

14BP99

Brush-Up Courses MCMR & EPP

Course Instructors

Mathematics – Joan de Martí
 Statistics – Pau Milan
 Computation – Annalisa Loviglio

Course Outline

The aim of this course is to refresh your memory of the tools in Mathematics and Statistics, which you are going to use in the courses throughout the master.

There will be an exam for this course.

Course Outline

The review classes are going to take place between Sept. 8 and Sept. 21, 2016.

Brush-Up Courses Schedule – 2015-2016:

Schedule	Monday 5	Tuesday 6	Wednesday 7	Thursday 8	Friday 09
9:30h – 11:30h				Mathematics	Mathematics
12h – 14h				Mathematics	Mathematics
15h – 17h					
17h – 19h					
Schedule	Monday 12	Tuesday 13	Wednesday 14	Thursday 15	Friday 16
9:30h – 11:30h	Statistics	Statistics	Statistics	Statistics	Statistics
12h – 14h	Mathematics	Mathematics	Mathematics	Mathematics	Mathematics
15h – 17h	Computation	Computation	Computation	Computation	Computation
17h – 19h					
Schedule	Monday 19	Tuesday 20	Wednesday 21	Thursday 22	Friday 23
9:30h – 11:30h		Statistics	Statistics		
12h – 14h		Statistics	Statistics		10- 13H Exam Math/Stats
15h – 17h	Computation	Computation			
17h – 19h					

Google Calendar Link:

https://calendar.google.com/calendar/embed?src=barcelonagse.eu_blie69ljfkundlq6odjnt8s30%40group.calendar.google.com&ctz=Europe/Madrid

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Course Outline

1. MATHEMATICS (18h)

1.1. Basics of Algebra and Analysis

- Sets and Basic Algebra
- Limits
- Continuity
- Differentiation, Taylor's Rule
- Matrix Algebra
- Total and Partial derivatives
- Implicit Function Theorem
- Concave and Convex Functions of a Single Variable
- Homogeneous Functions
- Integration

1.2. Optimization

- Unconstrained Maximization
- Necessary Conditions for Interior Extrema
- Sufficient Conditions for Local Extrema
- Equality Constraints and Lagrange Multiplier Method
- Envelope Theorem
- Inequality Constraints and Kuhn-Tucker Method (if time allows)

2. STATISTICS (18h)

2.1. Review of Probability (10h)

- Random Variables and Probability Distributions
- Expected Values, Mean and Variance
- Two Random Variables
 - o Joint and Marginal Distributions
 - o Conditional Distributions
 - o Bayes' Theorem
 - o The Law of Iterated Expectations
 - o Independence
 - o Covariance and Correlation
 - o The Mean and Variance of Sums of Random Variables
- The Normal, Chi-squared, Student t and F Distributions
- Random Sampling
- Large-Sample Approximations
 - o Convergence in Probability and Convergence in Distribution
 - o Law of Large Numbers
 - o Central Limit Theorem

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2.2 Review of Statistics (5h)

- Properties of Estimators
 - o Un-biasedness, Consistency and Efficiency
- Hypothesis Testing
- The t-statistic and the p-value
- Confidence Intervals

2.2 Regression Analysis (3h)

- Ordinary Least Squares
 - o Assumptions
- Statistical Properties of Estimators
- Maximum Likelihood
- GMM (if time)

3. COMPUTATION

1. Introduction to STATA

- Working with Stata: menu vs. command line vs. do files
- Help files, online PDF documentation since Stata 11
- Creating empty datasets and copy/pasting data
- Data import: different ways of importing data
- Describing the data
 - o Describe
 - o Sum
 - o Tabulate

2. Data sources

- Import data from main public data sources: World Bank (WDI), Penn Tables, Eurostat, ECB, ...
- Missing values: "." vs. "99"

3. Data manipulation

- Generating new variables. "Generate" vs. "Egen".
- Dropping variables
- Sorting
- Recode, group
- Labeling variables and values
- Logical expressions

4. Basis statistical routines

- Mean, standard deviation, correlation
- Percentiles
- (t-)Test on mean difference. Compare groups within one variable, compare two variables.
- Cross-tabulation of two binary variables and corresponding tests (Pearson)
- Cross-tabulation of two discrete variables and corresponding tests (Pearson)
- OLS with one explanatory variable

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- Internal variables: `_coef`, `_se`
 - More stored information: “Ereturn list”, “matrix list e(vce)”
 - Post estimation commands
5. Programming in do files
- If condition
 - Loops
 - Commenting
6. Graphing (here menu can be useful)
- Line plot. Legend, labels, shapes, colors, ...
 - Scatter plot
 - Combining graphs: “twoway”, e.g. scatter with regression line
 - Histogram
 - Kernel density, intuitive discussion of bandwidth
 - Step function for cdf
7. Panel data
- Data structure: Wide vs. long
 - Reshape
 - Xtset
 - Xtdes
8. Time Series data
- Tsset
 - Lag and forward operator
 - First difference and dlog
9. Presenting results

Required Activities

To be determined by the professors

Evaluation

Final exam on September 23rd from 10 to 13H. Room 20.021 in Jaume I Building

References

For those of you who would like to prepare before the classes start, here there are some useful references:

Math Review:

Martin J. Osborne, *Mathematical methods for economic theory: a tutorial* (2007),
<http://www.economics.utoronto.ca/osborne/MathTutorial/index.html>

Lawrence Blume and Carl P. Simon, (1994), *Mathematics For Economists*, W.W.

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Norton and Co., New York, London.

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Probability and Statistics Review:

There are many books that cover similar material. For example:

Elliot A. Tanis and Robert V. Hogg, *A Brief Course in Mathematical Statistics*, Prentice Hall.
<http://www.amazon.com/books/dp/0131751395>

The following is an excellent freely available source:

Jeremy Orloff, and Jonathan Bloom. *18.05 Introduction to Probability and Statistics, Spring 2014*.
(Massachusetts Institute of Technology: MIT OpenCourseWare), <http://ocw.mit.edu> (Accessed 2 Sep, 2015). License: [Creative Commons BY-NC-SA](https://creativecommons.org/licenses/by-nc-sa/4.0/)