Modeling Forum

Results of the 2002 Mathematical Contest in Modeling

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Introduction

A total of 525 teams of undergraduates, from 282 institutions in 11 countries, spent the second weekend in February working on applied mathematics problems in the 18th Mathematical Contest in Modeling (MCM).

The 2002 MCM began at 8:00 P.M. EST on Thursday, Feb. 7 and officially ended at 8:00 P.M. EST on Monday, Feb. 11. During that time, teams of up to three undergraduates were to research and submit an optimal solution for one of two open-ended modeling problems. Students registered, obtained contest materials, downloaded the problems at the appropriate time, and entered completion data through COMAP'S MCM Web site.

Each team had to choose one of the two contest problems. After a weekend of hard work, solution papers were sent to COMAP on Monday. Ten of the top papers appear in this issue of *The UMAP Journal*.

Results and winning papers from the first sixteen contests were published in special issues of *Mathematical Modeling* (1985–1987) and *The UMAP Journal* (1985–2001). The 1994 volume of *Tools for Teaching*, commemorating the tenth anniversary of the contest, contains all of the 20 problems used in the first ten years of the contest and a winning paper for each. Limited quantities of that volume and of the special MCM issues of the *Journal* for the last few years are available from COMAP.

This year's Problem A was about controlling the amount of spray hitting passersby that is produced by wind acting on an ornamental fountain located in the midst of a plaza surrounded by buildings. The water flow is controlled by

a mechanism linked to an anemometer located on top of an adjacent building. Students were asked to design a control algorithm that would provide a balance between an attractive spectacle and a soaking.

Problem B focused on the challenge associated with airline practices overbooking of flight reservations. Students were asked to determine an optimal overbooking strategy in light of operational constraints evolving from the events of September 11, 2001.

In additional to the MCM, COMAP also sponsors the Interdisciplinary Contest in Modeling (ICM) and the High School Mathematical Contest in Modeling (HiMCM). The ICM, which runs concurrently with MCM, offers a modeling problem involving concepts in mathematics, environmental science, environmental engineering, and/or resource management. Results of this year's ICM are on the COMAP Web site at `http://www.comap.com/undergraduate/contests`; results and Outstanding papers appeared in Vol. 23 (2002), No. 1. The HiMCM offers high school students a modeling opportunity similar to the MCM. Further details about the HiMCM are at `http://www.comap.com/highschool/contests` .

Problem A: Wind and Waterspray

An ornamental fountain in a large open plaza surrounded by buildings squirts water high into the air. On gusty days, the wind blows spray from the fountain onto passersby. The water flow from the fountain is controlled by a mechanism linked to an anemometer (which measures wind speed and direction) located on top of an adjacent building. The objective of this control is to provide passersby with an acceptable balance between an attractive spectacle and a soaking: The harder the wind blows, the lower the water volume and the height to which the water is squirted, hence the less spray falls outside the pool area.

Your task is to devise an algorithm that uses data provided by the anemometer to adjust the water-flow from the fountain as the wind conditions change.

Problem B: Airline Overbooking

You're all packed and ready to go on a trip to visit your best friend in New York City. After you check in at the ticket counter, the airline clerk announces that your flight has been overbooked. Passengers need to check in immediately to determine if they still have a seat.

Historically, airlines know that only a certain percentage of passengers who have made reservations on a particular flight will actually take that flight. Consequently, most airlines overbook—that is, they take more reservations than the capacity of the aircraft. Occasionally, more passengers will want to take

a flight than the capacity of the plane, leading to one or more passengers being bumped and thus unable to take the flight for which they had reservations.

Airlines deal with bumped passengers in various ways. Some are given nothing, some are booked on later flights on other airlines, and some are given some kind of cash or airline ticket incentive.

Consider the overbooking issue in light of the current situation:

- fewer flights by airlines from point A to point B;

- heightened security at and around airports,

- passengers' fear, and

- loss of billions of dollars in revenue by airlines to date.

Build a mathematical model that examines the effects that different overbooking schemes have on the revenue received by an airline company, in order to find an optimal overbooking strategy—that is, the number of people by which an airline should overbook a particular flight so that the company's revenue is maximized. Ensure that your model reflects the issues above and consider alternatives for handling "bumped" passengers. Additionally, write a short memorandum to the airline's CEO summarizing your findings and analysis.

The Results

The solution papers were coded at COMAP headquarters so that names and affiliations of the authors would be unknown to the judges. Each paper was then read preliminarily by two "triage" judges at Southern Connecticut State University (Problem A) or at the U.S. Military Academy (Problem B). At the triage stage, the summary and overall organization are the basis for judging a paper. If the judges' scores diverged for a paper, the judges conferred; if they still did not agree on a score, a third judge evaluated the paper.

Final judging took place at Harvey Mudd College, Claremont, California. The judges classified the papers as follows:

	Outstanding	Meritorious	Honorable Mention	Successful Participation	Total
Wind and Waterspray	4	48	60	167	279
Airline Overbooking	6	38	61	138	246
	10	86	121	305	525

The ten papers that the judges designated as Outstanding appear in this special issue of *The UMAP Journal*, together with commentaries. We list those teams and the Meritorious teams (and advisors) below; the list of all participating schools, advisors, and results is in the **Appendix**.

Outstanding Teams

Institution and Advisor	Team Members

Wind and Waterspray Papers

"Simulating a Fountain"
Maggie L. Walker Governor's School   Lyric P. Doshi
Richmond, VA   Joseph E. Gonzalez
John A. Barnes   Philip B. Kidd

"The Fountain That Math Built"
North Carolina School of Science
    and Mathematics   Alex McCauley
Durham, NC   Josh Michener
Daniel J. Teague   Jadrian Miles

"Wind and Waterspray"
U.S. Military Academy   Tate Jarrow
West Point, NY   Colin Landon
David Sanders   Mike Powell

"A Foul-Weather Fountain"
University of Washington   Ryan K. Card
Seattle, WA   Ernie E. Esser
James Allen Morrow   Jeffrey H. Giansiracusa

Airline Overbooking Papers

"Things That Go Bump in the Flight"
Bethel College   Krista M. Dowdey
St. Paul, MN   Nathan M. Gossett
William M. Kinney   Mark P. Leverentz

"Optimal Overbooking"
Duke University   David Arthur
Durham, NC   Sam Malone
David P. Kraines   Oaz Nir

"Models for Evaluating Airline Overbooking"

Harvey Mudd College	Michael B. Schubmehl
Claremont, CA	Wesley M. Turner
Michael E. Moody	Daniel M. Boylan

"Probabilistically Optimized Airline
    Overbooking Strategies, or
    'Anyone Willing to Take a Later Flight?'"

University of Colorado at Boulder	Kevin Z. Leder
Boulder, CO	Saverio E. Spagnolie
Anne M. Dougherty	Stefan M. Wild

"ACE Is High"

Wake Forest University (Team 69)	Anthony C. Pecorella
Winston-Salem, NC	Elizabeth A. Perez
Edward E. Allen	Crystal T. Taylor

"Bumping for Dollars:
    The Airline Overbooking Problem"

Wake Forest University (Team 273)	John D. Bowman
Winston-Salem, NC	Corey R. Houmard
Frederick H. Chen	Adam S. Dickey

Meritorious Teams

Wind and Waterspray Papers (48 teams)
Asbury College, Wilmore, KY, USA (Kenneth P. Rietz)
Beijing Institute of Technology, Beijing, P.R. China (Yao Cui Zhen)
Beijing University of Chemical Technology, Beijing, P.R. China (Yuan WenYan)
Beijing University of Posts and Telecommunication, Beijing, P.R. China (He Zuguo)
      (two teams)
Beijing University of Posts and Telecommunication, Beijing, P.R. China
      (Sun Hongxiang)
Bethel College, St. Paul, MN (William M. Kinney)
Boston University, Boston, MA (Glen R. Hall)
California Polytechnic State University, San Luis Obispo, CA (Thomas O'Neil)
Central South University, Changsha, Hunan, P.R. China (Xuanyun Qin)
The College of Wooster, Wooster, OH (Charles R. Hampton)
East China University of Science and Technology, Shanghai, P.R. China (Lu Yuanhong)
Goshen College, Goshen, IN (David Housman)
Hangzhou University of Commerce, Hangzhou, Zhejiang, P.R. China (Zhao Heng)
Hangzhou University of Commerce, Hangzhou, Zhejiang, P.R. China (Zhu Ling)
Humboldt State University, Arcata, CA (Roland H. Lamberson)
Jacksonville University, Jacksonville, FL (Robert A. Hollister)
James Madison University, Harrisonburg, VA (Caroline Smith)

Lafayette College, Easton, PA (Thomas Hill)
Lawrence Technological University, Southfield, MI (Scott D. Schneider)
Lawrence Technological University, Southfield, MI (Howard E. Whitston)
Luther College, Decorah, IA (Reginald, D. Laursen) (two teams)
Magdalen College, Oxford, Oxfordshire, United Kingdom (Byron W. Byrne)
Massachusetts Institute of Technology, Cambridge, MA (Daniel H. Rothman)
Nankai University, Tianjin, P.R. China (Huang Wuqun)
North China Electric Power University, Baoding, Hebei, P.R. China (Gu Gendai)
Northern Jiaotong University, Beijing, P.R. China (Wang Bingtuan)
Southern Oregon University, Ashland, OR (Kemble R. Yates)
State University of West Georgia, Carrollton, GA (Scott Gordon)
Trinity University, San Antonio, TX (Jeffrey K. Lawson)
Trinity University, San Antonio, TX (Hector C. Mireles)
University College Cork, Cork, Ireland (Donal J. Hurley)
University of Colorado at Boulder, Boulder, CO (Anne M. Dougherty)
University of Colorado at Boulder, Boulder, CO (Michael Ritzwoller) (two teams)
University of Elec. and Sci. Technology, Chengdu, Sichuan, P.R. China (Qin Siyi)
University of New South Wales, Sydney, NSW, Australia (James W. Franklin)
University of North Carolina, Chapel Hill, NC (Jon W. Tolle)
University of Washington, Seattle, WA (James Allen Morrow)
Wright State University, Dayton, OH (Thomas P. Svobodny)
Xavier University, Cincinnati, Ohio (Michael Goldweber)
Youngstown State University, Youngstown, OH (Angela Spalsbury)
Zhejiang University, Hangzhou, Zhejiang, P.R. China (Yang Qifan)

Airline Overbooking Papers (38 teams)
Albertson College of Idaho, Caldwell, ID (Mike P. Hitchman)
Asbury College, Wilmore, KY (Kenneth P. Rietz)
Beijing Institute of Technology, Beijing, Beijing, P.R. China (Zhang Bao Xue)
China University of Mining and Technology, Xuzhou, Jiangsu, P.R. China
    (Zhu Kaiyong)
Chongqing University, Chongqing, Shapingba, P.R. China (Yang Xiaofan)
Colgate University, Hamilton, NY (Warren Weckesser)
College of Sciences of Northeastern University, Shenyang, Liaoning, P.R. China
    (Han Tie-min)
Fudan University, Shanghai, P.R. China (Cai Zhijie)
Gettysburg College, Gettysburg, PA (James P. Fink)
Harbin Institute of Technology, Harbin, Heilongjiang, P.R. China (Wang Xuefeng)
Harvey Mudd College, Claremont, CA (Michael E. Moody)
Harvey Mudd College, Claremont, CA (Ran Libeskind-Hadas) (two teams)
Institut Teknologi Bandung, Bandung, Jabar, Indonesia (Edy Soewono)
Juniata College, Huntingdon, PA (John F. Bukowski)
Lipscomb University, Nashville, TN (Gary Clark Hall)
Maggie L. Walker Governor's School, Richmond, VA (John A. Barnes)
Maggie L. Walker Governor's School, Richmond, VA (Crista Hamilton)
Massachusetts Institute of Technology, Cambridge, MA (Martin Zdenek Bazant)

Nankai University, Tianjin, Tianjin, P.R. China (Ruan Jishou)
North Carolina State University, Raleigh, NC (Dorothy Doyle)
Northern Jiaotong University, Beijing, P.R. China (Wang Xiaoxia)
NUI Galway, Galway, Ireland (Niall Madden)
Pacific Lutheran University, Tacoma, WA (Zhu Mei)
School of Mathematics and Computer Science, Nanjing Normal University, Nanjing,
     Jiangsu, P.R. China (Zhu Qunsheng)
Shanghai Jiading No. 1 High School, Shanghai, P.R. China (Chen Li)
Shanghai Jiaotong University, Shanghai, P.R. China (Song Baorui)
South China University of Technology, Guangzhou, Guangdong, P.R. China
     (Lin Jian Liang)
South China University of Technology, Guangzhou, Guangdong, P.R. China
     (Zhuo Fu Hong)
Stetson University, DeLand, FL (Lisa O. Coulter)
Tianjin University, Tianjin, P.R. China (Rong Ximin)
Tsinghua University, Beijing, P.R. China (Hu Zhiming)
U.S. Military Academy, West Point, NY (Elizabeth Schott)
University of South Carolina, Columbia, SC (Ralph E. Howard)
University of Washington, Seattle, WA (Timothy P. Chartier)
Xidian University, Xi'an, Shaanxi, P.R. China (Zhang Zhuo-kui)
Youngstown State University, Youngstown, OH (Angela Spalsbury)
Youngstown State University, Youngstown, OH (Stephen Hanzely)

Awards and Contributions

Each participating MCM advisor and team member received a certificate signed by the Contest Director and the appropriate Head Judge.

INFORMS, the Institute for Operations Research and the Management Sciences, gave a cash prize and a three-year membership to each member of the teams from North Carolina School of Science and Mathematics (Wind and Waterspray Problem) and Wake Forest (Team 69) (Airline Overbooking Problem). Also, INFORMS gave free one-year memberships to all members of Meritorious and Honorable Mention teams.

The Society for Industrial and Applied Mathematics (SIAM) designated one Outstanding team from each problem as a SIAM Winner. The teams were from University of Washington (Wind and Waterspray Problem) and Duke University (Airline Overbooking Problem). Each of the team members was awarded a $300 cash prize and the teams received partial expenses to present their results at a special Minisymposium of the SIAM Annual Meeting in Philadelphia, PA in July. Their schools were given a framed, hand-lettered certificate in gold leaf.

The Mathematical Association of America (MAA) designated one Outstanding team from each problem as an MAA Winner. The teams were from U.S. Military Academy (Wind and Waterspray Problem) and Harvey Mudd College

(Airline Overbooking Problem). With partial travel support from the MAA, both teams presented their solutions at a special session of the MAA Mathfest in Burlington, VT in August. Each team member was presented a certificate by MAA President Ann E. Watkins.

Judging

Director
Frank R. Giordano, COMAP, Lexington, MA

Associate Directors
Robert L. Borrelli, Mathematics Dept., Harvey Mudd College,
    Claremont, CA
Patrick Driscoll, Dept. of Mathematical Sciences, U.S. Military Academy,
    West Point, NY

Contest Coordinator
Kevin Darcy, COMAP Inc., Lexington, MA

Wind and Waterspray Problem

Head Judge
Marvin S. Keener, Executive Vice-President, Oklahoma State University,
    Stillwater, OK

Associate Judges
William C. Bauldry, Appalachian State University, Boone, NC
Kelly Black, Mathematics Dept., University of New Hampshire,
    Durham, NH (SIAM)
Courtney Coleman, Mathematics Dept., Harvey Mudd College,
    Claremont, CA
Gordon Erlebacher, School of Computational Science and Information Technology, Florida State University, Tallahassee, FL
J. Douglas Faires, Youngstown State University, Youngstown, OH (MAA)
Ben Fusaro, Mathematics Dept., Florida State University,
    Tallahassee, FL
Mario Juncosa, RAND Corporation, Santa Monica, CA
John Kobza, Texas Tech University, Lubbock, TX (INFORMS)
Deborah Levinson, Compaq Computer Corp., Colorado Springs, CO
Veena Mendiratta, Lucent Technologies, Naperville, IL
Mark R. Parker, Mathematics Dept., Carroll College, Helena, MT
John L. Scharf, Carroll College, Helena, MT
Daniel Zwillinger, Newton, MA

Airline Overbooking Problem

Head Judge
Maynard Thompson, Mathematics Dept., University of Indiana,
    Bloomington, IN

Associate Judges
James Case, Baltimore, MD (SIAM)
Lisette De Pillis, Harvey Mudd College, Claremont, CA
William P. Fox, Francis Marion University, Florence, SC (MAA)
Jerry Griggs, University of South Carolina, Columbia, SC
Don Miller, Dept. of Mathematics, St. Mary's College, Notre Dame, IN (SIAM)
Lee Seitelman, Glastonbury, CT (SIAM)
Dan Solow, Mathematics Dept., Case Western Reserve University,
    Cleveland, OH (INFORMS)
Robert Tardiff, Salisbury State University, Salisbury, MD
Michael Tortorella, Lucent Technologies, Holmdel, NJ
Marie Vanisko, Carroll College, Helena, MT (MAA)
Larry Wargo, National Security Agency, Ft. Meade, MD (Triage)

Triage Sessions:

Wind and Waterspray Problem

Head Triage Judge
Patrick Driscoll, Dept. of Mathematical Sciences, U.S. Military Academy,
    West Point, NY

Associate Judges
Steve Horton, Michael Jaye, and Doug Matty, all of the U.S. Military Academy,
    West Point, NY

Airline Overbooking Problem

Head Triage Judge
Larry Wargo, National Security Agency, Ft. Meade, MD

Associate Judges
James Case, Baltimore, Maryland
Paul Boisen and 7 others from the National Security Agency, Ft. Meade, MD

Sources of the Problems

The Wind and Waterspray Problem was contributed by Tjalling Ypma, Mathematics Dept., Western Washington University, Bellingham, WA. The Airline Overbooking Problem was contributed by William P. Fox and Richard D. West, Mathematics Dept., Francis Marion University, Florence, SC.

Acknowledgments

Cautions

To the reader of research journals:

Usually a published paper has been presented to an audience, shown to colleagues, rewritten, checked by referees, revised, and edited by a journal editor. Each of the student papers here is the result of undergraduates working on a problem over a weekend; allowing substantial revision by the authors could give a false impression of accomplishment. So these papers are essentially au naturel. Editing (and sometimes substantial cutting) has taken place: minor errors have been corrected, wording has been altered for clarity or economy, and style has been adjusted to that of *The UMAP Journal*. Please peruse these student efforts in that context.

To the potential MCM Advisor:

It might be overpowering to encounter such output from a weekend of work by a small team of undergraduates, but these solution papers are highly atypical. A team that prepares and participates will have an enriching learning experience, independent of what any other team does.

COMAP's Mathematical Contest in Modeling and Interdisciplinary Contest in Modeling are the only international modeling contests in which students work in teams. Centering its educational philosophy on mathematical modeling, COMAP uses mathematical tools to explore real-world problems. It serves the educational community as well as the world of work by preparing students to become better-informed and better-prepared citizens.

Appendix: Successful Participants

KEY:

P = Successful Participation   A = Bicycle Wheel Control Problem
H = Honorable Mention   B = Hurricane Evacuation Problem
M = Meritorious
O = Outstanding (published in this special issue)

INSTITUTION	CITY	ADVISOR	A	B
ALABAMA				
Huntingdon College	Montgomery	Vyacheslav V. Rykov	P,P	
ARKANSAS				
Hendrix College	Conway	Duff Gordon Campbell	H	H
ARIZONA				
McClintock High School	Tempe	Ivan Barkdoll	P	
CALIFORNIA				
Calif. Institute of Technology	Pasadena	Darryl H. Yong	H	
Calif. Polytechnic State Univ.	San Luis Obispo	Thomas O'Neil	M,P	
		Jennifer M. Switkes	P	
California State University at Monterey Bay	Seaside	Hongde Hu	P	
California State University	Bakersfield	Maureen E. Rush	P	
Claremont McKenna College	Claremont	Mario U. Martelli	P	
Harvey Mudd College	Claremont	Michael E. Moody		O,M
		Ran Libeskind-Hadas		M,M
Humboldt State University	Arcata	Roland H. Lamberson	M	
Pomona College	Claremont	Ami E. Radunskaya		H
Sonoma State University	Rohnert Park	Elaine T. McDonald	H	P
University of San Diego	San Diego	Jeffrey H. Wright		P
University of Southern Calif.	Los Angeles	Robert J. Sacker		H
		Geoffrey R. Spedding	H	
COLORADO				
Colorado College	Colorado Springs	Peter L. Staab	P	
Colorado State University	Fort Collins	Michael J. Kirby		P
Mesa State College	Grand Junction	Edward. K. Bonan-Hamada	P	
Regis University	Denver	Linda L. Duchrow	P	
U.S. Air Force Academy	USAF Academy	Gerald E. Sohan	P	
		James S. Rolf		H
		J. Gerken	H	
		James E. West	P	
University of Colorado	Boulder	Anne M. Dougherty	M	O
		Michael Ritzwoller	M,M	
Univ. of Southern Colorado	Pueblo	Bruce N. Lundberg	P	

INSTITUTION	CITY	ADVISOR	A	B
CONNECTICUT				
Sacred Heart University	Fairfield	Peter Loth	P,P	
Southern Connecticut State Univ.	New Haven	Ross B. Gingrich		P
		Therese L. Bennett		P
DELAWARE				
University of Delaware	Newark	Louis F. Rossi	P,P	
FLORIDA				
Embry-Riddle Aeronautical Univ.	Daytona Beach	Greg Scott Spradlin	P	
Florida Gulf Coast University	Fort Myers	Charles Lindsey	P	
Florida State University	Tallahassee	Mark M. Sussman	P	
Jacksonville University	Jacksonville	Robert A. Hollister	M,P	
Stetson University	DeLand	Lisa O. Coulter		M
University of Central Florida	Orlando	Heath M. Martin	P,P	
Florida Institute of Technology	Melbourne	Michael O. Gonsalves	P,P	
GEORGIA				
Georgia Southern University	Statesboro	Jacalyn M. Huband		P
		Laurene V. Fausett		H
State University of West Georgia	Carrollton	Scott Gordon	M,P	
IDAHO				
Albertson College of Idaho	Caldwell	Mike P. Hitchman		M
Boise State University	Boise	Jodi L. Mead	P	
Idaho State University	Pocatello	Rob Van Kirk	P	
ILLINOIS				
Greenville College	Greenville	Galen R. Peters	P	H
McKendree College	Lebanon	Raymond E. Robb		P
Monmouth College	Monmouth	Christopher G. Fasano	P	
Wheaton College	Wheaton	Paul Isihara	P	
INDIANA				
Earlham College	Richmond	Charlie Peck	H	
Goshen College	Goshen	David Housman	M	H
Indiana University	Bloomington	Michael S. Jolly	H	
Rose-Hulman Institute of Tech,	Terre Haute	David J. Rader	P	H
Saint Mary's College	Notre Dame	Joanne R. Snow	P,P	
IOWA				
Grinnell College	Grinnell	Mark Montgomery	P	H
		Royce Wolf	H.P	
Iowa State University	Ames	Stephen J. Willson		H
Luther College	Decorah	Reginald D. Laursen	M,M	
Mt. Mercy College	Cedar Rapids	K.R. Knopp	P	P
Simpson College	Indianola	Murphy Waggoner	P	P
		Werner S. Kolln	P	H
Wartburg College	Waverly	Mariah Birgen	P	

INSTITUTION	CITY	ADVISOR	A	B
KANSAS				
Kansas State University	Manhattan	Korten N. Auckly	P	
KENTUCKY				
Asbury College	Wilmore	Kenneth P. Rietz	M	M
Bellarmine University	Louisville	William J. Hardin	P	P
Northern Kentucky University	Highland Heights	Gail S. Mackin	P	
		Shamanthi Marie Fernando	P	
MAINE				
Colby College	Waterville	Jan Holly	P	
MARYLAND				
Salisbury University	Salisbury	Michael J. Bardzell		P
Goucher College	Baltimore	Robert Lewand	P	
Hood College	Frederick	Betty Mayfield	P	
Mt. Saint Mary's College	Emmitsburg	John J. Dropp		P
		John E. August	P	P
Towson University	Towson	Mike P. O'Leary	P	
Washington College	Chestertown	Eugene P. Hamilton	P	
MASSACHUSETTS				
Boston University	Boston	Glen R. Hall	M	
Greenfield Community College	Greenfield	Peter R. Letson	P	
Massachusetts Institute of Tech.	Cambridge	Daniel H. Rothman	M,P	
		Martin Zdenek Bazant		M
Olin College of Engineering	Needham	Burt S. Tilley	P	
Simon's Rock College	Great Barrington	Allen B. Altman	P	H
		Michael Bergman	H	H
University of Massachusets	Amherst	Edward A. Connors		P
University of Massachusetts	Lowell	James Graham-Eagle	H	
Western New England College	Springfield	Lorna B. Hanes	P	
Worcester	Arthur	C. Heinricher	P	
MICHIGAN				
Calvin College	Grand Rapids	Thomas L. Jager	P	
Eastern Michigan University	Ypsilanti	Christopher E. Hee	H	
Hillsdale College	Hillsdale	John P. Boardman		P
Hope College	Holland	Aaron C. Cinzori		P
Lake Superior State University	Sault Sainte Marie	John H. Jaroma	H	
Lawrence Technological Univ.	Southfield	Howard E. Whitston	M	
		Ruth G. Favro		H
		Scott D. Schneider	M	
		Valentina Tobos	P	
Siena Heights University	Adrian	Toni Carroll	P,P	

INSTITUTION	CITY	ADVISOR	A	B
MINNESOTA				
Augsburg College	Minneapolis	Rebekah N. Dupont	H	
Bemidji State University	Bemidji	Colleen G. Livingston		H
Bethel College	St. Paul	William M. Kinney	M	O
College of Saint Benedict,				
St. John's University	Collegeville	Robert J. Hesse	P,P	
Gustavus Adolphus College	St. Peter	Thomas P. LoFaro	P	H
Macalester College	St. Paul	Daniel T. Kaplan	P	P
		Elizabeth Shoop		P
Winona State University	Winona	Barry A. Peratt		P
MISSOURI				
Missouri Southern State College	Joplin	Patrick Cassens	P	
Northwest Missouri State University	Maryville	Russell N. Euler	P	
Southeast Missouri State University	Cape Girardeau	Robert W. Sheets	P	
Truman State University	Kirksville	Steve J. Smith		P
Washington University	St. Louis	Hiro Mukai		P
MONTANA				
Carroll College	Helena	Holly S. Zullo	H	H
NEBRASKA				
University of Nebraska-Lincoln	Lincoln	Glenn W. Ledder		H
NEW JERSEY				
Rowan University	Glassboro	Hieu D. Nguyen		P
		Paul J. Laumakis	P	
William Paterson University	Wayne	Donna J. Cedio-Fengya	H	
NEW MEXICO				
New Mexico State University	Las Cruces	Caroline Sweezy		P
Western New Mexico University	Silver City	Thomas P. Gruszka		H
NEW YORK				
Colgate University	Hamilton	Warren Weckesser		M
Ithaca College	Ithaca	Jim Conklin	P	
Keuka College	Keuka Park	Catherine A Abbott		P
Manhattan College	Riverdale	Kathryn Weld		H
Rensselaer Polytechnic Institute	Troy	Peter R. Kramer	P	
Roberts Wesleyan College	Rochester	Gary L. Raduns		H
St. Bonaventure University	St. Bonaventure	Albert G. White	P	
U.S. Military Academy	West Point	David Sanders	O	
		Elizabeth Schott		M
		Gregory S. Parnell	H	
		Ray Eason	H	
Wells College	Aurora	Thomas A. Stiadle	P	
Westchester Community College	Valhalla	Sheela L. Whelan	P	

INSTITUTION	CITY	ADVISOR	A	B
NORTH CAROLINA				
Appalachian State University	Boone	Alan T. Arnholt	P	P
		Eric S. Marland	P,P	
Brevard College	Brevard	Clarke Wellborn	P	P
Duke University	Durham	David Kraines	P	O
Meredith College	Raleigh	Cammey E. Cole	P	
Mount Olive College	Mount Olive	Ollie J. Rose	P	P
North Carolina School of Science and Mathematics	Durham	Daniel J. Teague	O,P	
		John Kolena	H	
North Carolina State University	Raleigh	Thomas L. Honeycutt	H,P	
		Dorothy Doyle		M,P
University of North Carolina	Chapel Hill	Jon W. Tolle	M	
Wake Forest University	Winston-Salem	Frederick H. Chen		O
		Miaohua Jiang		P
		Edward E. Allen		O
OHIO				
Hiram College	Hiram	Brad Scott Gubser	P	
Malone College	Canton	David W. Hahn	P	P
Miami University	Oxford	Doug E. Ward		P
College of Wooster	Wooster	Charles R. Hampton	M	P
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Youngstown State University	Youngstown	Angela Spalsbury	M	M
		Bob Kramer	P	
		Stephen Hanzely		M
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Xavier University	Cincinnati	Michael Goldweber	M	
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		Robert L. Brandon		P
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Southern Oregon University	Ashland	Kemble R. Yates	M	H
University of Portland	Portland	Michael W. Akerman		P
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Clarion University	Clarion	Karen D. Bolinger	P	
		Richard M. Smaby	P	
		John W. Heard	P	

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Westminster College	New Wilmington	Barbara T. Faires	P,P	
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Charleston Southern University	Charleston	Stan Perrine	P	
University of South Carolina	Columbia	Ralph E. Howard		M
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SD School of Mines and Tech.	Rapid City	Kyle Riley	P	P
TENNESSEE				
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Lipscomb University	Nashville	Gary Clark Hall		M
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Southwestern University	Georgetown	Therese N. Shelton	H,P	
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		John A. Barnes	O	M
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Pacific Lutheran University	Tacoma	Mei Zhu	H	M
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Ripon College	Ripon	David W. Scott	P,P	
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		Yang Shangjun	H	
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		Wang Xinzhe	P,P	
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		Liu Hongying		P
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		Sun Hongxiang	M	
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		Qin Xuanyun	M	P
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		Zhang Xingyong		H
		Zhou Shengwu		P
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Dalian University	Dalian	Tan Xinxin	H	
Dalian University of Technology	Dalian	He Mingfeng		P,P
		Zhao Lizhong	P	P
		Wang Yi		P,P
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		Cao Yuan		P
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		Zhao Heng	M	
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		Luo Yuesheng		P
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		Du Xueqiao		H
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		Yue Xi Ting		P
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Inst. of Artificial Intelligence & Robotics	Shenyang	Cui Jianjiang	P	H
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		Wang Bingtuan		P
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		Pan LiQun		H,P
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INSTITUTION	CITY	ADVISOR	A	B
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UNITED KINGDOM				
Magdalen College	Oxford, England	Byron W. Byrne	M	

Editor's Note

For team advisors from China and Singapore, we have endeavored to list family name first, with the help of Susanna Chang, Beloit College '03.