Preface

This volume contains the problems from the first forty IMO-s, from 1959 to 1999.

The chronicle of the IMO (International Mathematics Olympiad) starts with the initiative of the Romanian Mathematics and Physics Society: in July 1959 on the occasion of a celebration the Society invited high school students from the neighbouring countries to an international mathematical competition. The event proved to be such a success that the participants all agreed to go on with the enterprise. Ever since, this competition has taken place annually (except for 1980) and it has gradually transformed from the local contest of but a few countries into the most important and comprehensive international mathematical event for the young. Only seven nations were invited for the first IMO, while the number of participating countries was well beyond eighty for the last event; wherever mathematical education has reached a moderate level, sooner or later the country has turned up at the IMO.

The movement has had a significant impact on the mathematical education of several participating countries and also on the development of the gifted. The aim of a more proficient preparation for the IMO itself has launched the organization of national mathematical competitions in many countries involved. As the crucial component of successful participation, the preparation for the contest has enriched the publishing activity in several countries. Math-clubs have been formed on a large scale and periodicals have started. Even though the competition certainly brings up some pedagogical problems, if the educators regard the competitions not as ultimate aims, but as ways to introduce and endear pupils to mathematics, then their pedagogical benefit is undeniable.

The administration of the competitions has not changed that much; the larger scale has obviously necessitated certain modifications but the actual contest is more or less as it used to be. The participating countries are invited to delegate a group of up to six students who are attending high school at the year of the contest or had just finished their secondary school studies. Three problems are posed each day over two consecutive days and the students have to produce written solutions in their native tongue. There are two delegation leaders accompanying each team; one of their tasks is to provide an oral translation of their students' work into one of the official languages—by now this has been almost exclusively English—for a committee of mathematicians from the host country. Together with this group of coordinators they eventually settle the score the solutions are worth; the highest mark is seven points for each problem. The contestants are then ranked according to their total scores; the awarding of the prizes has been administered according to the following principle: half of the participants are

given a prize: namely the proportion of the gold, silver and bronze medals is $1:2:3$ respectively.

The occasional professional problems are handled by the international jury formed by the leaders of the participating delegations; their most important and difficult task is to select the six problems for the actual contest, to formulate their official text and to prepare rough marking schemes for each of them. The organizers ask for proposals from the participating countries well in advance; in due course they produce a list of approximately twenty to twenty five problems from those suggested and the jury selects the final six from this supply.

There are almost two hundred problems in this book and they provide a full image of the challenge the students had to cope with during these forty years. One cannot claim that every single one of them is a pearl of mathematics but their overwhelming majority is interesting and rewarding; together they more or less cover the usual syllabus-chapters of elementary mathematics. When doing the selection, the jury usually tries to choose from the intersection of the respective curricula of the participating countries; considering that there are more than eighty of them this is not an easy job, if not impossible. The reader might notice that there are no problems at all from the theory of probability, for example, and complex numbers hardly show up.

From the retrospect of more than forty years one can certainly conclude that the IMO movement has had a significant role in the history of the second half of twentieth century mathematics. There are quite a few highly ranked mathematicians who started their career at an IMO; even at this point, however, we have to emphasize, that an eventual fiasco at the IMO or any other mathematical contest whatsoever usually has no implications at all about the mathematical potential of a well prepared student.

A careful reader will certainly realize that quite a few problems in this book are in fact simplifications or particular cases of more profound mathematical results; apart from the intellectual satisfaction of actually solving these problems, the discovery of this mathematical background and the knowledge gained from it can be the ultimate benefits of a high level study of this book.

At the end of the book we included a Glossary of Theorems (and their proofs) we used in the book and we refer to them by their numbers enclosed in brackets, e. g. [6].

May 2001 István Reiman
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