Background and History of the MCM

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Genesis

The concept of a national applied mathematics contest for undergraduates occurred to me in October 1983. The idea surfaced because of difficulties that we were having at Salisbury State University (now Salisbury University) with getting our students to prepare for the Putnam Mathematical Competition.

Salisbury has a high percentage of first-generation college students, and they tend to view facing such a formidable exam as an ordeal. The practice of the Putnam of reporting a large proportion of low numerical scores adds to the chilling effect. Finally, the small amount of applied content of Putnam problems did not generate much enthusiasm in practical-minded students.

There was much more to my notion of an applied mathematics contest than just offering different questions that would merit higher scores. For a dozen years, I had chafed at the overemphasis in established mathematics of the pure, formalistic approach, almost devoid of content. On many campuses, there was scarcely any appreciable applied or constructive mathematics presence.

In my mind, (classical) applied mathematics, computational mathematics, and statistics are as important a part of contemporary mathematical activities and curricula as pure mathematics. The model that I had in mind represents each of these four as a vertex of a tetrahedron. The edges, faces, and interior represent activities such as applied linear algebra, numerical analysis, or operations research. The Putnam deals with a small neighborhood of the pure mathematics vertex at the lofty apex of the tetrahedron. It would be difficult to tell from Putnam questions that the computer even existed.

These thoughts merged and then popped up in verbal form as "Applied Putnam." My on-campus colleagues liked the idea, but it seemed prudent to check with some off-campus mathematicians who had long involvements in applied mathematics. Calls to M.S. Klamkin (University of Alberta), H.O. Pollak (Bell Labs), and E.Y. Rodin (Washington University) elicited favorable responses and encouragement to proceed. I then called A.P. Hillman, who has had many years of experience with the Putnam. He urged me to start with a small pilot project and warned that I might be underestimating the difficulty of starting a national

contest. (He was right.)

Being Chair of the Education Committee of the Society for Industrial and Applied Mathematics (SIAM) gave me a natural forum for this project. I sent an outline of a proposal for a pilot contest to the committee in November 1983. The gist of the proposal is illustrated in **Table 1**.

Table 1.
The original proposal for an "Applied Putnam."

	Pure Putnam	"Applied Putnam"
Time of contest	December	March
Sessions	Two (three hours each)	Two (three hours each)
Number of problems	12	2
Type of problems	Structural, pure	Contextual, applied
Format	Individual students No calculator or computer aids	Teams of three students Microcomputers allowed

The committee liked the proposal but had strong reservations about the time allotted per problem. The feeling was that an applied mathematics problem could not be done in half a day; estimates ran from a day to a week. One experienced SIAM officer said that a realistic problem would need a whole semester! These observations, coupled with my own fairly unshakable view that a contest for undergraduates should not occupy more than a weekend, doomed one of my favorite schemes, that teams should be required to do one continuous problem and one discrete problem.

Although the committee looked on the idea with favor, SIAM's leadership felt that the committee already had enough projects and that it should continue to concentrate on the K–12 level. However, so many people had judged the idea to be good and workable that I decided to seek another forum.

Funding

Warren Page, then editor of the *College Mathematics Journal*, gave an invited lecture to the Maryland–DC–Virginia Section of the Mathematical Association of America in November of 1983. His lively presentation included many applied examples, so I approached him after his talk. Page listened as attentively as he could, while being badgered by another mathematician who kept trying to tie Page's talk to the Vietnam War. Page's initial reaction was that the concept was interesting but not feasible.

About three weeks later, Page called me at home to say that he had given this concept of an applied contest quite a bit of thought; it was a valuable idea and it ought to be done. Moreover, he had broached the subject to Sol Gar-

funkel, Executive Director of COMAP, which had been supporting applicable mathematics in a variety of ways since 1972. Garfunkel was very enthusiastic, and Page urged me to get in touch with him.

Although I was a member of COMAP and had used its materials, I had never had any interaction with Garfunkel. After one phone conversation, it was clear that we had similar goals. In fact, my personal campaign to "increase the applied mathematics presence on campus" might be one way to describe what COMAP had been doing over the years. He suggested that a proposal for a three-year grant be sent to the Fund for the Improvement of Post-Secondary Education (FIPSE) of the U.S. Dept. of Education, with COMAP the administering body and me as the Project Director. FIPSE had a reputation for backing novel ideas that might have far-reaching effects. The derivative term "Applied Putnam" was transformed into "Mathematical Competition [now Contest] in Modeling." A preliminary proposal made FIPSE's January 1984 deadline, and the three-year proposal was approved in June 1984.

Goals

The goals and purposes of the MCM are best described by two paragraphs from the abstract of the proposal to FIPSE:

> The purpose of this competition is to involve students and faculty in clarifying, analyzing, and proposing solutions to open-ended problems. We propose a structure which will encourage widespread participation and emphasize the entire modeling process. Major features include:
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> - 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 within a clearly defined format.
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> - The ability of participants to draw on outside resources including computers and texts.
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> - An emphasis on clarity of exposition in determining final awards with the best papers published in professional mathematics journals.
>
> 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.

Organizing

Garfunkel and I were in firm agreement that the contest must be primarily an educational experience, not a competitive one. In a sense, we wanted it to be closer to the spirit of traditional English sport than to modern American sports.

I formed an advisory board of mathematical scientists who had been early backers of an applied mathematics contest:

- A.P. Hillman, University of New Mexico;

- M.S. Keener, Oklahoma State University;

- H.O. Pollak, Bellcore;

- F.J. Roberts, Rutgers University;

- E.Y. Rodin, Washington University;

- L.H. Seitelman, Pratt & Whitney;

- Maynard Thompson, Indiana University; and

- myself as chair.

Hillman, who for many years directed grading for the Putnam, agreed to be chief grader. This coup eliminated one of the two swords that hung over our heads: finding suitable problems, and judging.

The advisory board first met in August 1984. We selected two types of problems, approved ground rules, set up a Putnam-like system of faculty advisors, and established a classification for solution papers. We set the inaugural contest for the weekend of 15 February 1985. The meeting was very productive; but we departed with a note of concern over the short amount of time for publicity, registration, and final write-up of contest materials. We wondered whether we could get our predicted 55 colleges to enter the first contest.

It turned out that 158 teams, representing 104 colleges, registered for the first contest, a response that overwhelmed us. Any more than 100 solution papers would be unmanageable; there wouldn't be enough judges to allow for multiple readers for each paper. It turned out that 90 papers, representing 70 colleges, were submitted—a large but tractable number. The MCM was a success!

Acknowledgment

About the Author

Ben was the founder of the MCM and its director for the first seven years. He has a B.A. from Swarthmore College, an M.A. from Columbia University (analysis), a Ph.D. from the University of Maryland (partial differential equations), and most recently (1990) an M.A. from the University of Maryland (computer science).

He taught at several other colleges and universities before going to Salisbury State in 1974, where he served as chair of the Mathematics and Computer Science Dept. 1974–82 and received the Distinguished Faculty Award in 1992. Ben was NSF Lecturer at New Mexico Highlands University and at the University of Oklahoma, Fulbright Professor at National Taiwan Normal University, and visiting professor at the U.S. Military Academy at West Point. He has taught most undergraduate mathematics courses, plus graduate courses in integral equations, partial differential equations, and mathematical modeling.

In recent years, Ben has been a major exponent of environmental mathematics, a topic on which he has presented several minicourses.