

Preface

This book is written based on my class notes developed while teaching the undergraduate graph theory course “Basic Graph Theory” at the Department of Computer Science and Engineering, Bangladesh University of Engineering and Technology (BUET). Due to numerous applications in modeling problems in almost every branch of science and technology, graph theory has appeared as a vital component of mathematics and computer science curricula of universities all over the world.

There are several excellent books on graph theory. Harary’s book (Graph Theory, Addison-Wesley, Reading, Mass, 1969) is legendary while Wilson’s book (Introduction to Graph Theory, 4th edn, Longman, 1996) is an excellent introductory textbook of graph theory. The book by West (Introduction to Graph Theory, 2nd edn, Prentice-Hall, 2001) is the most comprehensive book, which covers both introductory and advanced topics of graph theory. Agnarsson and Greenlaw in their book (Graph Theory: Modeling, Applications and Algorithms, Pearson Education, Inc., 2007) presented graph theory in a rigorous way using practical, intuitive, and algorithmic approaches. This list also includes many other nice books such as the book of Deo (Graph Theory with Applications to Engineering and Computer Science, 1974) and the book of Pirzada (An Introduction to Graph Theory, University Press, India, 2009). Since I have followed those books in my classes, most of the contents of this book are taken from those books. However, in this book all good features of those books are tied together with the following features:

- terminologies are presented in simple language with illustrative examples,
- proofs are presented with every details and illustrations for easy understanding,
- constructive proofs are preferred to existential proofs so that students can easily develop algorithms.

This book is primarily intended for use as a textbook at the undergraduate level. Topics are organized sequentially in such a way that an instructor can follow as it is. The organization of the book is as follows. In Chapter 1 historical background, motivation, and applications of graph theory are presented. Chapter 2 provides

basic graph theoretic terminologies. Chapter 3 deals with paths, cycles, and connectivity. Eulerian graphs and Hamiltonian cycles are also presented in this chapter. Chapter 4 deals with trees whereas Chapter 5 focuses on matchings and coverings. Planar graphs are treated in Chapter 6. Basic and fundamental results on graph coloring are presented in Chapter 7. Chapter 8 deals with digraphs. Chapters 9 and 10 exhibit the unique feature of this book; Chapter 9 presents some special classes of graphs, and some research topics are introduced in Chapter 10. While teaching the graph theory course to undergraduate students of computer science and engineering, I have found many students who started their research career by doing research on graph theory and graph algorithms. Some special classes of graphs (on which many hard graph problems are efficiently solvable) together with some research topics can give direction to such students for selecting their first research topics.

While revising research articles of my students I often face difficulties, since they are not familiar with formal mathematical writing. Thus I have used formal mathematical styles in writing this book so that the students can learn these styles while reading this book.

I would like to thank my undergraduate students of the Department of Computer Science and Engineering, BUET, who took notes on my class lectures and handed those to me. My undergraduate student Muhammad Jawaherul Alam started to compile those lectures. I continued it and prepared a complete manuscript during my sabbatical leave at Military Institute of Science and Technology (MIST), Dhaka. I have used the manuscript in undergraduate courses at BUET and MIST for students' feedback. I thank the students of Basic Graph Theory Course at BUET and MIST for pointing out several typos and inconsistencies. My heartfelt thanks go to Shin-ichi Nakano of Gunma University who read the manuscript thoroughly, pointed out several mistakes and suggested for improving the presentation of the book. I must appreciate the useful feedback provided by my former Ph.D. student Md. Rezaul Karim who used the manuscript in a course in Computer Science and Engineering Department of University of Dhaka. Some parts of this book are taken from our joint papers listed in bibliography; I thank all coauthors of those joint papers. I would like to thank my students Afia, Aftab, Debajyoti, Iqbal, Jawaaherul, Manzurul, Moon, Rahnuma, Rubaiyat, and Shaheena for their useful feedback. I would particularly like to express my gratitude to Mohammad Kaykobad for his continuous encouragement. I thank Md. Afzal Hossain of MIST for providing me a wonderful environment in MIST for completing this book. I sincerely appreciate the editorial team of Springer for their nice work.

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