

Syllabus

Teaching Approach

Class will include a mix of lectures and in class hands-on examples, using students' own computers.

I will often provide a Quatro document for you to go through prior to class so you can learn at your own pace and

Teaching team

Instructor: Naomi Tague (<https://tagueteamlab.org/>)

- **Office:** Bren Hall 4516
- **Office hours:** email to set a time
- **Email:** tague@ucsb.edu

Teaching assistant: Ojas Sarup

- **Office:** BH 4329 (Manzanita)
- **Office hours:** Friday 10:30 to 12:30
- **Email:** ojassarup@ucsb.edu

Where we will be

- **Lectures:** Tues, Thur 8:00am - 9:15 am (**BH 1414**)
- **Discussion Section 1** Tues 1:00pm-2:00pm (**BH 1510**)
- **Discussion Section 2** Tues 2:00pm-2:50pm (**BH 1510**)

please attend discussion section where. you signed up

Learning objectives

- Gain familiarity with different types of models and the situations where you might use them
- Understand how to choose the ‘right model’ for the job
- Know how to build simple models including
 - input-output models
 - basic dynamic models
 - matrix models
- Gain some basic skills that are useful in applying models including
 - parameter sensitivity analysis
 - uncertainty analysis
 - model calibration and evaluation

Computing

- I will assume that everyone has some basic R skills (from ESM 203, ESM 232, MEDS program courses or other courses), including how to use ggplot, and Quatro and build simple functions
- Many classes will be working classes so bring laptop to class
- Some of the material (example functions and Quatro code) will also be available on *github* I will also provide this material on *canvas* but if you are familiar with *git* then it may be faster to clone and then update the repository. We will discuss this further when we get to this part of the course

ChatGPT and other AI-tools

[Interesting Paper on AI-tools in Computing Education](#)

Tools

- Github Copilot (most widely used by programmers)
- ChatGPT

(both built from CODEX by OpenAI)

In 2020, test CODEX scored 78% on intro to computing test, in 2023 it scored 98%

Other studies show less accuracy...depends on the problem

Using AI-tools in this course

- AI-tools great resources but effective use requires understanding how to ask good questions
- Use this course to build that understanding, think about the meta concepts. Ask yourself
 - What are situations you might apply a technique/idea/concept;
- You gain skills by **Practicing**
- For assignments/practice
 - **Always** write the code yourself - but you use AI-tools to help find syntax
 - Use AI-tools to explain other peoples code (including class examples)
 - Use AI-tools to help interpret error messages

Attendance

- you are expected to come to class - its part of the learning (pair-share)
- some assignments will be started and even completed in class

Tentative schedule

Week	Lecture topics
April 1	Into: What is a model
April 3	Conceptual Models
April 8	Using models with data
April 10	Complex model Example
April 15	Informal Sensitivity Analysis (no formal lecture)
April 18.	Informal Sensitivity Analysis (no formal lecture)
April 22	Sensitivity Analysis I
April 24	Sensitivity Analysis II
April 29	Dynamic Models - Analytical Solutions
May 1	Dynamic Models - ODE Solver

Week	Lecture topics
May 6	Sensitivity with Dynamic Models
May 8	Stability with Dynamic Models
May 13	2 Variable/Time Series Models
May 15	What Makes a Good Model
May 20	Calibration
May 20/22	Make up - Calibration Exercise
May 22	Optimization
May 27	Discrete Models
May 29	Discrete Models 2
June 3	Return to Big Picture
June 5	Wrap Up

Assignments (Tentative Assign/Due Dates)

There are 8 +1(short Q/A) assignments. Some assignments will be done in groups.

Assign/Due	Assignment
April 1/3	Getting to know you (Q/A)
April 5/7	Conceptual Model
April 8/14	Almond Yield
April 15/21	Informal Sensitivity Analysis
April 24/1	Sobel
May 6/12	ODE with Sobel
May 13/2	Two-variable Dynamics
May 20 or 22/2	Model Calibration and Uncertainty
May 29/3	Final Assignment

Assignments will vary in length but most will be short coding assignments with a 1- paragraph write up.

Assignments will be submitted on [Canvas](#) *Canvas* provides grading rubrics that you may find helpful.

Protocols and Guidance

- Learning to program is hard and I may not always explain in a way that is accessible to you - So if you don't understand something *ASK*

- Ideally ask in class - you will help me to learn how to explain (or find an answer if I don't know it) and you will help others
 - if you don't feel comfortable asking , reach out to me or Ojas
- Environmental modeling and the coding involved gets better with practice and play - Don't just read the Quatro - try the code, try variations on the ideas presented, make up stuff to try, get your feet wet
- Programming means making mistakes, expect it, stay calm and try again - if you get frustrated step away and come back; be creative
- **Respect and Support each other**
 - when working in groups, pay attention to your partner, if they are not at your skill level, help them learn - recognize that we all have different backgrounds
 - listen - different perspectives contribute to modeling - ask questions; figure out how different people *see* the world (what is there conceptual model)
 - you learn by helping others - do that!
- If you are really struggling, reach out to Ojas or myself, we can help (or if you just want to chat about something)

Coding Best Practices

- clear, readable (well-documented) code
- informative variable and function names
- graphs that are easy to understand (labels, legends, strategic use of color)