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Stephen B. Maurer

Scoring 41 out of a possible 42, Joseph Keane of Pittsburgh, Pennsylvania, led the US team of 6 to a winner's tie with Russia in the 27th International Mathematical Olympiad, held July 9-10 in Warsaw. Both countries scored 203, followed by West Germany (196), China (177), East Germany (172) and Romania (171).

The Russians had 2 perfect papers (6 problems, 7 points each) and the Hungarians had one, but Keane was the only participant of the 210 from 37 countries to receive a Special Award for a particularly elegant solution. The problem he received it for is given at the end of this article. (Finding his solution is left to the reader!)

The US was the only one of last year's top 5 nations to make it to the top 5 this year. Last year the US was 2nd (180) behind Romania (201). The USSR was 6th in 1985 and 1st in 1984.

Keane received a Gold Medal, as did his teammates David Grabiner of Claremont, California (score 36), and Jeremy Kahn of New York City (35). The other team members all received Silver: Hohn Overdeck of Columbia, Maryland (32), Darien Lefkowitz of New York City (30), and William Cross of Kalamazoo, Michigan (29).

USAMO winners are greeted by Dr. Erich Bloch, Director of NSF. The winners from left to right are: Ravi D. Vakil of Ontario, Eric K. Wepsic of Massachussetts, David J. Grabiner of California, William P. Cross of Michigan, followed by Dr. Bloch and then Joseph G. Keane of Pennsylvania, Darien G. Lefkowitz and Jeremy A. Kahn, both of New York, and John J. Bulten of Oklahoma.

Notable this year was the strong showing by The People's Republic of China. This was only the 2nd time they participated, and the first time they fielded a full team. Another highlight was the Bronze Medal performance of a 10-year old from Australia.

The US team was again coached by Professor Cecil Rousseau of Memphis State University and Gregg Patruno of Columbia and the First Boston investment firm.

All the US team members but Kahn were seniors, an unusual situation. Thus, it will be challenging to build for next year's IMO in Cuba.

The US team was chosen based on the USA Mathematical Olympiad, held on April 22, and on additional work at a rigorous 4-week Training Session at the US Naval Academy. The highest scoring USAMO participants, and other high scoring nonseniors, were invited. 5 of the 6 students chosen for the IMO team were USAMO Winners (top 8); the 6th, John Overdeck, was a Winner in 1985. The other Winners of the 1986 USAMO were John Bulten of Tulsa, Ravi Vakil of Islington, Ontario, and Eric Wepsic of Boston. All 8 Winners were honored at elegant ceremonies in Washington, D.C., on June 2-3. The Greitzer/Klamkin Award, for the very top USAMO score, went to Keane—for the 2nd year in a row.

The success of the US team is partly the result of a broad-based program to discover and encourage mathematical talent. The USAMO is the third in the series of high school exams sponsored by the MAA and 6 other mathematics societies. Joe Keane also received the top score in the 2nd, the American Invitational Mathematics Examination, sharing a perfect score of 15 with Robert Southworth of Winchester,

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MA. For further information on the 1986 AIME, and on the 1st exam (AHSME), see page iii of the May-June ***FOCUS***; however, these results were erroniously attributed to 1985. MAA members can do much to strengthen this program by encouraging local schools to participate. An IMO/USAMO problems-solutions pamphlet, and similar pamphlets for the AIME and AHSME, are available. Members may contact Professor Walter E. Mientka, 917 Oldfather Hall, University of Nebraska, Lincoln, NE, 68588-0322 for prices.

Here is the problem that Joseph Keane solved so elegantly: 1986 IMO, Problem 3 (submitted by E. Germany): To each vertex of a regular pentagon an integer is assigned in such a way that the sum af all the five numbers is positive. If three consecutive vertices are assigned the numbers x, y, z, respectively, and $y<0$ then the following operation is allowed: the numbers x, y, z, are replaced by $x+y$, $-y$, $z+y$ respectively. Such an operation is performed repeatedly as long as at least one of the five numbers is negative. Determine whether this procedure necessarily comes to an end after a finite number of steps. (After participants asked for clarification it was announced that "necessarily" means regardless of which negative number y is operated on when there is a choice.)

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from the President's desk . . .

Lynn Arthur Steen, St. Olaf College

Proposal Pressure

In recent years the National Science Foundation's support for educational activities has had a very bimodal distribution, with strong programs at the pre-collegiate and post-graduate levels but virtually no support for undergraduate activities. Moreover, all existing programs for mathematics education and mathematics research are seriously inadequate when measured by the needs of the mathematics community. As a consequence, many mathematicians—especially many college mathematics faculty—have lost interest in trying to get NSF support either for themselves, for their departments, or for their students.

That's bad for at least two reasons. Those who don't apply stand no chance of receiving an award, so the total support for mathematics begins to dwindle. Moreover, since there is insufficient "proposal pressure" from mathematics, future budgets for mathematics are also placed in jeopardy, especially when put in competition against other fields where proposers inundate NSF with strong requests.

Consider these examples selected from among the very few NSF programs that bear directly on undergraduate mathematics. Last year only 25 mathematics students received NSF graduate fellowships out of 500 total awards. And despite widespread need for increasing computer resources in undergraduate mathematics, only 2 out of 200 awards made in the College Science Instrumentation Program (CSIP) went to mathematics curricular projects.

It is well known that mathematics students score better on the Graduate Record Examination than do most other students who take that exam. Even after suitable normalization to account for different pools of students taking different exams, mathematics GRE scores average one standard deviation higher than those in chemistry, biology, computer science, or economics.

Then why don't more mathematics students receive NSF Graduate Fellowships? Because not enough of them apply. To promote fairness in administration, and because of the difficulty of making cross-disciplinary comparisons, awards in different fields are generally made in proportion to applications. Last year only about 100 students—about 1 in 40 of those applying to graduate school—applied for an NSF Graduate Fellowship in mathematics.

There are many possible reasons for the shortage of mathematics applicants in the Graduate Fellowship competition: low interest in mathematics graduate school; reputation that only geniuses can get a Graduate Fellowship; insufficient encouragement from advisors and departments. The fact is, however, that both applications and awards are low even in proportion to the number of students entering graduate school, and as the GRE scores show, graduate-school-bound mathematics students will quite likely fare well in head-to-head competition with other students. The crucial missing ingredient is faculty encouragement.

A similar problem of weak proposal pressure exists in the CSIP program, although almost certainly for different rea-