

Review

Search **Graph theory (5th ed.)**

Diestel R., Springer International Publishing, New York, NY, 2017. 429 pp. Type: Book (978-3-662536-21-6)

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Graph theory provides a very comprehensive description of different topics in graph theory. This book can definitely be counted as one of the classics in this subject. The highlight is its wide coverage of topics in graph theory, ranging from the fundamentals to very advanced topics.

The book contains 12 chapters. The first chapter deals with the basic notions in graph theory. Besides the definition of fundamental graph classes and their properties, the notions of cycle space and cut space of graphs and certain related results are also included in this chapter.

In the second chapter, the author describes the terms independent sets, matching, covering, and packing in graphs. Besides König's theorem and Hall's theorem, this book also discusses certain advanced topics in matching such as the Erdős-Pósa property and Nash-Williams theorems (tree-covering and tree-packing theorems).

Connectivity in graphs is the topic of discussion in chapter 3. The structural characteristics of 2-connected and 3-connected graphs, Tutte's theorem on 3-connected graphs, Menger's theorem, Madler's theorem, and so on constitute the essence of this chapter.

Chapter 4 discusses the planarity of graphs. The topological prerequisites and the presentation of planarity in terms of these topological aspects make this chapter worthy and interesting to read. The concept of plane duality is also addressed in a beautiful manner.

Chapter 5 deals with graph coloring. Besides the traditional topics such as vertex coloring, edge coloring, and map coloring, some recent developments like list coloring of graphs and perfect graphs are also covered in this chapter. These topics will provide some useful insights to researchers in this area.

Advanced topics in networks and flows are discussed in chapter 6. Interesting discussions on group-valued flows, k -flows, flow-coloring duality, and Tutte's conjectures are included in this chapter.

Chapter 7 covers very interesting topics in extremal graph theory. Highlights of the chapter are the discussions on graph minors, Hadwiger's conjecture, Szemerédi's regularity lemma, and related topics.

The eighth chapter initiates a very detailed discussion of the theory of infinite graphs. This is the lengthiest chapter of the book and covers many areas including the countability, connectivity, matching, and coloring of infinite graphs.

While chapter 9 deals with Ramsey theory, chapter 10 is on Hamilton cycles in graphs. The notions of random graphs and probabilistic methods in graph theory are discussed in chapter 11. This chapter also includes some interesting discussions on threshold functions for graph property and related topics.

The last chapter of the book deals with certain topics on graph minors. The chapter progresses through the discussions on the graph minor theorem for trees, tree decompositions, tree width, and the general graph minor theorem.

The book ranks highly in terms of standards, originality, and class. There are several positive points to highlight: the approach, inclusion of relevant topics, precision in the presentation of these topics, depth and extent of the topics included, ample number of illustrations, and sufficient exercise problems. I have no doubt that this book will be a real asset for all graph theorists and those studying graph theory at all levels.

Recommendations

★ Reviewer Selected

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