Dear Members of the Recruiting Committee,

I have been teaching a course as an instructor for first-year Ph.D. students at Brown University. As a sample syllabus, I am attaching the syllabus for this course. I am also prepared to teach a variety of other courses that I listed in my teaching statement. If you would like to see a sample syllabus of other courses, please feel free to contact me.

Shunsuke Tsuda

Brown University, Department of Economics

ECON 2020

Computing for Economists

Meetings: Mondays and Wednesdays 10:30am-10:50am

Instructor: Shunsuke Tsuda (Shunsuke_Tsuda@brown.edu)

Office Hours: Thursdays 9:00-10:20am

Teaching Assistants: TBD

Course description:

This course introduces students to basic concepts in software engineering and scientific computing as preparation for conducting frontier research in all fields of economics. Topics in software engineering will include programming basics, object-oriented programming, directories, abstraction, documentation, unit testing, logging, parallel processing, automation, and version control. Topics in scientific computing and numerical methods will include floating-point arithmetic, numerical differentiation and integration, equation-solving, and numerical optimization. Coding will be in Python and applications will focus on topics likely to arise in economics research. Key concepts will be introduced in interactive lectures and reinforced in in-class group work and at-home assignments.

Learning goals:

- Understand basic software engineering to improve clarity, portability, accuracy, efficiency, and reproducibility of economics research projects.
- Get accustomed with basic programming and Python language to conduct various fields of economics research.
- Apply appropriate numerical methods to solve mathematical problems that cannot be solved analytically.
- Formulate research questions of personal interest that can be analyzed using computing tools.
- Independently acquire new computing skills as needed for your research.

Prerequisites:

- ECON 2010, or its equivalent mathematical knowledge.
- Complete assignment 0, distributed via e-mail in the early January, due at the second meeting.

Grading Policy:

There are about 7 basic assignments. Each assignment will practice and extend concepts covered in class, motivated by an economic application. Assignment grades constitute 70 percent of the final grade. Each assignment has an equal grade share (10 percent). There is a final project in which students choose an economic model and solve

and/or estimate and/or simulate it. Group work with 2-3 students is allowed. The detail will be announced during the lecture. The final project constitutes 20 percent of the final grade. Attendance at each of the course sessions will be recorded and will constitute 10 percent of the grade. All assignments are distributed and submitted using GitHub. (Assignment 0 guides how to setup Git and GitHub on your computer.)

References:

Lectures are based on lecture slides, which will be uploaded in the GitHub repository "class_materials". No specific textbook is required. The following resources are useful for your reference. Lecture slides are partly based on the resources with *. Additional readings will be announced during the course.

Python

*Lubanovic, Bill. 2014. *Introducing Python: Modern Computing in Simple Packages*. New York: O'Reilly Media

McKinney, Wes. 2017. *Python for Data Analysis: Data Wrangling with Pandas, Numpy, and IPython, 2nd edition*. New York: O'Reilly Media.

Vanderplas, Jake. 2016. *Python Data Science Handbook: Essential Tools for Working with Data*. New York: O'Reilly Media.

Github and Git

Git for beginners: The definitive practical guide

Pro Git Second Edition

*Software Carpentry. *Version Control with Git.*

Numerical methods and computation

*Collard, Fabrice. Lecture notes

*Judd, Kenneth L. 1998. *Numerical Methods in Economics*. The MIT press.

Teukolsky, Saul A. et al. *Numerical Recipes: The Art of Scientific Computing, 3rd edition.* Cambridge university press.

Applications to economics research

*Miranda, Mario J., and Paul L. Fackler. 2004. *Applied computational economics and finance*. MIT press.

*Sargent Thomas J. and John Stachurski, *Lectures in Quantitative Economics*.

Credit Hours:

You are expected to spend 180 hours on this course. In addition to the lectures (35 hours), you will spend approximately 3 hours per class on readings and review (75 hours), 5-10 hours each on the six (almost) bi-weekly assignments (50 hours), and 20 additional hours on the final project.

Accessibility and Accommodations Statement:

Brown University is committed to full inclusion of all students. Please inform me early in the term if you have a disability or other conditions that might require accommodations or modification of any of these course procedures. You may speak with me after class or during office hours. For more information, please contact Student and Employee Accessibility Services at 401-863-9588 or SEAS@brown.edu. Undergraduates in need of short-term academic advice or support can contact an academic dean in the College by emailing college@brown.edu. Graduate students may contact one of the deans in the Graduate School by emailing graduate_school@brown.edu.

Schedule:

The basic structure of the course consists of a lecture day and a lab day in each week. In lectures, a lecturer gives lectures focusing on theoretical aspects. In lab days, students bring laptops and solve numerical problems by Python with an instructor and a TA. The detail schedule follows below. We will announce in advance of each week if schedule deviates from the below.

Weeks	Meeting Dates	Topics	Assignments
0	Jan 20	First meeting: Course introduction	
1	Jan 25	Python Basics: Lab	Due: Assignment 0
	Jan 27	Python Basics & Floating-Point Arithmetic: Lab	
2	Feb 1	Object-Oriented Programming: Lab	
	Feb 3	Software Engineering: Lec	
3	Feb 8	Software Engineering: Lab (Code cleanup)	
	Feb 10	Software Engineering: Lec	Due: Assignment 1
4	Feb 15	**NO CLASS (Long weekend)**	
	Feb 17	Software Engineering: Lab (Git & GitHub)	
5	Feb 22	Pandas & Data Visualization: Lab	
	Feb 24	Pandas & Data Visualization: Lab	Due: Assignment 2
6	Mar 1	Nonlinear Equation Solving: Lec	
	Mar 3	Nonlinear Equation Solving: Lec (+ Lab)	
7	Mar 8	Nonlinear Equation Solving: Lab	
	Mar 10	Numerical Optimization: Lec	
8	Mar 15	Numerical Optimization: Lec (+ Lab)	Due: Assignment 3
	Mar 17	Numerical Optimization: Lab	
9	Mar 22	Numerical Differentiation: Lec	
	Mar 24	Numerical Differentiation: Lec (+ Lab)	Due: Assignment 4
10	Mar 29	Numerical Differentiation: Lab	
	Mar 31	Numerical Integration: Lec	
11	Apr 5	Numerical Integration: Lec (+Lab)	Due: Assignment 5
	Apr 7	Numerical Integration: Lab	Due: Final Project Proposal
12	Apr 12	Applications: Machine Learning	
	Apr 14	Applications: Text Analysis	Due: Assignment 6
13	Apr 19	Applications: Spatial Data and GeoPandas	
	Apr 21	(Backup)	
	Apr 23		Due: Final Project

*Assignment dues are **at 9 am of meeting dates**.

*Please download lecture slides in advance. Please bring your laptops in all meetings.

*For dates with "Lab", students solve in-class exercises with their computers.

*Potential topics in applications for research include applied econometrics, text mining, social network analysis, and introduction to machine learning using Python.