

McGILL UNIVERSITY
Department of Economics
Economics 257D: Honours Statistics

COURSE OUTLINE AND TERM 1 READING LIST

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This is the outline for Term 1 of Honours Economic Statistics. The two terms together form the statistics pre-requisite for later Honours Economics courses.

Term 2 will be taught by Prof. Jean-Marie Dufour. The two term grades will be equally weighted to arrive at a final grade for the D course.

N.B.: You may not be able to get credit for this course if you take or have taken other statistics courses. Be sure to check the 'Course Overlap' section under 'Faculty Degree Requirements' in the Arts or Science sections of the Calendar.

Administrative notes:

Official statements

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/integrity for further information).

According to Senate regulations, instructors are not permitted to make special arrangements for final exams. Please consult the calendar, section 4.7.2.1, General University Information and Regulations, at www.mcgill.ca.

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.

Extraordinary Circumstances Statement:

In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.

Copyright of lectures Statement:

All slides, video recordings, lecture notes, etc. remain the instructor's intellectual property. As such, you may use these only for purposes of your own learning (and research, with proper referencing/citation). You are not permitted to disseminate or share these materials; doing so may violate the instructors intellectual property rights and could be cause for disciplinary action.

Evaluation:

Evaluation is planned as follows (percentages are of the grade for the term, which forms one half of the full-year grade).

First term: assignments 5%, mid-term exam 25%, December exam 70%.

If someone is unable to write the first midterm for a documented medical reason, the weight will be added to the December exam; if someone is unable to write the December exam, again for a documented medical reason, the weight will be added to the second-term final exam in April.

In order to leave adequate time for both 250 and 257, I will co-ordinate with the first-term 250 instructor on midterm dates. We should be able to announce those dates by mid-September.

Note that the final (April) examination for the course, while emphasizing second-term material, may include some first-term material; this is a cumulative course and material from all parts of the course are examinable on the final.

Deferred and supplemental examinations:

In addition to what is stated in this syllabus, please familiarize yourself with the University rules on deferred and supplemental examinations. A deferred exam is one which replaces an exam that was missed; a supplemental exam is a second exam in a course which a student has failed, and becomes a second (not replacement) grade for the course. There are University rules governing the circumstances in which you have the right to take one or the other of these exams.

There is no supplemental examination for the December exam, because it is not a final examination for the course. As noted above, the weight will be transferred to the April exam.

The deferred or supplemental examination for this course, which in accordance with University rules will be held in August following the end of the course, covers in principle the entire course. It may be a deferred exam for some students (those who missed the April exam) and a supplemental for others (those who did not pass the course and want to try again to pass and then receive the credits). A supplemental examination mark is not combined with other evaluation during the year, for those who take it; that is, the supplemental examination is 100% of the supplemental grade. However if a student writes the August examination as a deferred exam because he or she missed the April exam, then it counts only for the weight of the exam that was missed.

A deferral requires a reason which is compatible with the University's policies, usually an illness. This requires documentation. If you are booking travel for the December holidays, it is your responsibility to be sure that you will be here for the examinations. That means either waiting until the examination schedule is available, or booking travel for the day following the last day of examinations in December.

A numerical grade will be computed for each term. The grade for the year will be the equally-weighted average of the two individual term grades. A final letter grade will be obtained from the overall numerical grade. Any letter grades assigned at intermediate

stages are for information only; computations will be based on the underlying numerical quantities. Prof. Dufour and I will compute and review final grades at the end of the year, and do any rounding-off one time only, then.

Transfers from Honours to Major program

Transfers from Honours to Major are routine, although this is an unusual feature within the University: these can be done after the first-term add/drop period. There are two time windows when transfers are permitted.

Window 1, up to the end of the week following return of the mid-term examination (exact dates will be available later). Note that 250 and 257 instructors co-ordinate midterm dates and grading to ensure that you have both midterm grades by a particular date (such as 1 November).

Window 2, during the January add/drop period. After the end of window 2, transfer to 227 is not possible.

If you transfer into 227, the grade will be based entirely on work in that course. The interim grade from 257 will not be used. The instructor in Term 1 of Econ 227, Dr. Youssef Camara, will determine the weights given to different elements of the work in that course. Note that this is **not** necessarily the same arrangement that is used for the microeconomics transfer 250-230; check the Econ 250 course outline for the arrangement that will be made in that case.

Note also that the coverage of Econ 227 and 257 is not identical; students who transfer must check carefully to be sure that they are familiar with all of the material covered in 227 before the transfer. This will of course be a bit challenging for students who transfer in January, and requires attention.

In the event that you decide to transfer, or are considering a transfer, be sure to speak with advisors in the Economics department. Lists of advisors for different programs are posted near the fourth-floor office in Leacock.

Office hours

Tentatively, Monday and Wednesday at a time to be discussed (to avoid overlap with other classes that most people take); our teaching assistant will hold some tutorial or office hours as well, to be determined. I might hold some office hours by zoom; we'll see. I will announce details as we go along.

I also usually am able to stay around after class (somewhere outside the classroom so as not to interfere with the next class) in order to answer any further questions that you might have that we didn't get to in class.

Please minimize the use of the email and speak to me in office hours or after class instead if at all possible; I receive a large volume of email and (a) things become lost; (b) it's impossible to deal with; (c) I've had a problem of chronic tendinitis for years, although I'm managing it with the help of speech recognition!

Textbooks:

For the first term of the course, I will post in pdf form, on MyCourses, Chapters 1-14 of a text (*Economic Statistics*), which will cover all of the material that we address. I add to this little by little as things occur to me, so the chapters may be updated from time to time.

There is no need to buy any textbook for the moment. When Prof. Dufour has chosen the textbook for Term 2, you might decide to buy that early in order to use it as your supplement for first term.

The draft chapters of this text posted on MyCourses will be referred to in the reading list below as **ES** for *Economic Statistics*. I want you to read the assigned chapters from *Economic Statistics* regardless of whether you have a supplementary text as well. If you find any errors or unclear parts in these chapters, I would really appreciate it if you would let me know, ideally with a precise page reference so that I can examine and if necessary fix the problem. Don't be hesitant to mention something because you think that you could be wrong: in any event it will be useful to me to revisit the exposition at a particular point and I will welcome any such suggestions.

Although no other textbook is required for the first term of this course, you should have something as reference, or share one with friends, to have a second source to read beyond my notes. The default option would be to get a used copy of some edition of the Newbold book. Any edition is fine (older editions are just as good if not better; the fourth edition, greenish-blue cover, is sometimes available used for a few dollars.). I will not be assigning any exercises that refer to a particular book or edition. We are studying topics rather than sections from a particular book, and you can study these topics from any one of a number of good statistics texts. Used versions of some good texts can often be found at low prices, online or even in used book stores.

Another possible choice, if you want to pick up an inexpensive older edition of something as a supplementary source, is Larsen, R.J. and M.L. Marx *An Introduction to Mathematical Statistics and its applications* (Pearson); **LM** in the reading list. This is a good text but some students don't find it easy to work with, in part because it has little or no content from economics, and the ordering of topics is also a poor match for the way that we will do things. Nonetheless, the alternative way of explaining the material may make it a good supplement.

In the reading list below, I will indicate a rough correspondence of chapters with topics for some edition of each of these three sources. However, the correspondence between chapters and topics changes between editions of the books, and you may need to re-map topics to chapters if you have another edition. I will not be assigning exercises directly from any book, so there is no concern of that type.

The following supplementary reference is more advanced, but you may wish to consult it for further reading, review, or problem resolution, or to have on your shelf for future reference. It's a classic text, and there are many used versions available, often (last time I looked) at remarkably low prices.

Mood, Graybill and Boes Introduction to the Theory of Statistics. McGraw-Hill, 1974.

Online resources:

You may also decide to supplement the lecture notes and a standard textbook with material from the web. Of course, you need to be very careful in doing this, because many of the things you will find online have errors that would typically have been caught in a published book (although of course published books have errors, they are generally fewer and less outrageous). The video or online materials that I have seen tend to be at a very introductory level, which may be of use in guiding your intuition, but would typically not be sufficiently precise to teach you to do the calculations that are necessary. So please don't rely on these things exclusively. If you do want to look at an online course, I would suggest trying the one on ED-X (Stat 2.1X-2.3X), a consortium that McGill is involved with, or the lessons at kahnacademy.com. Please let me know of your experience with these if you do try them.

Web postings (Mycourses):

I'm going to post (and update if necessary) the following items, at various points as we go through the term:

- Course outline (i.e. this)
- Chapters 1-14 from ES
- Assignments and sketch of answers
- Old exams

Laptops:

In general, I don't think it's a good idea to have laptops open in class. Much of the time, I know that people are on Facebook and it's distracting for other people in the class who are trying to participate. It's also not entirely compatible with a scholarly atmosphere; I would like people to be alert and able to ask questions in class if there's something that they don't follow.

However I do realize that some people prefer to take notes on their laptops (and I hope that those who do don't end up like me, with tendinitis – please check those ergonomic guidelines for laptop use). *If you are someone who wants to use your computer in class for taking notes, that is fine. In that case, come and speak to me and explain this, and I will trust that you will be doing nothing other than taking notes on your laptop.* But unless you have come to clear this with me, please do not open your computer in class. Please turn off cell phones, smartphones and other mobile devices as well, before class starts. I'll try to remember too.

It might also be necessary to modify this policy and bring laptops if the projection facilities in the classroom turn out not to be adequate. We shall see.

Topics: Term 1

This is a tentative list of topics to be covered; we may not get through all of this, or we may do slightly more. Chapters in LM are for the 4th edition. Chapters in SBE are from the 6th edition, with 5th and 4th listed separately where applicable.

I've listed a few things that I want you to be sure you understand as we get through each section, but this is NOT an exhaustive list, so please don't say to yourself, 'oh, I get that, I can skip class.'

0. *Introduction*

- ES, Ch. 1
- LM, Ch. 1
- SBE, Ch. 1

Some key concepts (introductory ideas only): experimental vs. non-experimental data; modelling, abstraction and learning from approximate models; prediction vs explanation; correlation vs causation

1. *Economic and financial data*

- ES, Ch. 2
- not covered explicitly in LM, SBE

Some key concepts: time series vs. cross-sectional data; aggregate vs. individual data; panel data; non-experimental data; transformations of data including difference, logarithms and their effects when used as transformations; simple graphical representations of data

2. *Descriptive statistics*

- ES, Ch. 3
- not covered in one place in LM, but the commonly-used statistics are described as estimators of the underlying theoretical quantities
- SBE, Ch. 3 (some material from 2.) (4th edition, Ch. 2).
- - Assignment 1

Some key concepts: features of the distributions of data revealed by simple statistics: not only concepts of the central tendency of data and their dispersion, but also indicators of asymmetry, locations of quantiles, relative frequency of extreme events and different types of risk revealed by these measures

3. *Learning from empirical observation*

- ES, Ch. 4.

Some key concepts: corroboration, falsification, asymmetry, deductive and inductive inference.

4. Probability

- ES, Ch. 5.
- LM, Ch. 2
- SBE, Ch. 4 (4th edition: ch. 3)
- - Assignment 2

Some key concepts: alternative concepts of probability; concepts such as sample space, outcome, event; axiomatic derivations of basic rules of probability; unconditional and conditional probability; bivariate probability; dependence and independence; Bayes' Theorem; Tchebychev inequality

4. Discrete and continuous probability distributions

- ES, Ch. 6-9
- LM, Ch. 3-4
- SBE, Ch. 5-6 (4th edition: ch. 4-5)
- - Assignment 3

Some key concepts: expectation, moments, density and cumulative distribution; particular distributions including the binomial, exponential, normal (Gaussian), t , χ^2 , F , joint distributions including bivariate and multivariate normal; effect of correlation on shape of the bivariate normal density; expectations of functions

5. Sampling

- ES, ch. 10-12
- LM: not covered in a single place; parts of Ch. 7 are relevant
- SBE, Ch. 7 (4th edition: ch. 6)
- - Assignment 4 (Computation etc.)

Some key concepts: sample versus population, sampling distributions of sample mean, sample variance and sample proportion in independently and identically distributed data; the case of normally distributed data vs. the more general case of asymptotic distributions based on a CLT; (weak) law of large numbers and a simple central limit theorem (CLT) [this is extremely important: don't make the mistake of thinking that this is some technicality that you can forget, please, or you'll never really understand the basis of a great deal of statistical inference)

6. Point and interval estimation

- ES, Ch. 13-14
- LM, Ch. 5
- SBE, Ch. 8-9 (5th edition, Ch. 8; 4th edition, Ch 7-8)
- - Assignment 5 if time permits

Some key concepts: estimator, bias, loss functions including the mean squared error (MSE); decomposition of the MSE; confidence intervals; the case of normally distributed data vs. the more general case of asymptotic confidence intervals based on a CLT