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This book is a most welcome addition to the facility location literature and a “must read” for students and researchers in the field as it addresses some of the most difficult and practical problems in facility location analysis. It is the product of doctoral research conducted by Joana Dias. As a member of the jury, I had the great pleasure to participate in Dr. Dias’ defense of her exceptional PhD thesis. Sitting in the 14th century “Sala of student torture” at the University of Coimbra (Portugal) is one of the academia’s greatest honors. It is quite humbling to occupy a seat on the jury balcony that has been occupied by outstanding scholars for over 500 years at a university whose rich traditions and academic excellence date back over 700 years.

The primary focus of this text is on the mathematical modeling of dynamic facility location problems. Facility location analysis has been an important human activity since our earliest ancestors identified the “best” caves for shelter. Its importance continues today as is evidenced by how many times we have heard that “location, location, location” are the three most important components of retail success. Mathematical modeling of location problems dates back at least 100 years to Weber (1909). However, it has been during the past 40 years that most of this research has occurred. The continuing importance of, and widespread interest in, location modeling is demonstrated by the number of articles and presentations addressing the topic by scholars in numerous disciplines including economics, engineering, geography, management science/operations research, production and operations management, and regional science among others.

There are several reasons for this on-going interest. First, facility location decisions are ubiquitous as they are made at all levels of human activity from individuals to corporations and governments. Second, they are strategic in nature as they often involve large capital outlays and the facilities function for long periods of time. The former justifies extensive quantitative analysis and the latter implies that they are often dynamic in nature as parameters such as demand and costs vary over time. Third, they frequently have important social, economic and environmental impacts that may affect various stakeholders differently. As a result, such decisions are often driven by multiple objectives. Fourth, they are “problem specific” in that their constraints and objectives vary greatly depending on the problem setting. Finally, they are generally difficult (or impossible) to solve optimally due to their computational complexity. As a consequence, heuristic solution procedures must be developed to solve most real-world problems. In order to facilitate the solution process, many facility location models simplify the underlying problem by considering only a single objective, and/or by ignoring its dynamic aspects and facility capacity constraints.

The research presented in this book tackles some of the most difficult facility location problems head-on. Specifically, it develops innovative solution approaches to dynamic facility location problems. By definition, dynamic models consider changes over time. Facility location models may be characterized as
“implicitly” dynamic or as “explicitly” dynamic (John Current, Ratik & ReVelle, 1998, John Current, Daskin & Schilling, 2001). Implicitly dynamic models are “static” in that all facilities are opened (or possibly closed) at the beginning of the planning period and remain that way throughout the planning horizon. These models are dynamic in that they account for the effects of future parameter changes in the initial set of locations. Explicitly dynamic models account for future parameter changes by locating facilities and scheduling their opening (and possibly closing) over the planning horizon.

This book presents innovative solution procedures for “explicitly dynamic” location problems which are generally more difficult to solve than are the implicitly dynamic ones. These procedures utilize primal-dual techniques and memetic algorithms. The text also addresses location decisions that involve capacitated facilities and multiple objectives. Historically, these are among the least modeled location problems. For example, a 1985 survey of location planning papers identified over 1,500 papers (W. Domschke & Drexel, 1985) and a 1990 survey of articles addressing multi-objective location problems identified only 46 articles (John Current, Schilling & Min, 1990). The latter article noted the need for additional research on dynamic and capacitated models as only 4 of the 46 articles were dynamic in nature and only 8 considered capacitated facilities. John Current, Daskin & Schilling, 2001, called for the development of new solution heuristics for multi-objective location models. This book makes major contributions regarding these three important areas of facility location research.

I have been conducting research on multi-objective location problems for over 30 years from J. L. Cohon, ReVelle, Eagles & Current, 1980, to Luis Alçada-Almeida, Coutinho-Rodrigues & Current, 2009. It is exciting to know that the future of the field is in good hands as brilliant young scholars like Joana Dias are taking on the challenging problems that still remain. Professors M. Eugénia Captivo and João Climaco deserve recognition for appreciating Joana’s talent, mentoring her, and supporting her in taking on such challenging research.

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