

# FOCUS

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## U.S. Students Rank Below Students from Other Countries in International Study

Charles Cable

A summary of U.S. results in the Second International Mathematics Study, released at a conference at the University of Illinois late in September, shows U.S. elementary and secondary students lagging behind students from other countries in achievement in mathematics.

The study, the largest such cross-national analysis ever conducted, provides detailed information from each of twenty-four participating countries about the content of the mathematics curriculum, how mathematics is taught, and how much mathematics students learn. It is designed to provide information that can be used by individual countries to analyze their school programs, and to help national officials plan future directions in school mathematics in their own countries.

The study surveyed the mathematics curriculum provided for two groups of students, those in the grade with the modal number of thirteen-year-olds and those enrolled in advanced mathematics classes in the terminal year of secondary school. In the U.S., approximately 7,500 eighth-grade students and 6,000 twelfth-grade students in Precalculus or Calculus classes participated in the study. These students completed inter-

nationally-developed mathematics achievement tests at the beginning of the 1981-82 academic year and again at the end of the school year. Student testing also included attitude inventories.

During the year, the teachers of the students in the survey answered questionnaires describing how they taught specific topics, their beliefs about teaching, and the resources and general teaching processes they employed. At the end of the year, they completed questionnaires indicating whether or not students in their classes were given the opportunity to learn the mathematics needed to respond to each item on the international tests.

Preliminary achievement results indicate a mean performance for U.S. students essentially in the middle of the distribution of international means for 13-year-old students (*continued on page 2*)

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## Joint Mathematics Meetings January 1985

The January 1985 Joint Mathematics Meetings will be held in Anaheim, California, January 9-13. The meetings will include the **68th Annual Meeting of the Mathematical Association of America**, January 11-13, the **91st Annual Meeting of the American Mathematical Society**, and the 1985 annual meetings of the **Association for Symbolic Logic**, the **Association for Women in Mathematics**, and the **National Association for Mathematicians**.

The meeting program, preregistration and housing forms, and Employment Register information and forms were mailed to all MAA members in the center section of the October issue of *FOCUS*. **MAA members are urged to send in their preregistration forms by November 15, if possible. However, preregistrations and contributed papers will continue to be accepted through November 30.** Anyone who has not preregistered for the meetings may register at the Registration Desk in the North Lobby of the Anaheim Convention Center, Tuesday, January 8, 4:00 p.m.-8:00 p.m., Wednesday, January 9, 8:00 a.m.-5:00 p.m., or Thursday, January 10 through Saturday, January 12, 8:00 a.m.-4:00 p.m.

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Meeting events for the January 1985 Joint Mathematics Meetings will be held in the Anaheim Convention Center, pictured above, and the Anaheim Marriott Hotel.

### U.S. Students (continued from page 1)

in the areas of Arithmetic, Algebra and Descriptive Statistics. In the area of Geometry, the U.S. eighth-grade mean was near the 25th percentile of the international distribution. U.S. performance in Measurement was substantially below that level.

Precalculus students, who make up the great majority of the senior high school sample in the U.S., achieved at a level substantially below the international mean and, in some cases, ranked with the lower one-fourth of the countries participating in that phase of the study. The achievement level of U.S. high school Calculus students, the best mathematics students in our country, was somewhat above the average achievement for the international sample.

A revealing piece of information in the study was the lack of intensity with which topics in Precalculus are covered in the U.S. Reports of classroom coverage of particular topics show that on the average, most topics in Precalculus are discussed for only one or two days at a time with no apparent distinction being made between very important ideas versus those of little importance. It also appears that there is inadequate review given to topics covered in the twelfth grade in the U.S. Teachers report that they teach a topic and go on without coming back to it later in the year. This is in sharp contrast to the practice in other countries of reviewing previous topics on a regular basis.

Another concern is the level of expectation that teachers hold for their student's performance. When teachers were asked how they initially presented a list of theorems in the areas of trigonometry, analytic geometry, college algebra, and calculus, the precalculus teachers reported basically asking students only to understand informal justifications of theorems. The calculus teachers, on the other hand, formally proved at least some of the theorems and expected their students to give informal justifications.

The responses from teachers clearly reveal that the U.S., unlike most other participating countries, does not have a national curriculum in mathematics. At both the eighth-grade and twelfth-grade levels, the U.S. curriculum was characterized by wide variation. There was also enormous variation in achievement across the country. Forthcoming reports, based on more complete analyses of the national and international data, identify specific sources of the variation in school mathematics programs and attempt to associate patterns of achievement with teaching practices as well as with curriculum patterns.

The Second International Mathematics Study was conducted by the International Association for the Evaluation of Educational Achievement (IEA), an international network of educational research centers. In each country, a national committee of specialists in mathematics education and testing was responsible for the study. The U.S. Committee was chaired by James T. Fey of the University of Maryland. Kenneth J. Travers of the University of Illinois at Urbana-Champaign directed the International Study.

Participating in the study were: Australia, Belgium (both Flemish and French), Canada, Chile, England, Finland, France, Hong Kong, Hungary, Ireland, Israel, Ivory Coast, Japan, Luxembourg, Netherlands, New Zealand, Nigeria, Scotland, Swaziland, Sweden, Thailand, and United States.

Information about availability of the report may be obtained from: Professor Ken Travers, Second International Mathematics Study, 341 Armory Bldg., 505 E. Armory St., University of Illinois, Champaign, IL 61820.

## Congress Appropriates Funds for Mathematics and Science Education

Congress has approved appropriations of \$100 million to fund Title II of the Education for Economic Security Act which it passed last July. (See *FOCUS*, September 1984.) The bill became Public Law 98-377 after President Reagan signed it on August 11.

Title II calls for a block grant program to fund state activities in training for new teachers, and retraining and inservice training for current teachers of science and mathematics. The program will be administered by the Department of Education.

National Science Foundation (NSF) programs authorized in the bill have received no appropriations to date. The Senate Appropriations Committee has asked NSF to report in January on how it is spending the funds for precollege mathematics and science education which were authorized before the new bill was enacted. Should NSF need additional funds, the committee could include them in a supplementary appropriations bill.

*The information in this article was current as of October 11, 1984.*



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## Bieberbach Conjecture Proved

Paul Zorn

One of the longest-standing and most renowned problems in mathematics has been solved by Professor Louis de Branges of Purdue University.

Felix Browder of the University of Chicago describes the 68-year-old Bieberbach conjecture as "perhaps the most important single conjecture in classical analysis—one that has stood as a challenge to mathematicians for a very long time." News that the conjecture had been verified spread quickly through the mathematical world last spring and summer as de Branges lectured in Europe and as preprints and informal communications circulated. At the August 1984 Joint Meetings of the MAA and the AMS (American Mathematical Society) in Eugene, Oregon, talk of de Branges' achievement was heard everywhere.

The Bieberbach conjecture concerns the class of one-to-one analytic (i.e., conformal) functions  $f$ , defined on the unit disk in the complex plane, for which  $f(0)=0$  and  $f'(0)=1$ . Every such function  $f$  can be written as a convergent power series  $z + a_2z^2 + a_3z^3 + \dots$ , where the  $a_n$  are complex constants. In 1916, the German mathematician Ludwig Bieberbach conjectured that for  $n=2,3,4, \dots$ ,  $|a_n| \leq n$ , and that equality holds only for the Koebe function, whose series is  $z + 2\alpha z^2 + 3\alpha^2 z^3 + \dots$ , where  $\alpha$  is a complex number of modulus one.

The most important property of one-to-one analytic functions was stated by Riemann in 1851 in his famous mapping theorem: every simply connected proper subregion of the complex plane is the image of the unit disk under a conformal mapping. Important in the proof is the principle that the mapping function can be estimated by its value and its first derivative at the origin. The Bieberbach conjecture refines this principle by estimating all the coefficients (and hence all the derivatives at the origin) of the mapping function. In this setting, verifying the Bieberbach conjecture became a leading problem of geometric function theory.

The Bieberbach conjecture can also be viewed as an infinite collection of optimization problems: for each  $n$ , to choose among all normalized conformal mappings of the unit disk the one which maximizes  $|a_n|$ . What de Branges has shown is that the Koebe function is the unique solution to every one of these problems.

The Bieberbach conjecture resisted all attempts at a general solution for nearly seven decades. Bieberbach himself verified only the case  $|a_2| \leq 2$ . The case  $|a_3| \leq 3$  was established in 1923 by Karl Loewner, a Czech, using a differential equation method that would later appear as part of de Branges' proof. Proofs were eventually found for coefficients through the sixth, the most recent only in 1972, by the Americans Roger Pederson and Menachem Schiffer. In another direction, the British mathematician J. E. Littlewood showed in 1923 that for all  $n$ ,  $|a_n| < en$ . Efforts to replace  $e$  with smaller and smaller constants continued for many years; by 1978, David Horowitz had used coefficient inequalities of Carl FitzGerald to show that  $|a_n| < 1.0657n$ . The conjecture was also verified for various special classes of conformal mappings, including those with starlike range (R. Nevanlinna, 1920), those whose coefficients are all real numbers (Dieudonné and others, about 1931), and those which are near in a suitable sense to the Koebe function (about 1961). In spite

(continued on page 7)

## New Directions in Two-Year College Mathematics

Mathematics at two-year colleges in this time of educational ferment was the topic of a conference July 11-14 at Menlo College. According to organizer Donald Albers, this was the first such national conference devoted to the concerns of two-year colleges. Funded by the Sloan Foundation, the conference was attended by 24 representatives of MAA, the American Mathematical Association of Two-Year Colleges (AMATYC), the National Council of Teachers of Mathematics (NCTM), the Society for Industrial and Applied Mathematics (SIAM), vocational organizations and publishers.

Papers presented covered a wide range of curricular, pedagogical and professional concerns. Topics which aroused the most discussion were faculty renewal, coordination with high schools and four-year colleges, statistics, technical mathematics, remediation and computers.

The conferees prepared a set of recommendations for consideration by MAA and other organizations for endorsement. Among the recommendations are some to the effect that:

- Two-year faculty have an urgent need for renewal, and various aspects of this renewal are the responsibility of, respectively, the faculty themselves, their institutions, the mathematics associations, government and foundations.
- Remedial mathematics needs fresh approaches, involving new material (eg., modern applications, discrete topics) and new use of tools (calculators, computers).
- Statistics deserves a much increased role, both as a non-calculus course and as an aspect of all elementary courses.

The conference proceedings will be published this winter by Springer-Verlag, under the same title as this article. The complete recommendations (2 pages) may be obtained from Professor Donald Albers, Menlo College, Atherton, CA 94025; or from Professor Amber Steinmetz, AMATYC President, Santa Rosa Junior College, Santa Rosa, CA 95401.

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## SAT Math Scores Up in 1983-84 Testing

The average scores of high-school seniors on the mathematics section of the Scholastic Aptitude Test (SAT) rose three points in 1983-84 to 471. This is the third year in a row that this score has risen, following a worrisome 17-year decline.

Verbal scores also increased, but only by a single point. The overall four-point increase raises the average combined mathematics and verbal score to 897, the largest increase since 1962-63. However, College Board officials warn that this represents only a "modest upward trend" and that the combined average is still 83 points lower than the average score of college-bound seniors in 1962-63.

George Hanford, College Board President, while describing the increases as "encouraging," nevertheless noted that "at the current rate, it would take until the year 2000 for the national math average to reach the level of 1963."

Hanford does not believe that the current surge of interest in the quality of education in U.S. schools can be credited for the increase. "The SAT measures verbal and reasoning abilities that develop over many years," he says. Hanford speculates that last year's high-school seniors may have enjoyed "better instruction in the lower grades." Among the students tested in 1983-84 were students whose scores on other tests in earlier grades were showing improvement in the 1970's.

In addition, results from a questionnaire accompanying the SAT indicate that students had taken more courses in high school than had the students who graduated before them, a continuation of a seven-year trend.

The average increase for female students on the mathematics section of the SAT was twice that for males—four points versus two. The average score of students who said they intended to major in education rose four points on the verbal section, to 398, and seven points on the mathematics section, to 425. However, these scores still are among those furthest below the national average.

Additional information about 1983-84 SAT scores appears in a report published by the College Board, "National College-Bound Seniors, 1984." Copies of the report may be obtained at no charge from: College Board, 888 Seventh Avenue, NY, NY 10106.

## Anderson Leading Fund-raising Efforts for International Congress

Former MAA President Richard D. Anderson is directing fund-raising efforts for the International Congress of Mathematicians (ICM), which will be held in August 1986 in Berkeley, California. The aim of the Committee on Special Funds for ICM, of which Anderson is chairman, is to keep registration fees within the reach of mathematicians in the U.S. and abroad. A companion effort to help defray expenses at the Congress of young mathematicians and mathematicians from countries with severe dollar shortages is also being organized.

The Committee on Special Funds is asking for assistance from members of the mathematical community in identifying people in corporations or foundations who might be helpful in securing donations for the Congress or its attendees. Names and addresses may be forwarded to: Professor Richard D. Anderson, Chairman, Committee on Special Funds, ICM 1986, P.O. Box 6887, Providence, RI 02940.

## COMAP To Start National Mathematical Competition in Modeling

The Consortium for Mathematics and Its Applications (COMAP) has announced that it will start a new national Mathematical Competition in Modeling next February. The purpose of this competition is to involve students and faculty across the country in analyzing and preparing solutions to open-ended problems. The competition will be funded by a three-year grant from the Fund for the Improvement of Post-Secondary Education (FIPSE).

This will be a team competition, with teams working for a four-day period to prepare a single solution paper. Each team will select one of two problems. The selection of problems and grading of solution papers will be overseen by an advisory committee chaired by Ben Fusaro of Salisbury State College. If funding permits, COMAP will offer three awards for each problem.

Major features of the competition include:

- The selection of realistic open-ended problems chosen with the advice of working mathematicians in industry and government;
- An extended period of time for teams to prepare solution papers;
- Use by participants of outside resources including computers, texts, and other written materials;
- Emphasis on clarity of exposition in selection of the award-winning papers;
- Publication of summary solutions in professional mathematics journals.

It is hoped that as the contest becomes established in the mathematics community, new courses, workshops and seminars will be developed to help students and faculty gain increased experience with mathematical modeling. Furthermore, publication of the outstanding papers will help to emphasize the importance of scientific exposition and the problem-solving process.

Announcements are being sent to all Departments of Mathematics in the United States requesting the appointment of faculty advisors and the selection of one or more teams of three students each.

For more information, contact: Solomon A. Garfunkel, Executive Director, COMAP, 271 Lincoln St., Suite No. 4, Lexington, MA 02173.

### Late Additions to Anaheim Program

In addition to the events listed in the program for the MAA Annual Meeting in Anaheim, California, January 11-13, there will be a panel discussion titled "Is there an alternative to remediation?" on Saturday, January 12, 7:00 p.m.-9:00 p.m. Donald Bushaw of Washington State University will chair the discussion.

An event on the program of the American Mathematical Society of special interest to MAA members is a presentation by John Polking, Director of the Division of Mathematical Sciences of the National Science Foundation, titled "Federal Support for the Mathematical Sciences: Research and Education." This session will be held on Wednesday, January 9, at 4:45 p.m.

## MAA Contests Committee Starts Junior High Exam

Starting in December 1985, the Committee on High School Contests (CHSC) will offer the American Junior High School Mathematics Examination (AJHSME). Modeled on the successful American High School Mathematics Examination (AHSME), now in its 36th year, the AJHSME will be a 30-question, 60-minute, multiple-choice examination aimed primarily at students in grades 7 and 8. All of the CHSC examinations are sponsored jointly by MAA, the Society of Actuaries, the National Council of Teachers of Mathematics, Mu Alpha Theta, the Casualty Actuarial Society, and, starting in 1985, the American Statistical Association.

The Committee is planning wide publicity for the AJHSME this school year and is offering reduced registration fees to schools which sign up early. MAA members are urged to check that their local schools know about AJHSME and encourage them to participate.

The AJHSME will be complementary to MATHCOUNTS, the national junior high school exam initiated in 1983-84 by the National Society of Professional Engineers. Whereas MATHCOUNTS emphasizes small team participation at local, state and national meets, the AJHSME will emphasize broad participation at each school. Able students identified by the AJHSME will be encouraged to enter the CHSC sequence of high school exams later in the year. The CHSC also hopes to have a positive influence on curriculum by emphasizing topics and skills which are appropriate today.

It is planned to score the AJHSME centrally. This will be CHSC's first foray into large scale computer scoring.

The AJHSME Chairman is: Professor Thomas Butts, Department of Science Education, University of Texas at Dallas, Box 688, Richardson, TX 75080.

## Applications Invited for Congressional Science Fellowship

Applications are invited from candidates in the mathematical sciences for the Congressional Science Fellowship for the twelve-month period beginning September 1, 1985. This fellowship is jointly supported by the American Mathematical Society (AMS), MAA, and the Society for Industrial and Applied Mathematics (SIAM). Fellows spend one year working on the staff of a member, a committee, or a support agency of Congress. The AMS-MAA-SIAM fellowship is one of some thirty similar fellowships supported by scientific societies in a program administered by the American Association for the Advancement of Science.

A prospective fellow must hold a doctorate in one of the mathematical sciences, and should have a broad scientific and technical background and a strong interest in the uses to which mathematics and other sciences may be put for the solution of societal problems. Experience in working with people in a non-mathematical setting is very desirable.

The Fellowship stipend is \$26,000. Relocation and travel expenses will be paid (up to \$1500). The Fellow is welcome to supplement the stipend with sabbatical salary or other employer contributions.

Application forms may be obtained from: Conference Board of the Mathematical Sciences, 1529 Eighteenth Street, N.W., Washington, D.C. 20036. The deadline for completed applications is January 1, 1985. The award will be announced by February 15, 1985.

## The Florida Section's Regional Meetings

The MAA's Florida Section has been involved in a statewide secondary/collegiate "articulation" project since 1976, long before such projects had become fashionable. High school, two-year college, four-year college, and university faculty come together once a year for one-day meetings organized by the Section to get to know one another and to explore their common concerns. Meetings are held in each of seven geographic regions in Florida, and in an eighth region in the Caribbean.

The Florida Section officers and regional organizers feel that the regional meeting program has significantly increased communication between the secondary and collegiate mathematics faculties in Florida schools and colleges. They would like to encourage other MAA Sections to launch similar programs.

For sample programs or additional information on meeting organization, write: Professor Bettye Anne Case, Department of Mathematics, Florida State University, Tallahassee, FL 32306; or Professor Don R. Lichtenberg, College of Education, University of South Florida, Tampa 33620.

### In Memoriam

**T. F. Cope**, of Rochester, Minnesota, died July 9, 1984. He was an MAA member for 60 years.

**Karen A. Cunningham**, a student at the University of Washington, Seattle, died this year at the age of 27. She was an MAA member for 3 years.

**Helen W. Henderson**, of the Exxon Company, Houston, Texas, died in May 1983. She was an MAA member for 32 years.

**Cheng-Tan Hsiao**, of National Chiao-Tung University, Hsinchu, Taiwan, died this year at the age of 33. He was an MAA member for 8 years.

**Joseph P. LaSalle**, of Brown University, died in July 1983 at the age of 83. He was an MAA member for 38 years.

**Geert C. E. Prins**, of Wayne State University, died this year at the age of 59. He was an MAA member for 10 years.

**K. Nageswara Rao**, of North Dakota State University, died July 28, 1984, at the age of 50. He was an MAA member for 6 years.

**Merrill E. Shanks**, of Tempe, Arizona, retired from Purdue University, died April 28, 1984, at the age of 73. He was an MAA member for 48 years.

**Samuel Skolnik**, of Los Angeles, California, died this year. He was an MAA member for 1 year.

**Robert Tates**, of IBM, Armonk, New York, died December 24, 1983, at the age of 58. He was an MAA member for 29 years.

**Fred Toney, Jr.**, of the University of North Carolina, died January 1, 1984, at the age of 47. He was an MAA member for 19 years.

**Strother H. Walker**, of the University of Colorado, died in February 1983 at the age of 70. He was an MAA member for 24 years.

**Felix P. Welch**, Professor Emeritus of Washington & Lee University, died September 22, 1984, at the age of 78. He was an MAA member for 19 years.

## Panel Issues Preliminary Report on Discrete Mathematics

The MAA's Panel on Discrete Mathematics in the First Two Years has issued a preliminary report of its findings and recommendations, which is now available without charge to MAA members.

The report contains a discussion of the issues involved in changing the standard mathematics curriculum, and tentative suggestions for solutions to some of the perceived problems. The report also contains a suggested course outline for a one-year freshman-sophomore level course in discrete mathematics, a discussion of its impact on calculus, a review of standards for preparation of computer scientists (from professional organizations in that field), and a bibliography. In addition, an attempt has been made to define the role of the elementary discrete mathematics course in the education of mathematics majors.

A review of the progress of the schools now experimenting with innovative programs under grants from the Sloan Foundation is included in the report. The work of the MAA Panel on Discrete Mathematics, including preparation of this preliminary report and the final panel report, is also funded by a grant from the Sloan Foundation.

MAA members may obtain a copy of the report from the MAA's Washington Office (1529 Eighteenth Street, N.W., Washington, D.C. 20036). Copies will also be available at the Registration Desk at the Joint Mathematics Meetings in Anaheim in January.

An open discussion of the report has been scheduled for the January meetings. The Panel expects a lively interchange. Responses and comments may also be sent to the chair of the Panel: Professor Martha J. Siegel, Department of Mathematics, Towson State University, Towson, MD 21204. The final report of the Panel is expected to be published by January 1986.

## Contributions Sought

### Russian-English Dictionary to be Revised

The American Mathematical Society's Translations Department is preparing a new edition of a Russian-English dictionary of the mathematical sciences. The first edition of this dictionary was published in 1961 under the joint auspices of the National Academy of Sciences of the USA, the Academy of Sciences of the USSR, and the American Mathematical Society. It has been recognized that a new edition would be desirable, and indeed, A. J. Lohwater, the original author, was working on a revision until his death in 1982.

To maximize the value of this undertaking, the Russian-reading mathematical public is hereby solicited to submit contributions to the word list. These may be of two kinds: 1) new meanings for terms already in the dictionary, 2) new entries. It would be helpful if contributors can cite a specific occurrence of the new word or meaning in the Russian literature, together with one or more occurrences of the corresponding term in a primary English language context (not a translation).

Responses should be addressed to the Translations Department, American Mathematical Society, P.O. Box 6248, Providence, RI 02940.

## Symposium to be Held in Strasbourg, France

### The Influence of Computers and Informatics on Mathematics and Its Teaching

The International Commission on Mathematical Instruction is organizing a symposium to be held March 25-30, 1985, in Strasbourg, France, on "The Influence of Computers and Informatics on Mathematics and Its Teaching." The main questions to be addressed by the symposium are:

- How do computers and informatics influence mathematical ideas, values, and the advancement of mathematical science?
- How can new curricula in mathematics be designed to meet the needs and possibilities of computers and informatics?
- How can the use of computers help in the teaching of mathematics?

About forty individuals from around the world will be invited to participate in the symposium. Anyone wishing an invitation should submit an abstract of a possible contribution to the symposium to: Dr. F. Pluvinage, IREM, 10 rue du General Zimmer, 67084 Strasbourg, Cedex, France.

A discussion document on the subject of the symposium, produced by the Program Committee, may be obtained from: Dr. A. G. Howson, Faculty of Mathematical Studies, The University, Southampton SO9 5NH, England. Members of the Program Committee are: R. F. Churchhouse (UK), B. Cornu (France), A. P. Ershov (USSR), A. G. Howson (UK), J. P. Kahane (France—Chair), J. H. van Lint (The Netherlands), F. Pluvinage (France), A. Ralston (USA), and M. Yamaguti (Japan). The symposium is supported by a grant from UNESCO.

## Calculus Articulation Panel Receives Grant from Sloan

The MAA Panel on Calculus Articulation, a panel of the Committee on the Undergraduate Program in Mathematics (CUPM), has received a \$7000 grant from the Sloan Foundation. The grant is helping to support a survey, conducted by the panel, of college and university mathematics departments and selected high school mathematics departments on the experience and expectations of those involved in teaching calculus.

The articulation problems that students encounter in making the transition from high school calculus courses to college calculus courses have grown both in number and intensity during the past ten to fifteen years. Today, the question of how to place these students in college mathematics courses is one of the most difficult problems confronting college mathematics departments. Students who take calculus in high school can be presumed to be among the more talented students in mathematics and science. Therefore the low retention rate of these students as mathematics or science majors is (or should be) a serious concern of our society.

The Calculus Articulation Panel consists of four high school teachers and three college teachers: Gordon Bushaw, Central Kitsap High School, Silverdale, Washington; Don Nutter, Firestone High School, Akron, Ohio; Ron Schnackenberg, Steamboat Springs High School, Steamboat Springs, Col-

orado; Barbara Stott, Riverdale High School, Jefferson, Louisiana; John Hodges, University of Colorado; Don Sherbert, University of Illinois, Champaign-Urbana; Don Small, Colby College.

Comments and suggestions on problems in calculus articulation are welcome. They should be sent to the chairman of the panel: Professor Don Small, Department of Mathematics, Colby College, Waterville, ME 04901. The panel expects to make its final report to the CUPM in January 1986.

Another MAA committee, the Committee on Placement Examinations, is preparing a special issue of the *Placement Test Newsletter* on the question of calculus placement. Individual copies of this issue will be available from the MAA Headquarters Office early in 1985; an announcement will appear in *FOCUS*.

## American Statistical Association Joins High School Contests Effort

Starting in 1985, the American Statistical Association (ASA) will become the sixth sponsor of the Committee on High School Contests (CHSC). As a sponsor, ASA will appoint a member to the committee and will provide financial support for the contests sponsored by the committee.

CHSC writes and administers the American High School Mathematics Examination (AHSME), the American Intermediate Mathematics Examination (AIME), and the USA Mathematical Olympiad (USAMO). In addition, starting in December 1985, the committee will initiate a junior high school examination. (See "MAA Contests Committee Starts Junior High Exam" on page 5 of this issue.)

The other five sponsors are: MAA (1955), Society of Actuaries (1955), Mu Alpha Theta (1965), National Council of Teachers of Mathematics (1968), and the Casualty Actuarial Society (1971).

In recent years, the Contests Committee has made a point of including some probability problems on its exams, precisely because this subject has been neglected in the schools. Providing statistics problems is harder, given the format of the exams. It is hoped that the ASA representative can assist with problems in both areas.

The ASA Board, which voted unanimously in favor of sponsorship, sees these as the benefits of ASA sponsorship: helping to promote mathematical sciences at the secondary level, increasing awareness of the statistics profession among students and teachers, and encouraging greater statistics content in high school curricula.

### Bieberbach (continued from page 3)

of the accumulated evidence and arsenal of techniques engendered by these efforts, no correct proof of the general conjecture had been offered before that of de Branges.

In his proof, de Branges combines the Loewner differential equation with an ingeniously constructed system of special functions to reduce the problem to a system of polynomial inequalities. By a remarkable coincidence, the same inequalities had been studied for entirely different reasons by Richard Askey and George Gasper in 1976; with their result, the proof was complete. Though his final proof is independent of it, de Branges credits a large computer at Purdue University with an important role in his discovery. Before he knew of

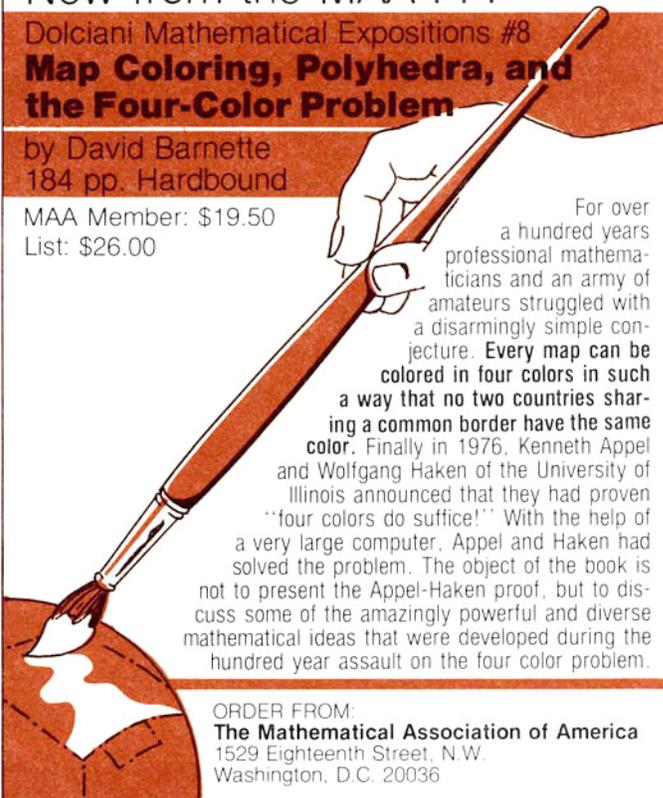
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For over a hundred years professional mathematicians and an army of amateurs struggled with a disarmingly simple conjecture. Every map can be colored in four colors in such a way that no two countries sharing a common border have the same color. Finally in 1976, Kenneth Appel and Wolfgang Haken of the University of Illinois announced that they had proven "four colors do suffice!" With the help of a very large computer, Appel and Haken had solved the problem. The object of the book is not to present the Appel-Haken proof, but to discuss some of the amazingly powerful and diverse mathematical ideas that were developed during the hundred year assault on the four color problem.



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Askey and Gasper's inequalities, de Branges worked with Walter Gautschi of the computer science department at Purdue to check special cases. The promising results encouraged de Branges to continue his ultimately successful line of attack on the general conjecture.

de Branges actually verified a conjecture of the Russian mathematician I. M. Milin, from which the Bieberbach conjecture follows. Milin and his colleagues in Leningrad would make another important contribution. By another coincidence, de Branges was scheduled to visit the Soviet Union beginning last April. There he presented his results in five marathon sessions of the Leningrad Seminar in Geometric Function Theory. The findings of the seminar, much shortened, were released in Russian and English by the Leningrad branch of the Steklov Mathematical Institute in preprint E-5-84. De Branges is now preparing a final version of his proof for publication.

Though the most famous problem of univalent function theory has now been solved, a rich legacy of knowledge and techniques remains. Important questions about the geometry of conformal mappings and about coefficient estimates for other classes of one-to-one and  $p$ -to-one functions remain unanswered. How and where de Branges' special methods may apply in these areas remains to be seen, but his achievement seems certain to spur new work and interest in analytic function theory. The most important benefits of de Branges' work may prove to be the deep and beautiful links it establishes among complex analysis, optimization theory, functional analysis, and special function theory.

*Paul Zorn is a member of the Department of Mathematics at St. Olaf College, Northfield, Minnesota.*

# Calendar

## National MAA Meetings

**68th Annual Meeting**, Anaheim, California, January 11-13, 1985.  
**65th Summer Meeting**, Laramie, Wyoming, August 12-15, 1985.  
**69th Annual Meeting**, New Orleans, Louisiana, January 9-11, 1986.

**70th Annual Meeting**, San Antonio, Texas, January 23-25, 1987.  
**71st Annual Meeting**, Atlanta, Georgia, January 8-10, 1988.

## Sectional MAA Meetings

**Allegheny Mountain** University of Pittsburgh, Johnstown, Pennsylvania, April 26-27, 1985.  
**Eastern Pennsylvania & Delaware** Swarthmore College, Swarthmore, Pennsylvania, November 17, 1984.  
**Florida** Stetson University, Deland, Florida, March 8-9, 1985.  
**Illinois** University of Illinois, Champaign-Urbana, Illinois, May 3-4, 1985.  
**Intermountain** Weber State College, Ogden, Utah, April 26-27, 1985.  
**Iowa** Drake University, Des Moines, Iowa, April 12-13, 1985.  
**Kentucky** Eastern Kentucky University, Richmond, Kentucky, April 19-20, 1985.  
**Louisiana-Mississippi** Broadwater Beach Hotel, Host: University of Southern Mississippi, Biloxi, Mississippi, February 15-16, 1985.  
**Maryland-DC-Virginia** U.S. Naval Academy, Annapolis, Maryland, November 9-10, 1984.  
**Michigan** Western Michigan University, Kalamazoo, Michigan, May 3-4, 1985.  
**Missouri** Central Missouri State University, Warrensburg, Missouri, April 12-13, 1985.  
**Nebraska** Hastings College, Hastings, Nebraska, April 1985.

**New Jersey** Rutgers University, New Brunswick, New Jersey, November 3, 1984.  
**Northeastern** Western New England College, Springfield, Massachusetts, November 16-27, 1984.  
**Ohio** Muskingum College, New Concord, Ohio, November 2-3, 1984.  
**Oklahoma-Arkansas** University of Tulsa, Tulsa, Oklahoma, March 29-30, 1985.  
**Rocky Mountain** Casper College, Casper, Wyoming, March 29-30, 1985.  
**Seaway** St. Bonaventure University, St. Bonaventure, New York, November 2-3, 1984.  
**Southeastern** Wake Forest University, Winston-Salem, North Carolina, April 12-13, 1985.  
**Southern California** San Diego State University, San Diego, California, November 9-10, 1984.  
**Southwestern** University of Arizona, Tucson, Arizona, April 12-13, 1985.  
**Wisconsin** Marquette University, Milwaukee, Wisconsin, April 26-27, 1985.

## Other Meetings

### NOVEMBER 1984

26-28. **National Meeting of the Operations Research Society of America and the Institute of Management Sciences**, Dallas, Texas. Contact: ORSA, 428 East Preston Street, Baltimore, MD 21202.

### DECEMBER 1984

9-12. **Canadian Mathematical Society Winter Meeting**. University of Western Ontario. Contact: S. Kochman, Department of Mathematics, The University of Western Ontario, London, Ontario, N6A 5B7, Canada.

### JANUARY 1985

7-8. **AMS Short Course, "Introductory Survey Lectures on Fair Allocation"**, Anaheim, California. Contact: AMS, P.O. Box 6248, Providence, RI 02940.

7-11. **NSF/CBMS Regional Conference on Multivariate Estimation: A Synthesis of Bayesian and Frequentist Approaches**, University of Florida. Lecturer: James O. Berger. Contact: Malay Ghosh, Department of Statistics, University of Florida, Gainesville, FL 32611.

9-13. **91st Annual Meeting of the American Mathematical Society**, Anaheim, California. Contact: AMS, P.O. Box 6248, Providence, RI 02940.

9-13. **Meeting of the Association for Women in Mathematics**, Anaheim, California. Contact: AWM, Box 178, Wellesley College, Wellesley, MA 02181.

12-13. **Annual Meeting of the Association for Symbolic Logic**, Anaheim, California. Contact: ASL, P.O. Box 70557, Pasadena, CA 91107.

16-18. **NCTM Seminar Series, "Computers in the Mathematics Curriculum"**, Philadelphia, Pennsylvania. Contact: NCTM, 1906 Association Drive, Reston, VA 22091.

### FEBRUARY 1985

11-15. **Southeastern International Conference on Combinatorics, Graph Theory and Computing**, Florida Atlantic University. Hour Speakers: Paul Erdős, Frank Thomson Leighton, Neil J. A. Sloane, and Robert E. Tarjan. Contact: Frederick Hoffman, Department of Mathematics, Florida Atlantic University, Boca Raton, FL 33431 (305-393-3345 or 3340).

27-March 1. **NCTM Seminar Series, "Computers in the Mathematics Curriculum"**, New Orleans, Louisiana. Contact: NCTM, 1906 Association Drive, Reston, VA 22091.

### MARCH 1985

18-22. **NSF/CBMS Regional Conference on Mathematical Ecology**, University of California, Davis. Lecturer: Simon Levin. Contact: Alan Hastings, Department of Mathematics, University of California, Davis, CA 95616.

21-23. **NCTM Parsippany Conference, "Teaching Mathematics Better . . . Teaching Better"**, Parsippany, New Jersey. Contact: Beverly Whittington, Conference Chairman, R.R. #2, Box 482, Trenton, NJ 08620.

27-29. **NCTM Seminar Series, "Computers in the Mathematics Curriculum"**, San Francisco, California. Contact: NCTM, 1906 Association Drive, Reston, VA 22091.

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