Data Structures and Algorithms using Python

Efficiently using data structures to collect, organize, and retrieve information is one of the core abilities modern computer engineers are expected to have. Python currently is one of the most popular programming languages, and as such, it has become vital for students to understand this concept in this language.

This student-friendly textbook provides a complete view of data structures and algorithms using the Python programming language, striking a balance between theory and practical application. All major algorithms have been discussed and analysed in detail, and the corresponding codes in Python have been provided. Diagrams and examples have been extensively used for better understanding. Running time complexities are also discussed for each algorithm, allowing the student to better understand how to select the appropriate one.

The book has been written with both undergraduate and graduate students in mind. Each chapter ends with a large number of problems, including multiple choice questions, to help consolidate the knowledge gained. This will also be helpful with competitive examinations for engineering in India such as GATE and NET. As such, the book will be a vital resource for students as well as professionals who are looking for a handbook on data structures in Python.

Subrata Saha is Head of the Department of Computer Applications at Techno India Hooghly, West Bengal. He has more than 20 years of teaching experience in various subjects in computer science and engineering, including data structures and algorithms, programming in C, C++, Java, and Python, basic computation, operating systems, and so on. He has previously published B*asic Computations and Programming with C* with the Cambridge University Press in 2016.

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Subrata Saha

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To my beloved wife,
Mrs Sriparna Saha, and my princess, Miss Shreya
Saha, whose constant support motivated me to
write this book

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Preface

In computer science and engineering, data structure and algorithm are two very important parts. Data structure is the logical representation of data, so that insertion, deletion, and retrieval can be done efficiently, and an algorithm is the step-by-step procedure to solve any problem. By studying different data structures, we are able to know their merits and demerits, which enriches our knowledge and our ability to apply the appropriate data structures at proper places when we try to write new applications. Studying different standard algorithms provides us much knowledge about solving new problems. Both data structures and algorithms are interrelated and are complementary to each other. By studying both data structures and algorithms, we may acquire a solid foundation of writing good code. This comprehensive knowledge helps to understand new frameworks as well.

With the studying of data structures and algorithms, it is very important to implement them using proper languages. Several books have been written on this topic using the C language. But today Python has become very popular because of its features such as being easy, open source, object oriented, portable, multi-threaded, extensive libraries, embeddable, etc. Hence, in this book data structures and algorithms are implemented using Python.

About the Book

This book is written to serve the purposes of a textbook for undergraduate courses of computer science and information technology and for undergraduate and postgraduate courses of computer application where data structure is one of the subjects in the syllabus. In this book different data structures and algorithms are discussed in a lucid manner so that students can understand the concept easily. All the relevant data structures and their operations are discussed with diagrams and examples for better understanding. After discussing relevant algorithms in detail, the algorithmic representation and the corresponding code in Python are given. Various programming examples along with new

problems for practice and a set of MCQ questions at the end of each chapter increase the self-learning process of the students.

The salient features of this book are:

- This book is written in very simple English for better understanding the complex concepts.
- In order to make the presentation visually interactive for students, neat labelled diagrams are provided wherever necessary. For each topic, explanations are clear and concise, avoiding verbosity as much as possible.
- Each topic is discussed in detail with proper examples.
- Algorithms are presented with algorithmic representation as well as with the corresponding code in Python.
- Complexity analysis is discussed for almost all problems discussed in this book and in very lucid manner for better understanding.
- A large number of solved programming examples.
- MCQ questions and their solutions.

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