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Computability and Complexity Theory. Springer-Verlag, New York Inc. (2001) ISBN 0-387-95055-9. £37.00/EUR 49.95. 206 pp. Hardbound.

This book is a solid textbook suited for one- or two-semester graduate courses on the theory of computing. While most textbooks for courses in theoretical computer science emphasize either the traditional theory of computing (Turing machines, halting problem, recursive sets, etc.) or pure complexity theory (complexity classes P and NP, polynomial hierarchy and so on), the book provides a nice presentation of the most important results from both areas. The authors are two of the leading researchers in the field of theoretical computer science, most notably complexity theory.

The book is divided into two parts: part 1 is on computability and part 2 covers complexity theory. However, the authors are very careful to provide the reader with numerous links between these two parts.

In part 1, a rather traditional approach to computational theory is taken. After providing the reader with the necessary mathematical background in Chapter 1, in Chapters 2 and 3, the authors study in detail Turing machines, recursive and recursively enumerable sets, undecidable problems, complete problems, as well as the arithmetical hierarchy. Highlights of this first part are Church's thesis, the recursion theorem and Rice's theorem.

Part 2, i.e. Chapters 4–7, gives a compact description of the most important aspects of complexity theory. In Chapter 5, basic results such as the speedup and hierarchy theorems are demonstrated while providing the standard techniques. Chapter 6 studies in detail the notion of NP completeness, one of the most influential concepts of complexity theory. After defining the classes P and NP, the famous Cook–Levin Theorem is demonstrated and a list of natural NP-complete problems is given. The last chapter, Chapter 7, gives an introduction to structural complexity theory. The polynomial hierarchy is introduced and studied, and various problems are shown to be complete for other complexity classes like PSPACE, EXP and NEXP.

All chapters are supported by numerous exercises for self-study purposes. The difficulty of the problems varies from easy to challenging.

This textbook is an excellent resource and guide for those looking to develop a solid grounding in the theory of computing. Beginning graduates, advanced undergraduates, and professionals involved in theoretical computer science, complexity theory and computability will find the book an essential and practical learning tool.

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