

Carleton University
ECON 4708 / ECON 5708: Economic Data Science –
Analytics
Fall 2026

General Course Information

Course and sections	ECON 4708A / ECON 5708F
Credit value	0.5 credit
Instructor	Prof. Matt Webb
Email	matt.webb@carleton.ca
Office	D-899
Office hours	Thursdays, 10:00–11:00 a.m. and 3:00–4:00 p.m.
Class time	Thursdays, 11:30 a.m.–2:30 p.m.
Class location	See Carleton Central and the Brightspace course page.
Course delivery	Primarily in person. The December 3 lecture is asynchronous online instruction.
Tutorials	None scheduled.
TA	None
Course Webpage	Brightspace

The Fall 2026 course outline is due to be available to registered students by September 2, 2026. The term begins September 9, and this course first meets September 10.

Calendar description

An introduction to methods of statistical and machine learning analytics for economic analysis. Tools relevant for both small and large data sets will be covered. Topics may include approaches to classification, dimension reduction strategies, and prediction models and tools.

Prerequisites, preclusions, and cross-listing

For ECON 4708, the 2026–27 Undergraduate Calendar lists ECON 2708 with a grade of C+ or higher and ECON 3210 (or equivalent) with a grade of C+ or higher as prerequisites. ECON 4708 includes an experiential learning activity and normally meets for three lecture hours per week.

ECON 5708 is the graduate cross-listed version of the course. The Graduate Calendar describes it as also offered at the undergraduate level, with different requirements, as ECON 4708, for which additional credit is precluded. Students may not receive additional credit for both versions.

Students registered in ECON 5708 complete additional, more advanced problem-set questions and write different, more technically demanding versions of the midterms and final examination.

Official course entries are available in the Undergraduate Calendar and Graduate Calendar.

Course Goals and Learning Outcomes

The course develops a practical and analytical understanding of modern statistical learning, with particular attention to applications in economics. By the end of the course, students should be able to:

- distinguish prediction, statistical inference, and causal inference problems;
- evaluate predictive performance using training/test splits, cross-validation, and appropriate loss functions;
- understand and apply regression, classification, regularization, nonparametric, tree-based, ensemble, neural-network, and unsupervised-learning methods;
- reason about causal variable selection using directed acyclic graphs (DAGs), including confounders, mediators, colliders, and back-door paths;
- explain the logic of Lasso, post-double-selection/Double Lasso, and high-dimensional causal inference;
- understand bootstrap inference, including residual, pairs, and wild bootstrap methods and extensions to multiple testing;
- interpret, compare, and communicate the strengths and limitations of statistical-learning methods in economic applications; and
- implement statistical-learning methods in code and move between software environments rather than treating any one programming language as the method itself.

Estimated learning hours

The scheduled instructional component is approximately 39 hours across the term, including the asynchronous December 3 module and time used for the three in-class midterms. A typical week also requires approximately two to three hours of reading/review and two to four hours of problem-set, coding, or assessment preparation. Workload varies around midterms and the final. ECON 5708 students should expect approximately one to two additional hours in weeks involving graduate-level questions. These estimates are planning guides rather than limits on the time individual students may need.

Textbooks, Course Materials, and Technology

Students are not required to purchase a textbook. The principal references are freely available from the authors' website:

- **ISLR2:** Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani (2021), *An Introduction to Statistical Learning, with Applications in R*, 2nd ed., Springer.
- **ISLP:** Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, and Jonathan Taylor (2023), *An Introduction to Statistical Learning, with Applications in Python*, Springer.

Both books and supporting resources are available at <https://www.statlearning.com/>. Additional readings and lecture materials will draw selectively from econometrics, causal inference, and machine learning, including sources on DAGs, bootstrap inference, Double Lasso/high-dimensional causal inference, and images as economic data. Links or copies will be provided through Brightspace where permitted.

Programming and software

The course is deliberately **not tied to one programming language**. R and Python are especially useful because the principal textbook editions provide parallel labs. Stata and other suitable statistical software may also be useful for some topics.

Unless a problem explicitly requires a particular language, coding exercises should be treated as implementations of statistical ideas rather than language-specific recipes. Code should be clearly labelled, reproducible, and accompanied by enough explanation to make the analysis understandable. Students should have access to a computer capable of running suitable statistical software and opening course materials. R, Python, and their common open-source development environments are available without licence fees.

Required costs

There are no required textbook or software purchases planned for this course. Students are responsible for ordinary computer and internet access. Any optional paid software, printed book, or enhanced AI service is not required and will have a no-cost alternative.

Evaluation

All graded evaluation is planned to be completed **in person**. The course grade is:

Assessment	Date	Weight
Midterm 1	Thursday, October 1	20%
Midterm 2	Thursday, November 5	20%
Midterm 3	Thursday, November 26	20%
Final examination	December 12–23 examination period	40%
Total		100%

Each midterm is approximately 90 minutes and is held at the **beginning** of the regular Thursday class. A shorter lecture follows. Midterms and the final emphasize concepts, interpretation, and mathematical/analytical reasoning rather than coding under exam conditions.

The final examination is cumulative. Its exact date, time, and location are scheduled by the University and will be announced after the December examination schedule becomes available. Students must remain available throughout the official December 12–23 examination period.

ECON 4708 and ECON 5708 have different examination versions. ECON 5708 assessments require greater technical sophistication and contain harder questions.

Ungraded problem sets and practice assessments

There are eight **ungraded** problem sets. They are not submitted and do not contribute directly to the course grade. Each problem set contains approximately four ECON 4708-level questions (roughly two mathematical/analytical and two coding/computational) plus two additional ECON 5708-level questions (roughly one mathematical/analytical and one coding/computational).

Approximately 25% of each midterm is taken from, adapted from, or closely related to the two problem sets associated with that midterm. Approximately 10% of final-exam points is taken from, adapted from, or closely related to Problem Sets 7 and 8. Practice versions of all three midterms and the final examination, with separate 4708 and 5708 versions and solutions, will also be provided.

Problem set	Planned release	Main assessment supported
PS1	September 10	Midterm 1
PS2	September 24	Midterm 1
PS3	October 8	Midterm 2
PS4	October 22	Midterm 2
PS5	November 5	Midterm 3
PS6	November 19	Midterm 3
PS7	November 26	Final examination
PS8	December 3	Final examination

Feedback and return of graded work

Problem sets, solutions, practice assessments, lectures, and office hours provide formative feedback beginning early in the term. Midterm 1 is the first graded work. Midterms will normally be returned within two weeks of the date on which they are written. Midterm feedback may be provided through returned scripts, posted solutions, class discussion, or a combination of these methods. Final examination scripts are handled under University procedures.

Grading scale

ECON 4708 and ECON 5708 use Carleton's 12-point letter-grade scale:

Grade	A+	A	A-	B+	B	B-	C+
Percent	90–100	85–89	80–84	77–79	73–76	70–72	67–69
Grade	C	C-	D+	D	D-	F	
Percent	63–66	60–62	57–59	53–56	50–52	< 50	

The scale follows the Undergraduate Calendar grading regulations and Graduate Regulations. Passing the course is based on the cumulative course grade; there is no separate satisfactory-performance requirement for the final examination beyond applicable University regulations.

Tentative Course Schedule

The schedule may be adjusted as the course develops. Students will receive reasonable notice of material changes. Reading Week is October 26–30. December 3 is asynchronous.

Week	Date / format	Topic	Reading
1	Sept. 10, 3h	Introduction to Statistical Learning.	ISLR2 / ISLP Ch. 2
2	Sept. 17, 3h	Regression and Econometric / Computational Foundations.	ISLR2 / ISLP Ch. 3
3	Sept. 24, 3h	Classification.	ISLR2 / ISLP Ch. 4
4	Oct. 1, midterm + 1.5h	Midterm 1, followed by Resampling and Cross-Validation.	ISLR2 / ISLP Ch. 5
5	Oct. 8, 3h	DAGs, Causality, and Control Selection.	Selected causal-inference readings
6	Oct. 15, 3h	Model Selection, Ridge, and Lasso.	ISLR2 / ISLP Ch. 6

Week	Date / format	Topic	Reading
7	Oct. 22, 3h	Double Lasso and High-Dimensional Causal Inference.	Belloni–Chernozhukov–Hansen and related material
–	Oct. 29	Fall break – no class.	
8	Nov. 5, midterm + 1.5h	Midterm 2, followed by Nonparametric Methods / Moving Beyond Linearity.	ISLR2 / ISLP Ch. 7 and notes
9	Nov. 12, 3h	Bootstrap and Multiple Hypothesis Testing.	ISLR2 / ISLP Chs. 5 and 13 plus extensions
10	Nov. 19, 3h	Regression and Classification Trees.	ISLR2 / ISLP Ch. 8
11	Nov. 26, midterm + 1.5h	Midterm 3, followed by Ensemble Methods.	ISLR2 / ISLP Ch. 8
12	Dec. 3, asyn-chronous	Neural Networks, Deep Learning, and Images as Economic Data.	ISLR2 / ISLP Ch. 10 plus application
13	Dec. 10, 3h	Unsupervised Learning.	ISLR2 / ISLP Ch. 12

Assessment Coverage

- **Midterm 1:** L01–L03; approximately 25% closely tied to PS1–PS2.
- **Midterm 2:** L04–L07; approximately 25% closely tied to PS3–PS4.
- **Midterm 3:** L08–L10; approximately 25% closely tied to PS5–PS6. Ensemble Methods are taught after Midterm 3 and are excluded.
- **Final:** cumulative, including Ensembles, Neural Networks/Images, and Unsupervised Learning; approximately 10% closely tied to PS7–PS8.

Evaluation Expectations and Academic Consideration

Attendance, participation, and punctuality

There is no separate attendance or participation grade. Regular, punctual attendance is strongly recommended because lectures integrate conceptual, mathematical, and computational material. Students are responsible for announcements and material covered in class or in the asynchronous module.

Submission, late work, and returned work

Problem sets are ungraded and are not submitted, so no late penalty applies to them. Graded midterms and the final occur at scheduled times; they are not ordinary take-home submissions and cannot be submitted late. Procedures for returning midterms and providing feedback will be announced in class or on Brightspace.

Missed midterms and academic consideration

Students experiencing short- or long-term extenuating circumstances should contact the instructor as soon as possible and normally no later than 24 hours after the affected coursework deadline, following Carleton's Academic Consideration Policy. Requests are not automatically approved; accommodations depend on the circumstances and applicable University rules.

There are no make-up midterms. If a student misses one midterm, the two remaining midterms will each be worth 25% of the final course grade and the cumulative final examination will be worth 50%.

Deferred final examinations

Students who cannot write the final examination because of circumstances beyond their control must follow the current deferral procedure applicable to their registration in ECON 4708 or ECON 5708. Requests and supporting materials must meet University deadlines. Undergraduate students should consult the Registrar's deferral information; graduate students should consult Section 9.3 of the Graduate Regulations. Travel plans during the examination period are not a valid reason for missing a scheduled final examination.

Use of Generative AI and Collaboration

The problem sets are ungraded practice. Students may use programming documentation, textbooks, classmates, and generative-AI tools while working on them, but should use those resources to support learning rather than replace it. Students remain responsible for checking code, mathematical reasoning, references, and factual claims and should be able to reproduce the logic independently. When AI-generated material is incorporated into work shared with the instructor or class, its use should be transparent and appropriately acknowledged.

Midterms and the final examination are individual, in-person assessments. Generative AI, internet access, and unauthorized collaboration are not permitted during those assessments. Students may use a non-programmable calculator; no other examination aids are permitted unless announced by the instructor.

Collaboration must not extend to impersonation, unauthorized sharing of assessment content, or presenting another person's or system's work as one's own. Students should consult Carleton's Academic Integrity Policy and current AI guidance.

Classroom Conduct, Devices, and Recording

Students and instructional staff should contribute to a respectful learning environment. Phones should be silenced. Laptops and other devices may be used for course-related work without disrupting others. Audio/video recording or redistribution of classes is not permitted without the instructor's written permission or an approved academic accommodation. This restriction does not prevent ordinary personal note-taking.

E-Proctoring

E-proctoring will not be used for evaluations in this course.

Email Communication

Students should use their Carleton email accounts and include "ECON 4708" or "ECON 5708" in the subject line. Questions about substantive course material are generally better handled during class or office hours than through long email exchanges.

Course Materials and Copyright

Lectures and course materials, including slides, handouts, recorded lecture videos, exams, problem sets, solutions, and similar materials, are protected by copyright. Students may make copies for their own educational use but may not publicly reproduce, post, or distribute course materials without the instructor's permission.

Academic Integrity, Accommodations, and University Policies

Students are responsible for following Carleton University's current regulations concerning academic integrity, examinations, deferred work, and academic accommodations.

- Academic integrity information and policy
- Academic consideration policy and forms
- Academic accommodation information
- Paul Menton Centre for Students with Disabilities
- 2026–27 Academic Year and examination dates
- Undergraduate academic regulations
- Graduate regulations

Students who require accommodation should begin the appropriate process as early as possible and observe published deadlines. Accommodation does not remove or lower essential course learning objectives. Students requesting accommodation for disability, religious observance, pregnancy/parental needs, or other protected grounds should follow the University's current accommodation procedures and communicate with the appropriate University office and the instructor as required.