

數學系課程核心教材內容

課程名稱：(中文) 最佳化方法(一) (英文) Optimization Methods (I)				開課單位	應數碩博班
				課程代碼	2105553
學分數	3	必/選修	選	開課年級	一
<p>教學目標：Introduce the theory, methods and applications for linear optimization problems.</p> <p>課程概述：Introduce the linear optimization models, simplex methods and interior point methods and their related theory, Duality and Sensitivity and their applications.</p> <p>先修科目或先備能力：Linear Algebra, Advanced Calculus</p>					
建議參考書目		<ol style="list-style-type: none"> 1. Linear and Nonlinear Programming, Stephen G Nash & Ariela Sofer 2. Linear Optimization and Extensions: theory and algorithms, Shu-Cherng Fang & Sarat Putheupura. 			

課程大綱

單元主題	內容綱要	上課週數
Optimization Models	Introduction to Linear Programming	1
Fundamentals of Optimization	Feasibility, Optimality, convexity, General Optimization Algorithm	1
Representation of Linear Constraints	Null and Range Spaces, Generating Null Space Matrices: Variable Reduction, Orthogonal Projection, Projections, QR Factorization	1~2
Geometry of linear Programming and The simplex Methods	Standard Form, Basic Solution, Extreme Points, Simplex Method, Revised Simplex Method, Two Phase Method, Big-M Method, Degeneracy	3~4
Duality and Sensitivity	Duality Problem, Duality Theory, Dual Simplex Method, Sensitivity Analysis, Parametric Linear Programming	2~3
Enhancements of the Simplex Method and Network Problems	Product Form of Inverse, Problems with Upper Bound, Column Generation, Decomposition Principle, Numerical Stability and Computational Efficiency, Network Problems, Network Simplex Method	3
Computational Complexity of Linear Programming	Computational Complexity, Worst-case and Average-case Analysis for Simplex Method, Ellipsoid Method	1~2
Interior-Point Methods for Liner Programming	Affine Scaling Method, Primal and Dual Affine Scaling Method, Path-Following Methods	1~2

數學系課程核心教材內容

課程名稱：(中文) 最佳化方法(二) (英文) Optimization Methods (II)				開課單位	應數碩博班
				課程代碼	2105554
學分數	3	必/選修	選	開課年級	一
<p>教學目標： Introduce the theory, methods and applications for linear optimization problems.</p> <p>課程概述： Introduce nonlinear optimization models, theory and methods for unconstrained nonlinear problems, theory and methods for constrained nonlinear problems, and interior point methods for convex programming problem.</p> <p>先修科目或先備能力： linear Algebra, Advanced Calculus, Optimization Methods (I)</p>					
建議參考書目	<p>1. Linear and Nonlinear Programming, Stephen G Nash & Ariela Sofer</p> <p>2. Interior Point Approach to Linear, Quadratic and Convex Programming Algorithms and Complexity, D. Den Hertog.</p>				

課程大綱

單元主題	內容綱要	上課週數
Nonlinear Optimization Models	Introduction to Nonlinear Programming	1
Fundamental of Nonlinear Optimization	Rate of Convergence, Taylor Series, Newton's Method for System of Nonlinear Equations	1
Basic of Unconstrained Optimization	Optimality Conditions, Newton's Method for Optimization Problems, Line-Search Methods, Trust-Region Methods	2~3
Methods of Un-constrained Optimization	Steepest Descent, Quasi-Newton Methods, Finite Difference Derivative Estimation, Automatic Differentiation, Multiple-direction Search, Termination Rules	3~4
Low-Storage Methods for Unconstrained Problems	Linear Conjugate Gradient Methods, Truncated-Newton Methods, Nonlinear Conjugate Gradient Methods, Limited-Memory Quasi-Newton Methods, preconditioning	3
Optimality Conditions for Constrained Problems	Lagrangian Function and Lagrange Multiplier, Optimality Condition for Linear Equality constraints, Optimality Conditions for Linear Inequality constraints, Optimality Conditions for Nonlinear constraints, Duality Theory	4
Methods for Constrained Problems	Feasible-Point Methods for Linear and Nonlinear Constraints, Computing the Lagrange Multipliers, Sequential Quadratic Programming, Penalty Methods, Barrier Methods	2~3
Interior-Point Methods for Convex Programming	Self Concordance, The Newton Decrement, Convergence of the Damped Newton Method, Convergence and Complexity	1~2