

INTRODUCTION

The enormous achievements in physics, chemistry and biology which took place between the 17th century and the end of the 19th century seemed to add strength to the conviction that the real world can be fully explained as an infinity of mutually consistent, continuous and, in principle, predictable processes, which can be described, on a satisfactory level, by using the well known methods of infinitesimal calculus. It is also well known now that this splendid conception of the real world was completely destroyed by further scientific progress in the 20th century. The more deeply we went into explaining the details of the construction of the real world, the weaker became the general concept of our interpretation of the universe as a whole. We have almost as many arguments for saying that the universe should be described as endless, continuous, predictable, etc. as against it. This is, probably, why some old-fashioned and forgotten scientific concepts sometimes return in our times in a new and attractive form, extending our cognitive possibilities.

In some sense discrete mathematics can be considered as one of the most classical mathematical disciplines. Indeed, we have an example of discrete mathematics in the arithmetics of natural numbers, which arise prior to many other classical branches of mathematics. Paradoxically, discrete mathematics is sometimes considered now as a new-discovered method of mathematical investigations. In fact, it is our understanding of the validity of the discrete approach to various scientific problems that is new and has proved fruitful in recent years.

However, it should be remarked that there is no general understanding of what discrete mathematics means exactly. In a wide sense discrete mathematics can be interpreted as a branch of mathematical investigations dealing with enumerable (discrete) sets. Thus, combinatorial analysis, graph theory, theory of formal grammars, discrete algebras and geometries, theory of finite automata, general theory of discrete computing and algorithms, theory of optimization techniques in discrete spaces (discrete programming) etc. should be considered as sub-disciplines of discrete mathematics. Even if this wide concept of discrete mathematics is accepted, certain doubts arise concerning, for example, the theory of Markov chains or some optimization problems in graph theory (theory of flows in communication networks). It should also be remarked that our growing interest in discrete mathematics in recent years is stimulated mainly by the needs of computer science and engineering. Therefore a pragmatic approach to the concept of discrete mathematics is also possible: discrete mathematics is a branch of logical and mathematical investi-

gations dealing with abstract objects describing the basic information processing methods and problems in networks containing enumerable sets of states. In this case discrete mathematics not only becomes much narrower in scope but also pursues mainly a practical aim. This last concept of discrete mathematics was dominant during the Semester on Discrete Mathematics organized at the International Stefan Banach Mathematical Center in 1977 and during the Symposium on the same topics, which ended the Semester. During the five months on the Semester the participants were given a wide presentation of modern approaches and the most valuable results obtained in discrete mathematics in various countries. The activities of the Semester and the Symposium have convinced us that no rigid frame for discrete mathematics investigations is desirable or possible now.

The present book contains selected contributions to discrete mathematics, presented during the Semester and the Symposium. Some of the papers included reflect new or extended results, which have not been published in this form before.

The Organizing Committee of the Semester and of the Symposium offer their thanks to the Lecturers and to the contributors of this volume. We would also be obliged to the readers who would care to send us their critical remarks concerning the book or suggestions for the future activities of the Banach Center in the domain of discrete mathematics.

The Vice-Chairman of the Semester and
of the Symposium on Discrete Mathematics

Juliusz Lech Kulikowski