

FOCUS

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Mathematics Majors are in Demand

R. D. Anderson

It is time, or well past time, for us to encourage bright undergraduates to major in mathematics. We have too long let the dismal academic employment opportunities for Ph.D.'s during the early and middle seventies adversely affect the morale of our whole profession. Anecdotal evidence from many sources indicates that professional opportunities for those with bachelor's, master's, or Ph.D. degrees in mathematics have substantially improved in the past few years.

Recent statistical evidence also supports the view that mathematicians are increasingly in demand and that we should be very upbeat when talking about opportunities for people who successfully study mathematics.

Increases in Employment of Mathematical Scientists

According to the *NSF Science Resources Studies Highlights*, April 9, 1982, there was a 19% increase in employment of mathematical scientists over the period 1978-1980. This compares with a 12% increase in employment of computer specialists and only a 7% increase in overall employment of scientists and engineers. Recently, the unemployment rate for computer specialists and mathematical scientists has been less than 1%.

These data, which include the employment experience of graduates at all degree levels, undoubtedly reflect the increasing mathematization and computerization of our developing technological society.

Salaries for Mathematical Sciences Graduates

A new study, conducted under the auspices of the Conference Board of the Mathematical Sciences (CBMS), *Employment of Recent Bachelor's and Master's Graduates in the Mathematical and Computer Sciences*, provides evidence that mathematics majors are also doing quite well in terms of salary. This study is based on National Science Foundation data from large representative samples of all master's and bachelor's graduates in science and engineering in the years 1972 through 1979. (Editor.—A summary of the CBMS study will be published in a later issue of *FOCUS*. Copies of the complete report may be obtained for \$2 from CBMS, 1529 Eighteenth Street, N.W., Washington, D.C. 20036.)

Some data from the NSF files concerning bachelor's graduates in mathematics and computer science are:

- Computer science graduates, as expected, are paid more than mathematics graduates—by about \$3000 per year. However, when one restricts the graduates to those employed in business and industry, the salary differential is reduced to about \$1500 for those one year past the bachelor's degree and to only about \$1000 for those two years past the degree. With mean salaries in 1980 of close to \$20,000, these differentials represent only 5% to 8% of salaries.

(continued on page 7)



USA Mathematical Olympiad winners pose in front of the statue of Einstein on the grounds of the National Academy of Sciences following the Awards Ceremony, June 8. They are, left to right, (front row) Washington Taylor IV, Edith Starr, Douglas Jungreis, W. David Vinke, (back row) Tsz Mei KO, Noam Elkies, Vance Maverick, Brian Hunt. See *U.S. Team Ties for Third Place in 1982 Olympiad* on page 3.

National Groups Explore Ways to Improve Precollege Mathematics and Science Education

NSB Commission on Precollege Education in Mathematics, Science, and Technology

Solutions to this country's critical need for high school graduates with solid backgrounds in science and mathematics are being explored by the new National Science Board (NSB) Commission on Precollege Education in Mathematics, Science, and Technology.

MAA members Frederick Mosteller of the School of Public Health, Harvard University, and Katherine P. Layton of Beverly Hills High School are among the twenty individuals who were sworn in at the Commission's first meeting July 9-10 in Washington, D.C. The Commission is co-chaired by William T. Coleman, former Secretary of Transportation, and Cecily Cannan Selby, chairperson of the Board of Advisors of the North Carolina School of Science and Mathematics. Testifying before the Commission at its first meeting were Paul DeHart Hurd (Professor Emeritus, Stanford University) on science education, James Fey (University of Maryland) on mathematics education, and Henry O. Pollak (Bell Laboratories) on education for technology.

The goal of the Commission is to define a national agenda for improving mathematics and science education in this country. The Commission will develop an action plan that will include a definition of the appropriate roles of federal, state and local governments, professional and scientific societies, and the private sector in addressing this problem. It will be active over a period of 18 months and is expected to issue interim reports on its findings at six-month intervals.

National Commission on Excellence in Education

NSB Commission activities will be closely coordinated with the activities of the Department of Education's National Commission on Excellence in Education, created in August 1981. This Commission is holding a series of meetings, hearings, and site visits around the country. The first hearing, held last March at Stanford University, dealt specifically with problems in science and mathematics education. Henry L. Alder, University of California, Davis, was one of five invited national experts to testify before the Commission.

National Convocation on Precollege Education in Mathematics and Science.

Further groundwork for the work of the NSB Commission was laid in May at a two-day convocation, attended by some 600 individuals, at the National Academy of Sciences. The purpose of this meeting was to draw public attention to the decline in the quality and quantity of precollege education in mathematics and science. The meeting was widely reported in the national media. Speakers included NSF Director John B. Slaughter, Secretary of Education Terrell H. Bell, Secretary of Defense Caspar W. Weinberger, Senator John H. Glenn, and astronomer Carl Sagan. White House assistant Edwin L. Harper delivered a message from President Reagan stating "This administration has deliberately suspended what had become a proliferation of small federal programs which—taken together—showed themselves to be ineffective in stemming the slide in science and math performance that had been evident for at least a decade . . . The answer lies in

the imaginative initiatives undertaken to bring together all levels of the private and public sectors to achieve the goal we all share."

Conference of AAAS Affiliates

Immediately following the convocation at the National Academy of Sciences, the American Association for the Advancement of Science (AAAS) held a two-day conference to determine what professional scientific and engineering organizations, working collectively, might do to help counteract America's problems in science and mathematics education. Fifty-three professional organizations affiliated with AAAS, including the Mathematical Association of America, American Mathematical Society, National Council of Teachers of Mathematics, and Conference Board of the Mathematical Sciences, were represented at the meeting.

During the meeting, three working groups developed a series of priorities for a coalition of professional organizations. A summary report of the conference or the more detailed *Conference Proceedings* may be obtained from Dr. F. James Rutherford, Chief Education Officer, AAAS, 1776 Massachusetts Avenue, N.W., Washington, D.C. 20036. Another meeting will be held this fall to work out an organizational framework for the coalition and to lay plans for addressing the priorities identified at the first meeting.



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NSF Science Education Directorate Replaced

The National Science Foundation (NSF) has replaced its Directorate for Science and Engineering Education with the Office of Scientific and Engineering Personnel and Education. Dr. Walter L. Gillespie has been appointed Office Director and Dr. Alphonse Buccino has been appointed his Deputy.

The Office, which reports to Dr. John B. Slaughter, Director of NSF, is the focal point within the Foundation for all policy and program matters related to scientific and engineering personnel and education. The Office has two sections:

- The Fellowships Section, which is responsible for operating the Graduate Fellowships Program, the Minority Graduate Fellowships Program, the NATO Postdoctoral Fellowships Program, and travel grants to NATO Advanced Study Institutes;

- The Award Administration and Liaison Section, which is responsible for managing major active awards that were funded through the Directorate for Science and Engineering Education, and for liaison with other government agencies and the public regarding education policy and programs.

U.S. Team Ties for Third Place in 1982 Olympiad

A strong U.S. team tied this year with East Germany for third place in an exceedingly close race in the International Mathematical Olympiad (IMO) held in Budapest, Hungary, on July 9-10, 1982. West Germany's team placed first with a score of 145 and the Russian team followed with a score of 137. The United States and East Germany were in hot pursuit at 136, and Vietnam occupied fifth place with a score of 133. Hungary, the host nation, placed sixth with a score of 125. For the first time since the United States joined in the IMO competition, all members of the U.S. team earned individual prizes.

One hundred students, chosen for their high scores on the Annual High School Mathematics Examination (*FOCUS*, May-June 1982), competed in the USA Mathematical Olympiad (USAMO) held on May 4. The eight students receiving the highest scores on this examination were declared 1982 USAMO Fellows by the MAA and were brought to Washington to be honored on June 8. The USAMO Awards Ceremonies, coordinated by Nura D. Turner of SUNY, Center at Albany, are held each year at the National Academy of Sciences and the beautiful Diplomatic Reception Rooms of the U.S. Department of State in Washington, D.C.

A milestone for the USAMO was the appearance of a young woman, Edith Starr of Philadelphia, Pennsylvania, among the traditional winners. This was an important first for the USAMO, now in its eleventh year, and promises to be only a first step in a long-awaited trend toward a more balanced representation of the sexes in mathematical competitions. The other seven 1982 USAMO Fellows are: Noam D. Elkies (New York City), Douglas S. Jungreis (North Woodmere, New York), Brian R. Hunt (Silver Spring, Maryland), Tsz Mei KO (Corona, New York), Washington Taylor IV (Cambridge, Massachusetts), Vance Maverick (Los Angeles, California), W. David Vinke (Alvinston, Ontario). Two of the winners, Elkies and Hunt, were also 1981 USAMO winners and members of the team that took top honors in the 1981 IMO held in the United States.

Following the Awards Ceremonies the winners and about 16 other students participated in a three week training session held at the U.S. Naval Academy at Annapolis. The purpose of the session was to prepare the U.S. team for the IMO and to give advanced training to able U.S. students who will be eligible for future teams. The 1982 training session was led by Professors Murray Klamkin and Andrew Liu, who accompanied the U.S. team to Hungary.

For reasons never fully explained but almost certainly based on financial considerations, Hungary invited teams of only four students from each of the participating nations, although teams of eight were the norm in previous years. The U.S. team consisted of USAMO fellows Elkies, Hunt, Jungreis, and Taylor. Accompanying the U.S. team as an observer was Professor Samuel Greitzer, Chairman of the MAA Subcommittee on the USAMO. Professor Henry Alder, former Secretary and President of the MAA, was present at part of the IMO as a member of the IMO Site Committee, appointed by the International Commission on Mathematics Instruction.

The sponsors of the USAMO are the MAA, the Society of Actuaries, the National Council of Teachers of Mathematics, Mu Alpha Theta, and the Casualty Actuarial Society. Financial support for the USAMO and the U.S. team is given by IBM, the Army Research Office, the Office of Naval Research, and Hewlett-Packard. The sponsors and seven book publishers presented awards to the USAMO Fellows.

Campaign to Free Massera

An international campaign to obtain freedom for the Uruguayan mathematician Professor Jose Luis Massera is now being directed by Henri Cartan, 95 Boulevard Jourdan, 76014 Paris, France and by Israel Halperin, 39 Elm Ridge Drive, Toronto, Ontario, M6B 1A2, Canada.

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Efforts Underway to Improve Articulation Between High Schools and Colleges

B.E. Rhoades

To paraphrase Charles Dickens, "These are the best of times and the worst of times." During the decade of the 70's, and now into the 80's, we have witnessed steadily declining SAT scores in mathematics and English, increasing enrollments in remedial courses, diminishing numbers of mathematics majors and prospective mathematics teachers, and a shortage of secondary school mathematics teachers now reaching crisis proportions.

At the same time, there are encouraging signs pointing to a reversal of these discouraging trends and to the emergence of a new national commitment to excellence in mathematics education. A number of these have been described in past issues of *FOCUS*: the establishment of the National Science Board (NSB) Commission on Precollege Education in Mathematics, Science, and Technology; the development of a series of recommendations on the college preparatory curriculum by the Ohio Board of Regents and the State Board of Education in Ohio; the founding of the North Carolina School of Science and Mathematics for scientifically and mathematically talented eleventh and twelfth graders; California Governor Brown's urgent call, in his State-of-the-State address last January, for increased support of mathematics and science education. The first meeting of the NSB Commission and various other national activities are described on page 2 of this issue of *FOCUS* in the article titled "National Groups Explore Ways to Improve Precollege Mathematics and Science Education."

The purpose of this article is to inform *FOCUS* readers about some other national and state-wide activities that are now underway, all directed toward the goals of better pre-college education and improved articulation between high schools and colleges, and the formation of a new MAA-NCTM Committee on Articulation.

Educational EQuality Project

In 1980 the College Board initiated the Educational EQuality Project in an effort to help reverse the perceived decline in the *quality* of secondary education in the United States and as a continuation of the Board's long-standing commitment to improving the *equality* of access to educational and career opportunities. The EQuality project is providing a framework for secondary schools and collegiate institutions to work together to reach consensus on the level and quality of academic preparation that should be expected of students moving from secondary schools to higher education.

The first phase of the project, which was completed in Spring 1980, resulted in a statement of the basic academic competencies that all high school students should acquire in reading, writing, speaking and listening, mathematics, reasoning, and studying.

The current phase of the EQuality project aims at the development of a statement of the preferred patterns of college preparation in six academic areas: the Arts, English, Foreign Languages, History/Social Studies, the Sciences, and Mathematics. Tentative statements in each of these areas have

been developed by an Advisory Committee composed of representatives from secondary schools and colleges and are serving as the stimulus for many discussions and dialogues. The College Board plans to publish the final versions of the statements in late Fall 1982.

Further information about the EQuality project may be obtained by writing to: Educational EQuality Project, The College Board, 888 Seventh Avenue, New York, NY 10106.

Persons attending the panel discussion "Articulation Efforts Between Universities and Schools" at the MAA Annual Meeting in Cincinnati in January 1982 learned of several successful efforts at improving articulation that are now taking place in several states. Joan P. Leitzel presented information about activities at Ohio State University, Philip C. Curtis, Jr. spoke about efforts in the state of California, and Franklin P. Wilbur described the Syracuse University Project Advance.

Ohio State

For many years Ohio State University has given placement examinations to in-coming freshmen. The period from the mid 60's through the mid 70's showed a decrease in the percentage of students ready for calculus and a marked increase in the number of students requiring remedial work in mathematics. Beginning in the mid 70's, Ohio State began a number of activities which have contributed to a reversal of these trends. These activities include sending performance data on freshmen at the University back to the high schools from which they graduated, sending letters to guidance counselors and parents which describe the mathematics needed to be successful at Ohio State, and development of a placement test program for high school juniors. The placement test program currently involves approximately 35,000 students from 219 high schools. Test results are sent to the student and the high school along with an indication of the remedial courses, if any, at Ohio State or the University of Akron that would be required for success in the student's intended program, if the student's mathematics skills were to remain at the same level. One observable result has been a sharp increase in mathematics enrollment by high school seniors. Additional state-assisted universities joined this program in the fall of 1982; it is anticipated that all of the state-assisted universities will eventually participate.

Another activity that is now underway is the development of a new senior mathematics course for students who tested at the lowest level on the placement test. This course, which will be piloted in about 25 high school classrooms next year, utilizes a highly numerical approach to algebra and geometry and makes extensive use of calculators and graphing. Writers include faculty from the mathematics and education departments of OSU and local high school teachers.

California

Because inadequate mathematics preparation of entering freshmen has posed academic problems for students at both the California State University and the University of California campuses, diagnostic tests in precalculus and algebra were developed by a joint faculty committee beginning in 1978 and are now being used for placement purposes by all campuses of the University of California and by most of the campuses of the California State University. Nearly 100 California high schools are also administering appropriate ver-

sions of these tests to their students at various levels. The results are used to uncover individual student deficiencies which then can be corrected with additional work, to indicate to the teacher where the course as a whole should be strengthened, and to help students select appropriate mathematics courses for the coming year.

The two university systems recently raised their entrance requirements in English and mathematics. Both will require four years of English. Starting in the fall of 1984 two years of college preparatory mathematics will be required of all students entering the California State University. For admission to the University of California, students graduating from high school in 1986 or later will be required to have successfully completed three years of mathematics—one year each of elementary algebra, geometry, and intermediate algebra. At the same time, the University of California will increase the overall amount of college preparatory work required for admission with a special emphasis on the work done in the last two years.

The Academic Senates of the California Community Colleges and the two university systems have also recommended that mathematics courses at the level of arithmetic, algebra I and II, and geometry be classified as remedial and that baccalaureate credit no longer be awarded to students who take such courses at the post-secondary level. Trigonometry, if taught as a separate course or in combination with more elementary topics, would be similarly classified as remedial.

In October 1981, the University of California Board of Admissions and Relations with Schools, of which Henry L. Alder is Chairman, sent a letter to the parents of all eighth grade students in California. In this letter parents were urged to advise their children to take English and mathematics every semester and to encourage their children to form good study habits. Professor Alder reports that the response from parents has been very positive.

Syracuse University

During the summer of 1972, superintendents and principals from seven high schools in the area of Syracuse, New York, met to discuss their dissatisfaction with their schools' programs for college-bound seniors. Declining academic motivation and boredom, particularly among senior-year students planning to enter college, were problems common to all schools represented. From these meetings, and from other similar discussions with high school teachers and university professors, the Syracuse University Project Advance (SUPA) evolved.

SUPA allows qualified high school students to enroll in regular Syracuse University courses as part of their senior-year program. Seven introductory courses (biology, calculus, chemistry, English, psychology, religion, and sociology) are taught in the high school by high school teachers. These courses are supervised by professors from the appropriate academic departments at Syracuse University. Students who successfully complete a course are entitled to a regular Syracuse University transcript, and credit earned by the student can be transferred to most colleges and universities in the country. SUPA is in its eighth year of operation and currently serves about 4,000 students each year from seventy-seven high schools in New York, Massachusetts, Michigan, and New Jersey. It has been enthusiastically accepted, both by participating high schools and by the University.

MAA-NCTM Committee on Articulation

The interest generated by the talks presented in Cincinnati on the activities in Ohio, California, and New York resulted in the formulation of a special joint MAA-NCTM Committee on Articulation to examine these and other articulation efforts nation-wide and to determine the roles that MAA and NCTM should play in these efforts. Committee members are: P. C. Curtis, Jr., University of California at Los Angeles; Chancey O. Jones, Educational Testing Service; Joan R. Leitzel, Ohio State University; Vincent O'Connor, Mathematics Supervisor, Milwaukee Public Schools; B.E. Rhoades (Chairman), Indiana University; Barbara Wickless, State Supervisor of Mathematics of Iowa; Gail S. Young, University of Wyoming. Comments, questions, and suggestions are welcome and should be sent directly to the Chairman: Professor B. E. Rhoades, Department of Mathematics, Indiana University, Bloomington, IN 47405.

People in the News



Henry L. Alder, Professor of Mathematics at the University of California, Davis, has been appointed to a four-year term on the California State Board of Education. Professor Alder, a former MAA Secretary and President, is widely known for his efforts on behalf of mathematics education both at the secondary and collegiate levels. As an indication of the range of his contributions to the mathematical community, readers may note that there are three articles in this issue of *FOCUS* alone mentioning state, national, and international mathematical activities in which Professor Alder has recently been engaged.



Joan R. Leitzel, Associate Professor of Mathematics at Ohio State University, was recently selected to receive an Alumni Award for Distinguished Teaching. Professor Leitzel has been recognized not only for her teaching but also for her contributions in course development and in counseling and advising students. Professor Leitzel is active in projects of the Ohio Section of the MAA and has served in various capacities with the Association. She chaired the ad hoc Committee on Improving Remediation Efforts in the Colleges and currently serves as a member of the Panel on Remediation and as a member of CUPM.

Everett Pitcher, retired Distinguished Professor of Mathematics of Lehigh University, has been honored with the establishment of a lecture series named for him. The income derived from the Everett Pitcher Lecture Series Fund will be used to bring distinguished mathematicians to the Lehigh campus. The expository lectures in the series will be designed to interest and challenge senior undergraduate mathematics majors and graduate students.

Announcing the 1982 Putnam Competition

The 43rd Annual William Lowell Putnam Mathematical Competition will be held at participating institutions on Saturday, December 4, 1982. This competition is supported by the William Lowell Putnam Prize Fund for the Promotion of Scholarship and is administered by the MAA. Any college or university in Canada or the United States may register eligible undergraduates. Registration forms will be mailed in September to institutions that participated in the 42nd competition. Other institutions that wish to enter undergraduates should request registration forms from Professor L. F. Klosinski, University of Santa Clara, Santa Clara, CA 95053. Completed registration forms must be received no later than October 15, 1982.

Further details are given in the Announcement Brochure that is mailed with the registration material. Reports of competitions, including examination questions and outlines of solutions, are published in the *American Mathematical Monthly*.

NSF Seeks Regional Conference Proposals

The National Science Foundation is seeking proposals from prospective host institutions in the U.S. for five-day regional conferences, each to feature 10 lectures by a distinguished guest lecturer on a subject of current research interest in the mathematical sciences. Topics for conferences may be concerned with any of the subdisciplines of the mathematical sciences. An applying institution should have at least a minimal research competence in the area of its proposal. The conferences should be planned for a summer week in 1983 (not earlier than May 1) or held during a recess in the succeeding academic year. The objective of the project is to stimulate and broaden mathematical research activity. The organization of the conferences, evaluation of proposals, and arrangements for publication of expository papers based on the guest speaker's lectures are expected to be carried out by the Conference Board of the Mathematical Sciences under contract with the Foundation. The conference awards themselves, however, are made by the NSF.

Each conference must plan for a single principal guest lecturer from outside the host institution and about twenty-five other participants. It is expected that the lecturer will give two lectures per day during the five days of the conference, with the remainder of the time available for study, informal discussion, and exchange of ideas.

Participants in a conference receive allowances for travel and subsistence under the host institution's grant from the Foundation for the conference. In addition, the principal lecturer receives from the Conference Board a fee for delivering the lectures and a second fee for organizing these into a substantial expository paper. The Conference Board arranges for editing and publication of these papers.

Proposals by prospective host institutions (twenty copies) should be sent directly to Data Support Systems Branch, National Science Foundation, 1800 G Street, N.W., Washington, D.C. 20550, and must be received by November 15, 1982.

During most of the eleven years since the establishment of the regional conference program, many more proposals of very high quality were submitted to the NSF than could

be funded. In the past two years, however, the number of such proposals has diminished markedly. As a result, only six conferences were held in 1982. Funding is expected to be available for ten conferences in 1983 and it is hoped that enough proposals of very high quality will be submitted so that a suitable selection can be made.

Inquiries regarding details of proposals for these regional conferences should be addressed to the Conference Board of the Mathematical Sciences, 1529 Eighteenth Street, N.W., Washington, D.C. 20036.

Information About Service Courses and Discrete Mathematics Courses Wanted

Service Courses in Mathematics

The MAA Panel on Service Courses is seeking information about successful service courses in mathematics. This panel was formed last winter by the Committee on the Undergraduate Program in Mathematics (CUPM) and the Committee on the Teaching of Undergraduate Mathematics (CTUM). Its aim is to develop recommendations for mathematics courses to serve students in disciplines other than mathematics.

Anyone with information about instances of interdepartmental cooperation which have led to unusual or otherwise noteworthy service courses in mathematics is urged to send a description of these courses and, if possible, course syllabi, and other instructional materials to the Chairman of the panel: Professor Donald W. Bushaw, Department of Pure and Applied Mathematics, Washington State University, Pullman, WA 99164-2930.

The Panel on Service Courses has also begun gathering information from representatives of other disciplines about the mathematics that they think their students should learn. So far, most of the activity has been in computer science, health sciences, and engineering.

Discrete Mathematics Courses

One of the recommendations to come out of the conference on the first two years of college mathematics which was held at Williams College, June 28-July 1, 1982, (*FOCUS*, May-June 1982) is that another new CUPM panel be formed. This panel would be responsible for extending and coordinating further investigations into the question of the relation of discrete mathematics to calculus at the freshman-sophomore level.

In anticipation of the formation of this panel, anyone with information about discrete mathematics courses which emphasize the algorithmic approach to mathematics often used in computer science is urged to send descriptions of these courses, along with any instructional materials available, to the CUPM Chairman, Donald W. Bushaw (address above).

These courses should be at the same level of sophistication as the standard first year calculus course, rather than at the (lower) level of most current finite mathematics courses or at the (higher) level of current discrete mathematics courses for upperclass students. Anyone who might be interested in offering a pilot program which incorporates such discrete mathematics courses into the first two years of the curriculum should also contact Professor Bushaw.

In Memoriam

John D. Arrison, Director of the Computer Center at Millikin University, died in November 1981 at the age of 47. He was a member of the MAA for 3 years.

Salomon Bochner, Professor at Rice University, died in May 1982 at the age of 82. He was a member of the MAA for 27 years.

Stewart S. Cairns, Professor Emeritus from the University of Illinois, died June 28, 1982 at the age of 78. He was a member of the MAA for 53 years.

William V. Gamzon, Professor at Los Angeles Harbor College, died in October 1981 at the age of 61. He was a member of the MAA for 32 years.

H.C. Griffith, retired from Florida State University, died December 2, 1981 at the age of 64. He was a member of the MAA for 33 years.

Franklin T. Haimo, Professor at Washington University, died June 3, 1982 at the age of 62. He was a member of the MAA for 35 years and Associate Editor of the *American Mathematical Monthly*, 1979-81.

E.A. Hazelwood, Professor Emeritus from Texas Tech University, died February 2, 1982 at the age of 78. He was a member of the MAA for 46 years.

Walter W. Jacobs, Professor Emeritus from American University, died in February 1982 at the age of 67. He was a member of the MAA for 26 years.

Georgina G. Kidder, Professor at the University of Puerto Rico, died May 27, 1982 at the age of 48. She was a member of the MAA for 22 years.

Basil R. Myers, Professor at the University of Maine, Orono, died April 6, 1982 at the age of 59. He was a member of the MAA for 13 years.

Irvine R. Pounder, retired from the University of Toronto and York University, died April 8, 1982 at the age of 91. He was one of the 1045 charter members who organized the MAA in 1915.

Mathematics Majors (continued from page 1)

- Even more striking is the non-existence of salary differentials of those employed in business and industry who identify their employment field as computer science or data processing. The data show that for employment of these individuals in the early summer of 1980, the recorded mean salaries of 1978 graduates were \$19,600 for those with (self-classified) degrees in mathematics and \$19,800 for those with degrees in computer science; for the 1979 graduates the figures were \$18,100 for mathematics graduates and \$18,500 for computer science graduates, differentials on the order of only 1% to 2% of salaries. The estimated total numbers of employed bachelor's graduates for the two years in this category were almost 7,000 from mathematics and almost 11,000 from computer science, indicating excellent employment opportunities for mathematics majors who know some computing.

- Generally speaking, the average salaries of mathematics bachelor's graduates employed in business and industry, particularly in the fields of operations research or engineering, were somewhat higher than those in computer specialties. Those in the fields of mathematics, statistics, or non-science business were lower. The estimated numbers employed in each of these five fields of specialties were

much smaller than in the field of computer science or data processing.

The general import of these data is that there are good-to-excellent business and industry employment opportunities for bachelor's graduates in mathematics and that salaries are almost comparable to those of graduates in computer science, particularly when the mathematics graduate has enough computing knowledge to qualify directly for a computing or data processing position.

Shortage of Mathematics Graduate Students

Anecdotal evidence, as well as some statistical data from the American Mathematical Society's Committee on Employment and Educational Policy, indicate that there continues to be a serious shortage of well-qualified graduate students in mathematics. There also appears to be a resultant developing shortage of really talented young research people in mathematics. Undergraduate mathematics majors with at least two of the three qualifications of (1) good undergraduate records, (2) good recommendations from their undergraduate faculty, and (3) good GRE scores have excellent opportunities to obtain graduate assistantship support at most state universities and at some private universities with well-recognized Ph.D. programs. Partly because many young Ph.D.'s in both pure and applied mathematics are seeking and finding non-academic employment, there is currently strong demand for young Ph.D.'s in non-Ph.D.-producing academic departments. For research-promising Ph.D.'s, there are excellent prospects for temporary positions in major departments with some later opportunities for tenure-track positions in other Ph.D.-producing departments. By the mid-nineties, faculty retirements should produce many further openings in tenure-track positions for young Ph.D.'s. Note that a beginning undergraduate in 1982 cannot expect to obtain a Ph.D. degree before about 1990 and thus will not face a tenure decision before the middle or late nineties, at a time when tenure should certainly be opening up.

The Future

There are three factors, jointly indicating a continuing shortage of quantitatively-oriented people in our society, which make the prospects for the mathematically-trained individual exceedingly bright over the next generation at least:

- The rapidly increasing development of computer technology requiring more technically-trained and quantitatively-oriented people.

- The demographic phenomena which, for the United States, will produce a drop of more than 26% in the 21-year-old age group population by the mid-nineties. This will create a need for a 35% increase in the number of technically-trained people in that age group just to maintain present numbers of work force entrants involved with science and technology.

- The continuing general deterioration, or at best non-improvement, of overall precollege student performance in mathematics and science.

There is every reason to encourage talented and well-motivated undergraduates to study as much mathematics as they profitably can. There are excellent employment opportunities for those who opt out before the Ph.D. and there are good academic, as well as non-academic, prospects for those who receive a Ph.D.

Listings Now Accepted for 1983-84 Sabbatical Exchange Program

The MAA Sabbatical Exchange Information Service (SEIS) is now accepting listings for the 1983-84 academic year. This service helps faculty members who are interested in no-cost sabbatical exchanges to contact individuals with similar interests at other institutions.

MAA members who want to be listed in the 1983 SEIS Directory should write to SEIS, Mathematical Association of America, 1529 Eighteenth Street, N.W. Washington D.C. 20036, enclosing the following information about themselves: (1) Name (2) Institution (3) Department (4) Address (5) Rank (6) Major field of interest (7) Highest earned degree (8) Names of courses recently taught (9) Normal teaching load (10)

Section of the United States or foreign country preferred for visit (11) Period during which exchange is desired (12) Whether this is an "official" sabbatical. In order to be included in the SEIS Directory, this information must reach the MAA Washington Office by December 1, 1982.

SEIS Directories will be sent to all SEIS participants in January 1983. Others who want copies should write to SEIS at the address above. There is no charge for MAA members. Non-members should enclose a check or money order for \$5.

Once the Directory is distributed, it is up to the individuals to contact likely prospects and to make all arrangements with the faculty members, departments, and institutions involved.

Calendar

National MAA Meetings

66th Annual Meeting, Denver, Colorado, January 7-9, 1983
63rd Summer Meeting, SUNY at Albany, New York, August 8-10, 1983

67th Annual Meeting, Louisville, Kentucky, January 27-29, 1984.
68th Annual Meeting, Anaheim, California, January 11-13, 1985.

Sectional MAA Meetings

Eastern Pennsylvania and Delaware West Chester State College, West Chester, Pennsylvania, November 20, 1982.

Indiana Wabash College, Crawfordsville, Indiana, October 16, 1982.

Maryland-DC-Virginia Gallaudet College, Washington, D.C., November 12-13, 1982.

New Jersey Rutgers University, Newark, New Jersey, October 31, 1982.

North Central University of Minnesota-Duluth, Duluth, Minnesota, October 29-30, 1982.

Northeastern Worcester State College, Worcester, Massachusetts, November 19-20, 1982.

Ohio Youngstown State University, Youngstown, Ohio, October 22-23, 1982.

Seaway St. Lawrence University, Canton, New York, November 12-13, 1982.

Southern California Pepperdine University, Malibu, California, November 13, 1982.

Other Meetings

OCTOBER 1982

1-2. **Tenth Annual Mathematics and Statistics Conference—Mathematics and Computing**, Miami University. (*FOCUS* May-June 1982)

1-2. **Annual Student Conference of the Ohio Delta Chapter of Pi Mu Epsilon**, Miami University. (*FOCUS* May-June 1982)

9. **Meeting of The Fibonacci Association**, San Jose City College, San Jose, California. Contact: Richard Vine, The Fibonacci Association, University of Santa Clara, CA 95053.

27-30. **Symposium on Inequalities in Statistics and Probability**, University of Nebraska-Lincoln. Contact: Y.L. Tong, Department of Mathematics and Statistics, University of Nebraska-Lincoln, Lincoln, NE 68588-0323.

NOVEMBER 1982

11-14. **American Mathematical Association of Two-Year Colleges Annual Convention**, Las Vegas, Nevada. Contact: Shirley Trembly, Convention Chairperson, Department of Mathematics, Bakersfield College, Bakersfield, CA 93305 or James Baldwin, Department of Mathematics, Nassau Community College, Garden City, NY 11530.

DECEMBER 1982

10-12. **Canadian Mathematical Society Annual Winter Meeting**, University of Toronto. Contact: Canadian Mathematical Society, 577 King Edward Avenue, Ottawa, Ontario K1N 6N5.

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