Maryland Mathematical Modeling Contest 2014 Guidelines

The 2014 contest problem is on page 2 of this document. Page 1 includes tips and guidelines for your successful submission.

Team identification numbers

To anonymize the judging process, each team will be identified by a number instead of teammate names. During Friday evening, you will receive an email with your **team identification number**. This number must be included on the title page of submitted solutions and is the only identifying information that should be included in your final, printed submission.

Solution layout

M3C solutions should be written up as a complete, self-contained paper in the style of a journal article or research project. It is suggested that solutions contain the following sections: **title page**, **abstract**, **introduction** (including background info), **problem description**, **model specification**, **model assumptions**, **results**, **model analysis** (strengths and weaknesses), **conclusion**, **code appendix**, **works cited**.

- The title page should contain your paper title and team number. No names!
- Abstracts should be well-written and engaging. This might not make a large difference for the local competition, but it is a critical part of doing well in the international MCM.
- No model will be perfect, especially one made in the limited time available. Therefore, it is crucial that your writeup of model assumptions, strengths, and weaknesses be thorough, honest, and insightful.
- Include all code you wrote yourself in the code appendix. If you make use of publicly available software libraries, include links to them (but *not* their content) in the appendix as well.
- Works cited can be in any standard format, as long as it is consistent and includes all information. **Include proper in-text citations**.
- There are useful contest links on the M3C website (www.norbertwiener.umd.edu/Education/m3c2014.html).

Submitting solutions

The 2014 M3C ends at 10:00 AM on Monday morning. Please bring a single printed copy to Matt Guay's office (MTH 2119, near the central rotunda of the math building) **no later than 10 AM**. If you need access to a free color printer, come to MTH 2119 after 9 AM but prior to 10 AM to print it from an electronic copy.

If printing in black-and-white, make sure that no important details from color figures are lost.

Contact information

During the course of the competition, competitors are not allowed to discuss their work with or seek help from people outside of their team. However, if you need any clarification on a problem or otherwise need to relay competition-related information, email Matt Guay at matt.d.guay@gmail.com.

Maryland Mathematical Modeling Contest 2014 Problem

The expanding Gobi desert

Desertification is the condition wherein a region becomes increasingly arid, often causing major environmental and sustainability problems. This phenomenon occurs in many parts of the world but we will focus here on the Gobi desert, which has been recently growing at a rate of 1390 square miles every year. This desertification process is causing significant problems for the northern regions of China. The Three-North Shelter Forest Program, aka *Green Great Wall* is a project intended to slow the desertification of the Gobi by planting large amounts of forest across northern China. The Green Great Wall is expected to be completed by 2050.

Modeling challenges:

Solutions are expected to address all parts of this modeling challenge.

1. Model the growth of the Gobi desert over the next 61 years (2014-2075), assuming no Green Great Wall is planted. Your model should include all portions of the Gobi desert, but with specific emphasis on its expansion into China. What geographic, ecological, societal, and climate factors will influence this growth?

2. Model the Green Great Wall and the ways it will change your growth model from part **1**. Ideal solutions will take into account the gradual expansion of the Wall between now and 2050, and the staggered effects the plantings will have on Gobi desertification. Note that growing a forest is not foolproof - not every tree planted may reach maturity, and environmental challenges such as storms may damage larger areas. Which risk factors pose the greatest threat to the Green Great Wall's success?

3. The Green Great Wall initiative comes with an opportunity cost - successful planting will require large amounts of rainfall and groundwater that may also be needed for other purposes (agriculture, human consumption, etc.). Analyze the water usage of your Green Great Wall model. How much water is required? Will its diversion to the Green Great Wall create scarcity problems for other human activities in the region?