BOOK REVIEWS

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*International Mathematics Tournament of Towns 1997–2002 Book 5*
By A.M. Storojnev, AMT Publishing, 2006
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The International Tournament of Towns is a mathematical problem-solving competition for high school students from towns throughout the world. The first Tournament of Towns took place in Russia in 1979–1980, and it has grown to the point where towns from all regions of the world participate. The Tournament takes place each year and consists of two stages: Autumn and Spring. Each stage has two papers: an "O" level, less difficult but less points; and an "A" level, more difficult and more points. There are two versions of each paper, Junior and Senior. The Senior paper is intended for students from the last two years of high school (in Canada, grades 11 and 12), and the Junior paper is intended for students from lower grades. Individual scores are based on the best of the four papers submitted using the points from the top three problems on each paper, and are scaled based on the student’s grade level. A town’s score is based on the scores from the best papers from the town, where the number of papers used to determine the score is based on the town’s population. Students who exceed a certain minimum score are awarded a diploma by the Russian Academy of Sciences.

This book consists of 5 sections, each containing the eight papers from one Tournament, for the Tournaments 19 through 23, covering the years 1997 to 2002. Each section contains solutions to all of the problems from that Tournament. There is a small amount of duplication of problems, since a few problems appear on both the Junior and Senior versions of a paper. There are 212 different problems altogether in the book. A list of 62 general references is given at the end of the book; however, nowhere in the book is this material cited.

The problems in this book are not for the mathematically faint at heart. Though elementary (in that they do not require knowledge of calculus, linear algebra, or other areas of advanced mathematics), they all require a certain degree of mathematical sophistication. Even the easiest problems require some ingenuity. The more difficult problems require a high level of insight and imagination to solve. Almost every paper contains at least one geometry problem, none of which includes a diagram. Other problems cover areas such as number theory, algebra, counting (but not standard combinatorics), and logic. Some problems are difficult to classify, as they combine one or more standard problem types. Many require the proof of a result rather than a simple calculation. Several problems assume knowledge of standard games such as chess, checkers, and cards.
The following three problems should give some feel for the style of problems encountered in this book:

**Tournament 21, Junior, Autumn 1999 (O Level) #1**
A right-angled triangle made of paper is folded along a straight line so that the vertex at the right angle coincides with one of the other vertices of the triangle and a quadrilateral is obtained.

(a) What is the ratio into which the diagonals of this quadrilateral divide each other? (2 points)

(b) This quadrilateral is cut along its longest diagonal. Find the area of the smallest piece of paper that is obtained if the area of the original triangle is 1. (2 points)

**Tournament 22, Senior, Autumn 2000 (O Level) #4**
Among a set of $2N$ coins, all identical in appearance, $2N - 2$ are real and 2 are fake. Any two real coins have the same weight. The fake coins have the same weight, which is different from the weight of a real coin. How can one divide the coins into two groups of equal total weight by using a balance at most 4 times, if

(a) $N = 16$; (3 points)

(b) $N = 11$? (2 points)

**Tournament 20, Senior, Spring 1999 (A Level) #6**
A rook is allowed to move one cell either horizontally or vertically. After 64 moves the rook visited all cells of the $8 \times 8$ chessboard and returned back to the initial cell. Prove that the number of moves in the vertical direction and the number of moves in the horizontal direction cannot be equal. (8 points)

The solutions in this book are elegant and well crafted. The majority were prepared by Andy Liu of the University of Alberta. All of the solutions are terse, with extraneous or elementary justifications left to the reader. Many solutions refer to areas of mathematics that high school students would not normally be familiar with, or to results from more familiar areas that high school students would not have encountered. For example, some concepts and results from graph theory are used in several solutions. This aspect of the solutions could certainly stimulate the interested reader to delve into an unfamiliar topic, but might discourage the more casual reader.

This book would be a valuable resource for anyone interested in mathematical problem-solving. Mathematicians involved in preparing mathematics competitions would find in it inspiration for creating their own problems. High school or university mathematics students would find it useful as preparation for any mathematics competition. The Australian Mathematics Trust should be congratulated for publication of problems of this quality and level.
Tribute to a Mathemagician
Edited by Barry Cipra, Erik D. Demaine, Martin L. Demaine, & Tom Rodgers, published by AK Peters, Wellesley, MA, 2005
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The Mathemagician is Martin Gardner, for whom the Gathering for Gardner (GaG) is named. The fifth gathering (GaGS) in 2004 led to this book, an edited collection of thirty articles contributed by participants. The articles are preceded by In Memoriam, four pieces dedicated to the lives and contributions of Edward Hordern and Nobuyuki Yoshigahara. The title of the book is fitting, as “Tribute” sets the tone for the whole book, which not only provides intellectual amusement but also displays the human side of the mathematical community.

Articles from popular authors such as Raymond Smullyan, Peter Winkler, Jerry Slocum, and Dennis Shasha appear amidst the diversity, which is challenging to summarize here. A few examples are offered. First, from Chris Manlanka’s “bouquet of brainteasers”:

A bouquet contains red roses, white roses, and blue roses. According to the florist, the number of red roses and white roses comes to 100; the number of white roses and blue roses comes to 53. The number of blue roses and red roses comes to less than that.

How many roses of each color are there?

Sliding-coin puzzles, a cryptic crossword, tiling problems, and various other challenges appear. Among the challenges are polyomino activities, including an unusual article entitled Polyomino Number Theory (III) by Uldis Barbans, Andris Cibulis, Gilbert Lee, Andy Liu, and Robert Wainwright, in which the focus is the compatibility of pentominoes (as in pentominoes that share common multiples). Principles of number theory are integrated through definitions such as, “A polyomino A is said to divide another polyomino B if a copy of B may be assembled from copies of A.” The article provides a fine example of how mathematical thinking, language, and playfulness meet in this field of recreational mathematics.

Norman L. Sandfield writes on “Chinese Ceramic Puzzle Vessels”. Ross Eckler shifts the focus to wordplay with “A History of the Ten-Square”, as he examines the development of those alphabetical arrangements in which all columns and rows correspond to English words. Bill Cutler’s “Designing Puzzles with a Computer” offers another view on the history and cultural place of puzzles.

The unusual blend of contributions is high calibre, as one expects when keen mathematicians step forth to honour someone they respect. Readers will enjoy the material, as will casual browsers. Indeed the book offers something new on each viewing!