McGill University
Department of Economics
Economics 257D: Honours Statistics
Term 2: Winter 2025
Course outline

Professor: Jean-Marie Dufour

January 2025
Version: April 7, 2025

This course covers basic statistical and econometric theory for Honours students. The topics include: point estimation, hypothesis testing, confidence sets, linear regression, some additional advanced topics.

In addition to the main recommended textbook, documents and other material relevant to the course will be available from my web page:

`http://www.jeanmariedufour.com`
`http://www.jeanmariedufour.org`

- **Lecture hours**: Monday 14:35 - 15:55; Wednesday 14:35 - 15:55.
- **Room**: BURN 1B45.
- The course involves 26 lectures of 80 minutes.
- **Beginning**: Monday, 6 January 2025. End: Wednesday, 9 April 2025.
  3-7 March 2025 is the Winter reading break (no lectures).
- **Final exam period**: Monday, 14 April 2025 to Tuesday, 30 April 2025.
- **Office hours**: (Leacock 525) Monday 16:15 - 17:30 (or by appointment).
- **Teaching assistants**:
  Endong Wang (endong.wang@mail.mcgill.ca)
- **TA sessions**: TBA
- **e-mail**: `jean-marie.dufour@mcgill.ca`

Evaluation will be based on 3 elements:

1. a mid-term exam: 25%;
2. assignments: 25%; as part of the assignments, students are expected to learn how to a run linear regressions using the R software (mtcar data);
   - as requested by some students, each student has the option of handing in an extra regression analysis based on a different data set (of their choice); this statistical analysis may count for 50 % of the total grade for assignments (i.e., 1/2 of 25%); handing in such an optional assignment cannot lower the final grade of a student; if the optional assignment is not judged satisfactory (or simply not handed in), the only assignments which will be taken into account are those posted on the homepage for the course (`http://www.jeanmariedufour.com`); the optional assignment must be handed in on April 15, 2025 (or earlier);
3. a final exam: 50%;
4. if the grade of a student on the final exam is superior to the grade on the mid-term exam, the midterm grade fro this student will be replaced by the grade on the final exam.

Student
In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded.

McGill University values academic integrity. Therefore all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see www.mcgill.ca/students/srr/honest/) for more information).
L'université McGill attache une haute importance à l'honnêteté académique. Il incombe par conséquent à tous les étudiants de comprendre ce que l'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir de telles actions, selon le Code de conduite de l'étudiant et des procédures disciplinaires (pour de plus amples renseignements, veuillez consulter le site www.mcgill.ca/students/srr/honest/).

Class schedule

Week	Day	Time (13:05-14:25)	
1	Monday	6 January 2025	
	Wednesday	8 January 2025	
2	Monday	13 January 2025	
	Wednesday	15 January 2025	
3	Monday	20 January 2025	
	Wednesday	22 January 2025	
4	Monday	27 January 2025	
	Wednesday	29 January 2025	
5	Monday	3 February 2025	
	Wednesday	5 February 2025	
6	Monday	10 February 2025	
	Wednesday	12 February 2025	
7	Monday	17 February 2025	
	Wednesday	19 February 2025	Mid-term exam
8	Monday	24 February 2025	
	Wednesday	26 February 2025	
9	Monday	3 March 2025	Reading week (3-7 March 2025)
	Wednesday	5 March 2025	Reading week (3-7 March 2025)
10	Monday	10 March 2025	
	Wednesday	12 March 2025	
11	Monday	17 March 2025	
	Wednesday	19 March 2025	
12	Monday	24 March 2025	
	Wednesday	26 March 2025	
13	Monday	31 March 2025	
	Wednesday	2 April 2025	
14	Monday	7 April 2025	
	Wednesday	9 April 2025	Last lecture
15		14-30 April 2025	Final exam (time to set)

Readings and main references

The symbol * represents required readings. Photocopied lecture notes also constitute required reading.

1. Review of matrix algebra
2. Basic statistical theory
   (a) Statistical problems
   (b) Sampling distributions
   (c) Asymptotic notions: laws of large numbers and central limit theorems
   (d) Point estimation
   (e) Interval estimation and confidence intervals
   (f) Hypothesis tests
3. Statistical dependence and regression theory
   (a) Multivariate distributions
   (b) Measures of dependence between random variables
   (c) Optimal prediction and statistical regression
4. Linear regression
   (a) Estimation of linear regression models
   (b) Hypothesis testing in the classical linear regression model
   (c) Confidence intervals
   (d) Prediction from linear regression
   (e) Asymptotic theory
   (f) Coefficients of multiple determination
   (g) Partitioning formulas
   (h) Specification errors
   (i) Monte Carlo tests in linear regressions
   (j) Multicollinearity
   (k) Binary regressors
   (l) Tests for structural change
   (m) Analysis of residuals

5. Optional topics [subject to time availability]

   (a) Introduction to time series models
   (b) Generalized least squares and related topics
   (c) Instrumental variables methods
   (d) Multivariate models
   (e) Maximum likelihood estimation
   (f) Methods of moments
   (g) Simultaneous equations

Final exam (Monday, April 15, 2025)

The exam will be a closed book exam.

Students are responsible for the notes covered in class from January 8 to till April 10 (inclusive), except for the following material.

1. From "Covariance, correlation and linear regression between random variables":
    (a) Section 5.3, 5.4, and 5.5.
2. From "Covariance matrices and multiple linear regression between random variables":
    (a) Section 3
3. From "Classical linear model":
    (a) Proof of Theorems 3.7 to 3.11.
    (b) Proof of 3.16
    (c) Section 8.
4. Notes number 14-17 (on home page).