SCORING GUIDELINES

Teams should:

- Use mathematical models **either developed originally or discovered through research**.
- Demonstrate a depth of understanding of their solution.
- Provide additional insight if their solution is drawn from sources.

For each of questions 1 through 3, teams should **create a mathematical model**, which means:

- Define all variables and parameters (with units).
- Justify assumptions.
- Describe the mathematical approach(es) used in the model.
- Apply to or demonstrate for any situations presented.
- Discuss implications of the result(s).

Guidance on the parts of the problem is below; a solution paper template can be downloaded for more direction:

<table>
<thead>
<tr>
<th>Solution Component</th>
<th>Considerations</th>
<th>Value</th>
</tr>
</thead>
</table>
| Executive Summary  | • Overview of the problem (all three parts).  
• Brief description of the mathematical approaches that will be used.  
• Provide and discuss a summary of the results (even if they are incorrect).                                                                                                                                                                                                                          | Up to 20% |
| Question 1         | • An accessible entry point to a larger problem.  
• A warm-up—it is anticipated that most teams will develop a solution for this question.                                                                                                                                                                                                                     | Up to 20% |
| Question 2         | • Investigation of essential issues underlying this real-world problem.  
• The main event—every team can have some success and many teams will cover it well.                                                                                                                                                                                                                 | Up to 25% |
| Question 3         | • A challenging aspect; requires broader and/or deeper perspective.  
• The discriminator—many teams will do something, while only a few will have striking results.                                                                                                                                                                                                           | Up to 15% |
| Discretionary points | • Team examined a wider set of circumstances.  
• Team used a creative problem solving perspective.  
• Team made connections between all three parts and the overall driving question.  
• Paper is exceptionally well written/organized.  
• Detailed sensitivity analysis is presented.  
• Model verification is performed.  
• Strengths and weaknesses are addressed.  
• Effective and well-motivated use of technical computing.                                                                                                                                                                                     | Up to 20% |

More on reverse

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Other considerations

Basic Modeling and Writing Concerns:

- Check that the units are consistent.
- All figures and graphs should have a title, a label, a caption, and the axes should be labelled.
- All tables should have a title, a header, a label, and a caption.
- All variables and parameters should be clearly defined.
- Motivate and fully explain the use of any complicated mathematical expressions.
- When citing outside sources, clearly explain what statistics, models, equations, or insights you took from each source.

Clearly insincere or disrespectful submissions should receive a total score of 0 (zero) and do not receive certificates of participation.

Comments from judges for teams are encouraged and are emailed to teams. Judges may be brief and/or relay questions they had about a team’s work.

The Technical Computing Award

If a team chooses to solve one or more parts of the challenge using a programming platform (specifically something other than a spreadsheet), they may be eligible for the Technical Computing Award. Solutions must demonstrate outstanding use of computing which advances the model and/or reveals its implications.

**Code** must be formatted to make it easy for judges to understand what the program is doing and how the algorithm is executed. This means:
- Code must include comments that describe how the code works.
- Variables should have meaningful names.
- Code should use consistent indentation to allow for easy readability.

Teams must also discuss their program **in the paper**:
- Teams must justify the use of technical computing. That is, it must be clear why the team leveraged a computer program instead of just a calculator.
- Teams should include a brief summary of the purpose and key features of their code.
- If a “built-in” function is used:
  - it should be clear that the team knows what the underlying function does and why it was chosen, and
  - the input parameters should be clearly provided and justified.
- Teams must include an explanation or demonstration of how the code was tested for accuracy or correctness.

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1See Appendix B of the handbook *Math Modeling: Computing & Communicating* for examples.