Course Outline

Pre-Sessional Quantitative Methods for Economics course – EC5555

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Version 1.0

AIMS

The aim of this course is to give students a mathematical and statistical background necessary for studying and working at postgraduate level Economics. The course will cover basic analytical methods used regularly in the MSc Economics/Finance & Industrial courses, with a particular emphasis on optimisation, but will also introduce basic matrix analysis and statistics.

LEARNING OUTCOMES

Upon completion of the course students should:

- be confident in differentiation and integration of standard functions;
- be confident with basic manipulations of vectors and matrices;
- be able to understand and solve various optimisation problems, both unconstrained and constrained with equality or inequality constraints;
- have seen enough proofs of mathematical theorems to be familiar with the basic methods.

COURSE DELIVERY

The course will be delivered through ten sessions distributed over two weeks.

Sessions will combine ten 2-hour lectures with nine 1-hour seminar classes given over to exercises and problem solving, so that the students will have opportunity to practice what they have learnt. Problem sets will be handed out in lectures. You should expect to prepare answers each evening in preparation for the next day's seminar classes.

Lecture notes will be provided on the Economics Department Website under the reference EC5555 Pre-sessional Quantitative Methods Course.

ASSESSMENT

At the end of the course there will be a short test (1 hour long). This test will show how much your abilities have improved and which subjects you need to study further. The test will examine your abilities in the above subjects. The pass mark is 50%. Note that this test do not affect your Master's mark. However students who do poorly in the test are unlikely to do well in the degree. If you do poorly, you should therefore seriously reconsider whether you should continue. There are options at the start of term to transfer to an alternative programme. Previous students have successfully moved on to MSc International Accounting and MSc International Management, which are courses run by the School of Management.

READING

This is very much a textbook-based course. The standard textbook for this course is:

- Alpha C. Chiang & Kevin Wainwright: "Fundamental Methods of Mathematical Economics", McGraw-Hill, 4th Edition [but any edition is fine]

Multiple copies are available on both short and extended loan in the Bedford Library, Course code 330.0151 CH, but as you will be studying from it every day and it is a useful reference for material covered in the other MSc courses, students are strongly encouraged to buy their own copy (available from the campus book-shop or online).

The "Mathematical methods for economic theory: a tutorial" by Martin J. Osborne is very useful and it is strongly recommended to use it. You find it at the following URL: http://www.economics.utoronto.ca/osborne/MathTutorial/index.html

The statistics element is adequately covered in the appendices of what is also the course text for EC5040 Econometrics

- William Greene, *Econometric Analysis*, 7th Edition, Prentice Hall, 2006. (G) (Library code: 330.01 GRE)

Alternatively you may wish to purchase,

- Edward K. Dowling, Mathematics for Economists, Schaum.

This has a large number of worked examples – ideal for understanding how to do the problems on the course.

TIMETABLE

Please note that the following *planned* lecture schedule is only indicative and changes are possible. It may be the case that more (or less) time needs to be spent on certain topics, so the actual lectures may not be in complete correspondence with the plan. Therefore, coverage of topics may sometimes overflow from one session to the other.

Lecture 1: Vectors, scalar products, linear independence, matrices, multiplication of matrix by vector, matrix by matrix multiplication. Transpose, properties of transpose. Identity matrix. Singularity. Rank. Determinants. Cofactors, Minors & adjoint matrices

Lecture 2: Calculating inverses, using matrix expansion, solving linear systems of equations using inverses. Cramer's rule and solution to linear equations. Jacobians.

Lecture 3: Definition of derivative, differentiation of functions of one variable. Exponential function, natural logarithm, general powers and exponents. Chain rule, Taylor expansions of functions of one variable (any order), general Taylor series

Lecture 4: Taylor expansions of functions of several variables to first and second order. Derivatives of implicit functions in the one function of one variable case. Unconstrained optimisation, definition of local and global, strict or non-strict extrema.

Lecture 5: First and second order conditions for functions of one variable. First and second order conditions for local extrema of functions of several variables. Convex and concave functions, Quadratic forms, eigenvalues & eigenvectors. Definiteness of a matrix

Lecture 6: Optimisation with equality constraints, Lagrange multipliers, first order conditions, validity of Lagrange's theorem and examples where it fails, second order conditions, the bordered Hessian.

Lecture 7: Optimisation with inequality constraints. Convexity and concavity of functions of several variables. Quasi-concavity. The Kuhn-Tucker theorem, with examples of cases where it works and where it doesn't.

Lecture 8: Integration: definite and indefinite integrals of one and several variables, partial integration, substitution. First order differential equations.

Lecture 9: Dynamic Optimisation. Hamiltonians

Lecture 10: Probability, Expectations and Distribution Theory Discrete & continuous random variables, distributions derived from the normal distribution. Expected Values, Moment Generating Functions, Law of Large Numbers