Engineering Education at NSF to a level compatible with overall NSF funding, to maintain the Science and Engineering Education Directorate, and to encourage the National Science Board to refocus the Foundation's science education effort toward pre-college education for science and technology.

This position taken by the CSSP Executive Board represents a realization by major segments of the science research community of the vital importance of elementary and secondary education not only for the long term health of

science itself but also for the useful applications of science and of science education to problems of society. None of the members of the Executive Board of CSSP are from organizations involved primarily in pre-college education. We do not speak out of self interest except as improved pre-college education in science, mathematics and communications skills would benefit all of our professional communities. Indeed, this emphasis on the crisis in pre-college education may actually be against the immediate financial interests of those organizations which have major concern for undergraduate education per se.

Some amplification of the military manpower aspect of the crisis is in order. The military manpower problem is similar to, but perhaps more acute than, the problem of getting a better trained civilian work force. The two together create a much more serious long term problem. There are known problems with recruiting qualified people at various levels, particularly at the high school graduate level. The supply of military personnel comes primarily from the supply of young males in our population. There is a known more-than-25% decrease in the 20 year old population from 1981 to 1993. This means that in the mid-nineties to maintain present numbers for the military we shall have to recruit 35% more of the young age group at a time when other demands for quantitatively and technologically oriented people will be increased both by the short supply of young people and by the increasing demands of technology for better qualified civilian work force entrants.

We must begin now to reverse the pattern of deteriorating student performance as evidenced not only in test scores but in the emergence of much remedial work in many colleges and universities.

To this end, CSSP has created a panel to design in some detail a Presidential Commission for Excellence in Educa-



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tion for Science and Technology. The primary thrust of the proposed Commission is at the pre-college level with the Commission designed to develop cost-effective priorities for action, to coordinate and stimulate activity in both the scientific and the school communities, and to greatly increase the public awareness of our nation's needs in this domain. A preliminary report from this panel is due by the end of April.

Our nation badly needs leadership from the Congress to meet both our current and our future needs in all levels of training for those who must function in an increasingly complex technological society."

(MAA members may wish to write their Senators or Representatives concerning the issues raised in this testimony.—Editor)

Two Classical Conjectures Verified

Two long-standing conjectures, one from matrix theory and one from analysis, recently lost their status as "famous unsolved problems."

The van der Waerden Conjecture

This conjecture was first posed over fifty years ago by B. L. van der Waerden of the University of Amsterdam. It asserts that

$$\text{per}(A) \geq n!/n^n$$

for any doubly stochastic $n \times n$ matrix A , and that equality can hold if and only if all the entries of A are $1/n$.

A square matrix is *doubly stochastic* if it has nonnegative entries and all rows and columns add up to 1. The *permanent* (*per*) of a matrix is almost the same as the determinant except that it is the elementary products which are summed, instead of the *signed* elementary products. Despite their similarity, the concept of a permanent was developed independently of that of the determinant, appearing almost simultaneously in 1812 in the memoirs of Cauchy and Binet. It has been shown to be impossible to relate the permanent in some simple way to the more tractable determinant.

Permanents are important partly because of their mathematical applications to combinatorics and probability theory. Outside of mathematics, they play an important role in the theoretical development of physical chemistry and structural physics.

In spite of many efforts, particularly in the last 21 years, the van der Waerden Conjecture eluded resolution in its general form until last November when it yielded to a new method of attack devised by G. P. Yegorychev of the Kirenski Institute of Physics, USSR. Yegorychev's solution utilizes an inequality involving permanents which first appeared in the 30's in an article by the well-known Russian mathematician A. D. Alexandrov. According to Henryk Minc of the University of California, Santa Barbara, "once you have this inequality, the way to use it to obtain the result is immediate, if you spot it." Unfortunately, Alexandrov's article in which this inequality is proved was never translated into English and remained virtually unknown to Western mathematicians until now.

The Littlewood Conjecture

This conjecture was first published in a 1948 paper by British mathematicians Hardy and Littlewood, although there is some evidence that Littlewood had formulated it as early as 1930. It states that

$$\int_{-\pi}^{\pi} \sum_{k=1}^N \exp(in_k x) dx$$

grows as N grows, the lower bound being simply $K \log N$. (The n_k are distinct integers and K is a constant independent of N .)

In 1958 Paul Cohen, then of the Massachusetts Institute of Technology, established a weak form of the conjecture with a smaller function in place of $\log N$. More recently, John Fournier of the University of British Columbia and S. K. Pichorides, a Greek mathematician visiting at the University of California, Los Angeles, raised the lower bound further but did not reach $\log N$.

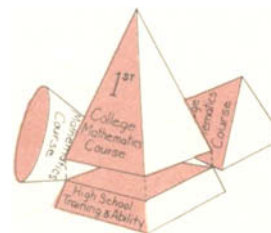
Now there is a short, simple proof that completely solves the problem. It appears in the May 1981 issue of the *Annals of Mathematics* in a paper by three American mathematicians, O. Carruth McGehee of Louisiana State University, Brent Smith of Illinois State University, and Louis Pigno of Kansas State University. The decisive idea in this proof was the brain child of Brent Smith. His inspiration was to replace the combinatorial counting methods which had been used previously by a thoughtful use of the Cauchy-Schwartz inequality.

One of the interesting things about this result is that it provided a completely unexpected bonus—a generalization of a famous inequality on Fourier series first proved by Hardy in the 20's. Furthermore, it provides new insights into the algebra of transforms of measures on the circle and will probably produce some new results in the theory of Banach spaces.

However, for both of these conjectures, the real reason for the excitement that surrounds their resolution has little to do with their mathematical significance. According to McGehee, speaking about the Littlewood Conjecture, "a problem gets a certain glamour when it has resisted solution for so many years," a sentiment also expressed by Minc with regard to the van der Waerden Conjecture. It is the remarkable stubbornness of these problems as well as the brilliance of those who tried to solve them and failed which makes their conquest an occasion for celebration in the mathematical community.

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from the Editor's mailbox . . .

"Thank you very much for the first issue of *FOCUS*. I found it very interesting, and the article on Finite Simple Groups fascinating! I wish you every success with this publication, and look forward to all future issues." Leslie Upton, Ontario, Canada.

"Just a note to thank you for the first issue of *FOCUS*. This is really an effective communication tool, and I want to compliment you and your staff for what I think is an extremely good-looking newsletter. I am sure it will be a success." Andrew T. Boggs, Executive Vice-President, American Society of Heating, Refrigerating, and Air-Conditioning Engineers.

"The first issue of *FOCUS* seems to have been delayed in the mail but it was worth waiting for. You are setting a high standard for yourself." R. P. Boas, Northwestern University, Editor, *American Mathematical Monthly*.

"I have just received my copy of the new *MAA FOCUS*. Congratulations on an excellent first issue. This new periodical should certainly assist in keeping our profession better informed. I was particularly pleased in the emphasis which both Al Willcox and Dick Anderson placed on the need to involve our younger colleagues. The NCTM should also push this concept in our activities." James D. Gates, Executive Director, National Council of Teachers of Mathematics.

"I just read through the first issue of your new publication *FOCUS*. It's a marvelous idea and a topnotch job. For starters, it's very well written. It's beautifully designed and printed. And most important, the content is exactly right for me. The topics, the treatment, the amount and choice of detail, couldn't be improved upon. I don't know how often you plan to publish, but I'm already looking forward to my next issue. My thanks to everyone connected with this exciting and very welcome new venture." Miriam Hecht, Hunter College.

"*FOCUS* is terrific! Congratulations to you and your hearty band. Finally, something that I can say that I've read from cover to cover." Donald J. Albers, Editor, *The Two-Year College Mathematics Journal*.

"Heartiest congratulations on vol. 1, no. 1 of *FOCUS*! It is superb. The balance of articles and announcements, of ideas on the one hand and facts on the other, is very satisfying. I look forward to future issues." Ivan Niven, University of Oregon.

Thanks to the many other FOCUS readers who also wrote to offer their congratulations.—Editor

AMS Reports Upward Trends in Employment and Enrollment

Every year for the past 24 years, the American Mathematical Society has conducted a survey of conditions in the mathematical sciences. The results of this year's survey are particularly encouraging, indicating positive trends in both employment and enrollment.

The complete report on the 24th Annual AMS Survey appears in the February 1981 issue of the *Notices of the American Mathematical Society*. Highlights are reprinted here with the permission of the AMS.

Employment

- Between Fall 1979 and Fall 1980, the number of full-time faculty members increased by approximately 3%. 394 with doctorates and 161 without. The number of part-time faculty members increased by 10%.
- The outflow of faculty members to nonacademic employment held at about the same rate as last year (3%). Among those faculty members who left academic life, virtually none were subsequently unemployed.
- Of the 858 new doctorates, all but 7 had found jobs by the Fall of 1980, more than two-thirds in academia. Many of the others accepted employment in companies in high technology, computer-information processing, or communications.

There are some indications that a *shortage* of Ph.D.'s for the academic marketplace now exists:

- The marked increase in non-doctorate faculty (the first reported in the AMS survey since 1971), possibly due to the inability of many departments to hire Ph.D.'s.
- Improvements in the ratio of applicants to positions available in the Employment Register. (This ratio fell below one for the first time in recent memory at the San Antonio meeting in January 1980.)
- A rather large number of advertisements in the January 1981 issue of *Employment Information in the Mathematical Sciences*.

Mathematics departments offering bachelors or, at most, masters degrees continue to face keen competition from industry, paying higher salaries, and from university departments, offering a more research-oriented environment.

The nonacademic job market looks as if it will remain strong for Ph.D.'s willing and qualified to work in the applied mathematical sciences.

Enrollment

- There was a 17% jump over last year in the number of junior and senior mathematics majors and an 8% increase in the number of first-year graduate students. Overall graduate enrollment increased by 3.5%.
- Course enrollments rose again in 1980 by 8% or more in all categories of mathematical sciences departments. In computer science courses, the increase was 24%, continuing the dramatic increases of recent years.

These increases in enrollment are undoubtedly the driving force behind the increases in full- and part-time faculty as well as increases in class size reported by almost all types of institutions.

61st SUMMER MEETING

Mathematical
Association of
America

●
Pittsburgh

August 17-19, 1981

The Sixty-First Summer Meeting of the Mathematical Association of America will be held on the campus of the **University of Pittsburgh** from Monday, August 17 through Wednesday, August 19, 1981. The meeting will be held in conjunction with meetings of the American Mathematical Society, August 18-21, the Association for Women in Mathematics, August 19, and Pi Mu Epsilon, August 18-19.

The **Board of Governors** will meet at 9:00 a.m. Sunday, August 16. This meeting is open to all members of the Association. There will be a joint meeting of the **Section Officers and the Board of Governors** Sunday at 4:00 p.m. The annual meeting of **Section Officers** is scheduled for Sunday evening at 7:00 p.m.

On Monday at 9:10 a.m. and 1:20 p.m. and Tuesday at 9:00 a.m., Daniel Gorenstein of Rutgers University will deliver the **30th Earle Raymond Hedrick Lectures** under the title "Finite Simple Groups."

Mathematical films will be shown on Monday evening at 7:00 p.m.

There will be an MAA Mini-Course, "The Use of Computers to Teach Mathematics," conducted by Donald O. Norris of Ohio University on Monday and Wednesday evenings from 7:00 p.m. to 9:00 p.m. Registration information is on page iii of this program.

The **Carl B. Allendoerfer, Lester R. Ford, and George Pólya Awards** for expository writing will be presented at the Business Meeting of the Association at 10:00 a.m. on Tuesday.

On Tuesday evening at 6:30 p.m. the Association will sponsor its sixth annual **Twenty-Five Year Member Banquet**.

Participants are invited to join a social hour from 5:30 p.m. to 6:30 p.m. prior to the banquet. A cash bar will be available. The emcee for the banquet will be G. Baley Price of the University of Kansas. The program will not include any speakers, but rather, will be designed so as to afford the opportunity to make new acquaintances and to renew old friendships. The tickets cost \$13 each. They must be purchased at the Registration Desk no later than 4:30 p.m. on Monday, August 17.

There will be two **special evening sessions** on the use of computers in undergraduate mathematics, one on Tuesday at 7:30 p.m. and one on Wednesday also at 7:30 p.m. The Tuesday evening session is entitled "Computers in the Undergraduate Mathematics Curriculum: Experiments, Project Reports and the National Consortium on Uses of Computers in Mathematical Science Education." This session has been organized by Ronald H. Wenger, Director of the Mathematical Sciences Teaching and Learning Center of the University of Delaware. Gerald J. Porter of the University of Pennsylvania will preside at the Wednesday evening session, "Microcomputer Graphics in Undergraduate Mathematics."

The Allegheny Mountain Section of the Association will sponsor a **Wine and Cheese Party** on Wednesday from 5:30 p.m. to 7:00 p.m. All registered participants are invited to attend. Meeting badges must be worn.

The AMS and MAA will cosponsor a talk by the **AMS-MAA-SIAM Congressional Science Fellow**, Cheryl G. Tropf. The date and time of her talk will be announced at the meeting.

The dates and times of other **MAA invited addresses, panel discussions, and open sessions** are listed on pages iv and v of this program.

Registration

Registration Fees

Meeting preregistration and registration fees only partially cover the expenses of holding meetings. All mathematicians who wish to attend sessions are expected to register, and should be prepared to show their meeting badge, if so requested. All participants who did not preregister may register at the meeting for the Joint Meetings, the MAA Mini-Course, or the AMS Short Course.

The fees for registration at the meeting are:

Joint Mathematics Meetings

Member of MAA, AMS, ITME	\$42
Nonmember	\$65
Student/Unemployed	\$11

MAA Mini-Course

All participants	\$15
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AMS Short Course

Student/Unemployed	\$10
All Other Participants	\$30
One-day Fee (Second Day Only)	\$15

Registration fees may be paid at the meetings in cash, by personal or travelers' checks, or by Visa or MasterCard credit cards. Canadian checks must be marked for payment in U.S. funds.

There will be no extra charge for members of the families of registered participants, except that all professional mathematicians who wish to attend sessions must register independently. All full-time students currently working toward a degree or diploma qualify for the student registration fees, regardless of income. The unemployed status refers to any person currently unemployed, actively seeking employment, and who is not a student. It is not intended to include persons who have voluntarily resigned from their latest position.

Nonmembers who register at the meetings and pay the \$65 nonmember registration fee are entitled to a discount of the difference between the member registration fee of \$42 and the nonmember registration fee of \$65 as a \$23 credit against dues in either the MAA or AMS or both, provided they join before September 21, 1981. Nonmember students who register at the meetings and pay the \$11 registration fee are also entitled to a discount of the difference between the student preregistration fee of \$6 and the registration fee of \$11 as a \$5 credit against dues in either the MAA or AMS or both, provided they join before September 21, 1981. Nonmembers and nonmember students who thus qualify may join at the meetings or by mail afterwards, up to the deadline.

Registration Dates and Locations

Registration will begin at 4:00 p.m. on Sunday, August 16 in the Litchfield Towers Lobby. Participants who have preregistered for any of the three activities listed above will be provided with appropriate materials with their preregistration packets.

Registration Desk Hours

Sunday, August 16	4:00 p.m. to 8:00 p.m.
Monday, August 17	8:00 a.m. to 4:30 p.m.
Tuesday, August 18 through Thursday, August 20	8:30 a.m. to 4:30 p.m.

Neither the Registration Desk nor the telephone message center (see below) will be open on Friday, August 21. There will, however, be a small desk set up outside David Lawrence Hall where local information will be available and where a staff member will provide limited assistance to participants. No registration or cash transactions will be possible at this desk.

Information on the publications and activities of the MAA and AMS may be obtained at the AMS/MAA Information Section of the Registration Desk. Also available at the Registration Desk is information on audio-visual aids, baggage and coat checking, lost and found, check cashing, and local information. A log for registration of comments about the meeting is also available at the Registration Desk. Participants are encouraged to share suggestions for improvements in the meeting format or services and thus contribute to the success of future meetings.

Exhibits

The book and educational media exhibits will be open from 1:00 p.m. to 5:00 p.m. on Monday, August 17, and from 8:30 a.m. to 4:30 p.m. on Tuesday and Wednesday, August 18 and 19.

Book Sales

Books published by the MAA and AMS will be sold for cash prices somewhat below the usual prices when these same books are sold by mail. These discounts will be available only to registered participants wearing the official meeting badge. Visa and MasterCard credit cards will be accepted for book sale purchases at the meeting. The book sales will be open the same days and hours as the Registration Desk.

Book and Journal Exchange

At the Joint Books and Journals display in the exhibit area, notebooks will be available with lists of books on mathematics for sale or being sought. A small listing fee is charged. There will be separate notebooks of books for sale and books wanted with names and addresses of the owners or seekers. The details of the transactions themselves are to be arranged by the participants. MAA and AMS will not accept responsibility for settling disputes if arrangements go awry.

Mail and Telephone Messages

All **mail and telegrams** for persons attending the meetings should be addressed to the participant, % Department of Mathematics and Statistics, University of Pittsburgh, Pittsburgh, Pennsylvania 15260. Mail and telegrams so addressed may be picked up at the mailbox in the registration area during the hours the Registration Desk is open. U.S. mail not picked up will be forwarded after the meeting to the mailing address given on the participant's registration record.

A **telephone message center** will be located in the registration area to receive incoming calls for participants. The center will be open from August 16 through August 20 only, during the same hours as the Registration Desk. Messages will be taken and the name of any individual for whom a message has been received will be posted until the message has been picked up at the message center.

MINI-COURSE THE USE OF COMPUTERS TO TEACH MATHEMATICS

7:00 p.m.-9:00 p.m. Monday and Wednesday
211 David Lawrence Hall

On Monday and Wednesday evenings, Donald O. Norris of Ohio University will conduct another in the series of MAA Mini-Courses. **Enrollment for this Mini-Course is limited to 30 participants and there is a \$15 registration fee to be made payable to The Mathematical Association of America.**

The Mini-Course is open only to persons who have registered for the Joint Meetings and paid the registration fee. Meetings participants who have not pre-registered for this course and are interested in attending should inquire at the Registration Desk.

Mini-Course Abstract: A brief introduction to BASIC will be followed by discussions of how computers can be used in a variety of courses. These will include the more traditional approaches such as the use of computers in calculus and differential equations courses as well as the use of simulation models in liberal arts courses or mathematics education classes. It is planned that microcomputers will be available for use by the participants.

Social Events

Fallingwater Tours

The Local Arrangements Committee has arranged for tours of Fallingwater, the famous summer home of the Kaufman family, designed by Frank Lloyd Wright. These tours are scheduled for 1:00 p.m. on Tuesday, August 18 and Thursday, August 20. The admission fee is \$3 per person, and there will be an additional charge of \$10 if transportation to and from Fallingwater is required. To arrive at Fallingwater by 1:00 p.m., it will be necessary to leave Pittsburgh by 10:00 a.m. Interested persons must register for these tours as admission to Fallingwater is by reservation only.

Picnic

A picnic will be held at 6:30 p.m. on Thursday evening, August 20, at the Athletic Shelter in Schenley Park which is a pleasant walk from the campus. Tickets will be on sale at the Transparencies Section of the Registration Desk for \$10 each. **Unfortunately, there is provision for only 200 individuals so that once that number is reached, no more tickets can be sold.**

Baseball Game

The Pittsburgh Pirates baseball team will play the San Francisco Giants at Three Rivers Stadium on August 17, 18, and 19 at 7:30 p.m. and the San Diego Padres on August 21 and 22 at 7:30 p.m. For ticket information and/or reservations, call 412-323-1150.

Concert

On Wednesday, August 19, a concert will be given in the Heinz Memorial Chapel at 12:15 p.m. by Robert Sutherland Lord, organist and member of the University of Pittsburgh faculty. There will be no admission charge.

Summer List of Applicants

At the direction of the AMS-MAA-SIAM Committee on Employment Opportunities, the Society will publish a summer list of mathematical scientists seeking employment for distribution at the meeting. The applicant resume form will be utilized to prepare this listing. Copies of the list will be available at the Transparencies Section of the Registration Desk for \$1. Following the meeting, they may be purchased from the AMS Office in Providence for \$1. This list should prove useful to employers who have last minute openings.

Instead of an Employment Register at the meeting, there will be an opportunity for posting of both applicant resume forms and employers' announcements of open positions in or near the main meeting registration area. No provision will be made for interviews. Arrangements will be the responsibility of the employer and the applicant. There will be no special room set aside for interviews. Messages may be left in the message box located in the registration area.

Special applicant and employer forms will be available at the Transparencies Section of the Registration Desk both for applicants to post resumes and for employers to post forms announcing positions. Employers who do not plan to attend and wish to display literature only may do so at no charge. This material must, however, be received in the Providence Office no later than July 10, and preferably should accompany the preregistration/housing form. Both should be mailed to the Mathematics Meetings Housing Bureau, P.O. Box 6887, Providence, Rhode Island 02940. Information cannot be taken over the telephone, either in Providence after July 10 or at the meeting.

Applicants who submit an applicant form but do not plan to attend the meeting will be listed on the printed list only. There is no provision made for posting resumes for participants who do not attend the meeting.

Activities of Other Organizations

The **American Mathematical Society (AMS)** will sponsor a series of four Colloquium Lectures presented by Serge Lang of Yale University. The tentative title of the lecture series is "Units and Class Numbers in Algebraic Geometry and Number Theory." The lectures will be given at 1:00 p.m. on Tuesday, August 18, and at 11:10 a.m. on Wednesday, Thursday, and Friday, August 19, 20, and 21. The AMS will present a one-half day short course entitled "The Mathematics of Networks" on Saturday and Sunday, August 15 and 16. The 1981 Leroy P. Steele Prizes will be awarded at a session at 4:00 p.m. on Thursday, August 20.

Pi Mu Epsilon (IIME) will hold its annual meeting on Tuesday and Wednesday, August 18 and 19. The J. Sutherland Frame Lecture will be given at 8:30 p.m. on Tuesday.

The **Association for Women in Mathematics (AWM)** will hold a panel discussion at 3:00 p.m. on Wednesday, August 19, and its Business Meeting at 4:00 p.m. the same day.

MAA PROGRAM

Program Committee: W. E. Deskins, Chairman; William A. Beck, Allan G. Bluman, John D. Bradburn, Charles A. Cable, Barbara T. Faires, Frank Hergeist, Beverly Michael, Earle F. Myers, John O. Riedl, Jr., Melvin Woodard.

SUNDAY, August 16

9:00 a.m.-4:00 p.m.
2-P56 Forbes Quadrangle

4:00 p.m.-5:30 p.m.
2-P56 Forbes Quadrangle

7:00 p.m.-9:30 p.m.
2-P56 Forbes Quadrangle

MAA Board of Governors Meeting

MAA Board of Governors and Section Officers Joint Meeting

Section Officers Meeting

MONDAY, August 17

9:00-9:10 a.m.
120-121 David Lawrence Hall

Welcome to Pittsburgh

Jerome L. Rosenberg, Dean of the Faculty of Arts and Sciences, University of Pittsburgh

9:10-10:00 a.m.
120-121 David Lawrence Hall

The EARLE RAYMOND HEDRICK LECTURES: "Finite Simple Groups"

HEDRICK LECTURE I: "The Enormous Theorem"

Daniel Gorenstein, Rutgers University

10:10-11:00 a.m.
120-121 David Lawrence Hall

"The Trouble with Area"

Marvin I. Knopp, Rutgers University

11:10 a.m.-Noon
120-121 David Lawrence Hall

"Development of the Theory of Cluster Sets"

A. J. Lohwater, Case-Western Reserve University

1:20-2:10 p.m.
120-121 David Lawrence Hall

HEDRICK LECTURE II: "The Friendly Giant and His Relatives"

Daniel Gorenstein

2:20-3:10 p.m.
120-121 David Lawrence Hall

"Combinatorics and Geometry"

Dwijendra K. Ray-Chaudhuri, Ohio State University

3:20-4:10 p.m.
120-121 David Lawrence Hall

"Constant-weight Codes, Sum-free Sets and Harmonious Graphs"

Ronald L. Graham, Bell Laboratories

3:20-4:20 p.m.
111 Law School

Panel Discussion of Institutional Responses to "Math Anxiety"

David A. Blaeuer, SUNY, College of Buffalo

Clifford A. Baylis, Jr., Community College of Allegheny County

Rosalie B. Jackson, Waynesboro College

Beverly K. Michael, University of Pittsburgh

4:30-5:30 p.m.
111 Law School

OPEN SESSION on Programs in Mathematics in Four-Year Colleges and Universities

Barnet M. Weinstock, University of North Carolina, Charlotte

John W. Jewett, Oklahoma State University

4:30-5:20 p.m.
120-121 David Lawrence Hall

"Operations Research in the Federal Reserve System"

Patrick L. Hayes, Federal Reserve System

7:00-9:00 p.m.
211 David Lawrence Hall

MAA-MINI COURSE: "The Use of Computers to Teach Mathematics"

MAA FILM PROGRAM

120-121 David Lawrence Hall

7:00-7:09 p.m.

Complex Functions Graphs: $w=z$ and $w=e$

7:11-7:30 p.m.

Shapes of the Future: Some Unsolved Problems in Geometry—Two Dimensions

7:35-7:39 p.m.

The Seven Bridges of Königsberg

7:41-8:03 p.m.

Adventures in Perception

8:05-8:30 p.m.

Modelling Surveys—a B.B.C. broadcast as part of the Open University's Foundation Course in Mathematics

8:32-8:41 p.m.

Powers of Ten

8:43-8:57 p.m.

Symmetries of the Cube

8:59-9:07 p.m.

How Far is Around?

9:09-9:38 p.m.

Math Anxiety: We Beat It, So Can You!

PREREGISTRATION AND HOUSING RESERVATION REQUEST FORM

Summer Meetings, University of Pittsburgh, Pittsburgh, Pennsylvania

Joint Mathematics Meetings
August 17-21, 1981

MAA Minicourse
August 1981

AMS Short Course
August 15-16, 1981

MUST BE RECEIVED IN PROVIDENCE NO LATER THAN JULY 10, 1981

Please complete this form and return it with your payment(s) to

MATHEMATICS MEETINGS HOUSING BUREAU

P.O. Box 6887, Providence, Rhode Island 02940, Telephone: (401) 272-9500, Ext. 239

PREREGISTRATION: Deadline for receipt of preregistration fee(s) is July 10, 1981. Make checks payable to AMS. Please note that a separate check for the MAA Minicourse must be made out to the Mathematical Association of America. **HOUSING BUREAU SERVICES:** Participants desiring to obtain confirmed reservations for university accommodations **MUST PREREGISTER** and forward room deposit payable to AMS **PRIOR TO THE DEADLINE OF JULY 10.** One night's room deposit must accompany preregistration fee(s) with balance due at check-in time.

CANCELLATIONS: To cancel or change a confirmed reservation, please write to the Mathematics Meetings Housing Bureau at the address above, or call the telephone number above, prior to JULY 22. No refund of deposit or change in accommodations can be made after that date. Also note that 50% of preregistration fee(s) only is refundable if notification is received in Providence on or before August 14.

JOINT MATHEMATICS MEETINGS	REGISTRATION FEES –	Preregistration	At Mtg.
Member of AMS, MAA, ΠME <input type="checkbox"/>		\$32	\$42
*Student or unemployed <input type="checkbox"/>		\$ 6	\$11
Nonmember <input type="checkbox"/>	Please affix AMS or MAA label here.	\$49	\$65
AMS SHORT COURSE	If none, complete 1-3 below.		
Member/Nonmember <input type="checkbox"/>		\$25	\$30
*Student or unemployed <input type="checkbox"/>		\$ 5	\$10
One day Fee (2nd day only) <input type="checkbox"/>		—	\$15
MAA MINICOURSE <input type="checkbox"/>		\$15	\$15

*All full-time students currently working toward a degree or diploma qualify for the student registration fees, regardless of income. The unemployed status refers to any person currently unemployed, actively seeking employment, and who is not a student. It is not intended to include persons who have voluntarily resigned from their latest position.

PREREGISTRATION SECTION (See over for HOUSING SECTION)

Joint Mathematics Meetings [] AMS Short Course [] MAA Minicourse []

1) _____ (3) { AMS member code _____
NAME (Please print) surname first middle or

2) _____ { MAA member code _____
ADDRESS number and street city state zip code

4) _____
ADDRESS FOR CONFIRMATION OF ROOM RESERVATION

5) Employing institution _____ Unemployed []

6) I am a student at _____ (7) Name of spouse _____
(List if accompanying to meeting)

8) Accompanying children (number) _____ (names, ages, sexes) _____

9) Member of AMS [] MAA [] ΠME [] NONMEMBER [] (Member discount applies only to members of AMS, MAA, or ΠME) Member of other organizations: AWM [] MAG [] NAM []

10) Fallingwater Tour: Tuesday, August 18 [] or Thursday, August 20 []
Tour only, \$3 [] Number of tickets requested _____
Tour including transportation, \$13 [] Number of tickets requested _____

11) Total amount enclosed for (10) \$ _____ (12) Joint Meetings fee enclosed \$ _____
(13) AMS Short Course fee enclosed \$ _____

14) Room deposit for residence hall accommodations \$ _____ (See reverse)

15) TOTAL AMOUNT ENCLOSED FOR 10 THROUGH 14 \$ _____ (payable to AMS)

16) MAA Minicourse fee enclosed \$ _____ (payable to MAA) \

17) NOTE: Canadian checks must be marked "In U.S. Funds".

A \$2 charge will be imposed for all invoices prepared when preregistration/housing forms are submitted without accompanying check(s) for the preregistration fee(s), or are accompanied by an insufficient amount.
PLEASE BE SURE TO COMPLETE THE HOUSING SECTION ON REVERSE SIDE.

PREREGISTRATION AND HOUSING RESERVATION REQUEST FORM
HOUSING SECTION

I WILL NOT REQUIRE A ROOM.

Please reserve the following residence hall accommodations:

1. LITCHFIELD TOWERS (air-conditioned)

Please circle each night room will be occupied.

- | | |
|---|--------------------------------------|
| _____ Singles @ \$12/per day (no meals) | Night(s) of 8/14 8/15 8/21 |
| _____ Singles @ \$13/per day | Night(s) of 8/16 8/17 8/18 8/19 8/20 |
| _____ Doubles @ \$16/per day (no meals) | Night(s) of 8/14 8/15 8/21 |
| _____ Doubles @ \$28/per day | Night(s) of 8/16 8/17 8/18 8/19 8/20 |

I will arrive on _____ and depart on _____
(date and time) (date and time)

I will share a double room with _____ who will arrive on _____
(date and time)
 and depart on _____
(date and time)

2. FORBES HALL (air-conditioned)

Please circle each night room will be occupied.

- | | |
|---|--------------------------------------|
| _____ Singles @ \$13/per day (no meals) | Night(s) of 8/14 8/15 8/21 |
| _____ Singles @ \$19/per day | Night(s) of 8/16 8/17 8/18 8/19 8/20 |
| _____ Doubles @ \$18/per day (no meals) | Night(s) of 8/14 8/15 8/21 |
| _____ Doubles @ \$30/per day | Night(s) of 8/16 8/17 8/18 8/19 8/20 |

I will arrive on _____ and depart on _____
(date and time) (date and time)

I will share a double room with _____ who will arrive on _____
(date and time)
 and depart on _____
(date and time)

3. BRUCE HALL (suites for use by families and groups of 3 or more; not air-conditioned)

Please circle each night suite will be occupied.

- | | |
|---|--------------------------------------|
| _____ Singles @ \$13/per day (no meals) | Night(s) of 8/14 8/15 8/21 |
| _____ Singles @ \$19/per day | Night(s) of 8/16 8/17 8/18 8/19 8/20 |
| _____ Doubles @ \$18/per day (no meals) | Night(s) of 8/14 8/15 8/21 |
| _____ Doubles @ \$30/per day | Night(s) of 8/16 8/17 8/18 8/19 8/20 |

We will arrive on _____ and depart on _____
(date and time) (date and time)

I will share suite with _____
 _____ . Total number of occupants: _____

Do you intend to purchase meal tickets for accompanying children (16 years of age or under) for University Towers dining hall? Yes No

4. DEPOSIT REQUIREMENTS: As stated in the meeting announcements, a deposit of your first night's lodgings is required by the University of Pittsburgh. Please include the appropriate amount along with this form. Make check payable to AMS. FORMS RECEIVED WITHOUT DEPOSITS WILL BE RETURNED.
NO REFUNDS OF DEPOSITS CAN BE MADE AFTER JULY 22.

NOTE: Preregistration is a requirement in order to obtain the services of the Mathematics Meetings Housing Bureau. Please be sure to complete the PREREGISTRATION SECTION on the reverse side.

University Housing

Participants desiring confirmed reservations for on-campus housing **must preregister prior to the deadline of July 10, 1981**. Rooms may be available for those who do not preregister, but this cannot be guaranteed.

The following general statements apply to all residence hall accommodations at the University of Pittsburgh.

No university residence hall rooms may be occupied before August 14. All participants must be checked out of the residence halls no later than noon on August 22. Check out time on other days is 1:00 p.m., and anyone failing to check out by this time will be charged another night's lodging and food by the university.

Two sheets, a pillow, and one pillowcase are provided for each bed being occupied, as well as a set of towels, soap, and drinking glass. Washcloths are not available, nor are clothes hangers. There are only a limited number of blankets available, so participants are advised to bring their own if they want to be sure of having one. Housekeeping will clean the rooms daily, but will not make the beds. Clean towels will be exchanged for used as needed at a central location. Rooms are equipped with desks and chairs, dressers, and table lamps. Most rooms have two single beds.

No pets are allowed in the residence halls. Alcoholic beverages are allowed in the residence halls, provided the 21 year age limit is observed.

There will be no telephone service in any of the university accommodations, but there are pay telephones and campus telephones in the public lobby areas in the residence halls, and many are located about the campus, such as in the basement of the Cathedral of Learning and in the lobby of the Student Union.

No more than two adults may occupy a room at the same time.

Children 16 years of age or under may stay in the same room with a parent and occupy a bed at no charge; the single room rate would be charged for the parent. If the child is young enough to occupy a crib or sleeping bag, the child may stay in a room with both parents at no charge; the double room rate would be charged for the parents. A child over 16 years of age will be considered an adult and must occupy a bed and pay the adult rate. No cots or cribs are available from the University for children.

Those preregistering and requesting university housing before the July 10 deadline **must include a deposit for one night's lodging or lodging and food**. Details are given below. The deposit should be submitted at the same time as the preregistration/housing form. Forms received without the deposit will be returned.

Should it be necessary for participants to cancel their preregistration and housing, they should be aware that the housing deposits can be refunded **only up to July 22**. Those wishing to cancel should write or telephone the Mathematics Meetings Housing Bureau before this deadline, since no refunds of housing deposits can be made after these monies have been turned over to the University.

All those who request university housing in advance will receive a written confirmation from the Mathematics Meetings Housing Bureau. This confirmation should be presented to the university clerk at time of check-in. The remainder due on food and/or lodgings for the duration of each participant's stay as originally requested on his or her preregistration/housing form is due in full at time of check-in. No changes

can be made in arrival or departure dates or in the amount paid to the University after July 22. Cash, personal checks or travelers' checks will be accepted; credit cards will not. Checks must be payable to the University of Pittsburgh.

Individuals who fail to preregister and obtain confirmed university accommodations must go to the desk in the main lobby at Litchfield Towers in order to receive a room assignment. However, the number of rooms held for latecomers is quite small.

There are three types of accommodations available at the University of Pittsburgh:

Litchfield Towers (7 on campus map) 3990 Fifth Avenue. This residence hall is air-conditioned, and has community rest rooms and showers. It may be necessary for one sex or the other to use the rest rooms on either the floor above or below the one on which their rooms are located. Elevators stop only on floors with common lounge areas (floors 3, 6, 9, 12, 15, 18, and 21) so that it may be necessary to use the stairs when going to the rest room.

Vending machines and laundromats are located in each tower. No irons or ironing boards are available. Participants should bring their own laundry detergent.

Accommodations for the period Sunday, August 16 through Thursday, August 20 includes breakfast and lunch on August 17-21. Rates are:

Single occupancy	\$18/day
Double occupancy	\$14/day per person

Those occupying rooms Friday or Saturday, August 14 and 15, or Friday, August 21, would pay reduced rates because no food service is available the following day. These rates are:

Single Occupancy	\$12/day
Double Occupancy	\$ 8/day per person

Those requesting single rooms in Litchfield Towers beginning on August 14 or 15 must submit a deposit of \$12, and those requesting double rooms beginning on those dates \$16. Those requesting single rooms beginning on August 16 or later should submit a deposit of \$18, and those requesting double rooms \$28.

Participants receiving confirmations for rooms in Litchfield Towers should check-in upon arrival at the desk in the main lobby. At time of check in participants will receive one key which will open the door from the main lobby to the tower, the door to the sleeping rooms, and the stairwell doors.

Forbes Residence Hall (52 on campus map), 3525 Forbes Avenue. The residence is air conditioned. The number of rooms available is limited. If the Housing Bureau is unable to obtain a room in Forbes for anyone so requesting, the Bureau will obtain a room in Litchfield Towers instead. The rooms are arranged so that a pair of rooms shares a connecting room containing a wash basin and toilet. Community showers are at either end of the wings. There is elevator service; kitchen and laundry facilities are located on each floor. Participants should bring their own kitchen utensils and laundry detergent. No irons or ironing boards are available.

Accommodations in Forbes Residence Hall for those occupying rooms during the period Sunday, August 16 through Thursday, August 20 includes breakfast and lunch on August 17-21. Rates are:

Single Occupancy	\$19/day
Double Occupancy	\$15/day per person

Those occupying rooms Friday and/or Saturday, August 14 and 15, or Friday, August 21 would pay reduced rates because no food service is available the following day. These rates are:

Single Occupancy \$13/day
Double Occupancy \$ 9/day per person

Those requesting single rooms in Forbes beginning on August 14 or 15 must submit a deposit of \$13, and those requesting double rooms beginning on those dates \$18. Those requesting single rooms beginning on August 16 or later should submit a deposit of \$19, and those requesting double rooms \$30.

Participants receiving confirmations for rooms in Forbes on August 14 should check in at the main desk after 8:00 a.m. After August 14, the desk at Forbes will be open 24 hours daily until some time later during the meetings, when it will revert to 8:00 a.m. to 4:00 p.m. daily operation.

At check-in time, participants will receive one key which unlocks the front door of the residence hall and the sleeping room door.

Bruce Hall (8 on campus map). Participants bringing their families will be assigned to this residence hall. Some suites may also be available to nonfamily groups of three or more. **This residence hall is not air-conditioned.** The rooms are arranged in suites of from one to three bedrooms, with living area, kitchenette, and bath. Bunk beds may be in some of the larger bedrooms. Participants should bring their own cooking utensils.

Accommodations in Bruce Hall for those occupying rooms during the period Sunday, August 16 through Thursday, August 20 includes breakfast and lunch, August 17-21. Rates are:

Single Occupancy \$19/day
Double Occupancy \$15/day per person

Those occupying rooms Friday and/or Saturday, August 14 and 15 or on Friday, August 21 would pay reduced rates because no food service is available the following day. These rates are:

Single Occupancy \$13/day
Double Occupancy \$ 9/day per person

Those requesting single rooms in Bruce Hall beginning on August 14 or 15 must submit a deposit of \$13, and those requesting double rooms a deposit of \$18. Those requesting single rooms beginning on August 16 or later should submit a deposit of \$19, and those requesting double rooms \$30.

All those receiving confirmations for rooms in Bruce Hall should check in upon arrival in the main lobby of Litchfield Towers which is open 24 hours daily. At check-in, participants will receive one key which will unlock the front door of the residence hall and the suite door.

Food Services

Breakfast and lunch for those participants staying in University accommodations will be served in the University Towers Dining Room, located in the lower level of the Litchfield Towers Residence Hall. Breakfast will be served from 6:30 a.m. to 8:30 a.m. and lunch from 11:30 a.m. to 1:00 p.m. The dining hall will not be open for dinner. Food service will begin with breakfast on Monday, August 17 and end with lunch on Friday, August 21. Those attending the AMS Short Course on August 15 and 16 or still on campus on Saturday, August 22, must eat off campus; an adjustment has been made in the daily room and board rate for these individuals.

Participants must show their room key and tag to the dining hall cashier as proof of payment in advance for meals.

Children 16 years of age and under staying free in the residence halls with parents may eat breakfast and lunch in the University Towers Dining Room also. Parents should pay for these meals in advance at check-in time, in return for which they will receive a room key tag for the child.

Breakfast costs \$2.40, and lunch \$3.60. Those staying off campus may buy their lunch in the University Towers Dining Room if they purchase a meal ticket in the cafeteria.

Seconds are allowed except when steak is served. Participants are asked to observe the university rule that no food or beverages are allowed out of the cafeteria.

Hotel Accommodations

Blocks of rooms have been set aside for use by participants at the University Inn and the Hyatt Pittsburgh. Participants should make their own reservations early directly with the hotels, and should identify themselves as participants in the Joint Mathematics Meetings. The rates listed below are subject to change, and to a 7% tax.

The following codes apply: FP = Free Parking; SP = Swimming Pool; AC = Air Conditioned; TV = Television; CL = Cocktail Lounge; RT = Restaurant. The age limit for children under which there is no charge, providing a cot is not required and they are in the same room with a parent, is shown in parentheses on the same line as the charge for an extra person in the room. In all cases, "Single" refers to one person in one bed; "Double" refers to two persons in one bed; and "Twin" refers to two persons in two beds. A roll-away cot for an extra person can be added to double or twin rooms only. Participants will be advised of deposit requirements by the hotels at time of confirmation.

The University Inn

Forbes Avenue at McKee Place, Pittsburgh, Pennsylvania 15213

Telephone: 412-683-6000

Single: \$42.00 Double: \$49.00

Extra person in room: \$5.00 (12 years)

Code: FP, AC, TV, CL, RT

10 minute walk from campus

Hyatt Pittsburgh

112 Washington Place, Pittsburgh, Pennsylvania 15219

Telephone: 412-391-5900

Single: \$50 Double: \$55 Twin: \$55

Extra person in room: \$12 (18 years)

Code: SP, AC, TC, CL, RT

15-20 minute bus ride from campus

MAA PROGRAM

7:00-10:00 p.m.

Pi Mu Epsilon Reception

9:00-9:50 a.m.

120-121 David Lawrence Hall

10:00-10:50 a.m.

120-121 David Lawrence Hall

11:00-11:50 a.m.

111 Law School

11:00-11:50 a.m.

120-121 David Lawrence Hall

5:30-6:30 p.m.

Ballroom, Student Union

6:30 p.m.

Ballroom, Student Union

7:30 p.m.

120-121 David Lawrence Hall

7:30 p.m.

7:45 p.m.

8:15 p.m.

8:45 p.m.

9:15 p.m.

TUESDAY, August 18

HEDRICK LECTURE III: "The Thirty-Years War"

Daniel Gorenstein

MAA Business Meeting

"The Math Workshop"

Deborah Hughes-Hallett, Harvard University

"Transition from Academia to Industry"

Ervin Cramer, Aerospace Corporation

Social Hour for Participants in the Banquet for Twenty-Five Year Members

Banquet for Twenty-five Year Members

SPECIAL EVENING SESSION:

"Computers in the Undergraduate Mathematics Curriculum: Experiments, Projects Reports and the National Consortium on Uses of Computers in Mathematical Science Education."

Introduction to the Session and Report on the National Consortium

Ronald H. Wenger, University of Delaware

"Instructional Software in the Undergraduate Math Curriculum"

Theron D. Rockhill, State University College, Brockport, New York

"Use of CONDUIT Materials in Teaching Mathematics"

David A. Smith, Duke University

"Results of a Project to Incorporate the Computer into the Mathematics Curriculum"

Sheldon P. Gordon, Suffolk Community College

"Simulation and Mathematical Modeling Using Computers"

Marialuisa McAllister, Moravian College

WEDNESDAY, August 19

1:20-2:10 p.m.

120-121 David Lawrence Hall

2:20-3:10 p.m.

120-121 David Lawrence Hall

2:20-3:10 p.m.

111 Law School

3:20-4:10 p.m.

120-121 David Lawrence Hall

3:20-4:10 p.m.

111 Law School

4:20-5:10 p.m.

111 Law School

5:30-7:00 p.m.

Ballroom, Student Union

7:00-9:00 p.m.

211 David Lawrence Hall

7:30 p.m.

120-121 David Lawrence Hall

"Astrophysics and Cosmology"

Cyril Hazard, University of Pittsburgh

"The Interaction of Complex-Analytic Geometry and Theoretical Physics"

R. O. Wells, Jr., Rice University

"Statistics and the Law"

Mary W. Gray, American University

"On the Way Primes, Sums of Squares and Other Integer Sequences are Distributed"

Heini Halberstam, University of Illinois

"Community College—Fast-paced Mathematics"

John R. Starmack, Community College of Allegheny County

"About that Text You are Planning to Write"

Marvin R. Schlichting, Triton College

Wine and Cheese Party sponsored by the Allegheny Mountain Section of the Association

MAA Mini-Course: "The Use of Computers to Teach Mathematics"

SPECIAL EVENING SESSION: "Microcomputer Graphics in Undergraduate Mathematics"

Mark John Christensen, Georgia Tech

Roy E. Myers, Pennsylvania State University at New Kensington

Gerald J. Porter, University of Pennsylvania

Travel

Pittsburgh International Airport is located 17 miles from city center (20 minutes). The airport limousine presently costs \$4.95. The limousine stops at several hotels, including The University Inn, which is quite close to campus.

Taxi fare from the airport to the campus presently costs about \$20. Cars can be rented at the airport.

Penn Central Station is served by Amtrak with two trains daily from both east and west.

Participants driving to the meeting should be aware that the city section in which the campus is located is called Oakland. The major city streets that go through Oakland are Forbes Avenue and Fifth Avenue. The highway that goes through Oakland has several names and numbers: US 22-30, I-376, Penn-Lincoln Parkway, and "the parkway."

Local Information

Pittsburgh operates on Eastern Daylight Time during the summer. The campus of the University of Pittsburgh is located in a metropolitan area with a population of nearly 2,000,000, but is quite close to the Schenley Park and Play Area including Schenley Nature Museum, where nature trails and woodland settings are available to all. Also located in the area are the Phipps Conservatory, one of the acclaimed botanical gardens of the world, Carnegie-Mellon University, and many other points of interest.

Weather

Pittsburgh weather in August is unpredictable ranging from hot and humid to cool and rainy. August temperatures range from 64F to 84F (18C to 29C).

Camping

Camping facilities are available at the following Pennsylvania State Parks within a 50 mile radius of Pittsburgh:

Keystone State Park near New Alexandria, Pennsylvania. Write to: Department of Environmental Resources, RD #2, Box 101, Derry, Pennsylvania 15627. Telephone: 412-668-2939.

Raccoon Creek State Park near Frankfort Springs, Pennsylvania. Write to: Department of Environmental Resources, RD #1, Hookstown, Pennsylvania 15050. Telephone: 412-899-2200.

Additional information may be obtained from the Office of Public Information, Department of Environmental Resources, Box 2063, Harrisburg, Pennsylvania 17120.

The following private campgrounds are near Pittsburgh:

Campground '70, Bentleyville, Pennsylvania 15314. Telephone: 412-239-2737. **Pittsburgh North KOA**, Mars, Pennsylvania 16046. Telephone: 412-776-1150. **Twilight Campground**, Charleroi, Pennsylvania 15002. Telephone: 412-483-6235. **Washington KOA**, Washington, Pennsylvania 15301. Telephone: 412-225-7590.

Medical Services

If a medical emergency should arise in the residence halls, please contact the front desk immediately. Otherwise, dial 2121 from campus phones, or 911 from outside phones. For medical services of a less immediate nature, the Presbyterian-University Hospital (B on the campus map) is located at DeSoto and O'Hara Streets (telephone 647-3333), and the Children's Hospital (C on the campus map) is located at 125 DeSoto Street (telephone 647-5555).

Child Care

All facilities reasonably close to the university are either closed during August or not equipped for short-term arrangements. The Local Arrangements Committee will, however, have available a list of private babysitters; ask at the Local Information Section of the Registration Desk.

Crib Rental

Cribs may be rented from the following, all of which are a considerable distance from the university. **A-R-A A-ACTION Rental, Inc.**, 3038 Babcock Blvd, Rt. 19 off I-79. Telephone: 412-931-2204. \$11.00 per week picked up or \$22.00 per week delivered. **A-R-A United States Rent Aalls**, 4856 Clairton Blvd. Telephone: 412-884-0300. \$11.95 per week picked up or \$15.95 per week delivered. **A to Z Rental Center**, 4015 William Penn Highway, Monroeville, Pennsylvania. Telephone: 412-856-7760. \$10.00 deposit; \$13.00 per week picked up or \$30.00 per week delivered.

Parking

A limited number of parking places is available for participants receiving room assignments in Litchfield Towers. The fee is \$2/day. Permits and keys to the parking area can be obtained at the main desk in Litchfield Towers or Forbes Hall. Information on parking for those not staying in either of these residence halls will be available at the Registration Desk.

Athletic Facilities

The following University athletic facilities are available to participants: tennis courts, swimming pools, handball and squash courts, quarter-mile track, basketball, softball, and baseball. A guest card will be issued at the main desk in Trees Hall, upon presentation of a residence hall key, to each person requesting the use of athletic facilities. It is expected that a charge of \$1.00 will be made for the guest card.

A running track and public golf course are in nearby Schenley Park. Jogging is possible in the park, and the parcours is adjacent to the running track. (Note: a parcours is a sequence of stations for exercise fitted out with various types of facilities for exercise and a sign at each station outlining appropriate exercises.)

Bookstores

The University of Pittsburgh Book Center at 4000 Fifth Avenue is open from 8:30 a.m. to 5:00 p.m. Monday through Friday. Other bookstores in the area are the Atlantic Bookshop, 3714 Forbes Avenue, and Jay's Bookstall at 3604 Fifth Avenue.

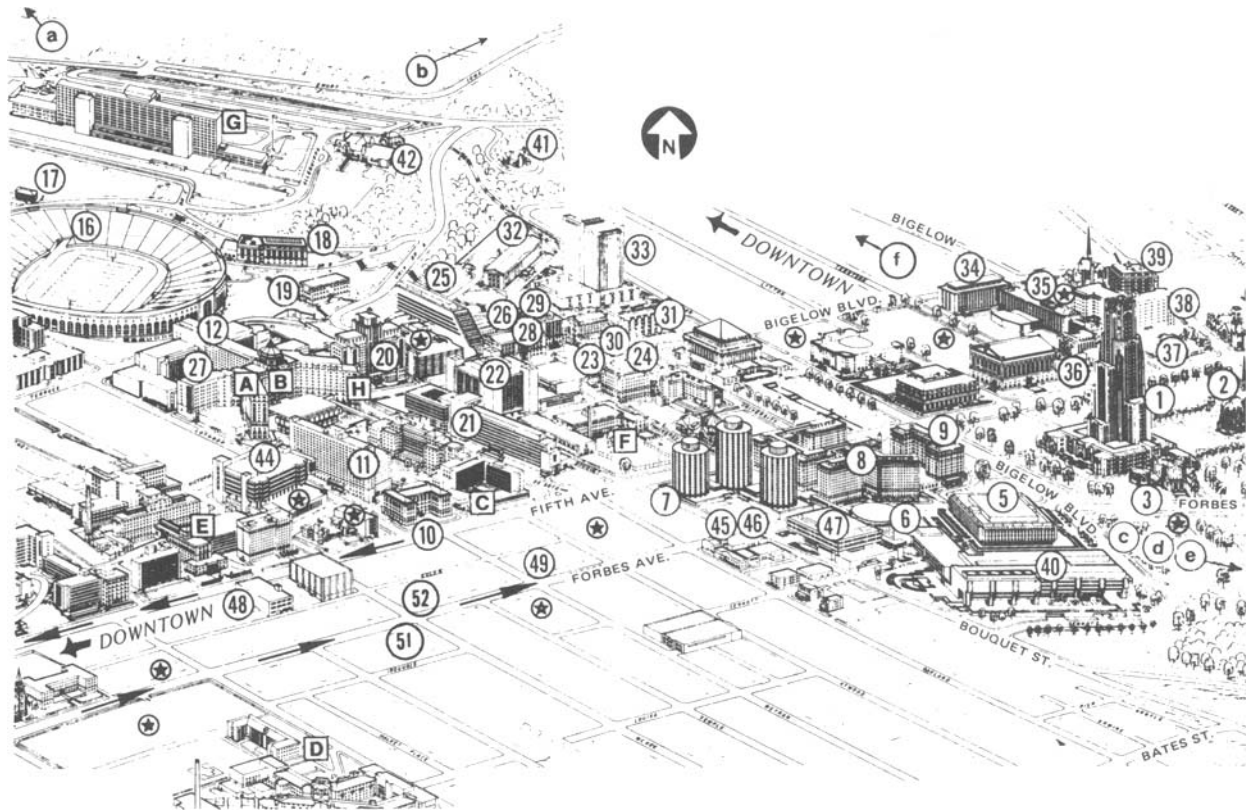
Libraries

Reading room privileges will be extended to participants at the University libraries. August hours are from 8:30 a.m. to 5:00 p.m. Copies of the University Library Guide will be available at the Local Information Service of the Registration Desk.

Local Arrangements Committee

Jacob Burbea, Chairman; Earle F. Myers, Publicity Director; Elayne Arrington-Idowu, F. Gonzalez Asenjo, William A. Beck, Mario Benedicty, Frank T. Birtel (ex-officio), Henry W. Block, W. Eugene Deskins, Barbara T. Faires, James P. Fink, William G. Fleissner, Ka-Sing Lau, William J. LeVeque (ex-officio), David P. Roselle (ex-officio), Kathleen Ann Taylor, Earl G. Whitehead, and Melvin Woodard.

UNIVERSITY OF PITTSBURGH AND VICINITY



UNIVERSITY BUILDINGS AND FACILITIES

(★ = PUBLIC PARKING)

- | | | |
|--|--|---|
| 1 Cathedral of Learning | 21 Graduate School of Public Health
(Crabtree Hall and Parran Hall) | 37 Music Building |
| 2 Heinz Memorial Chapel | 22 Benedum Hall of Engineering | 38 Ruskin Hall |
| 3 Stephen Foster Memorial | 23 Gardner Steel Conference Center | 39 Library |
| 5 Hillman Library | 24 Mervis Hall | 40 Forbes 1 Building (Schools of
Education and Public
and International Affairs
and the Social Sciences) |
| 6 Lawrence Hall | 25 Learning Research and Development Center | 41 Campus Nursery and Child
Development Center |
| 7 Litchfield Towers (Dormitory Housing) | 26 Nuclear Physics Laboratory | 42 Falk School |
| 8 Schenley Quadrangle (Amos, Holland,
McCormick, Brackenridge, and
Bruce Halls, Bookstore) | 27 Radiation Center (Clinical and Research) | 44 School of Nursing Building |
| 9 Student Union-Schenley Hall | 28 Allen Hall | 45 Oakland-Bouquet Offices |
| 10 Falk Clinic | 29 Engineering Hall | 46 University UP Gallery |
| 11 Lothrop Hall | 30 Thaw Hall | 47 School of Law |
| 12 Scaife Hall (Medicine) | 31 Space Research Coordination Center | 48 Hill Building 3434 Fifth Ave. |
| 16 Pitt Stadium | 32 Alumni Hall | 49 Loeffler Building, 3601 Forbes |
| 17 Varsity Hall (Campus Police) | 33 Chemistry Building | 51 Crossgates Inn |
| 18 Pennsylvania Hall | 34 Crawford Hall (Life Sciences and
Psychology Departments) | 52 Forbes Residence Hall |
| 19 Mineral Industrial Building | 35 Langley Hall (Psychology) | |
| 20 Western Psychiatric Institute and Clinic | 36 Clapp Hall (Life Sciences) | |

□ AFFILIATED INSTITUTIONS

- A Eye and Ear Hospital
- B Presbyterian-University Hospital
- C Children's Hospital
- D Magee-Womens Hospital
- E Montefiore Hospital
- F Frick School
- G Veterans Administration Hospital
- H Pittsburgh Child Guidance Center

○ OFF MAP

- (a) Allegheny Observatory, 159 Riverview Ave.
- (b) Computer Center, 600 Epsilon Drive
(Industrial Park)
- (c) Phipps Conservatory (flowers and exotic plants)
- (d) Schenley Nature Museum
- (e) Schenley Park and Play Area
- (f) Hyatt Pittsburgh

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Twenty-Five Nations Accept IMO Invitation

On July 8, about 180 high school students from the nations shown on the map will arrive in New York City prepared to engage in friendly but intense competition in the 1981 International Mathematical Olympiad (IMO). This will be the first time that the IMO has been held in the United States.

A committee chaired by A. B. Willcox, MAA Executive Director, has been busy for months with the myriad arrangements which must be made. The schedule of activities for the students includes sightseeing and recreation in New York City and Washington, D.C. in addition to two days of competition. The expenses of the students and their escorts while in this country will be paid from gifts to the MAA from NSF, IBM, Hewlett-Packard, Rockwell International, Texas Instruments, Upjohn, The Army Research Office, and the Annual High School Mathematics Examination.

The United States IMO team usually consists of the eight students who scored highest on the USA Mathematical Olympiad (USAMO). Students earn the right to participate in the USAMO, in turn, by placing among the top 150 or so in the Annual High School Mathematics Examination. (The results of the 1981 Examination are reported on page 8 of this issue. This issue went to press too early to include the results of the USAMO.—Editor)

Following the USAMO awards ceremony in Washington, D.C. in June, the eight winners, along with sixteen other young mathematicians, will spend the next four weeks in a rigorous training session.

Two adults, a Leader and a Deputy, will accompany each of the twenty-six teams. The Leaders and Deputies constitute

a Jury and bear the responsibility for selecting the problems to be solved in the contest. They also decide on the scoring of the problems and make final decisions involving the grading of problems and awarding of prizes.

The contest will take place on July 13 and 14 in Washington, D.C. Three problems will be presented on each of these days to be completed in four and one-half hours. The students' papers are first graded by their own Leader and Deputy and then are reviewed by teams of Coordinators from the United States.

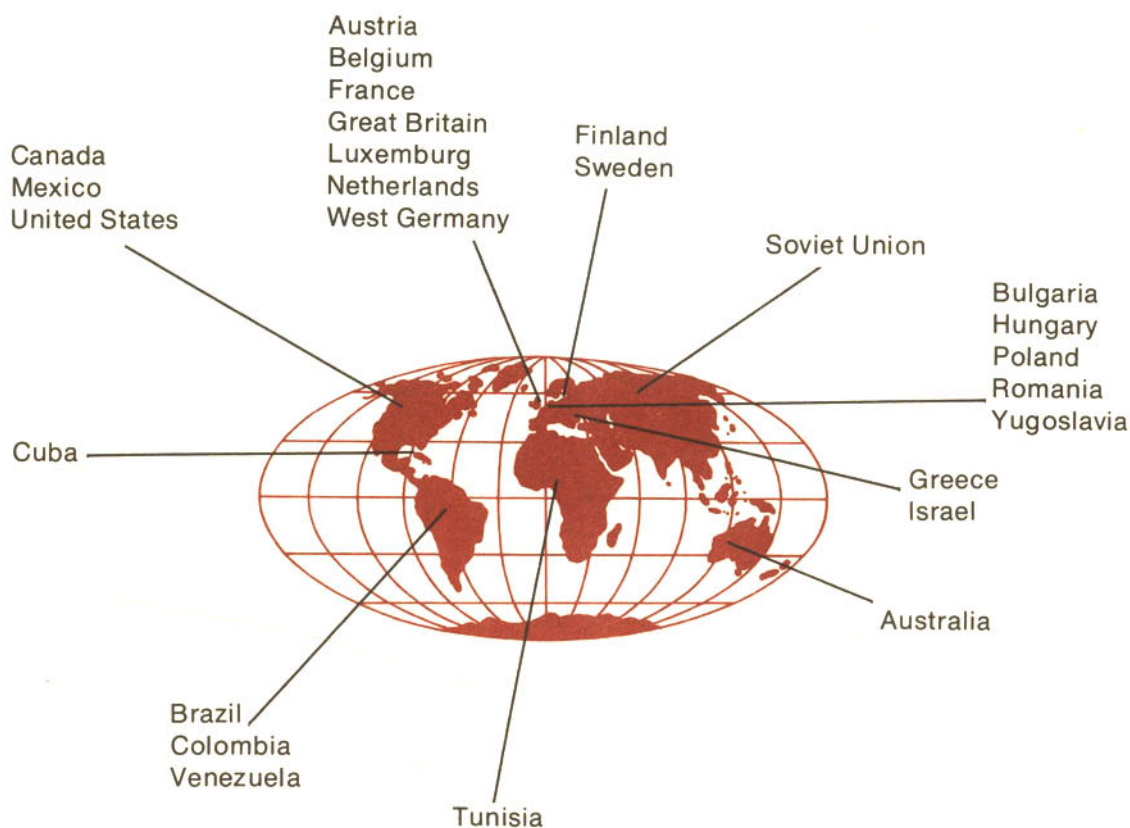
Like its athletic counterpart, the competition is officially among individuals, but national team standings are calculated unofficially. From 1974, when the USA first became a participant, through 1979, the USA has been among the top five teams, winning first place in 1977. The IMO was not held in 1980.

The IMO does not have an official continuing organization. Instead, at each IMO the delegations agree informally to accept an invitation from one of the nations. From that moment on, the new host nation takes the initiative.

IMO-81 will close on July 19 with a gala ceremony at which the awards and prizes will be distributed. The awards ceremony will be followed by a reception in the Great Hall of the National Academy of Sciences in honor of the contestants, the Jury, and other participants.

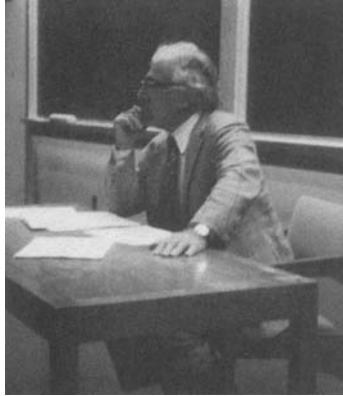
The outcome of IMO-81 will be reported in the September issue of *FOCUS*.

Best wishes to the USA team (and, of course, *all* IMO-81 teams)!



Gorenstein to Present Hedrick Lectures at Summer Meeting

Professor Daniel Gorenstein of Rutgers University will present three lectures on the classification of finite simple groups at the MAA Summer Meeting in Pittsburgh, Pennsylvania, two on Monday, August 17, and the third on Tuesday, August 18.



In the first lecture "The Enormous Theorem," Gorenstein will give a broad overview of the classification theorem and an explanation of the extreme length of its proof. The length of the complete classification is unprecedented in the history of mathematics, encompassing some five hundred pages, totalling many thousands of journal pages.

Much of the excitement surrounding simple group theory has been a result of the discovery of 26 so-called *sporadic* groups which are not a part of any infinite family of simple groups. The largest of these is Griess' "Friendly Giant" consisting of approximately 10^{54} elements. Gorenstein will describe the group-theoretic origins of the sporadic groups in his second lecture, entitled "The Friendly Giant and His Relatives."

In the third lecture, "The Thirty-Years War," Gorenstein will give highlights of some of the many battles that were fought during the roughly thirty-year period in which more than a hundred mathematicians struggled with the classification.

Interested in a No-cost Sabbatical?

If the answer is yes, the MAA's Sabbatical Exchange Information Service (SEIS) can help you contact faculty members with similar interests at other institutions. Details about how the program works and what you need to do to participate in it for the 1982-83 academic year will be published in the September and November issues of *FOCUS*.

One of the past participants in this program who arranged a successful exchange is Professor Charles Rees of the University of New Orleans. Professor Rees sent this letter to the MAA Headquarters last September:

"Hello,

I just wanted to report to you that I participated in an exchange initiated via SEIS, and to thank you greatly for this service. It provided me and my family with the best year of our lives.

I was listed in the SEIS Directory in December 1977, and I exchanged jobs, houses, and cars with P. Ramankutty of Auckland, New Zealand.

Please continue this service. I have told many others about it, and I hope to use it again myself.

Cordially, Charles Rees"

So whether or not you are eligible for a sabbatical, if you feel the need for a change of scene, plan on participating in SEIS. There is no cost and no obligation. Just the chance for the best year of your life!

Washington University Ranks Number One on Putnam

Three mathematics students from Washington University, St. Louis, won top honors for their school in the 41st William Lowell Putnam Competition held on December 6, 1980. For their outstanding performance, Kevin P. Keating, Nathan E. Schroeder, and Edward A. Shpiz will receive a team prize of \$5000 and individual prizes of \$250.

The next four winning teams in rank order are:

School	Team Members
Harvard University	Michael Raship, Ehud B. Reiter, Brian F. Sheppard
University of Maryland, College Park	Ravi B. Boppana, Brian R. Hunt, Eric I. Kuritzky
University of Chicago	Daniel J. Goldstein, Nicholas F. Reingold, Michael P. Spertus
University of California, Berkeley	Randall L. Dougherty, Lin Goldstein, Robin A. Pemantle

The awards for second place are \$2500 for the team and \$200 for each team member, for third place \$1500 and \$150, for fourth place \$1000 and \$100, and for fifth place \$500 and \$50.

A total of 2043 students from 335 colleges and universities in the United States and Canada participated in this year's Putnam Competition. There were teams from 237 schools.

The names of several "old pros" at mathematical competition appear on the list of the top ten winners. Eric D. Carlson of Michigan State University, Randall L. Dougherty of the University of California, Berkeley, and Lawrence E. Penn of Harvard University, all of whom were among the five highest ranking individuals, are former winners of the USA Mathematical Olympiad. Michael J. Larsen of Harvard University, who placed among the next five individuals, and several students on the honorable mention list also have won high honors in past USA Olympiads. Some of these students have also represented the United States in International Mathematical Olympiads.

The origins of the Putnam Competition are described in *The Mathematical Association of America: Its First Fifty Years*, edited by Kenneth O. May: "In 1938 the Putnam Competition was initiated as a result of a gift from the trustees of the Putnam estate and through the intervention of George David Birkhoff. Mr. Putnam had desired the money to be used to emphasize team competition as a way of spurring mathematical interest and achievement. The structure of the contest was also designed to encourage the participation of small colleges which might be able to field only individual contestants. From 1938 on, the competition was held annually, with two exceptions. Because of war, no contest took place from 1943 to 1945. In 1958 two contests were held."

A detailed report of the results of the 1980 competition will be published in the *American Mathematical Monthly*.

Readers interested in testing their mathematical mettle against former Putnam winners will find problems from 27 past Putnam Competitions collected in a single volume, *The William Lowell Putnam Mathematical Competition—Problems and Solutions: 1938-1964*, published last fall by the MAA.

Board of Governors Raises MAA Dues

At its meeting on January 8, 1981 the MAA Board of Governors approved a new schedule of annual dues and subscription rates to become effective in 1982. The new schedule will represent an increase of about 30% for most categories of membership. The Board took this action after extensive discussion of the Association's budget, dues, activities, and membership benefits. The essential fact emerging from that discussion was that a 30% increase in income from dues and publication sales will be necessary if the MAA is to maintain its essential services and programs.

In reaching this conclusion the Board took into account the following information:

- The MAA has incurred *modest* operating deficits in recent years but anticipates *serious* deficits in the next few years if dues and publication income does not increase.
- The MAA has made concerted efforts to control costs and increase the efficiency of its operations.
- Inflation in communications services—paper, postage, composition, printing—is substantially exceeding general inflation.
- Travel costs are increasing at an alarming rate at the same time that outside sources of travel support are dwindling.
- The MAA dues have been 25% lower than the average for organizations of similar size, budget, and purpose. This will remain true even *after* the new 1982 dues go into effect.
- MAA dues were not raised in 1981.
- New services have been added in recent years which greatly increase the benefits of MAA membership.

The Board expressed confidence that members will recognize these problems and will continue to support the Association. The Officers and the Executive Director pledged to continue and increase their efforts to control costs and thereby minimize future dues increases.

two new books from the maa ■ ■ ■

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PRIME-80 Follow-up

Committee Investigates Remedial Programs

The MAA's ad hoc Committee on Improving Remediation Efforts in the Colleges has found that although college remedial programs differ considerably in goals, content, instructional format, and cost, the most successful ones often share certain characteristics. Among these are:

- The involvement of regular faculty in the program.
- Enthusiasm among teachers coupled with respect for the potential of the students in the program.
- An informal atmosphere which encourages peer interaction.
- A strong emphasis on problem-solving; a de-emphasis on vocabulary.
- A substantial commitment in time and effort from students.
- Reasonable financial support, including appropriate rewards for faculty.

These and other findings of the Committee were presented to the Board of Governors in Ann Arbor in August 1980 and appeared in the "News and Notices" section of the *American Mathematical Monthly* in March 1981. Reprints of this article and a set of information sheets on various successful remedial programs prepared by the Committee may be obtained by writing to the MAA's Washington Office.

Remedial instruction in mathematics has become a matter of increasing concern in the mathematical community in recent years because of the large numbers of freshmen entering college who lack adequate preparation in mathematics. Sharp increases in remedial enrollment have occurred in virtually all types of collegiate institutions.

The MAA Executive Committee formed the Committee on Improving Remediation Efforts in the Colleges in Summer 1978 in response to a recommendation from the PRIME-80 Conference (see note below). The Committee gathered information on remedial programs and developed a series of recommendations on future MAA activities in the area of remediation. To carry out the Committee's recommendation that remediation become an ongoing concern of the Association, a Joint Panel on Remediation has been formed under the sponsorship of the Committee on the Undergraduate Program in Mathematics, The Committee on the Teaching of Undergraduate Mathematics, and the Committee on Two-Year Colleges. This Panel is chaired by Gerald Alexanderson of the University of Santa Clara.

The Committee on Improving Remediation Efforts, being an ad hoc committee of the Association, was disbanded in January 1981. Members of the Committee were Robert Bumcrot, Philip M. Cheifetz, Ronald M. Davis, Donald M. Hill, Eleanor G. Jones, Joan P. Leitzel (Chairperson), and Jean J. Pedersen.

The PRIME-80 (Prospects In Mathematics Education for the 1980's) Conference was called by the Executive Committee of the MAA in Spring 1978 in order to assess the impact during the 80's of the new challenges in collegiate mathematics education. Reports on other MAA committee activities which have grown out of the PRIME-80 Conference will appear in future issues of FOCUS.

Record Number of Students Take High School Mathematics Exam

Over 422,000 students from 7000 high schools in the United States and Canada and approximately 15,000 students from 11 foreign countries participated in the Annual High School Mathematics Examination this year. This is the largest number of students to take the Examination since it was initiated in 1950.

The Examination, which is administered by the MAA Committee on High School Contests, is a ninety-minute, multiple choice examination based on precalculus mathematics with emphasis on algebra and geometry. All secondary (and pre-secondary) students are eligible to participate through their schools.

Two hundred sixty nine students won places on the Honor Roll by earning scores of 100 points or more out of a possible 150 points. The majority of these students are high school seniors, but there were also 68 juniors, 14 sophomores, and 3 freshmen who made the Honor Roll. The top 159 Honor Roll students were invited to participate in the USA Mathematical Olympiad which was held on May 5, 1981.

The MAA publishes problems from the annual examinations in 1950-60, 1961-65, and 1966-72 in the *New Mathematical Library* series (Volumes 5, 17, and 25).

Further information about the Annual High School Mathematics Examination can be obtained from Dr. Walter E. Mientka, Executive Director, MAA Committee on High School Contests, Department of Mathematics and Statistics, University of Nebraska, Lincoln, Nebraska 68588.

Requests for Combined Membership List Due by July 1

This is the year that the *Combined Membership List* (CML) of AMS, MAA, and SIAM is distributed free of charge to any MAA member requesting a copy. This is done only in odd-numbered years.

If you want a copy of the CML, watch the mail for the CML request card and return it to the MAA's Washington Office before July 1, 1981. *This will be your only opportunity to request a free copy.* The cost of the CML at all other times is \$5 for members and \$10 for non-members.

Special School (continued from page 1)

studies. Interdisciplinary offerings, internships, and a mentor program are integral parts of the school curriculum.

Students at the School of Science and Mathematics are not the only constituency served by the School. Teachers and students throughout North Carolina will benefit from the innovative ideas and new approaches that will evolve as a natural consequence of interaction between a talented faculty and talented students. The School is determined to make the techniques and methods that result from these experiences readily available throughout the State. As the first formal offering in this phase of the program, the School is running two summer workshops on the uses of microcomputers in the teaching of mathematics, science, and computer programming. Over 250 applications were received for the 120 positions in the two-week residential workshops, dramatic proof that North Carolina teachers are eager for additional training in the mathematical sciences.

Funding for the School has been achieved through an extraordinary partnership between the public and private sectors. In this the School has been extremely fortunate. The summer workshops, for example, are partially funded by the Fund for the Advancement of Science and Mathematics Education in North Carolina and by a gift from R. J. Reynolds Industries, Incorporated, of Winston-Salem. The development of software for integrating the microcomputer into the curriculum is being aided by a grant from the Apple Education Foundation and the National Science Foundation. The purchase of a VAX-11/750 minicomputer has been made possible by a grant of \$100,000 from a private corporation. Generosity such as this from private individuals, corporations, and foundations is helping increase the momentum started by the people of North Carolina when they established the School.

The impact of the School has been immediate. Interest has been elicited not only by the unique nature and purpose of the School, but also by recognition that discrete elements—governments, foundations, corporations, individuals, and the scientific and educational communities—have been catalyzed in a singular way to implement a singular goal.

Readers who have suggestions for the program or who want information about the School may write to Dr. Steve Davis, NCSSM, 1912 Club Boulevard, Durham, NC 27705.

FOCUS

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