

2010 HiMCM Contest Director's Article

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The High School Mathematical Contest in Modeling (HiMCM) completed its thirteenth year in excellent fashion. The mathematical and modeling ability of students, and faculty advisors, is very evident in the professional submissions and work being done. The contest is still moving ahead slowly, growing with a positive first derivative, and consistent with our positive experiences from previous HiMCM contests.

This year the contest consisted of 295 teams consisting of 1131 students from 52 total schools. These institutions were from twenty-two states and three different countries. Of the 1131 students, almost 40% were female students. The breakdown was 439 female and 692 male students. There were thirty-one all female teams this year. This year, we again charged a registration fee of \$75.

The teams accomplished the vision of our founders by providing *unique* and *creative mathematical* solutions to complex open-ended real-world problems. This year the students had a choice of two problems both of which represent real-world issues.

Commendation: All students and advisors are congratulated for their varied and creative mathematical efforts. Of the 295 teams, 161 submitted solutions to Problem A and 134 to Problem B. The thirty-six continuous hours to work on the problem provided for quality papers; teams are commended for the overall quality of their work.

Many teams had female members. There were 439 female participants on the 295 teams. There were 1131 total participants, so females made up over 38.8% of the total participation, showing this competition is for both genders. This percent is almost triple the percent of woman in other math competitions. There was at least one female on most of the teams and 10.5% of the teams were all female (31 teams).

Teams again proved to the judges that they had "fun" with their chosen problems, demonstrating research initiative and creativity in their solutions. This year's effort was a success!

Judging: We ran three regional sites in December 2010. They are:
Naval Postgraduate School in Monterey, CA
Francis Marion University in Florence, SC
Carroll College in Helena, MN.

Each site judged papers for problems A and B. The papers judged at each regional site may or may not have been from their respective region. Papers were judged as

Outstanding, Meritorious, Honorable Mention, and Successful Participant. All finalist papers for the Regional Outstanding award were sent to the National Judging. For example, eight papers may be discussed at a Regional Final and only four selected as Regional Outstanding but all eight papers are judged for the National Outstanding. Papers receive the higher of the two awards. The national judging chooses the "best of the best" as National Outstanding. The National Judges commended the regional judges for their efforts and found the results were very consistent. We feel that this regional structure provides a good structure for the future as the contest grows.

Judging Results:

Problem	National Outstanding	Outstanding	Meritorious	Honorable Mention	Participant	Total
A	3	21	42	66	29	161
%	2%	13%	26%	41%	18%	
B	6	9	34	62	23	134
%	5%	7%	25%	46%	17%	
Total	9	30	76	128	52	295
%	3%	10%	26%	43%	18%	

National Outstanding Teams

Evanston Township High School, Evanston, IL
 Glenbrook North High School, Northbrook, IL
 Illinois Mathematics and Science Academy, Aurora, IL
 Hanover High School, Hanover NH
 Mills Godwin High School, Richmond, VA
 Shanghai Foreign Language School Affiliated to SISU, Shanghai, China
 Hong Kong International School, Hong Kong (3 Teams)

Regional Outstanding Teams

Albuquerque Academy, Albuquerque, NM
 Central Academy, Ankeny, IA
 Charter School of Wilmington, Wilmington, DE (3 Teams)
 Chesterfield County Mathematics and Science High School, Midlothian, VA (2 Teams)
 Evanston Township High School, Evanston, IL (2 Teams)
 Hanyoung Foreign Language High School, Seoul, Korea
 Hong Kong International School, Hong Kong (4 Teams)
 Illinois Mathematics and Science Academy, Aurora, IL (3 Teams)
 Maggie Walker Governor's School, Richmond, VA (5 Teams)
 Middlesex School, Concord, MA
 Mills Godwin High School, Henrico, VA (2 Teams)
 NC School of Science and Mathematics, Durham, NC
 NO.2 High School of East China Normal University, Shanghai, China
 North Springs Charter School, Atlanta, GA
 Shanghai Foreign Language School, Shanghai, China
 The Ellis School, Pittsburgh, PA

NCTM Standards: The director and the judges asked that we add this paragraph. Many of us have read the NCTM standards and clearly realize the mapping of this contest to the NCTM 9-12 mathematics standards. This contest provides a vehicle for using mathematics to build models to represent and to understand real world behavior in a quantitative way. It enables student teams to look for patterns and think logically about mathematics and its role in our lives. Perhaps in a future Consortium article we will dissect a problem (paper) and map the standards into it.

General Judging Comments: The judge's commentaries provide specific comments on the solutions to each problem. As contest director and head judge, I would like to speak generally about solutions from a judge's point of view. Papers need to be coherent, concise, and clear. Students need to restate the problem in their own words so that the judges can determine the focus of the paper. Papers that explain the development of the model, assumptions, and its solutions and then support the findings mathematically generally do quite well. Modeling assumptions need to be listed and justified, but only those that come to bear on the solution (that can be part of simplifying the model). Laundry lists of assumptions that are never referred to in the context of the model development are not considered relevant and deter from a paper's quality. The mathematical model needs to be clearly developed, and all variables that are used need to be well defined. Thinking outside of the "box" is also considered important by judges. This varies from problem to problem but usually includes model extensions or sensitivity analysis of the solution to the team's inputs. Students need to attempt to validate their model even if by numerical example or intuition. A clear conclusion and answers to specific scenario questions are all key components. The strengths and weakness section is where the team can reflect on their solution and comment on the model's strengths and weaknesses. Attention to detail and proofreading the paper prior to final submission are also important since the judges look for clarity and style. Citations are also very important within the paper as well as either a reference or bibliography page at the end. We encourage citations within the paper in sections that deal directly with data and figures, graphs, or tables. We have noticed an increase in use of Wikipedia. Teams need to realize that although useful, the information might not be accurate. Teams need to acknowledge this.

Facts from the 13th Annual Contest:

- Wide range of schools/teams competed including teams from Hong Kong and China.
- The 295 teams representing US and International institutions representing a 6.4% increase in participation.
- There were 1131 student participants, 692 (61.2%) male and 439 (38.8%) female. There were 50 all female teams.
- Schools from only twenty-two states participated in this year's contest.

The Future:

The contest, which attempts to give the under-representative an opportunity to compete and achieve success in mathematics, appears well on its way in meeting this important goal.

We continue to strive to improve the contest, and we want the contest to grow. Any school/team can enter, as there are no restrictions on the number of schools or the numbers of teams from a school. A regional judging structure is established based on the number of teams.

These are exciting times for our high school students. Mathematics continues to be more than learning skills and operations. Mathematics is a language that involves our daily lives. Applying the mathematical principles that one learns is a key to future success. The abilities to recognize problems, formulate a mathematical model, use technology, and communicate and reflect on one's work are keys to success. Students gain confidence by tackling ill-defined problems and working together to generate a solution. Applying mathematics is a team sport!

Advisors need only be motivators and facilitators. They should encourage students to be creative and imaginative. It is not the technique used but the process that discovers how assumptions drive the techniques that is fundamental. Let students practice to be problem solvers. Let me encourage all high school mathematics faculty to get involved, encourage students, make mathematics relevant, and open the doors to success.

Mathematical modeling is an art and a science. Teach your students through modeling to think critically, communicate effectively, and be confident, competent problem solvers for this new century.

Contest Dates:

Mark your calendars early: the next HiMCM will be held in November 2011. Registrations are due in October 2011. Teams will have a consecutive 36-hour block within the contest window to complete the problem. Teams can register via the Internet at www.himcm.org.

MathModels.ORG

It is highly recommended that participants in this contest as well as prospective participants take a look at the new modeling web site, www.mathmodels.org, which has a wealth of information and resources.