**Econ 411/611 Computational Economics Spring 2024**

3 Credits

TTh: 1:00 – 2:15 PM

Synchronous Zoom Meeting

Instructor: James Caton

Office Hours: <https://ndsu.zoom.us/j/96847265599>

12:00 PM – 1:00 PM M

4:00 PM – 5:00 PM Th

Office: Barry Hall, 400C

Email: [james.caton@ndsu.edu](mailto:james.caton@ndsu.edu)

Phone: 701-231-7337

Website: <http://JamesLCaton.com>

*\*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)

<https://www.anaconda.com/download>

**Zoom Meetings:**

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

Join the class meeting on Zoom here: <https://ndsu.zoom.us/j/96304501265>. Students are required to share screen.

**Github:**

Students must make a GitHub account for the course and send that account to me. If you prefer, you may choose not to include personal indicators with your account. I will track identifiers.

**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”.

**Use your notes as a scratchpad! 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**

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 who need accommodations in this course are invited to share these concerns or requests with the instructor and contact the [Center for Accessibility and Disability Resources](https://www.ndsu.edu/disabilityservices/) as soon as possible.

**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 and are encouraged to provide Activation Orders.

**Family Educational Rights and Privacy Act (FERPA)**

Your personally identifiable information and educational records as they relate to this course are subject to [FERPA](https://www.ndsu.edu/onestop/student-privacy-policy-ferpa).

**Important Dates (Full NDSU dates/deadlines can be found** [**here**](https://www.ndsu.edu/onestop/academic-calendar)**)**

Jan 1 Mon HOLIDAY — New Year's Day (offices closed)

Jan 8 Mon Classes begin at 4:00 p.m.

Jan 9 Tue First full day of classes

Jan 15 Mon HOLIDAY — Martin Luther King, Jr. Day (no classes, offices closed)

Jan 16 Tue Last day to be added to Campus Connection Wait Lists

Jan 18 Thu Last day to Add classes via Campus Connection\* Permit needed after this date.

Jan 18 Thu Last day for no-record Drop of classes @ 100% refund\*(full semester classes only)

Jan 18 Thu Last day to Withdraw to Zero Credits @ 100% refund\*(full semester classes only)

Jan 24 Wed Payments due for NDSU account balances

Jan 29 Mon Last day to submit requests to Audit, Pass/Fail

Feb 19 Mon HOLIDAY — Presidents' Day (no classes, offices closed)

Feb 19 Mon Last day to Withdraw to Zero Credits @ 75% refund\*full semester classes only)

Mar 4-8 Mon-Fri Spring Break Week (no classes, offices open)

Mar 15 Fri Late fee applied to unpaid account balances (11:59 p.m.)

Mar 21 Thu Last day to Withdraw to Zero Credits @ 50% refund\*(full semester classes only)

No refunds issued for withdraw to zero credits after this date.

Mar 29-Apr 1 Fri-Mon HOLIDAY -- Spring Recess (no classes, offices closed Friday, offices open Monday)

Apr 5 Fri Last day to Drop classes with 'W' record\*

Apr 5 Fri Last day to Withdraw to Zero Credits for Spring

Apr 15 Mon Late fees applied to unpaid account balances (11:59 p.m.)

Apr 29-May 3 Mon-Fri Dead Week

May 6-10 Mon-Fri Final Examinations

May 11 Sat Commencement ceremony

**Homework Schedule:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Dates** | **Section** | **In Class Project** | **Content** | **Due:** |
| **Week 1:** *1/8-1/14* | Hello World! | **Project 1:** 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:** 1/15-1/28 | Lists and Dictionaries | **Project 2:** Chapter 2: Working with Lists  **Project 3:** Chapter 3: An Introduction to *numpy* and *pandas;* | 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**:  Introduction to Numpy, Pandas, and Matplotlib |
| **Week 4-5:** 1/29-2/11 | Functions and Data Structures | **Project 4:** Chapter 4: Functional Programming: Rudimentary Statistics and Analytics | Functions; summary statistics; correlation / covariance matrix; data visualization; Data structures and libraries; | **Week 5:**  **Homework 3**:  Functional Programming: Rudimentary Statistics and Analyticss |
| **Week 6:** 2/12-2/18 | Visualizing Data | **~~Project 5:~~** ~~Visualizing Monetary Policy~~ | ~~manage and clean data; import and write csvs; encoding; data visualization; stack plots~~ | **~~Homework 4:~~**  ~~Visualizing Monetary Policy~~ |
| **Weeks 7-8:** 2/19-3/3 | Probability Distributions | **Project 6:** Chapter 5: Probability Distributions |  | **Week 7**:  **Submit Project Proposal** **in Jupyter Notebook**  (1000 words; at least 2 data sources; at least 2 different types of data visualizations)  **Week 8**:  **Homework 5:**  Chapter 5: Probability Distributions |
| Spring Break: 3/4-3/10 |  |  |  |  |
| **Week 9-11:** 3/11-3/31 | Hypothesis Testing and Ordinary Least Squares | **Project 7:** Hypothesis Testing  **Project 8:** Working with OLS | Efficient data visualization; ordinary least squares; linear algebra; statistics; data management; *statsmodels* | **Week 10:**  **Homework 6:**  Hypothesis Testing |
| **Weeks 12-14:** 4/1-4/21 | Geocoded Data | **Project 9:** Partial Correlations and Directed Acyclic Graphs  **Project 10:**  Working with Geocoded Data | Partial correlation; directed acyclic graphs; residuals; multi index; indicator variables; quantiles; panel regression; Geopandas; GIS; | **Week 12**:  **Homework 7:**  Working with OLS  **Week 13:**  **Homework 8:**  Partial Correlations and Directed Acyclic Graphs  **Week 14:**  **Homework 9:**  Working with Geocoded Data |
| **Week 15:** 4/22-4/28 | Advanced Analytics | **Project 11:**  Chapter 8: Advanced Data Analysis |  | **Week 15**:  **Homework 10:**  Project 11 Homework  Upload Rough Draft of Project to GitHub. Must be at least 2500 words with 10 citations.  **Due 4/23** |
| **Week 16:** 4/29-5/3  5/8 1PM | 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 Wednesday May 8 at 1 PM.**