Modeling, Simulation and Analysis
CS 250, Spring 2018
Final Project
Due in part by Thursday, April 26, and
in part by Thursday, May 3, and
in part by Monday, May 14, and
in part by Wednesday, May 16,
with a code demo by Friday, May 18.
(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 previous assignments:

- 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, by the final deadline, 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.)

- As always, for full credit, your work must be sufficiently documented to demonstrate an understanding of the relevant concepts and questions for each exercise. In general, always explain your work.

The purpose of a write-up document is to contribute to the clear, explanatory documentation of your work. It should be employed to complement the commenting in code, providing a description in English prose; it should not be simply a repeat of code comments.

- 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 programming portions of this assignment are to be electronically submitted to our course dropbox in two parts. As discussed in class, the first version of your code must be submitted by the end of the day on **Monday, May 14**; the revised final version must be submitted by the end of the day on **Wednesday, May 16**.

  Please submit your work to the `hwfinal` directory in our course dropbox—that is, with the command `submit250 hwfinal <your-directory-name>`.

- The first versions of the non-programming portions of this assignment are due by the end of the day on **Monday, May 14**; the revised final versions—including printouts of your code and your write-up document—must be submitted by the end of the day on **Wednesday, May 16**.

  IMPORTANT NOTE for the **May 14** deadline: You do not need to submit printouts of your draft code or write-up document; submitting them electronically is sufficient for the May 14 deadline.

  IMPORTANT NOTE for the **May 16** deadline: Please be sure to submit printouts of the final version of your code and write-up (as well as submitting them electronically to the course dropbox) by the end of the day on May 16.

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

- You will need to demo your code with me before the end of the day (i.e., before I leave campus) on **Friday, May 18** as part of the evaluation of your work on these exercises. Failure to do so may result in a penalty of up to 50%. Please prepare for that demo, and please contact me to schedule it when 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 previously mentioned, project proposals must be approved by me—we need to make sure the scope and focus are reasonable for a Final Project assignment for our CS250. There are some deadlines associated with this:

- A pre-proposal for your project must be **approved** (not merely presented) by Thursday, April 26. This will likely require meeting to discuss your ideas for your project—please email me with your ideas before we meet. (It needn't be more than a pre-draft of a paragraph or two.)
- A final proposal for your project must be **approved** (not merely presented) by Thursday, May 3.

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 encountered various 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 earlier 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 more about these exercises in class, but please feel free to ask me any clarifying questions about them, in class or out of class!