

Preface

The field of networks is a lively one, both in terms of theoretical developments and in terms of the diversity of its applications. Many problems of design and analysis of large systems can be formulated and solved using techniques of network theory. Such problems include communication systems, electrical networks, computer networks, transportation, scheduling of industrial processes, facility location, and modeling of combinatorial optimization problems.

Network theory originated many years ago, before our information age. In the eighteenth century, Euler solved the famous Königsberg Bridge problem and later Kirchoff initiated the theory of electrical networks. But it was not until late last century, when Bell invented the telephone, that many areas of network theory were stimulated.

After the appearance of the first graph theory book (by D. König) in 1936, there was tremendous development regarding the theory and applications of networks. Hitchcock proposed the first complete algorithm for the transportation problem in 1941, Dantzig proposed the simplex algorithm for linear programming in 1947, and algorithms for the minimum spanning tree (Kruskal, 1956) and shortest path problems were proposed (Prim, 1957). During the same period, the first commercial computers became available. As it happened with many other areas of research, the fields of computer science and networks influenced each other in many respects. In 1962 the book by Ford and Fulkerson on "Flows in Networks" appeared. With the development of new data structure techniques and the theory of computational complexity we entered a new era of algorithmic developments in networks.

During the second half of our century we saw major technological developments in all areas of human endeavor and particularly in information processing. Computer networks play a vital role in providing fast, reliable, cost-effective means of communication and information sharing. In addition, network techniques and computer technology enable us to solve large-scale network models that appear in applications such as transportation and telecommunications.

It is clear that the theory and applications of networks is so great that this book could not give a full account and systematic treatment of the subject in its entirety. It is our intention to introduce a number of special topics in order to show the spectrum of recent research activities and the richness of ideas in the development of algorithms and the applications of networks. While we were able to provide only a glimpse of this expansive field, we felt that this glimpse would allow the reader to sense the breadth and the depth of the field.

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