

Preface

The need of optimal partition arises from many real-world problems involving the distribution of limited resources to many users. An important example is the “clustering” problem whose goal is to partition the data into clusters to minimize the intra-cluster distances and to maximize the inter-cluster distances. This book is the first attempt to collect all theoretical development on the topic of optimal partition to a single source. In fact, it does much more than simply collecting the results; it provides a general framework to unify these results and presents them in an organized and simplified way. There are also many new results in this book.

Because of its size, this book is partitioned (optimally, we hope) into two volumes. Volume 1 focuses on single-parameter partition problem where each element in the set to be partitioned is represented by a single parameter, i.e., a 1-dimensional point. We develop basic theory and methods to attack the optimal partition problem as a foundation to solve the multi-parameter partition problem in Volume 2. However, partition points in a multi-dimensional space have some fundamental differences from partitioning points in a line. For example, points in a line can be linearly ordered, but no such natural order exists for points in high-dimensional space, forcing the development of theory and methods unique to Volume 2.

We also collect a set of optimal-partition problems which have been discussed in the literature in the first chapter of Volume 1, and use the results in this book to give solutions to these problems (or explaining why they can't be solved) in the last chapter of Volume 2.

Earlier and shorter versions of this book have been taught thrice by the first author as a 1-year graduate course in National Chiao-Tung University. Many students were able to do research and to solve problems which were open then but now a part of the literature cited in this book.

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