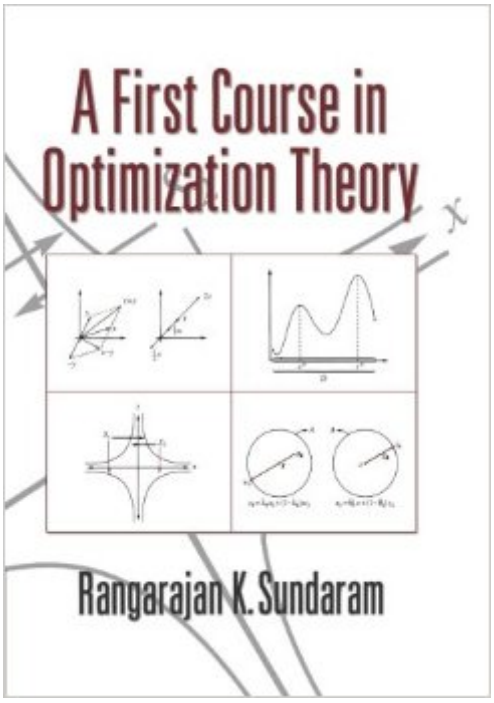
A First Course In Optimization Theory



Synopsis

This book introduces students to optimization theory and its use in economics and allied disciplines. The first of its three parts examines the existence of solutions to optimization problems in Rn, and how these solutions may be identified. The second part explores how solutions to optimization problems change with changes in the underlying parameters, and the last part provides an extensive description of the fundamental principles of finite- and infinite-horizon dynamic programming. A preliminary chapter and three appendices are designed to keep the book mathematically self-contained.

Book Information

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Customer Reviews

This book gives a nice introduction to the theory of optimization from a purely mathematical standpoint. The computational and algorithmic aspects of the subject are not treated, with emphasis instead placed on existencetheorems for various optimization problems. The author does an effective job of detailing the mathematical formalism needed in optimization theory. After a brief review of background mathematics in the first chapter, the author outlines the objectives of optimization theory in Chapter Two. He also gives some examples of optimization problems, such as utility maximization, expenditure minimization, profit maximization, cost minimization, and portfolio choice. All of these examples are extremely important in industrial, logistical, and financial applications. The author is also careful in this chapter to outline his intentions in later chapters, namely, that of finding the existence of solutions to optimization problems, and also in the characterization of the set of optimal points. The existence question is outlined in Chapter Three

using only elementary calculus, and the Weierstrass theorem is proved. Necessary conditions for unconstrained optima are examined in the next chapter, again using only elementary calculus and linear algebra. Lagrange multipliers and how they are used in constrained optimization problems are effectively discussed in Chapter 5. To discuss how optimization problems vary with a set of parameters, in particular if they vary continuously with the set of parameters, the author introduces the concept of a corespondence. This is essentially a map that assigns sets to points. His discussion of upper and lower-semicontinuity is very clear and I think one of the best presentations given at this level.

This book mostly has clearly written proofs and easy-to-follow explanations for students who have some experience in proofs or basic analysis. In my opinion, it is definitely not a book for someone who has only seen calculus.However, I have three very large problems with this book.The first, and most important, is that the book is not self contained. In many theorems in Chapter 1, the reader is asked to see Baby Rudin for the proof. While it’s pretty easy to find a PDF of Baby Rudin online for free, this is still not ideal. First, because Rudin and this book use different terminology/symbols for the same concepts, so there is a bit of unnecessary complexity in figuring how out Rudin’s proof fits into this book’s theorem. For example, the proof of Theorem 1.21 in this book is left to the proof of Rudin’s Theorem 2.41. However, Rudin relies on the concept of k-cells, which this book never speaks of. Second, and most importantly, Rudin’s proofs rely on concepts that this book has not defined. For example, Theorem 1.28 in this book relies on the proof of Theorem 2.36 in Baby Rudin. However, the proof in Baby Rudin relies on the concept of an "open cover," which this book does not define until a couple theorems later!The second complaint I have about this book is that sometimes the proofs are sloppy. For example, at the beginning of section 1.2.8, the author states that unbounded sets must be compact and states that an unbounded sequence cannot contain a convergent subsequence. Instead of explaining why, though, he simply puts "(why?)" in the text. While this might be great for a student who is following this book in a class or with an instructor, this is incredibly frustrating for someone who is studying on their own.

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