Modeling, Simulation and Analysis  
CS 250, Fall 2015  
Final Project  
Due in part by Tuesday, November 24, and  
in part by Tuesday, December 1, and  
in part by Sunday, December 13, and  
in part by Wednesday, December 16.  
(Please see the notes and descriptions of exercises below!)  

Final Project: Modeler’s Choice!  

Some introductory notes from your Prof., some of which are new, and some of which are  
reminders and repeats of notes from the previous assignment:  

• In consultation with me, you will choose a project for this Final Project assignment.  
  Together, we will determine the component exercises for this project. (See below for  
  more details.) For each programming exercise, please electronically submit your code  
  to the course dropbox. In addition, on or before the due date, please turn in printouts  
  of your code and answers to non-programming questions on paper.  
  Note that there is more to this project than selecting a topic—see the Exercises below!  

• If you are developing a model, your write-up should include not only the model itself—  
  e.g., the differential equations (or finite difference equations), constants, and initial  
  conditions that may comprise the model—but also an explanation of how the model  
  was developed, including what each variable / parameter in the model stands for, what  
  simplifying assumptions were made, and what the reasons were for your decisions.  
  Include all pertinent information; incomplete write-ups may not merit full credit.  

• For simulations, your write-up should include the values of constants / parameters  
  employed for each run of the simulation and a very brief explanation of why you chose  
  to run those particular values for simulations. Descriptions of results should be concise  
  and information-heavy; feel free to include figures (e.g., Matlab plots) in write-ups to  
  illustrate your observations.  

• As always, readability is an essential part of the assignment: Make sure both your  
  code and your write-up are easy to read and understand. As part of this, be sure to  
  follow all style guidelines previously discussed in this course, and other good practices  
  for program development and presentation. (For instance, if an RK4 simulation is part  
  of the project, be sure to follow the guidelines for HW3.)  

• In general, if there are any questions about readability or about what might be good  
  to include in a write-up, please let me know!  

• The non-programming portions of this homework, including printouts of all code, are  
  due in my office Wednesday, December 16.
The programming portions of this assignment are to be electronically submitted to our course dropbox in two parts. As we discussed in class, the first version of your code must be submitted by Sunday, December 13; the revised final version must be submitted by Wednesday, December 16.

Please submit your work to the hwfinal directory in our course dropbox—that is, instead of hw3 in the submit250 script, put hwfinal when you submit your work.

(Please see the description of Exercises below for some other important deadlines!)

You will need to demo your code with me after your final code and writeup are complete and before the end of the day on Friday, December 18 as part of the evaluation of your work on these exercises. Please prepare for that demo, and contact me to schedule it where you are ready!

Exercises

1. **Find A Topic!** The first thing to do is identify a project topic—one that you will be excited about working on!

   As mentioned above, project proposals **MUST** be approved by me—we need to make sure the scope and focus are reasonable for a Final Project assignment. There are some deadlines associated with this:
   - A pre-proposal for your project must be approved (not merely presented) by Tuesday, November 24.
   - A final proposal for your project must be approved (not merely presented) by Tuesday, December 1.

   For the final proposal, we must agree on exactly what will be modeled and what the component exercises will be for the project.

2. **Modeling & Simulation!** You must then, of course, actually design and implement the model and the relevant simulations. But that’s not all there is to this Final Project assignment!

3. **Code Validation!** It is important for all programming projects—and especially for work in interdisciplinary computational science—to be sure your code is well validated. For the write-up for this Final Project, be sure to explain the criteria you use to determine if your code functions properly, and the tests you ran on your code to do that validation. (This does not need to be more than you would normally do, if you normally thoroughly validate your code! It just needs to be fully documented.) If you have any questions about how to test or validate code, or what to include in your write-up, please let me know!

   (Note: If you wanted a “practice run,” you might consider writing up your code validation criteria and tests for your exercises from HW3. Although that is not an assigned part of HW3, I will be happy to go over it with you, as preparation for this exercise!)
4. **Evaluation!** In this course, we have discussed (to varying degrees) a few ways to evaluate a model. For examples:

- A model could be evaluated by collecting empirical data and seeing how well the model fits the data.
- A model could be evaluated by coming up with hypotheses and seeing how useful the model is for hypothesis testing.
- Perhaps more generally, a model could be evaluated by analyzing it using the dimensions and overall framework presented in Webb’s article *Can robots make good models of biological behavior?*, from our reading assignment early this semester.

(There are also other ways, I’m sure, but let’s stay with these for now.)

In your write-up for this Final Project, evaluate your model in one of the above three ways. Because collecting empirical data may not be possible within the scope of your projects, it is perfectly fine to instead come up with some hypotheses and test them using your model, or do an analysis of your model in the framework from Webb’s article. If you choose to come up with hypotheses and test them, it is **highly recommended** that you consult with me to make sure they would be sufficient for this exercise; if you evaluate your model along Webb’s dimensions, feel free to do a thorough write-up without consulting with me as part of it.

If you have questions about how to evaluate your model, please let me know!

We will talk about Exercises 3 and 4 in class, but please feel free to ask me any clarifying questions about them, in class or out of class!