BOOK REVIEWS

ALAN LAW

Mathematical Puzzle Tales, by Martin Gardner,
with a foreword by Isaac Asimov,
published by the Mathematical Association of America, 2000,
ISBN: 0-88385-533-X, softcover, 151+xiii pages, $22.50 (U.S.).
Reviewed by **Edward J. Barbeau**, *University of Toronto, Toronto, Ontario.*

Since its inaugural issue in the spring of 1977, each issue of *Isaac Asimov's Science Fiction Magazine* has contained a puzzle from Martin Gardner, dressed up as a brief science fiction tale. This book collects the first thirty-six. Most of them are mathematical, covering a variety of topics — numbers, geometry, games of strategy, combinatorics, simple logic — but a few involve word play and trivia (which name of a US state shares at least one letter in common with the name of each other state?).

Several of the problems are well-known chestnuts (such as the seventh about an even number of people shaking an odd number of hands in a social encounter, or the nineteenth, which is a version of the water-and-wine mixing problem); some are straightforward for a mathematical reader. But others are new and challenging. For example, the ninth puzzle concerns the organisms *toroidus klonefakus* that have the shape of a torus and divide like cells. Sometimes this division results in linked specimens; three, for example, may constitute a set of Boromean rings in which no two but all three are interlocked. The reader is asked to imagine how a larger colony could be linked in a circular chain in such a way that, if one is eaten by a predator, all the rest can swim free. Some puzzles touch on interesting research questions.

As you would expect in a Martin Gardner book, the author follows up the puzzles with solutions, comments from readers, discussions, generalizations, references to the literature, and ancillary problems. Readers turning to solutions in the "first" answer section will often be led to an investigation consummated in a "second" answer section, which in some cases, will lead to a "third" answer section. There is a two-page bibliography of other recreational books.

Apart from feeding my own pleasure, I anticipate using certain problems in my courses, particularly one for undergraduates who plan to go into school teaching. Seasoned with Gardner's wry whimsy and zest for the incongruous, this monograph would provide enjoyment for quite a general audience.

Machine Proofs in Geometry. Automated Production of Readable Proofs for Geometry Theorems,
by Shang-Ching Chou, Xiao-Shan Gao and Jing-Zhong Zhang,
published by the World Scientific (Series on Applied Mathematics, Vol. 6), 1994, ISBN 981-02-1584-3, hardcover, 461 + xvii pages, $96.00 (U.S.).
Reviewed by **Maria Hernandez Cifre**, *Universidad de Murcia, Spain.*

In this book, the authors Chou, Gao and Zhang present an automated method for proving theorems in Geometry. They have developed a technique which produces short and, most important, readable proofs for hundreds of geometric statements in plane and solid geometries. They have also implemented this method in a computer program which produces the full proof of the different theorems.

When we are trying to learn or teach Classic Geometry, the basic geometric concepts (such as points, lines, circles, angles, ...) are easily understandable; the main difficulties appear when we want to prove geometric results by using logical reasonings to justify them, because there exist no methods or algorithms that can be useful to solve most problems. Each proof requires particular tricks that lead to the solution. One of the main contributions of this book is precisely the fact mentioned above: to give a systematic method that produces *easily readable* proofs, even for extremely difficult theorems in Geometry.

The main tool used by the authors is the *area method*. This technique is one of the oldest and most effective in plane geometry; Pythagoras' Theorem was first proved using the areas of triangles. The authors recognize the generality of this method, and develop it into a systematic way for solving very different types of geometric problems.

The book starts introducing the main geometric concepts and results that will be necessary for the rest of the book at an elementary level: Signed Areas, Pythagoras Difference, Full-Angles, the Co-side and Co-angle Theorems and the classic Area Method. The authors present also in this first part many interesting examples, classical geometric theorems which are proved by the new method. One of the facts that makes this book attractive and readable is the use of many examples to help provide easier and more understandable text.

In the following parts, the authors mechanize the area method in an algorithmic way, introducing it step by step: first they consider geometric problems involving just collinearity and parallelism (that is, statements in affine geometry). Later, perpendicular lines and circles are included (statements in metric geometry). The last part of the book is dedicated to developing this *mechanical theorem proving method* in Geometry of dimension three, showing also that this method works not only for Euclidean Geometry, but also for non-Euclidean Geometries, such as the Geometry of Minkowski.

The book concludes with a collection of 400 theorems in plane geometry which have been proved by a computer program based on the method that the authors have developed in the first part of the book. The simplicity of the proofs obtained can be checked in this last chapter, illustrating the great efficiency and the power of their method. But at the same time, these mechanical proofs can be easily understandable. This fact helps the readers to design such proofs by themselves when they need to solve difficult problems in Geometry.

Farewell

My three year appointment as Book Reviews Editor ends with the publication of this month's Crux. It has been fun.

I would like to take this opportunity to acknowledge the many reviewers I have dealt with during my tenure; their efforts have provided us with quite a variety of interesting and useful reviews. I also wish to single out one person for special thanks — Jennifer Keir in the Computer Science Department at the University of Waterloo. Jennifer's expertise in LaTeX combined with her sharp proof-reading eye have made my job an easy one throughout: her continued support is much appreciated.

Alan Law

Welcome

We look forward to the next Book Reviews Editor, John Grant McLoughlin.

John has considerable experience in the Canadian problem solving community, with time spent in Waterloo, Labrador City, Corner Brook, Buffalo and Kelowna, before taking up his present appointment in the Faculty of Education at Memorial University. We take this opportunity of welcoming John "on board".

Bruce Shawyer