

1. Record Nr.	UNINA9910820519603321
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Titolo	Undergraduate convexity : from Fourier and Motzkin to Kuhn and Tucker // Niels Lauritzen
Pubbl/distr/stampa	Singapore, : World Scientific, 2013
ISBN	981-4412-52-X
Edizione	[1st ed.]
Descrizione fisica	1 online resource (300 p.)
Disciplina	515.88
Soggetti	Convex domains Algebras, linear
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Preface; Acknowledgments; Contents; 1. Fourier-Motzkin elimination; 1.1 Linear inequalities; 1.2 Linear optimization using elimination; 1.3 Polyhedra; 1.4 Exercises; 2. Affine subspaces; 2.1 Definition and basics; 2.2 The affine hull; 2.3 Affine subspaces and subspaces; 2.4 Affine independence and the dimension of a subset; 2.5 Exercises; 3. Convex subsets; 3.1 Basics; Minkowski sum, dilation and the polar of a subset; 3.2 The convex hull; 3.3 Faces of convex subsets; Interlude: Integral points in convex subsets; 3.4 Convex cones; The recession cone; Finitely generated cones 3.5 Caratheodory's theorem 3.6 The convex hull, simplicial subsets and Bland's rule; Non-cycling; 3.7 Exercises; 4. Polyhedra; 4.1 Faces of polyhedra; 4.2 Extreme points and linear optimization; 4.3 Weyl's theorem; 4.4 Farkas's lemma; 4.5 Three applications of Farkas's lemma; 4.5.1 Markov chains and steady states; 4.5.2 Gordan's theorem; 4.5.3 Duality in linear programming; 4.6 Minkowski's theorem; 4.7 Parametrization of polyhedra; 4.8 Doubly stochastic matrices: The Birkhoff polytope; 4.8.1 Perfect pairings and doubly stochastic matrices; 4.9 Exercises; 5. Computations with polyhedra 5.1 Extreme rays and minimal generators in convex cones 5.2 Minimal generators of a polyhedral cone; 5.3 The double description method; 5.3.1 Converting from half space to vertex representation; 5.3.2 Converting from vertex to half space representation; 5.3.3 Computing the convex hull; 5.4 Linear programming and the simplex algorithm;

5.4.1 Two examples of linear programs; 5.4.2 The simplex algorithm in a special case; 5.4.3 The simplex algorithm for polyhedra in general form; 5.4.4 The simplicial hack; 5.4.5 The computational miracle of the simplex tableau; The simplex algorithm
Explaining the steps5.4.6 Computing a vertex in a polyhedron; 5.5 Exercises; 6. Closed convex subsets and separating hyperplanes; 6.1 Closed convex subsets; 6.2 Supporting hyperplanes; 6.3 Separation by hyperplanes; 6.4 Exercises; 7. Convex functions; 7.1 Basics; 7.2 Jensen's inequality; 7.3 Minima of convex functions; 7.4 Convex functions of one variable; 7.5 Differentiable functions of one variable; 7.5.1 The Newton-Raphson method for finding roots; 7.5.2 Critical points and extrema; 7.6 Taylor polynomials; 7.7 Differentiable convex functions; 7.8 Exercises
8. Differentiable functions of several variables8.1 Differentiability; 8.1.1 The Newton-Raphson method for several variables; 8.1.2 Local extrema for functions of several variables; 8.2 The chain rule; 8.3 Lagrange multipliers; The two variable case; The general case and the Lagrangian; 8.4 The arithmetic-geometric inequality revisited; 8.5 Exercises; 9. Convex functions of several variables; 9.1 Subgradients; 9.2 Convexity and the Hessian; 9.3 Positive definite and positive semidefinite matrices; 9.4 Principal minors and definite matrices; 9.5 The positive semidefinite cone
9.6 Reduction of symmetric matrices

Sommario/riassunto

Based on undergraduate teaching to students in computer science, economics and mathematics at Aarhus University, this is an elementary introduction to convex sets and convex functions with emphasis on concrete computations and examples. Starting from linear inequalities and Fourier-Motzkin elimination, the theory is developed by introducing polyhedra, the double description method and the simplex algorithm, closed convex subsets, convex functions of one and several variables ending with a chapter on convex optimization with the Karush-Kuhn-Tucker conditions, duality and an interior point algori
