**Econ 411/611 Computational Economics Spring 2023**

3 Credits

TTh: 11:30 – 12:45 PM

Synchronous Zoom Meeting

Instructor: James Caton

Office Hours: <https://ndsu.zoom.us/j/93448215337>

12:00 PM – 1:00 PM M

3:00 PM – 4:00 PM Th

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*\*Syllabus subject to change to suit needs of the class and its online format\**

**Course Description:**

This course teaches elementary programming skills that are required for economic computation.

Students are introduced to computational methods for economic modeling and data analysis. They will learn to manage and visualize economic data and learn to automate these processes. Students will create a library of elementary statistical functions and an OLS regression.

**Course Bulletin**

Economic computation for modeling, analysis, and data management, including an introduction of rudimentary elements of programming required for economic computation.

**Course Objectives:**

1. Students will develop understanding of and practice with computational methods.
2. Students will analyze data that is processed and/or generated using different computational models.

**Course Learning Outcomes:**

Upon successful completion of the course, students will be able to:

1. build elementary computational programs for economic analysis. (UPLO 5)
2. understand the general syntax and structure required for statistical programming. (UPLO 5)
3. retrieve, generate, and analyze economic data. (UPLO 5)
4. manage and transform large data sets. (UPLO 5)
5. build functions that interpret data using statistical equations. (UPLO 5)
6. efficiently create a variety of visualizations for economic data. (UPLO 5)
7. build an agent-based model. (UPLO 5)

**Course Prerequisites**:

Econ 201 or 202

Stat 330 or Stat 367

**Required Texts:**

Students will use a digital copy of *[Learn Python for Economic Computation: A Crash Course](https://github.com/jlcatonjr/Learn-Python-for-Stats-and-Econ),* a text that I have created for the course. This will be available for free to students.

**Grading:**

Classroom Notes (Participation): 20%

Project Statement 1%

Project Proposal 3%

Rough Draft: 6%

Final Project: 25.01%

Project Presentation 4.99%

Homework 40%

**Extra Credit**

There will be opportunities for extra credit. The Challey institute, the Center for the Study of Public Choice and Private Enterprise, and the Wold Lecture Series will hold events throughout the semester. You may receive extra credit for attending any one of these events. To receive extra credit, you must sign an attendance sheet and complete a 1-page writeup (single spaced, Times New Roman 11 font, with one-inch margins) that discusses the content of the event and considers the implications of that content. Each writeup may be awarded up to 1% extra credit that will contribute to the overall class grade.

Be aware that there will be no additional extra credit offered to help students to raise their grade.

**Grades**

Between 90% and 99.99% A

Between 80% and 89.99% B

Between 70% and 79.99% C

60% and Less Than 69.99% D

Less Than 60% F

**Course Software:**

Python 3.0+

Anaconda (with Spyder)

**Zoom Meetings:**

All class meetings will be accessible via Zoom. Recordings will be made available after class.

Students must register that the registration URL: <https://ndsu.zoom.us/meeting/register/tJYudO-trT8rHNSET0pEZ-K9_-xvss7lLl9L>

Join the class meeting on Zoom here: <https://ndsu.zoom.us/j/92336534160>. Students are required to share screen.

**Class Notes (Participation):**

Class notes for each section should be recorded in a Jupyter Notebook and must be uploaded to your GitHub account by the last Sunday of each section by 11:59 PM. Class notes should be uploaded to a folder titled “In Class Projects”.

**Notes should be in your own words. Notes should reflect exploration of concepts. If you create multiple iterations of a concept, include that in your notes. Verbatim copies of the professor’s notes will be penalized.**

Students are expected to participate in class by working on exercises presented in class, asking questions, using online resources (i.e., Google, Stack Overflow, official Python documentation) to find solutions to problems, and participating in discussion.

Excused absences will be discussed on a case by case basis

I will drop your lowest class notes grade.

**Homework:**

A homework is due at the end of the week indicated in the schedule. Homework is to be uploaded to Github by the last Sunday of each section by 11:59 PM. Homework should be uploaded to a folder titled “Home Projects”. **Graduate students enrolled in ECON 611 must complete additional exercises where indicated in the homework.**

I will drop your lowest homework grade.

**Attendance:**

Students are expected to attend class. To receive credit for participation for a missed class with an excused absence, students may complete a make-up an assignment based on the material covered during the class period that was missed.

Excused absences are specified in NDSU Policy 333 and include: participation in university sanctioned events, absences due to pregnancy or related conditions, religious observance, legally mandated absence, absence due to military service, personal illness, death of an immediate family member. Students who anticipate excusable absences shall notify the instructor as soon as possible, preferably by the third week of class. In the case of unanticipated excusable events, the student needs to contact the instructor as soon as possible. Students have the responsibility to visit with the instructor if exams or assignments are scheduled during times where absences are required.

*Excused absences will be discussed on a case by case basis*

**Project:**

**ECON 411**

Undergraduate students are required to build a computational model that processes or generates data and complete an article using a Jupyter Notebook (At least 4000 words *plus* bibliography with at least 5 academic sources) that describes the model, its results, and their significance.

**ECON 611**

Graduate students are required to build a computational model that processes or generates data and complete an article using a Jupyter Notebook (At least 6000 words *plus* bibliography with at least 15 academic sources) that describes the model, its results, and their significance. The paper is expected to be of sufficient quality to send to a journal.

Attendance of all presentations is required.

**Communication**

Whenever necessary, I will email the class with announcements via blackboard. This requires that each student regularly check his or her @NDSU.edu email account. It is the student’s responsibility to activate the NDSU.edu email account and employ it in communicating with their department and university administration whenever necessary.

When you send an email to me please put ECON 411/611 in the title line of the email.

**Academic Honesty:** All students taking any course in the College of Agriculture, Food Systems, and Natural Resources are under the Honor System (<http://www.ag.ndsu.edu/academics/honor-system-1>). The Honor System is a system that is governed by the students and operates on the premise that most students are honest and work best when their honesty, and the honesty of others, is not in question. It functions to prevent cheating as well as penalize those who are dishonest. It is the responsibility of the students to report any violations of the honor pledge to the instructor, honor commission or the Dean of the College of Agriculture, Food Systems, and Natural Resources.

The academic community is operated on the basis of honesty, integrity, and fair play. [NDSU Policy 335: Code of Academic Responsibility and Conduct](http://www.ndsu.edu/fileadmin/policy/335.pdf) applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the [Office of Registration and Records](http://www.ndsu.edu/registrar/). Informational resources about academic honesty for students and instructional staff members can be found at [www.ndsu.edu/academichonesty](http://www.ndsu.edu/academichonesty).

**Students with special requirements:** Any students with disabilities or other special needs, who need special accommodations in this course are invited to share these concerns or requests with the instructor as soon as possible. The instructor may ask for verification and that, plus other assistance, can be requested from Disability Services in NDSU Library Suite 17 (231-8463). <http://www.ndsu.edu/disabilityservices/>.

**Veterans and military personnel**: Veterans or military personnel with special circumstances or who are activated are encouraged to notify the instructor as early as possible.

***Important Dates***

*January 16 Martin Luther King Jr. Holiday (no class, offices closed)*

*January 19 Last day to add classes via Campus Connection*

*January 19 Last day for no-record drop of classes @ 100% refund*

*January 19 Last day to withdraw to 0 credits @ 100% refund*

*January 24 Financial Aid applied to Student Accounts*

*January 30 Last day to submit request to audit, pass/fail*

*February 20 Presidents’ Day Holiday (no classes, offices closed)*

*March 3 Grades of Incomplete convert to F*

*March 13-17 Spring Break (no classes)*

*March 15 Undergraduate Spring graduation application due*

*March 15 Graduate student Intent to Graduate due*

*March 2nd week Summer/Fall registration appointment times available*

*April 6 Last day to drop classes with record (W)*

*April 6 Last day to withdraw to 0 credits*

*April 7 No classes, offices closed*

*April 10 No classes, offices open*

*April 14 Spring commencement participation deadline*

*May 1-5 Dead Week*

*May 8-12 Final Examinations*

*May 13 Commencement*

*May 16 Grades are due*

**Homework Schedule:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Dates** | **Section** | **In Class Project** | **Reading** | **Content** | **Due:** |
| **Week 1:** *1/9-1/15* | Hello World! | **Project 1:** Chapter 1: The Essentials | **Chapter 1:** The Essentials | Introduction to Jupyter; printing; object types; arithmetic; string functions; type errors  Reference Sheets: [Jupyter](https://github.com/jlcatonjr/Learn-Python-for-Stats-and-Econ/blob/master/In%20Class%20Projects/Reference%20Sheet%20for%20Jupyter.ipynb); [GitHub](https://github.com/jlcatonjr/Learn-Python-for-Stats-and-Econ/blob/master/In%20Class%20Projects/Reference%20Sheet%20for%20Github.ipynb) | **Week 1:**  Open [GitHub](https://github.com/) Account; download [Git](https://git-scm.com/downloads). |
| **Week 2-3:** 1/16-1/29 | Lists and Dictionaries | **Project 2:** Chapter 2: Working with Lists  **Project 3:** Dictionaries and Data Frames | **Chapter 2:** Working with Lists | Defining lists vs. arrays; creating, appending/inserting, concatenating, sorting, deleting objects from, slicing, and copying lists; list functions; list length; if statements; for loops | **Week 2:** Homework 1: Working with Lists  **Week 3:** Project Statement Due (1 Paragraph; Include at least 1 data source);  Homework 2: Dictionaries and Dataframes |
| **Week 4-5:** 1/30-2/12 | Functions and Data Structures | **Project 4:** Chapter 3: An Introduction to *numpy* and *pandas;*  **Project 5:** Chapter 5: Functional Programming: Rudimentary Statistics and Analytics | **Chapter 3**: An Introduction to *numpy* and *pandas;*  **Chapter 4:** Functional Programming: Rudimentary Statistics and Analytics | Functions; summary statistics; correlation / covariance matrix; data visualization; Data structures and libraries; | **Week 5:** Homework 3: Introduction to Numpy, Pandas, and Matplotlib |
| **Week 6-7:** 2/13-2/26 | Visualizing Data | **Project 6:** Visualizing Monetary Policy |  | manage and clean data; import and write csvs; encoding; data visualization; stack plots | **Week 6**: Submit Project Proposal in Jupyter Notebook  (1000 words; at least 2 data sources; at least 2 different types of data visualizations) |
| **Weeks 8-9:** 2/27-3/12 | Probability Distributions | **Project 7:** Chapter 5: Probability Distributions |  |  | **Week ~~7~~ 8:** Homework 4: Visualizing Monetary Policy  **Week ~~8~~ 9**: Homework 5: Functional Programming: Rudimentary Statistics (from Project 4: Chapter 3) |
| Spring Break: 3/13-3/19 |  |  |  |  |  |
| **Week 10-12:** 3/20-4/9 | Hypothesis Testing and Ordinary Least Squares | **Project 7:** Hypothesis Testing  **Project 8:** Working with OLS | **Chapter 7:** Building an OLS Regression | Efficient data visualization; ordinary least squares; linear algebra; statistics; data management; *statsmodels* | **Week  ~~9~~ 12**: Homework 6: Working with OLS |
| **Weeks 13-14:** 4/10-4/23 | Advanced Analytics | **Project 9:** Partial Correlations and Directed Acyclic Graphs  **Project 10:** Chapter 8: Advanced Data Analysis | **Chapter 8:** Advanced Data Analysis | Partial correlation; directed acyclic graphs; residuals; multi index; indicator variables; quantiles; panel regression | **Week 13:** Homework 7: Partial Correlations and Directed Acyclic Graphs (4/16)  **Week 14: Optional** Homework  EC: Advanced Data Analysis (4/16)  Upload Rough Draft of Project to GitHub. Must be at least 2500 words with 10 citations.  **Due 4/23** |
| **Week 15:** 4/24-4/30 | Geocoded Data | **Project 11:** Working with Geocoded Data |  | Geopandas; GIS; | **Week 15**:  Project 11 Homework |
| **Week 16:** 5/1-5/7  5/9 8AM | In class Presentations |  |  |  | Present Project; Attend Presentations\*  **5/9 11:59 PM: Latest Possible Submission for Final Project** |

\***Students are required to be present for all presentations during Week 16 and on Tuesday May 9 at 8 AM**