更多数学建模资料获取

B 站数学建模试看课程：

https://www.bilibili.com/video/av20238704

清风数学建模视频课程的课表：

http://note.youdao.com/noteshare?id=2e1cc342928466bb632b33304a56e368

视频录制了 45 个小时，累计 800 多页 PPT，讲解的了 20 多个常用模型，内容非常详细，并配有作业讲解。

关注微信公众号：《数学建模学习交流》可获得更多数学建模技巧和比赛信息。

怎么在手机上购买资料：在公众号后台发送“买”这个字，就可以获得一个链接，点进去后就可以购买了（购买方式和淘宝一样）

Practitioner's Commentary: The Outstanding Discussion Groups Papers

Vijay Mehrotra
CEO
Onward Inc.
888 Villa St., Suite 210
Mountain View, CA 94041
vijay@onward-net.com
http://www.onward-net.com

As an operations management consultant, I am used to dealing with difficult problems, incomplete information, and unclear objectives. My profession requires

- a willingness to wrestle with such assignments by understanding the key business goals and issues;
- a desire to solve the problems by finding the right roles for the right people, models, processes, and information systems;
- and an ability to "sell" our solutions by presenting both our methods and our results clearly to diverse and demanding audiences.

That's why I loved this problem.

This problem is a decidedly nontrivial combinatorial optimization problem with lots of different dimensions. It features 7 different time slots, with multiple concurrent meetings per time slot, 3 different classes of people, and a whole lot of restrictions on how these people are to be scheduled. Moreover, the students were also asked to create a solution method that

- could be run by an individual with no technical knowledge,
- could be re-run in less than one hour if inputs were changed slightly, and
- was sufficiently general enough to tackle slightly different versions of the same problem, with different parameters or more general constraints.

The UMAP Journal 18 (3) (1997) 347–350.

In summary, it is a tough, practical problem requiring creative thinking, thorough analysis, and diverse skills.

That's why I was so impressed with the winning papers (and with several other high-quality submissions).

Because this is not a cookie-cutter problem, there is no "right" way to solve it. The problem's complexity—different types of board members, different sessions with different constraints, different parameter values—prevents teams from using a standard modeling framework and turning the crank. Accordingly, the best papers, including the winners published here, tackled the problem with many different methods, including simulated annealing, greedy algorithms, graph theory, and integer programming.

From the practitioner perspective, this is a key aspect of what the MCM should be teaching: Though the vast majority of academic curriculum in mathematics is organized around specific methods (e.g., multivariable calculus, probability theory, linear programming, etc.), the actual problems that we face as practitioners are rarely well defined and often require us to stretch beyond what we has been presented in the classroom. The top submissions in this competition reflect an appreciation for this fact, revealing creativity in the way in which different models and methods are leveraged to tackle a difficult and very real type of problem.

Young practitioners often become discouraged at the lack of direct application (and direct appreciation) of their freshly minted skills. Buried in large organizations or saddled with narrow responsibilities, many leave the mathematical sciences for other pursuits. This is a distressing outcome, because of the following paradox: When models do not fit real problem / decisions, it is often merely evidence that the problem is difficult, which is precisely why we, and our customers, need structured frameworks and models to help solve them! Yet too few of our graduates understand this notion.

The skills that mathematics students possess, even at what most faculty members consider to be an elementary level, are powerful problem-solving tools, when applied creatively and thoughtfully. In addition to modeling skills and mathematical insights, these tools are brought to life by a strong understanding of the business context, by the ability to use the computer to actually solve the problem, and also by the ability to effectively communicate the nature of the problem, the description of the solution methodology, and the results of the analysis.

However, the same mathematical tools are of limited value when detached from actual problems and viewed in isolation. In this year's competition, papers which looked for a simple "turnkey" solution, or conversely solved the mixing problem narrowly and without regard to extensions or modifications, were not evaluated favorably. The nonstandard and dynamic nature of the problem is an important aspect that had to be addressed in order for a submission to impress the judges in the competition, just as it would in practice in industry and business.

Conversely, in almost all of the highly rated entries, there were a number of

characteristics that appeared over and over again. These common themes are evident in all of the papers published here, and are discussed below.

First of all, the best papers all demonstrate a clear understanding of the problem and its competing objectives. All of the desired elements (minimal common membership, maximal interaction between different board members, in-house representation, senior officer group restriction) are explicitly included in the analysis, whether represented as model constraints, as part of an objective function, or as part of the post-solution verification. These award-winning submissions all had a good sense of how these different elements of the problem were in conflict with one another, while also developing solution techniques to reconcile these competing goals.

Once again, in practice, this is something that we face on a regular basis. In countless presentations throughout my career, I have faced questions like "How did you account for X?" and "Where does Y fit into what you did?" In today's world, where the volume of data grows ever faster but valuable information and knowledge are increasingly hard to find, it is a major challenge for analysts to determine what to include, what not to include, and why. As Einstein said, "Things should be made as simple as possible, but not any simpler." The process of identifying the key aspects of a problem, decidedly a black art, is a huge part of what this competition offers to its participants.

Another common theme in this year's winning entries was an understanding of the power of good abstraction. As you read each of the papers published here, you will see a precise and well-presented mathematical formulation of the problem that they propose to solve, along with a clear description of how this abstract problem formulation relates to the "real" problem that is being addressed. In turn, the quality of the abstraction that was selected is directly related to

- the adaptability of the solution to different problems or slightly different conditions, and
- the computational feasibility of the selected solution method.

Note that there were several elegant formulations that couldn't be solved and many clever solutions that couldn't be extended. None of those papers appears here.

Finally, each of the winning entries took the time to examine critically the quality of the scheduling solution generated by their modeling methods. It is challenging to define a standard for what a "best" solution is, yet this type of yardstick is essential for assessing how well a specific method works. Once more, this is something that we as practitioners struggle with, both in trying to determine how successful we have been and in identifying areas where we can improve.

While my primary purpose is to celebrate and illuminate the best of the best of this year's papers, I think it is important to step back and examine the gauntlet that is the MCM. Competitions can be frightening and / or overwhelming, especially when we don't quite know what we're doing, we've got very

little time to do it, and we've no choice but to work with other people to get it done. Contests can bring out the best in us, especially when we are desperately trying to do our best, for we can discover a deeper-than-imagined capacity for hypothesizing, learning, assessing, analyzing, and cooperating. In some sense, the MCM is just an extreme case of what we struggle with today in our projects and in our careers.

Today, in business and in life, we typically don't have all the information about the problems, don't always know who the judges are and what they are thinking, aren't sure what the absolute best approach is, and are perpetually time-constrained. Our choices are clear: either not to participate (or go through the motions half-heartedly), because of all of the uncertainties; or to dive in, think hard, work with our teammates, struggle and fall down a few times, take our best shot, clean up our mess as best we can, and explain clearly what we did and why we did it. The MCM gives students a chance to go through this experience at a relatively young age, to make use of things that they have learned already, and to learn a good deal more simply by going through the process.

About the Author

Dr. Vijay Mehrotra is the co-founder and CEO of Onward, an operations management consulting firm based in Mountain View, CA. He has been a management consultant since 1987, specializing in the application of appropriate mathematical models to key business problems. He has worked with clients in many industries, including semiconductor manufacturing, call center operations management, container shipping, electric power, and sales and marketing management. Vijay holds a Ph.D. in Operations Research from Stanford University and a B.A. in Mathematics and Economics from St. Olaf College.