MASTER IN ECONOMICS

MATHEMATICS Course 2019/2020

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DESCRIPTION OF CONTENTS: PROGRAMME

0. Functions of one variable

0.1.Introduction to functions of one variable
0.2.Domain, image and graph of a function
0.3.Inverse function
0.4.Limits and continuity
0.5.Derivatives and approximation of first and second order
0.6.Concave and convex functions

Bibliography: Chapter 2, 3 and 4 of [4b]

1. Linear Algebra

1.1. Matrices and vectors. Rank of a matrix
1.2. Determinants
1.3. Inverse matrices
1.4. Linear systems
1.5. Equivalent and similar matrices
1.6. Eigenvalues and eigenvectors. Diagonalization
1.7. Quadratic forms

Bibliography: Chapter 1 of [4]. Sections 1.3 and 1.5 of [3]

2. The Euclidean Space R^n

2.1. Scalar product of two vectors. Norm of a vector
2.2. Topology in R^n: Open and closed balls. Interior and closure points of a set. Open and closed sets. Bounded and compact sets.
2.3. Limit of a function. Iterated limits
2.4. Continuous functions
2.5. Weierstrass Theorem

Bibliography: Sections 1.1, 1.2. Subsection 1.4.1 and Chapter 3 of [3].

3. Differential Calculus of Several Variables. Part I

3.1. Directional derivatives. Partial derivatives. Jacobian matrix. Gradient
3.2. Derivability and differentiability of a function
3.3. Geometric interpretation of real differentiable functions. Tangent plane. Direction of maximum increasing/decreasing of a function
3.4. Chain rule

Bibliography: Sections 2.1 and 2.9 of [4]. Subsections 1.4.2, 1.4.3 and 1.4.4 of [3].

4. Differential Calculus of Several Variables. Part II

4.1. Second order derivatives. Hessian matrix
4.2. The implicit function theorem

4.3. Taylor approximation

Bibliography: Sections 2.6 and 2.7 of [4]. Subsections 1.4.5 and 1.6.3 of [3].

5. Optimization Problems and Convex Analysis

5.1. Unconstrained optimization problems. Relative extrema

5.2. Convex and concave functions. Differentiable and twice differentiable convex functions. Minimizing a convex function.

5.3. Constrained optimization problems.

5.3.1. Linear programming. The Simplex Method

5.3.2. Nonlinear programming. Optimization problems with equality constraints. The Lagrange Multiplier Method. Optimization problems with inequality constraints. The Kuhn-Tucker Theorem

Bibliography: Sections 2.2, 2.3, 2.4, 2.5 of [4]. Subsections 1.2.9 and 1.6.1, and Sections 7.1, 7.2 of [3]. Sections 2.1-2.6 and Chapter 3 of [2]. Chapter 2 of [1].
Chapter 3 of [4], Chapters 2-7 of [3]. Section 2.7 and Chapter 4 of [2]. Chapter 3 of [1]

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[2] Bazaraa, S., Sherali, H.D., Shetty, C.M., Nonlinear Programming. Theory and Algorithms, John Wiley & Sons, 3rd Edition, 2006

[3] Sundaram, R.K., A first course in Optimization Theory, Cambridge U., Press, 1996

[4] Sydsaeter, K., Hammond P., Seierstad, A., Strom A., Further Mathematics for Economic Analysis, Financial Times-Prentice Hall, 2nd Edition, 2008

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