Guide for Incoming Students

1. MICROECONOMICS

The lecture is taught in two parts.

Contents of Part 1:

1. Consumer Theory
2. Decisions under Uncertainty
3. Producer Theory
4. General Equilibrium

The material is presented on a formal mathematical level. Results are derived formally but more complicated proofs are not covered in this lecture.

Math Prerequisites for Part 1: The course requires some familiarity with multivariate calculus, standard mathematical techniques used in formal undergraduate courses and a few more results. Here is a detailed list:

1. Limits, Continuity, Differentiability, Integration of univariate functions, compact sets in R^n, intermediate value theorem.
2. Vector- and Matrix notation. Scalar Products
3. Multivariate Calculus: partial derivative, Young's theorem, Hessian matrix, convex and concave functions, positive and negative (semi-)definite matrices, implicit function theorem, homogeneous functions of any degree
4. (Constrained) Optimization: Lagrangian, Kuhn-Tucker Conditons, Envelope Theorem, Weierstrass' theorem,
5. Probability Theory: Expected Value, Jensen's inequality

These topics are also reviewed in a refresher course at the beginning of term 1 but if you are not familiar with them it is useful to review them before you get busy during the term. You can find treatments of these topics in

- *Mathematics for Economists* (Pemberton & Rau)
- *Mathematics for Economists* (Simon & Blume)
  This is more advanced than Pemberton & Rau and covers much more than is needed in preparation for this course.

Economics Prerequisites for Part 1: Students should be familiar with basic microeconomics terminology and definitions of: Elasticities, normal and inferior goods, luxuries and necessities. income expansion paths, Engel curves, utility functions, budget sets, indifference curves, isoquants, price-taking behaviour, Cobb-Douglas and CES utility- and production-functions, Edgeworth-Box. It is expected that you are able to derive solutions to utility maximization problems, cost-minimization problems and profit maximization problems.

Generally the material of Part 1 is presented in a self-contained manner but you are expected to be able to solve the problems mentioned above without difficulty and should review the terminology and basic concepts.

Textbooks you can use to review are for example:

- Microeconomics – Principles and Analysis (Cowell)
- Intermediate Microeconomics (Varian)

The recommended textbooks for Part 1 of the course are:

- Lecture notes that will be made available at the beginning of the term.
- G. Jehle and P. Reny, Advanced Microeconomic Theory, Addison-Wesley, 2000. (or other editions)
  This book covers most material discussed in the first part but the mathematical proofs go sometimes far beyond the level of ECONG021
- A. Mas-Colell, M.D. Whinston and J.R. Green, Microeconomic Theory, Oxford University Press, 1995.
  This book is more advanced and comprehensive than Jehle and Reny and goes far beyond the content of the course. If you are planning to do a PhD, it is a good investment.

Contents of Part 2:

1. Game theory
2. Contract theory

For prerequisites, see Maths and Stats.

Textbooks: Jehle and Reny, Mas-Colell, Whinston and Green as in the first half. We won't cover all chapters in the textbook, and you can choose between the two textbooks. Relevant topics are game theory (JR Ch 7, MWG Ch 7-9) and contract theory (JR Ch 8, MWG Ch 14). For more advanced reading in contract theory, you can take a look at Bolton and Dewatripont, but we won't cover at that level during lectures.

2. MACROECONOMICS

Pre-requisites:

- see maths & stats

Summer reading:

- Gerogry Mankiw (2006), "The Macroeconomist as Scientist and Engineer", Journal of Economic Perspectives.
  Link: https://scholar.harvard.edu/files/mankiw/files/macroeconomist_as_scientist.pdf
- V.V. Chari and Patrick Kehoe (2006), "Modern Macroeconomics in Practise: How Theory is Shaping Policy", Journal of Economic Perspectives.
  Link: http://www.skchugh.com/images/ChariKehoe_2006JEP_MacroTheoryAndPolicy.pdf
- Nobel Prize lecture Christopher A. Sims
  http://www.nobelprize.org/mediaplayer/index.php?id=1743
- Robert E. Hall (2016), "The Macroeconomics of Persistent Slumps", in John Taylor and Harald Uhlig, eds*., Handbook of Macroeconomics*, *Vol. 2*.
  Link: http://web.stanford.edu/~rehall/HBC010716.pdf

Textbooks:

- *David Romer*, "Advanced Macroeconomics", Third Edition, McGraw-Hill, 2006.
- *Daron Acemoglu*, "Introduction to Modern Economic Growth", Princeton University Press, 2009.

3. ECONOMETRICS

Prerequisites:

It is assumed that students have a working knowledge of basic linear algebra (e.g. linear systems of equations, matrix algebra), multivariate calculus (e.g. partial derivatives, multivariate optimization), elementary probability theory (e.g. joint distributions, conditional expectations, variances and correlations), and statistical inference (e.g. consistency, unbiasedness, condence intervals, hypothesis testing).

Summer Preparation:

Just make sure you are familiar with the mathematics prerequisites. In particular, students in the past have sometimes struggled with matrix algebra in the beginning of the course. For this you might want look at the chapter on multivariate regression and the appendix on matrix algebra in

Stock and Watson, Introduction to Econometrics, Pearson Education, 2nd edition, 2006.

Textbook:

There is no required textbook for this class, but the class often follows the notation and presentation in:

Wooldridge, Econometric Analysis of Cross Section and Panel Data: Second Edition, MIT Press, 2010.

4. MATHEMATICS AND STATISTICS

The mathematics and statistics refresher course is designed as a review and we assume that your prior studies covered the concepts we discuss. Therefore, we strongly encourage you to go through the topics list in the syllabus as soon as possible, make sure that your prior studies indeed covered them, and study the corresponding reading materials (also suggested in the syllabus) where that is not the case.

1 Overview

Lecturers: Suehyun Kwon and Daniel Wilhelm

Teaching Assistant: tba

Summary: This course revises some of the analytical tools most frequently used in economics and econometrics. It has a strong practical focus, aiming at ensuring that all students handle the basic analytical concepts used in the other MSc courses.

Summer preparation and quiz: Before the course starts, you are strongly encouraged to have worked through the topics listed in section 3 by reading the suggested material and solving relevant exercises in the recommended textbook chapters.

Lectures: The taught part of the course will review the content in section 3 and not cover any additional material.

2 Textbooks

For the mathematical background part of the course we will use

(PR) Pemberton, M. and N. Rau (2011): "Mathematics for Economists: An Introductory Textbook", Manchester University Press (any newer edition is fine, but notice that the numbering of chapters has changed after the 2011 edition)

and we strongly recommend you have it for reference. The statistics part will focus on

(SW) Stock, J. H. and M. Watson (2011): "Introduction to Econometrics", Pearson, 3rd edition

whose chapters on probability and statistics are a concise review of relevant topics for our course. We will also draw some content from

(W) Wooldridge, J. (2010): "Econometric Analysis of Cross Section and Panel Data", MIT Press, 2nd edition.

which will also be used in the core econometrics courses later on. If you like a more detailed review and need to learn some concepts from scratch,

(DS) DeGroot, M. H. and M. J. Schervish (2011): "Probability and Statistics", Pearson, 4th edition.

may be a better option than (SW). If you have a solid background in probability and statistics, there is probably no need to buy (SW) nor (DS).

Optional further reading: For a more formal discussion of unconstrained and con- strained optimisation, see Appendix M.J–M.N of Mas-Colell, Whinston, and Green (1995). Ljungqvist and Sargent (2004) is a great macro textbook that covers dynamic program- ming in more detail and provides lots of economic applications.

3 Topics

1. Mathematical preliminaries
   Sets; Sequences and limits; Open sets and closed sets, compact sets. Required reading: (PR) Ch. 3 and 5
2. One-variable calculus
   Functions; Limits and continuity; Slope and derivatives; Using derivatives to characterise functions; Using derivatives to approximate functions at a point. Required reading: (PR) Ch. 3, 6, 7, 9 and 10.2
3. Integral calculus
   Indefinite integral; Integration rules; Definite integral; The fundamental theorems of calculus; Special integration rules. Required reading: (PR) Ch. 19, 20
4. Matrix algebra
   Matrices and vectors; Matrix operations; Systems of linear equations; Rank of a matrix; Determinant of a matrix; Eigenvalues and eigenvectors; The relationship be- tween the determinant and the eigenvalues and eigenvectors of a matrix; Quadratic forms; Definite matrices.
   Required reading: (PR) Ch. 11 to 13 and 25
5. Calculus of several variables
   Functions of several variables; Partial derivative; The chain rule; Higher order derivatives; Approximation at a point; Turning points; Concavity and convexity; The implicit function theorem; Homogeneous functions.
   Required reading: (PR) Ch. 14 and 15
6. Optimization with several variables
   Unconstrained optimisation; Optimisation with equality constraints; Optimisation with inequality constraints; The general case: optimisation with mixed constraints; The envelope theorem and comparative statics analysis.
   Required reading: (PR) Ch. 16 to 18
7. Introduction to dynamic optimisation in discrete time
   Existence of a solution; Policy function; Brief introduction to difference equations. Required reading: (PR) Ch. 27 and 28
8. Introduction to probability
   Events and probability, simple operations; Conditional probability and the Bayes theorem; Independence.
   Required reading: (SW) Ch. 1 and 2.1; alternatively: (DS) Ch. 1 and 2
9. Random variables
   Single random variables: discrete and continuous random distributions, functions of random variables, moments; Bivariate distributions: marginal distribution, con- ditional distribution, moments, independence, law of iterated expectations; Vectors of random variables; Important

distributions.
Required reading: (SW) Ch. 2.2 to 2.4; alternatively: (DS) Ch. 3 to 5
10. Conditional expectations in econometrics
Properties of conditional expectations; elasticities, partial effects, linear projections. Required reading: (W) Ch. 1 and 2
11. Large samples
Random samples and sample moments; Weak law of large numbers; Central limit theorem; The delta method.
Required reading: (SW) Ch. 2.5 to 2.6 (alternatively: (DS) Ch. 4 and 5) and (W) Ch. 3
12. Estimation and testing
Estimation; Distribution of sample mean in large samples; Confidence intervals; Hypothesis testing.
Required reading: (SW) Ch. 3 (alternatively: (DS) Ch. 6 to 8) and (W) Ch. 3

Assessment

There will be a closed-book, two-hour final exam in October, immediately after the end of this course. Students who fail this exam will be provided with additional support during term 1 and they will be allowed to re-sit the exam the following May/June. Please note that if you fail the October exam, you will be unable to qualify for a Merit or a Distinction. Previous years' exams will be made available for students to practice.

References

Ljungqvist, L., and T. J. Sargent (2004): Recursive Macroeconomic Theory. MIT Press, 2nd edn.

Mas-Colell, A., M. D. Whinston, and J. R. Green (1995): Microeconomic Theory. Oxford University Press.