PREFACE

Although it may not be as strong as Japanese Yen, discrete mathematics is becoming a rather popular field among young Japanese researchers. We believe that the amount of contribution made by Japanese is steadily growing. Conference activities are also flourishing: The First Japan Conference on Graph Theory and Applications in Hakone, and Japan–USA Joint Seminar on Discrete Algorithms and Complexity Theory in Kyoto were just held in the summer of 1986. The next International Symposium on Mathematical Programming is scheduled to come to Tokyo in 1988.

Suggested by Peter Hammar, we thought it appropriate to have this type of issue in this time, and started the project in the spring of 1984 by asking some of the leading researchers their opinions and submission of papers. To get a balanced perspective, we did not pinpoint the theme of the issue, but, at the same time, to avoid too much diversity, we restricted the papers to those which are directly related to applications. As a result of this, some important areas where contributions by Japanese are remarkable, e.g., block designs and pure graph theory, are not included.

Iri's ''Personal Reminiscence'' is not a technical paper discussing mathematical results. It is an updated version of his essay originally written about ten years ago. Nevertheless it is included here because it vividly conveys the atmosphere of a group in the 1960's when the concept of complexity is moulded, developed and applied in Japan. The graph realization problem mentioned therein is one of the important problems to which Japanese researchers made significant contributions.

Another important contribution made in Japan would be the discovery of the concept of principal partition and the development of its theory. It has been applied to a variety of fields such as electrical circuits and water supply networks. As one of the main contributors at the initial stage of the development, Ozawa, in his survey, tries to explain the concept in a refined and unifying manner from his own standpoint, putting emphasis on its applications.

Other papers all focus on original contributions. Murota considers in his ''Menger-Decomposition'' paper how such decomposition can be used to analyze the structural solvability of a system of non-linear equations. Murota's second paper on ''Homotopy Base'' discusses the problem of finding a set of relations that characterizes the commutativity of a given diagram. It is formulated in the framework of a preordered matroid, and a greedy type algorithm is provided. As the paper by Murota and Fujishige notes, the problem can be solved more efficiently by resorting to a graph-theoretic method.

Fujishige shows that the out-of-kilter method for the ordinary minimum-cost flow problem can be extended to a more general problem of the submodular flow.

The underlying polyhedron and the system of linear inequalities are also clarified.

Masuzawa, Hagiwara and Tokura treat the problem of augmenting a set of arcs to make a digraph G k-vertex-connected. The paper shows that a minimum augmenting set can be found in $O(k|V|)$ time if G is a rooted directed tree.

Two papers by Sekiguchi, and Ishii, Masuda and Nishida are concerned with machine scheduling problems. Sekiguchi presents a decomposition theory of a sequencing problem described in a rather abstract fashion. It can be applied to various problems such as the two-machine minimum makespan flow-shop problem and the minimum total expected cost fault detection problem. Ishii et al. give a polynomial-time algorithm for the two-machine mixed shop scheduling problem in which machine speeds need also be determined.

Finally, Katoh and Ibaraki propose an approximation scheme for the minimization of a quasiconcave function over a given feasible set. In particular, fully polynomial-time approximation schemes are developed for some stochastic programming problems with 0–1 variables.

We do not claim that these papers in any way represent the current status of discrete mathematics in Japan, but would like to ask the reader to regard them as samples taken from many ongoing research activities. All the papers, of course, have gone through the standard screening process. We would like to extend our thanks to all of the authors and the referees for their efforts, and to Peter Hammer for his encouragement and patience.

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