

Refresher Course in Basic Mathematics and Statistics

Course Outline

Instructor: Rebecca Stuart

Place: R.113, building A.-L. Breguet 2

Daily schedule:

09:15-10:00 Lecture and discussion exercises

10:15-11:00 Lecture and discussion exercises

11:15-12:00 Lecture and discussion exercises

Lunch

13:15-14:15 Lecture and discussion exercises

Topics

Day 1: Single-variable calculus

- Function forms
 - Geometric properties of functions (increasing or decreasing, concave or convex)
 - Exponential and logarithmic functions
- Differentiation rules and applications
 - Definition and rules
 - High-order derivatives
 - Composite functions and chain rule
- Extension to multi-variable functions
 - Partial derivatives
- Integration concepts and rules
 - Areas and definite integrals

Day 2: Optimization

- Unconstrained optimization
 - First and second order conditions
- Constrained optimization
 - Lagrange functions
 - Examples and interpretation of the results

Day 3: Probability

- Basic definitions
 - Union, intersection, complement, and conditional probability
- Random variables
 - Probability mass and density functions
 - Cumulative distribution function
- Moments of a single random variable distribution
 - Mean
 - Variance and standard deviation
- Some common distributions
 - Normal distribution, student t-distribution, Chi-square distribution, F-distribution
- Distribution of several random variables
 - Joint probability
 - Conditional probability density function
 - Conditional mean and variance
 - Covariance and correlation

Day 4: Statistics

- Population and random sampling
 - Sampling method
- Estimation of population mean and variance
 - Population mean
 - Population variance
- Confidence interval and p-value
 - Test statistic
 - Confidence interval
 - p-value
- Hypothesis testing
 - One-tail test
 - Two-tail test

Day 5: Introductory linear algebra and linear regression

- Vector and matrix notation
- Basic operations
 - addition, subtraction, product
 - transpose
 - inverse
- Linear regression (OLS with one independent variable)

References

- [BWA] Boslaugh, S. and Watters, P.A. (2008): Statistics in a Nutshell, 1st edition, O'Reilly.
- [CAR] Carter, Michael (2001): Foundations of Mathematical Economics, 1st edition, The MIT Press.
- [CIA] Chiang, Alpha C. (1984): Fundamental Methods of Mathematical Economics, 3rd edition, McGraw-Hill.
- [DOW] Dowling, Edward T. (2001): Introduction to Mathematical Economics, 3rd edition, Schaum's Outline Series, McGraw Hill.
- [HGL] Hill, R.C., Griffiths, W.E. and Lim, G.C. (2008): Principles of Econometrics, 3rd edition, John Wiley & Sons.
- [SBL] Simon, K. and Blume, L. (1994): Mathematics for Economists, 1st edition, W.W. Norton & Company.
- [SWA] Stock, J. and Watson, M. (2007): Introduction to Econometrics, 2nd edition, Pearson International Edition.
- [SH1] Sydsaeter, K. and Hammond, P. (2008): Essential Mathematics for Economic Analysis, 3rd edition, Prentice Hall.
- [SH2] Sydsaeter, K., Hammond, P., Seierstad, A. and Strom, A.(2008): Further Mathematics for Economic Analysis, 2nd edition, Prentice Hall.