Project proposal

Checklist

1. Question to be answered / motivation
    - why would anyone be interested in this topic: curiosity, societal implications, technological development
2. Current state-of-the-art:
    - what is the closest study you can find related to or similar to your topic (what do we know about the topic)
    - is there a computer code available for it. e.g.:
        - there is code available but it is for a more complex model
        - there is code available but it is in a different language
        - there is code available but you will implement it differently
        - there is a description of model and results but no code
    - is there a computer code in a related domain
3. Objective and scope:
    - what processes will you include / exclude
    - what scenarios will you consider

(what will you calculate?)

Plotting / writing graphical user interfaces is not the objective for the project

4. Approach:
    - what is the model equation - is it mechanistic or empirical (e.g., conservation equation, or a parametrized relationship between input and output)
    - will you be using the model for forecasting/prediction problem or inference (e.g., want to understand model parameters)
5. Expected schedule - items to include, feasibility
    - collection of data for evaluating model parameters, results
    - how will I evaluate whether model is working properly?
    - elements of project: (data I/O, creation of scenarios, simulation/computation, analysis of results, report writing)

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Methodological and Ideological Options

Human and nature dynamics (HANDY): Modeling inequality and use of resources in the collapse or sustainability of societies

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Questions

Is a sustainable society possible?

What pathways lead to societal collapse?

Model

$$\begin{cases} \dot{x} &= (ay)x - bx \\ \dot{y} &= cy - (dx)y \end{cases}.$$

Scenarios

1. Egalitarian society (No-Elites): Scenarios in which $x_E=0$.
2. Equitable society (with Workers and Non-Workers): Scenarios in which $x_E \geq 0$ but $\kappa \equiv 1$.
3. Unequal society (with Elites and Commoners): Scenarios in which $x_E \geq 0$ and $\kappa > 1$.

Topics

After exercises

Structuring computation

- data models
- control flow
- memory management

Numerical modeling

- for forecasting
- for inference

During exercises

Workflow

- version control and collaboration through git
- automation 1: C/MATLAB integration
- automation 2: shell scripting and string processing
- data and code organization (project directory structure, modules)
- documenting code, citing prior art

Updates from MathWorks

- Released its own MATLAB code guidelines (see here about style guides)

- 2025b was released (optional to update)