MONT 104N – Modeling the Environment
Information on Final Exam
December 1, 2012

General Information and Groundrules

As announced in the course syllabus, the final exam for our Montserrat seminar will be given at the announced time for MWF 9:00am classes:

Thursday, December 13, 8:00am to 10:30am

I will see about obtaining the small classroom SW 330 (the room where we did the midterm) for our use that day.

- This will be an individual exam. No sharing of information in any form will be permitted during the exam.
- You may use a calculator during the exam, but no other electronic devices.
- If you are well-prepared and work steadily, I expect the exam will take about 1 1/2 hours (90 minutes) to complete. However, you will have the full 2 1/2 hour period (150 minutes) to work if you need that much time.
- This will be a *comprehensive* exam. The exam questions may cover concepts and techniques from any section of the course (Chapters 1 through 9 in the Langkamp-Hull textbook). But I will only ask about topics we have actively discussed in class – for instance, we have not talked about "chaotic" solutions of logistic difference equations (yet!)).
- There will be four or five mathematical problems (each possibly with a few separate parts). These questions will be similar to things you have seen on the problem sets or the group projects. Some sample exam questions are given later in this document.
- The exam will also include an essay question (worth about 1/3 of the total points) on the set topic below. It should take you between 30 and 45 minutes to produce a good, detailed answer for that question. So it will be necessary to spend a sufficient portion of your preparation time on deciding what you want to say.

Review Session

If there is interest, I would be happy to run a review session for the final. If we do it in the evening either Monday, December 10 or Tuesday, December 11, we might start with a class dinner in the Mulledy social space.

Essay Topic

In general terms, what is a mathematical model? Describe what they are, how they are constructed, and how they are used. Give examples of two different types of mathematical models we have studied in this course. Next, *why* do we try to build mathematical models of aspects of the real world? Can *any* mathematical model be a completely accurate representation of some aspect of the natural world? As an example, why do scientists

think it is important to understand how much CO_2 is present in the atmosphere? What tends to happen when CO_2 levels rise? Describe a key piece of evidence that suggests human activities might have changed atmospheric CO_2 levels over the past 50-200 years. Explain the case for saying the evidence points to that conclusion, and relate your answer to the results of modeling exercises we did in this class.

Sample Mathematical Questions

Answers for all of these are given in the back of our Langkamp-Hull textbook, so you can check your work:

1) Chapter 1/17, 19 (Note: the conversion factor you need for 19 is given on page 329(!) I will supply any information you would need for qeustions like these ones.)
2) Chapter 2/5,7,19,25 (Note: in 5, "normalized" means compute the CO_2 output per 10^{12} BTU produced)
3) Chapter 3/3,9,17,19 (Note: for 17, see example on pages 58 and 59)
4) Chapter 4/5, 15
5) Chapter 5/3,7,11abcf
6) Chapter 6/5a, 7
7) Chapter 7/7, 9
8) Chapter 8/3, 11
9) Chapter 9/1a and new part b: Give a rough hand sketch of what the solution with $p(0) = 30$ would look like, 15.

Note: I could also ask you "qualitative" questions relative to the process of fitting a linear, exponential, or power law model like some of the questions from the midterm, including questions about the process of transforming the data via logarithms for the exponential and power law cases. I *can't* ask you to compute a regression equation for linear, exponential, or power law model fitting of course, since apart from one simple linear example, we only did those with Excel.)