



Hungarian Problem Book IV (MAA Problem Book Series)

From Mathematical Association of America



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The Eötvös Mathematics Competition is the oldest high school mathematics competition in the world, dating back to 1894. This book is a continuation of *Hungarian Problem Book III* and takes the contest through 1963. Forty-eight problems in all are presented in this volume. Problems are classified under combinatorics, graph theory, number theory, divisibility, sums and differences, algebra, geometry, tangent lines and circles, geometric inequalities, combinatorial geometry, trigonometry and solid geometry. Multiple solutions to the problems are presented along with background material. There is a substantial chapter entitled *Looking Back*, which provides additional insights into the problems.

Hungarian Problem Book IV is intended for beginners, although the experienced student will find much here. Beginners are encouraged to work the problems in each section, and then to compare their results against the solutions presented in the book. They will find ample material in each section to help them improve their problem-solving techniques.

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Editorial Review

Review

Composed in a tradition that has enriched the experience of countless young students with elementary mathematics through a wealth of original problems that elicit creative thinking in ingenious settings, *Hungarian Problem Book IV* is designed and executed in such a way that does credit to, and in some ways surpasses its origins. The translation and edition, begun by Robert Barrington Leigh and Andy Liu and completed by the latter, of the original Hungarian compilation of problems from the Kurschak Competition of 1947 to 1963, is complemented by a carefully constructed framework of results in algebra, geometry, number theory and combinatorics that make it a self-contained resource for study, contemplation and enjoyment.

Here can be found problems that have become classics in the literature of mathematical competitions, as well as many not encountered in other collections and that most readers will find both refreshing and intriguing.

Breadth is achieved not only by the topics spanned but also by presenting many alternative solutions to each problem...

Additionally, George Berzsenyi's foreword is most informative, setting, the scene perfectly. We most highly recommend to our readers this new addition to an excellent series of publications that comes to us from the MAA. --Maria Falk de Losada

World Federation of National Mathematics Competitions

--Ana Momidic-Reyna, MAA Reviews

Every young (or not so young) mathematician enjoys a good problem to ponder, hence the popularity of mathematics competitions, ranging from local in-school contests to international meetings where (a bit of) national prestige is at stake. The oldest, and one of the most famous, of these is the Hungarian mathematics competition (Eotvos/Kurschak) held annually since 1894. This volume, published by the MAA, collects the problems from this competition from 1947 to 1963 along with solutions and commentary. Since the competition is for senior high school students the problems need less mathematical background knowledge than, for example, the Putnam competition problems and are concentrated mainly in combinatorics, geometry and elementary number theory. The MAA has also published collections of problems from earlier years (Volume 1, 1894 to 1905, Volume 2, 1906 to 1928, Volume 3, 1929 to 1943) and it is an interesting exercise to compare these to see how taste in the choice of problems has evolved. The current volume contains extensive commentary and alternative solutions for many of the problems as well as valuable advice for students and coaches preparing for similar competitions and concludes with an interesting discussion of possible extensions of some of the problems. This is a valuable resource which should be part of every college and high school library. --Keith Johnson, CMS Notes

Anticipated to widen the originality of elementary mathematics problems and deepen the creativity and diversity of their solutions, *Hungarian Problem Book IV* proves to be a valuable tool for students interested in preparing for mathematics competitions and for all those involved in organizing them. The book is a precious collection of problems from the Kurschak Mathematics Competition, which is the oldest high

school mathematics competition in the world.

Robert Barrington Leigh and Andy Liu have worked diligently in the translation of the original 48 problems from the Hungarian Kurschak Competition of 1947 to 1963, editing and organizing them by subject: combinatorics, graph theory, number theory, divisibility, sums and difference, algebra, geometry, tangent lines and circles, geometric inequalities, combinatorial geometry, trigonometry and solid geometry. The experienced reader will find some new and intriguing problems here.

Hungarian Problem Book IV is of course a sequel to *Hungarian Problem Book III*. The latter discusses Polya's four-step method for problem-solving, focusing mostly on the first three steps (understanding the problem, making a plan, and carrying out the plan). The final chapter of *Hungarian Problem Book IV*, "looking Back," illustrates the usage of the fourth step in Polya's problem-solving process, which is looking back and eliciting further insights into the problems. An example is the discussion of problems in number theory. The authors begin by proving that an integer can be expressed as the sum of two squares if and only if twice that number can be so expressed. Then he deviates from this problem to another one, as he tries to determine all positive integers m such that $(m-1)!$ is divisible by m . He draws the solution from Wilson's Theorem, and proves it using geometric intuition. Next, he digresses once again to consider the Fermat's Little Theorem (which is a result very close to Wilson's Theorem) and proceeds to prove it. Finally, he explores Waring's Problem and looks back at yet another related problem which involves the Fermat Numbers. Thus this discussion exhibits an astonishing interplay between results of the different problems.

The problems and their solutions draw on numerous famous theorems and concepts; to name a few: Ramsey's Theorem, Hamiltonian cycles, Farey fractions, Chebyshev's Inequality, Vieta's Formulae, Cantor's Diagonalization Method, Hall's Theorem, Euler's formula, etc., all of which are introduced and explained.

Hungarian Problem Book IV enriches its readers' problem-solving technique and challenges their creative thinking. --MAA Reviews

About the Author

Robert Barrington Leigh was one of the very best students of Andy Liu's Saturday Mathematical Activities, Recreations and Tutorials program. Later in life, Leigh won two Bronze Medals at the International Mathematical Olympiad. He has also won seventh to sixteenth place in the Putnam Competitions from the three times he participated. Tragically he died before he could enter the Competition for the fourth time.

Andy Liu received a BS degree with First Class Honors in Mathematics from McGill University in 1970. He earned his MS in Number Theory and a Doctorate of Philosophy in Combinatorics from the University of Alberta, Edmonton. Dr. Liu has earned numerous teaching awards and is very well-known in problem-solving circles. He won the David Hilbert International Award in 1996 from the World Federation of National Mathematics Competitions. He was the Deput Leader (under Murray Klamkin) of the USA Mathematical Olympiad Team from 1981-1984.

Users Review

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Phillip Ruiz:

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Charles Moreno:

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