Syllabus for Economics Computational Bootcamp
https://canvas.wisc.edu/courses/222489

Instructional Mode: Virtual

Lectures: 2:00-3:15, Tuesdays and Thursdays

Credit Hours: This course meets for two 75-minute lectures each week over June and carries the expectation that students will work on course learning activities for about 6 hours every week outside of class.

Instructor: Garrett Anstreicher, anstreicher@wisc.edu, 7316 Social Sciences.

Office Hours: 2:00-3:15, Mondays and Wednesdays

Course Description: This four-week course is designed to quickly familiarize students with numerical analysis, including what it is, how it works, and how it applies to economics. The course will be taught in the Julia programming language.

The first week of the class will be dedicated to familiarizing students with Julia. Students will learn how to set up their own Julia environment, how to conduct basic exercises in it, and how to use Git for version control. Students will also learn about how to maximize Julia's performance and the concepts of compilation more broadly.

The second week of the course will focus on more advanced techniques in Julia, including parallelization, optimization routines, and the approximation of continuous functions via interpolation and splines.

The third week of the course will introduce the concept of dynamic programming. Students will work through a variety of classic dynamic programming problems and will learn how dynamic programming can be applied to economic models. The fourth week of the course will be spent working through instructive economic models in depth.

Additional Resources: Material in this course borrows considerably from https://julia.quantecon.org/. Additional helpful resources and exercises may be found there. Documentation for the Julia language is at https://docs.julialang.org/en/v1/.

Problem Sets and "Grading": Problem sets will be weekly and will require using Julia to execute a variety of tasks. The "grade" for the class is entirely based on the three problem sets, each which will be given equal weight.

Learning Outcomes:

- Familiarity with the Julia programming language, including but not limited to performance optimization and parallelization.
- Broader understanding of computer functionality and performance optimization.
- Familiarity with dynamic programming and its applications to economics.
- Familiarity with general taxonomy of economic models and increased comfort in coding and estimating them.

Week 1: Intro

1. Lesson 1 – Intro to Programming and Julia
    a. Comparison of different languages
    b. Setting up a Julia environment
    c. Basics – printing, vectors, loops
    d. Using packages
    e. Coding example: white noise plot, simple OLS, optimal growth model
2. Lesson 2 – Proper usage: maximizing performance and version control
    a. Good coding practices.
    b. Background: explanation of compilation
    c. Optimizing Julia's performance and Julia's profiler
    d. Introduction to Git
    e. Coding example: optimized optimal growth model.

Week 2: Advanced Usage

3. Lesson 3 – Optimizing and approximating arbitrary continuous functions
    a. Introduction to optimization
    b. Coding example: optimizing the Rosenbrock function with Newton's method, LBFGS, and Nelder-Mead.
    c. Introduction to spline interpolation
    d. Coding example: Interpolating a sine wave.
    e. Final coding example: optimal growth with interpolated value/policy functions.
4. Lesson 3 – Parallelization and Linstat.
    a. Explain what parallelization is.
    b. Pros and cons of parallelization.
    c. Coding example: parallelized optimal growth model.
    d. Russell or somebody else from SSCC gives introduction to Linstat.
    e. Possible introduction to Condor, but this is getting pretty advanced.

Week 3: Dynamic Programming

5. Lesson 5 – Intro
    a. Explanation of the idea
    b. Run through classic problems: Fibonacci sequence, egg dropping, etc.
6. Lesson 6 – Applications to Economics
    a. High-level taxonomy of economic models.
    b. Coding example: backward induction discrete-time Ben-Porath problem.

Week 4: Stochastic Methods

7. Lesson 7 – Monte Carlo
    a. TBD
8. Lesson 8 – Markov Chains
    a. TBD

Boilerplates

Misconduct Statement: Academic Integrity is critical to maintaining fair and knowledge-based learning at UW Madison. Academic dishonesty is a serious violation: it undermines the bonds of trust and honesty between members of our academic community, degrades the value of your degree and defrauds those who may eventually depend upon your knowledge and integrity.

Examples of academic misconduct include, but are not limited to: cheating on an examination (copying from another student's paper, referring to materials on the exam other than those explicitly permitted, continuing to work on an exam after the time has expired, turning in an exam for regrading after making changes to the exam), copying the homework of someone else, submitting for credit work done by someone else, stealing examinations or course materials, tampering with the grade records or with another student's work, or knowingly and intentionally assisting another student in any of the above. Students are reminded that online sources, including anonymous or unattributed ones like Wikipedia, still need to be cited like any other source; and copying from any source without attribution is considered plagiarism.

The Department of Economics will deal with the offenses harshly following UWS14 procedures:

1. The penalty for misconduct in most cases will be removal from the course and a failing grade.
2. The department will inform the Dean of Students as required and additional sanctions maybe applied.
3. The department will keep an internal record of misconduct incidents. This information will be made available to teaching faculty writing recommendation letters and to admission offices of the School of Business and Engineering.

If you think you see incidents of misconduct, you should tell your instructor about them, in which case they will take appropriate action and protect your identity. You could also choose to contact our administrator Tammy Herbst-Koel (therbst@wisc.edu) and your identity will be kept confidential.

For more information, refer to https://www.students.wisc.edu/doso/academic-integrity/.

Grievance Procedure: The Department of Economics has developed a grievance procedure through which you may register comments or complaints about a course, an instructor, or a teaching assistant. The Department continues to provide a course evaluation each semester in every class. If you wish to make anonymous complaints to an instructor or teaching assistant, the appropriate vehicle is the course evaluation. If you have a disagreement with an instructor or a teaching assistant, we strongly encourage you to try to resolve the dispute with him or her directly. The grievance procedure is designed for situations where neither of these channels is appropriate.

If you wish to file a grievance, you should go to room 7238 Social Science and request a Course Comment Sheet. When completing the comment sheet, you will need to provide a detailed statement that describes what aspects of the course you find unsatisfactory. You will need to sign the sheet and provide your student identification number, your address, and a phone where you can be reached. The Department plans to investigate comments fully and will respond in writing to complaints.

Your name, address, phone number, and student ID number will not be revealed to the instructor or teaching assistant involved and will be treated as confidential. The Department needs this information, because it may become necessary for a commenting student to have a meeting with the department chair or a nominee to gather additional information. A name and address are necessary for providing a written response.

Accommodations for students with disabilities: The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform faculty [me] of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. Faculty [I], will work either directly with the student [you] or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA.

Diversity and Inclusion: Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals.

The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background people who as students, faculty, and staff serve Wisconsin and the world.