

Road Trip

MLB TURNS TO BUSINESS SCHOOLS TO SOLVE UMPIRE SCHEDULING CHALLENGE.

IT'S NOT JUST THE TEAMS that spend the season traveling in Major League Baseball. The crews travel too — the quartets of umpires who call every game and who are subject to such complex work rules that scheduling their movements from city to city took a team of business professors and MBA students to perfect.

Baseball is a game of statistics, so let's start with the numbers. Thirty MLB teams play a total of 2,430 games in 780 scheduled series in 27 different cities during a six-month season. Each team plays half of their games at their home park. Once the teams' playing schedules have been determined, the umpiring crews have to be scheduled too.

That's a very complex problem. Umpiring crews have no home park; their life is one of constant travel — 35,000 miles, on average, each season. It might sound practical to simply assign one crew to each team, but the rules, designed to maintain impartiality, forbid any single crew from calling more than four series for any team during a season. They also should work each team at home and on the road. Crews are required to visit each Major League Baseball city at least once during a season. Umpires can't call a game the day after they travel, nor can they work any more than 21 days in a row without time off. And those are just some of the rules, all of which have to be taken into account when putting the travel schedule together.

Other factors to be considered are efficiency — minimizing travel times and distances whenever possible to reduce wear and tear on the crews — and economy — keeping travel costs as reasonable as possible.

It's a daunting process, and one that previously took weeks to obtain sub-optimal results when done manually by a former umpire using a Microsoft Excel spreadsheet, explains Tallys Yunes, assistant professor of management science, and part of the group brought in by MLB to computerize the scheduling process. He worked with Michael A. Trick at Carnegie Mellon University's Tepper School of Business, Hakan Yildiz at

Michigan State University's Eli Broad College of Business, and a group of MBA students.

Their challenge was a vastly more complex version of the classic "traveling salesman problem," which determines the most efficient route for a salesman to hit all of the cities in his territory. Yunes's team went at the project, which they dubbed the "traveling umpire problem," using mathematical techniques from the field of operations research.

Specifically, they developed a method of creating a mathematical representation of the situation and then feeding that model into a computer. "It's a what-if game. Billions of combinations are possible. None are absolutely perfect, but some are always better than others," Yunes says. "The computer zips through the universe of possible answers and is able to quickly produce a high-quality solution." In 2006, the first year they worked on the problem, the team came up with three "best" scenarios, each slightly better than the others in certain ways, and let MLB select the one it liked most. As the model evolved, just one scenario is now sent to MLB each year for its input or approval. Their research was published in an academic paper in the operations research journal *Interfaces*, in its 2011 special issue, "Analytics in Sports."

"The lesson from our paper isn't specific to baseball," says Yunes. "It's the usual lesson one can take from papers that apply an analytical approach to decision making. Using advanced analytical techniques allows firms to tackle complicated decision problems more quickly and more effectively. It's not unlike the way airlines schedule their routes or call centers schedule operators. Long gone are the days when business can be run by relying only on one's gut feelings and experience. Mathematics and statistics have become essential tools for success."

— Robert S. Benchley

