

Guidelines for Mathematical Modeling Contests: Paper Structure, Workflow, and Writing Strategy

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02/05/2026

1 Reading the Problem and Literature Search

1.1 Initial Reading Strategy

When first encountering a modeling problem, do not attempt to fully understand every unfamiliar term immediately. Instead, begin by identifying key concepts and terminology, and search for relevant academic literature directly.

A practical search pattern is:

- $(Key\ term)$ + “quantification”
- $(Key\ term)$ + related application domain

As new models and concepts appear in the literature, continue expanding the search iteratively. All useful references should be saved and archived systematically.

Recommended tools include:

- Google Scholar
- EasyScholar browser extension (for journal ranking and impact factors)
- AI-assisted search tools (ChatGPT or Bing-based academic search)

1.2 Importance of Interpretability

Model interpretability is essential. Whenever a model is cited or adopted, the following must be clearly explained:

- Why the model is appropriate
- How it fits the specific problem
- The meaning and role of each parameter

High-quality figures are strongly encouraged, following conventions used in published papers.

2 Problem Selection Strategy

2.1 Choosing the Right Problem

Teams should choose problems based on:

- Existing strengths in modeling and programming
- Availability of data
- Time constraints (typically 3–3.5 hours for initial selection and feasibility analysis)

Problems requiring excessive domain-specific terminology or unclear data sources should generally be avoided.

2.2 Innovation-Oriented Modeling

Innovation follows a clear process:

1. Identify the core problem
2. Survey existing methods
3. Analyze limitations of current approaches
4. Propose an improved or extended method

Literature-based modeling helps avoid overly traditional solutions and raises the overall quality of the work.

3 Team Workflow and Division of Labor

A typical division of labor may include:

- **Writing Lead:** problem restatement, assumptions, literature review, narrative coherence
- **Modeling Lead:** mathematical formulation, theoretical justification
- **Programming Lead:** data processing, simulation, reproducibility

All code, AI prompts, and intermediate results should be shared (e.g., via Overleaf, Google Drive, or Colab) to ensure reproducibility.

4 Paper Structure and Logical Flow

4.1 Standardized Writing Order

A recommended writing order is:

1. Assumptions

2. Problem Analysis
3. Model Construction
4. Results and Validation
5. Sensitivity and Robustness Analysis
6. Conclusions

Assumptions define the model's scope and should reflect the reasoning process used to simplify the problem.

4.2 Model Flow Diagrams

Every high-quality MCM paper includes:

- An overall model flow diagram
- A core model diagram highlighting key mechanisms

These diagrams should appear early in the paper to improve readability and help judges understand the structure quickly.

5 Figure and Result Presentation

All figures should:

- Include labeled axes
- Match the corresponding subproblem
- Use consistent color schemes

When many results exist, present representative quantitative results and refer readers to tables or appendices for full details.

6 Abstract Writing Guidelines

The abstract should be concise and information-dense. A recommended structure is four sentences:

1. Problem background and objective
2. Core model and its key components
3. Main results and effectiveness
4. Extensions, comparisons, or secondary findings

Each sentence should contribute new information; avoid narrative filler.

7 Writing Model Sections

Each model subsection should:

- Clearly describe the modeling process
- Highlight critical modeling choices
- End with a one-sentence conclusion summarizing results

Explicit numerical results are preferred over qualitative descriptions whenever possible.

8 Final Polishing and Presentation

To enhance clarity and impact:

- Use bold text for key findings
- Ensure logical continuity between subproblems
- Move lengthy derivations to appendices

Before submission, all team members should jointly proofread the paper.

9 Official MCM Expectations

According to COMAP guidelines, a strong submission should:

- Be well-organized and easy to follow
- Clearly define variables and assumptions
- Justify model choices
- Include validation and sensitivity analysis
- Explicitly state conclusions
- Properly document references

10 Conclusion

A successful MCM paper balances mathematical rigor, clarity of exposition, and effective visualization. Careful problem selection, literature-informed modeling, and disciplined writing are key to achieving top-tier results.