Computability: Mathematical Sketchbook: Graduate Texts in Mathematics 146

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Computability theory is a branch of mathematical logic that studies the limits of computation. It is concerned with the question of what can and cannot be computed by a computer. In this book, we will explore the fundamental concepts of computability, including Turing machines, recursive functions, and the Church-Turing thesis. We will also explore more advanced topics, such as the incompleteness theorems and the theory of effective computability.

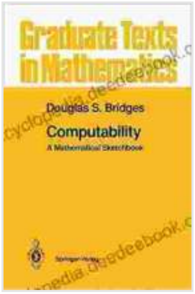
Chapter 1: Turing Machines

A Turing machine is a mathematical model of a computer. It consists of a tape divided into cells, each of which can store a symbol. The machine also has a head that can read and write symbols on the tape. The head can move left or right on the tape, and it can change the symbol in the current cell.

Computability: A Mathematical Sketchbook (Graduate Texts in Mathematics 146) by Sophie de Mullenheim

5 out of 5

Language : English



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Turing machines are very simple devices, but they are capable of computing any function that can be computed by a computer. This is because a Turing machine can simulate any other type of computer.

Chapter 2: Recursive Functions

Recursive functions are a type of mathematical function that can be defined in terms of itself. For example, the factorial function can be defined as follows:

factorial(n) = { 1 if n = 0 n * factorial(n - 1) otherwise }

Recursive functions can be used to compute a wide variety of problems. For example, they can be used to find the greatest common divisor of two numbers, to determine whether a number is prime, and to generate the Fibonacci sequence.

Chapter 3: The Church-Turing Thesis

The Church-Turing thesis states that any function that can be computed by a computer can also be computed by a Turing machine. This thesis is widely accepted by computer scientists, and it is considered to be one of the fundamental laws of computer science.

The Church-Turing thesis has a number of important implications. For example, it means that there are no problems that can be solved by a computer but not by a Turing machine. It also means that any problem that can be solved by a computer can be solved in a finite amount of time.

Chapter 4: The Incompleteness Theorems

The incompleteness theorems are two theorems that were proved by Kurt Gödel in 1931. These theorems show that any formal system that is capable of expressing basic arithmetic is either incomplete or inconsistent.

The incompleteness theorems have a number of important implications. For example, they show that it is impossible to develop a complete and consistent theory of mathematics. They also show that there are problems that cannot be solved by any computer.

Chapter 5: The Theory of Effective Computability

The theory of effective computability is a branch of computability theory that studies the computability of problems. This theory is concerned with the question of what problems can and cannot be solved by a computer.

The theory of effective computability has a number of important applications. For example, it can be used to determine whether a particular problem is solvable by a computer, and it can be used to develop efficient algorithms for solving problems.

Computability theory is a fascinating and important branch of mathematics. It has a wide range of applications, and it provides a deep understanding of the limits of computation. This book provides a comprehensive to the theory of computability, with a focus on its mathematical aspects. It is a valuable resource for students, researchers, and anyone else who is interested in learning more about computability theory.

References

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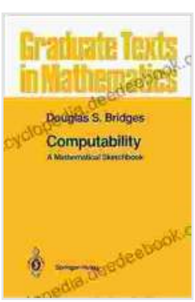

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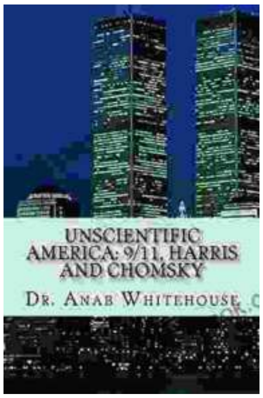

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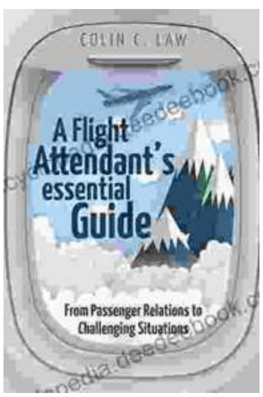

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