Further problems of entertainment

David Singmaster

Wheels, Life and Other Mathematical Amusements.
By Martin Gardner.
W. H. Freeman: 1984. Pp.261.
$15.95, £15.95.

MARTIN Gardner's fans, many of whom have been suffering withdrawal symptoms since his retirement from *Scientific American*, can take some comfort in the fact that the books of his collected columns are several years behindhand. *Wheels, Life and Other Mathematical Amusements* is his first collection since 1979 and covers the years 1970–1972.

Gardner's columns invariably attracted many other people to work on the problems he discussed and their results would be reported in later columns. In previous collections, such material was generally simply appended to the original article. However, the great lapse of time from the initial appearance of these articles has required much revision and addition to many of them, sometimes as long as the originals. Indeed, there is a whole new chapter on the Game of Life. Thus there is more new material in this collection than one would have expected.

Among the highlights is the account of non-transitive dice. One makes a set of four peculiarly numbered dice called A, B, C, D. These are used in a game where two players throw a die and the die with the larger number wins. Then die A is better than B, which is better than C, which is better than D, which is better than A! If you generously allow your opponent to pick his die first, and you pick the preceding die in the cycle, then you have a 2/3 chance of winning.

Rather different is "A Set of Quickies". Here Gardner has included one of his own problems: what is the largest number of unit cubes which can touch a unit cube properly (that is, with some portion of common face)? Gardner gave a solution with 20 cubes and was surprised to get solutions with 22, 23 and 24 cubes. Whether 24 is maximal remains an open question. "Advertising Premiums" covers a variety of classical puzzles — especially those of Sam Loyd, who invented the Trick Donkeys, the Pony Puzzle, the Pencil on a Loop of String and Get off the Earth — while another chapter includes Charles Addams's Skier. The Addams cartoon shows a skier whose two tracks pass on either side of a tree. If you found such ski tracks, could you give at least six possible explanations?

Finally, three chapters deal with John Conway's Game of Life, which was first published by Gardner and promptly consumed many hours of computer time, even generating a newsletter which ran for several years. A further chapter contains new material and brings the story up to date.

If you know Gardner's works, you will need no encouragement to buy this book; if you don't, you will find it a delightful introduction to the most popular mathematical writer of our time. □

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Chemist's wood

Gavin S. Hall

Wood: Chemistry, Ultrastructure, Reactions.
By D. Fengel and G. Wegener.
Walter de Gruyter: 1984. Pp.613. DM 245.

Wood, the main title (and indeed the only title on the spine) does not give much of a clue as to the subject matter and scope of this substantial book. The sub-title, however, provides an accurate pointer to the contents which deal primarily with the chemical characteristics of wood — the ligno-cellulosic raw material of which trees and shrubs are composed. As would be expected with such an important resource, the subject is already well documented and there are a number of books on the subject. The authors acknowledge this fact and state as their aim the presentation of a comprehensive account of progress in wood chemistry based on information published between 1960 and 1982. Their book therefore builds on earlier, standard works such as *Wood Chemistry* by L. E. Wise and E. C. Jahn (Reinhold, 1952), *The Chemistry of Lignin* by F. E. Brauns and D. A. Brauns (Academic, 1960) and *The Chemistry of Wood* by B. L. Browning (Interscience, 1963).

Of the 18 chapters, averaging some 30 pages each, six are devoted to chemical composition, constituents and ultrastructural relationships. One of these deals with the often neglected but increasingly significant component of forest crops — bark, and gives a concise account of its general anatomy and chemical composition. Two further chapters deal with the structure and ultrastructure of wood from the chemist's viewpoint. The second half of the book concerns itself with the reactions of wood in relation to environmental factors, such as light, heat and micro-organisms, acids and alkalis, and then with industrial processing for pulp and chemical derivatives.

One of the notable features is the list of references found at the end of each chapter. Some idea of the thoroughness with which the authors have undertaken their task can be gauged by the fact that in all there are some 2,900 citations (or 160 per chapter). If trying hard to find fault, one might have asked for more obvious critical analysis and interpretation of the source material. However, overall this is a very competent, readable review of the literature, one produced by acknowledged specialists in the field. The style and form of presentation are such that newcomers will be stimulated to delve deeper into the various subject areas, a process greatly facilitated by the references to literature surveyed. The linguistic versatility of the authors has clearly enhanced the value of this aspect of the book.

Wood is well-produced, with an appropriate leavening of tabular, diagrammatic and photographic material. It will serve well either as a refresher course for those whose interest or occupations involve wood chemistry, or as a starting point for the student seeking to specialize in the subject. □

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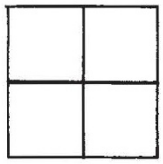
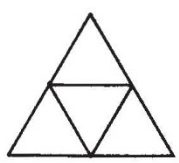
Divisive difficulties from David Singmaster

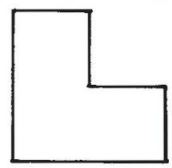
The following problems start from an old chestnut, but have a new twist. The solutions will appear in Nature *of 23 August.*

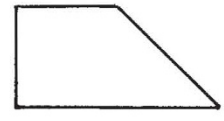
It is easy to divide a square or an equilateral triangle into four congruent areas as shown below.





A. Divide these two figures into four congruent areas.





B. When you have done Part A, try to divide a square into *five* congruent areas.

C. If you find Part B easy or you already know the solution, then find another solution which is not symmetric to the first solution. (Hint: many people will consider the other solutions unacceptable! It is not known if any "acceptable" solutions exist.)