**IM2C 2025 Australian Judges’ Commentary**

The Australian IM2C judges congratulate the 77 teams from 21 schools all across Australia who participated in the 2025 International Mathematical Modeling Challenge. The quality of the entries this year was very high. Two teams, *sin(madness)* from James Ruse Agricultural High School and *Team Big M* from Canberra College, have advanced to the international round. Teams *I am rectangular* and *Pi-rates*, also from James Ruse, were very close runners-up.

The solution by the team *Tellytubby Tetrahedrons* from Caulfield Grammar, was judged to be the top entrant from the Year 7 to 9 junior teams.

**The 2025 Challenge – Global Sports League**

The challenge, designing a match schedule for an international sports league, was a combination of scheduling and optimization problems. The solution needed to be expanded to include additional teams and generalized to other team sports. No data was supplied, and teams had to select their own factors and criteria to optimize.

The written components of the challenge included a summary, a non-technical letter, a visual graphic of the schedule, the complete solution with a 20-page limit, and optional references and appendices.

The use of Artificial Intelligence was allowed, but teams were expected to provide a report of how it was used, with question prompts and responses.

**Interpreting the problem and creating models**

Teams interpreted the purpose of the Sports League in various ways, ranging from developing grass-roots level sporting interest to maximizing broadcasting revenue from professional sports. The primary problem was generally seen to be team selection and matching to create a single-season schedule. There was an opportunity to explore the relative merits and utility of different kinds of tournaments. Variations and combinations of round-robin, Swiss and knock-out tournaments were commonly used and discussed. Factors used to select the countries involved in the tournament were evaluated in different ways, from simple rating scales to matrix methods that were possibly too sophisticated or needed further explanation and justification.

A secondary problem was the minimization of costs such as carbon emissions, fuel, travel distance, jet lag and so on. Time zones and locations in latitude and longitude provided some additional difficulties to be considered, but most teams found the correct formula for calculating distances across a sphere. One team derived an equivalent formula from first principles, using only high school maths. Most teams handled the minimization of local, regional and global travel costs in realistic ways, and some added data of actual flights, days of the week, and so on.

**Solving the problem, checking results and presenting findings**

For this challenge, it is possible to select teams arbitrarily, write down a league schedule and be done. However, the sheer number of possible feasible solutions means that the best solutions justified their approach. Many teams discussed how they explored methods of evaluating different sets of factors and methods of finding better solutions.

The factors chosen to select team country, locations, costs, etc., and some of the solution methods, were mostly reasonable but unfortunately, some were not practical. The absence of data meant students rated factors based on personal opinions and intuition. When some factors were obviously better or worse than others, this was adequate. Some students went further and used pairwise comparisons and matrix methods to arrive at factor weightings based on the eigenvector corresponding to the dominant eigenvalue of a comparison matrix containing subjective values. Although this is impressive mathematically, it does artificially increase the implied precision by several orders of magnitude. Teams who decided to take these approaches would have benefited from spending more time discussing how the method worked and the advantages of using the method.

There are several methods of finding better solutions in a large space of possibilities. Some teams used classical machine learning methods such as simulated annealing or genetic algorithms, and they demonstrated their understanding of the techniques well. A couple of teams used constraint propagation solvers, available online or as programming modules, without explaining how they work. The lack of explanation made it difficult for judges to allocate credit for the work, as it was difficult to ascertain the students’ understanding of the underlying processes.

There were some great examples of progressive model/schedule development and sensitivity analysis. A few teams described and evaluated alternative methods before choosing and developing one of them. Some teams used programmed simulations, usually in Python, to show the correct working of their schedules. Instead of an overall simulation, there was also an opportunity to discuss how the result of a single match influences the outcome; how each result contributes information and how the information flows in the tournament, but we did not see any reports doing that. Except in a few cases, sensitivity analysis remains an area for improvement in most of the entries.

Clear and effective communication is the most important feature of a good report. This year, reports were generally well structured and pleasant to read, particularly when text was balanced with tables, diagrams and colour. The introduction of variables and assumptions where they are necessary in the text can help to create flow and understanding, and it inspires confidence in the team’s ability and understanding of the mathematical modelling process.

Writing forms a large part of the report, so teams are encouraged to plan well, allocate duties among members, start early and take time to finish well.

**Finally**

We congratulate all participating teams on their efforts during this challenge, we thank each school and team advisor for their support, and we hope every team member will continue to improve their skills in reasoning and communicating mathematically. We eagerly look forward to seeing the entries to the 2026 Challenge.