

CONTENTS

The book contains twelve chapters, followed by eleven Mathematical Reviews. The reviews are numbered separately, from R1 to R11.

1. Introduction	1
1.1 Mathematical Economics	
1.2 Outline of the Book	
1.3 Notes on the Literature	
Part I: Optimizing Theory	
2. The General Optimizing Problem	9
2.1 Introduction	
2.2 The General Structure	
2.3 Constraints and the Feasible Set	
2.4 The General Optimizing Problem	
2.5 The General Solution Principle	
2.6 Conditions for a Global Optimum	
2.7 Important Special Cases	
2.8 Direct Solutions or Optimal Conditions?	
Exercises	

3. The Theory of Linear Programming	23
3.1 Introduction	
3.2 The Feasible Set	
3.3 Duality	
3.4 The Optimum Conditions	
3.5 Basic Solutions	
3.6 The Basis Theorem	
3.7 Interpretation of the Dual Variables	
Further Reading	
Exercises	
4. Classical Calculus Methods	45
4.1 Introduction	
4.2 The Lagrangean Function	
4.3 Interpretation of the Lagrange Multipliers	
4.4 A Geometrical Note	
4.5 Second Order Conditions for the Classical Case	
4.6 The Substitution Effect of Neoclassical Demand Theory	
4.7 Global Optimum Conditions in the Classical Problem	
Exercises	
5. Advanced Optimizing Theory	61
5.1 Introduction	
5.2 Nonnegative Variables	
5.3 Inequality Constraints	
5.4 Saddle Points and Duality	
5.5 The Dual Variables	
5.6 The Minimax Theorem	
5.7 Existence of Optimal Solutions	
Further Reading	
Exercises	
Part II: Static Economic Models	
6. Input-Output and Related Models	79
6.1 Input-Output Models	
6.2 The Closed Model	

6.3	The Leontief Open Model	
6.4	Direct and Indirect Input Requirements	
6.5	Factor Intensity in the Leontief Model	
6.6	A Labor Theory of Value	
6.7	The Substitution Theorem	
6.8	Matrix Multipliers	
	Further Reading	
	Exercises	
7.	Linear Optimizing Models	98
7.1	Activity Analysis of Production	
7.2	The Production Set	
7.3	Efficient Production	
7.4	Constrained Production	
7.5	Consumption as an Activity	
	Further Reading	
	Exercises	
8.	Nonlinear Optimizing Models	120
8.1	Introduction	
8.2	Neoclassical Demand Theory	
8.3	Convexity Proof of the Substitution Theorem	
8.4	The Neoclassical Transformation Surface	
8.5	Returns to Scale	
8.6	Relative Factor Intensity	
8.7	Generalized Production Theory	
	Further Reading	
9.	General Equilibrium	138
9.1	Equilibrium in a Market Economy	
9.2	Walras' Law and the Budget Constraint	
9.3	The Excess Demand Theorem	
9.4	The Walras-Wald Model	
9.5	The Arrow-Debreu-McKenzie Model	
	Further Reading	
Part III: Dynamic Economic Models		
10.	Balanced Growth	159
10.1	Introduction	
10.2	A Leontief-Type Model	

- 10.3 The Von Neumann Growth Model
- 10.4 The Von Neumann-Leontief Model
- 10.5 General Balanced Growth Models
- Further Reading

11. Efficient and Optimal Growth 174

- 11.1 Efficiency and Optimality in Dynamic Models
- 11.2 The Principle of Optimality
- 11.3 Efficient Growth
- 11.4 Properties of Efficient Paths
- 11.5 A Turnpike Theorem
- 11.6 An Explicit Turnpike Example
- Further Reading

12. Stability 195

- 12.1 The Concept of Stability
- 12.2 Stability Analysis
- 12.3 Market Stability
- 12.4 Stability of Decentralized Economic Policy

Part IV: Mathematical Reviews

R1. Fundamental Ideas 213

- R1.1 Sets
- R1.2 Ordered and Quasi-Ordered Sets
- R1.3 Cartesian Products and Spaces
- R1.4 Functions, Transformations, Mappings, Correspondences
- R1.5 Closedness and Boundedness
- R1.6 Complex Numbers
- Exercises

R2. Linear Algebra 225

- R2.1 Vectors
- R2.2 Fundamental Theorem of Vector Spaces
- R2.3 Basis and Rank
- R2.4 Sums and Direct Sums
- R2.5 Scalar Products
- R2.6 Complex Vectors

R2.7 Matrices	
R2.8 Matrix Algebra	
R2.9 Matrix-Vector Products and Linear Transformations	
R2.10 Partitioned Matrices	
R2.11 Vector Sets	
Exercises	
R3. Linear Equations and Inequalities	243
R3.1 Introduction	
R3.2 The Rank of a Matrix	
R3.3 Homogeneous Equations	
R3.4 Nonhomogeneous Equations	
R3.5 Nonnegative Vectors and Vector Inequalities	
R3.6 Fundamental Theorem on Linear Inequalities	
R3.7 Results on Linear Equations and Inequalities	
Exercises	
R4. Convex Sets and Cones	259
R4.1 Geometric Ideas	
R4.2 Convex Sets	
R4.3 Separating and Supporting Hyperplanes	
R4.4 Extreme Points	
R4.5 Convex Cones	
R4.6 Finite Cones and Homogeneous Inequalities	
R4.7 The Dual Cone	
Exercises	
R5. Square Matrices and Characteristic Roots	276
R5.1 Introduction	
R5.2 Determinants and Cramer's Rule	
R5.3 The Inverse of a Square Matrix	
R5.4 Characteristic Roots and Vectors	
R5.5 Diagonalization	
R5.6 Convergence of Matrix Series	
R5.7 Characteristic Row Vectors	
R5.8 Numerical Examples	
Exercises	

R6. Symmetric Matrices and Quadratic Forms	295
R6.1 Symmetric Matrices	
R6.2 Quadratic Forms	
R6.3 Constrained Quadratic Forms	
Exercises	
R7. Semipositive and Dominant Diagonal Matrices	305
R7.1 Introduction	
R7.2 Indecomposability	
R7.3 Properties of Semipositive Square Matrices	
R7.4 Properties of Dominant Diagonal Matrices	
R7.5 Proofs	
Exercises	
R8. Continuous Functions	319
R8.1 Introduction	
R8.2 Derivatives and Differentials	
R8.3 Some Mapping Relationships	
R8.4 Maxima and Minima	
R8.5 Convex and Concave Functions	
R8.6 Homogeneous and Homothetic Functions	
R8.7 The Brouwer Fixed Point Theorem	
R8.8 Linear Homogeneous Vector-Valued Functions	
Exercises	
R9. Point-to-Set Mappings	342
R9.1 Introduction	
R9.2 The Graph of a Mapping	
R9.3 Continuity	
R9.4 Continuity Properties of Optimal Solutions	
R9.5 The Kakutani Fixed Point Theorem	
Exercises	
R10. Linear Differential and Difference Equations	354
R10.1 Preliminary Remarks	
R10.2 Solutions	
R10.3 The First Order Linear Scalar Equation	
R10.4 Complex Solutions	

R10.5 The First Order Vector Equation

R10.6 Reduction to First Order Vector Equation

R10.7 A Note on Particular Solutions

Exercises

R11. Calculus of Variations and Related Topics

376

R11.1 Optimizing with an Infinite Number of Variables

R11.2 Basic Calculus of Variations

R11.3 Extensions of the Basic Analysis

R11.4 Pontryagin's Principle and Related Topics

References

385

Index

395