

# ECON 5100: Review of Quantitative Methods

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## 1 Course information

### 1.1 Location and timing

The class will span 12 lectures. The first four — on Aug 3 (Wed), Aug 5 (Fri), Aug 10 (Wed), Aug 12 (Fri) — will be online. The next 8 lectures will be on Mondays, Wednesdays, and Fridays from August 17th to September 2nd from 2:30 to 5:15 PM.

Online venue for both classes and by-appointment office hours:

- Zoom Meeting ID 712 9044 4585; Password Mk06aL

Offline Venue: Room 306 of Esther Lee Building at CUHK.

### 1.2 Instructor

Dr Sambuddha (Som) Ghosh will be teaching this class. You are encouraged to e-mail all your questions to [microtheorist@gmail.com](mailto:microtheorist@gmail.com) without hesitation. Please use Econ 5100 in the subject line for all emails.

### 1.3 Evaluation

The course evaluation will comprise a take-home midterm exam (30%), class participation inclusive of homework (20%), and an offline final exam (50%). If we are unable to have off-line classes for some reason we may have to reduce the class participation percentage. The final exam will be on the 9th of September at a location to be announced.

### 1.4 Academic honesty and plagiarism

Attention is drawn to University policy and regulations on honesty in academic work, and to the disciplinary guidelines and procedures applicable to breaches of such policy and regulations. Details may be found at:

<http://www.cuhk.edu.hk/policy/academichonesty/>.

With each assignment, students will be required to submit a signed declaration that they are aware of these policies, regulations, guidelines and procedures. For group projects, all students of the same group should be asked to sign the declaration.

For assignments in the form of a computer-generated document that is principally text-based and submitted via VeriGuide, the statement, in the form of a receipt, will be issued by the system upon studentsâ uploading of the soft copy of the assignment. Assignments without the receipt will not be graded by teachers. Only the final version of the assignment should be submitted via VeriGuide.

## 2 Goals of the course

This course attempts to provide you with basic mathematical literacy at the MPhil and PhD levels. There are two ways of teaching a course like this. One is to ignore proofs altogether and simply introduce numerous concepts and theorems in a toolkit fashion. The other is to teach this as a mathematics course, but designed with economic applications in mind. I have chosen the second approach for two reasons. First, proofs and concepts will be useful for understanding future courses such as Microeconomics and Econometric methods. Second, it will benefit you in the longer run if you decide to write your dissertation on theory including econometric theory. In addition part of the PhD is a formal training in using mathematical tools to model economic phenomena and answer economic questions. So I decided to compensate for the depth by paring down the material so you can digest it.

The following broad areas are covered in the course:

1. Linear algebra
2. Mathematical analysis
3. Optimisation theory

The last two topics will be directly useful for microeconomic theory, which will be taught by me in the main part of the Autumn semester. While linear algebra will not be very extensively used in my course, I cover it in detail because it is extremely useful for econometrics, which is also one of your core courses.

## 3 References

The first is the textbook. Readings refer to sections in the indicated editions.

- Simon and Blume (SB)
- de la Fuente (F)
- Chiang (C)

## 4 Course outline with basic readings

I provide below a detailed list of topics, classified by lecture number. Each lecture is followed by the relevant sections of the textbook. Lecture 0 is for background reading; it's covered in every higher secondary system — read it before my class commences. Lectures 3-6 could be swapped with 7-10.

Lecture Number

Lec 0 **Basic univariate calculus, exponents and logarithms** (SB Ch 2, 4.1, 5)

Lec 1 **Sets, functions, binary relations** (SB Appendix A1; lecture notes)

Lec 2 **Real numbers, cardinality** (lecture notes)

Lec 3 **Metric spaces, open sets, continuity** (SB Ch 12; lecture notes)

Lec 4 **Compactness, convergence** (SB Ch 29; lecture notes)

Lec 5 **Differential calculus** (SB Ch 14, 15, 30.1; lecture notes)

Lec 6 **Integral calculus** (SB Appendix A4; lecture notes)

Lec 7 **Systems of linear equations** (SB Ch 7)

Lec 8 **Vector spaces** (SB Ch 11, 27)

Lec 9 **Matrix algebra** (SB Ch 8)

Lec 10 **Determinants** (SB Ch 9, 26)

Lec 11 **Unconstrained (static) optimisation** (SB Ch 17)

Lec 12 **Constrained (static) optimisation** (SB Ch 18.1-3, 19.1-3)

Lec 13 **Evaluation**

**End notes.** For lack of time I have been forced to partially or completely omit some topics such as

- Karush-Kuhn-Tucker (KKT) conditions
- Differential equations
- Dynamic programming

KKT conditions will be covered in detail in my micro theory course. For the other topics I am very willing to give you reading guides.