AM115 First project assignment

Summary:

(1) Choose three topics from the list below for your first group project by the end of this Thursday, rank them in terms of your preference, email TF and wait for confirmation.

(2) Prepare a written report and a 7-minute presentation. The due date for the project report and the presentation slides is given on the course website and the presentations will be given in class.

Here is a list of possible topics for your first project. Please choose your first, second and third choices for a project from this list.

Please email your **three** selections to TF. Please set the subject of your email to "APM 115 Project 1 Ranking". Please send only one email per group. Your group's project must be approved **before you start working on the project**. We want to ensure that the projects are distinct from one another so you may only get your second (or, on rare occasions, third) choice (allocation will be on a first come first serve basis).

The project list follows:

1) Multiple species pred-prey model (*i.e.*, 2 prey, 2 predators or other such combinations)

2) Food chain or food web model (*i.e.*, b eats a, c eats a & b, etc.)

3) Seasonal variability for growth and/or carrying capacity of predator-prey model

4) Love triangle/rectangle model and/or other extensions (e.g. nonlinear interactions, distance love etc.)

5) Extension of the epidemic model.

6) Chemical oscillations.

Each of the above may be formulated as a deterministic model, and/or a stochastic model simulation and/ or via an equation for an appropriate probability distribution function. It would be desirable to provide some real-life context for the above project ideas.

7) Tobacco Reduction: To explore the dynamics of a tobacco cessation program

8) Intoxication: To model the level of intoxication in someone who is consuming alcohol over a certain period of time.

9) Pharmacology model: what doses of the drug should be given and what should the period between doses be?

10) Arms race: To model the evolution of the weaponry of two (or more) countries.

11) Warfare: To model the outcome of a war based on the sizes, efficiencies, reinforcements etc. of the two forces, and the type of warfare.

12) Happy marriage or divorce? Predict marital outcome based on the couple's personalities and

interactions.

13) A box model for kidney dialysis exploring which way to run the dialysis loop (with or against the blood loop)

14) Test a vaccination strategy on a simple SIR disease model.

15) Island biogeography (how migration and extinction determine the number of species on islands).

Any of these subjects should be great fun to work on. We are open to other related project ideas. (Eventually you will need to come up with your own idea for a project for the second and the final projects.) We hope you'll enjoy this and are happy to help you along the way!

The three final products of your project are:

1) A (roughly) 6-page report (single spaced, 12 pt font, all figures included) written by each group. The report format includes a 100-word abstract summarizing your problem, motivation, approach and results; then, section 1 with an introduction explaining why your problem is interesting and important and giving some background. Next, section 2 deriving and describing your model, including equations and algorithm; section 3 with the results and analyzes. Section 4 includes a discussion of the results, and the final conclusion section (section 5) briefly summarizes everything from motivation to discussion.

2) A 7-minute presentation. You will need to upload your report (pdf file) to the course webpage, The presentation (in PowerPoint, Keynote or PDF format) must be uploaded by the time specified on the canvas site**.**

3) The Matlab/python code(s)

4) In the report, please give a brief statement of each team member's contribution to the project. Also, submit your individual statements on your contribution to the project to Canvas.

Advice:

A good project is based on a creative idea/model formulation and uses a detailed and diverse analysis of its results. Don't try to do too much, stick to one good idea and analyze the model well, rather than trying to solve for too many different model variants. A good model should also teach you new things that were not obvious or clear at the outset. An important part of your analysis should be the variation of model parameters and the examination of the sensitivity of the results to these parameters. This will give you a sense of how robust your conclusions are and how sensitively they depend on the parameters. Similarly, consider using diverse analyzes such as fixed point analysis, linearized stability, stochastic methods, analytic solutions, etc.

Checklist on things to pay attention to (based on criteria used in Mathematical Contest in Modeling):

1. State clearly and motivate what you are going to do.
2. Explain assumptions and rationale/justifications. Emphasize the key assumptions that bear on the problem. Clearly list all variables used in your model.
3. Describe your model design and its justification (why you are using this particular type of

models).
4. Describe model testing and sensitivity analysis.
5. Discuss the strengths and weaknesses of your model or approach.

Please feel free to write us with any questions.

AM115 teaching staff