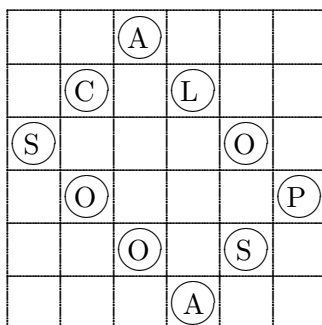


Preface

I love Japanese seafood. When I solve or compose puzzles, I often have with me a 6×6 plate containing 36 *sushi* pieces, a pot of *matcha* (Japanese tea) and a dish containing two kinds of *wagashi* (Japanese pastry), *mochi* pieces which are sweet rice cakes and *yokan* pieces which are red bean gelatins. It is a total cultural immersion.

When I look up after a while, I discover that only ten sushi pieces remain, as shown in the diagram below.



S = Scallop **C** = Crab **A** = Abalone
L = Lobster **O** = Oyster **P** = Prawn

These are the only kinds of sushi pieces on the plate. I remember that originally, each row and each column contains six different pieces of sushi. Moreover, if the plate is divided into six 2×3 sections or six 3×2 sections, each section also contains six different pieces of sushi. I wonder what kinds of sushi the other pieces are. Then I realize that I have composed a new puzzle, solved later in this Preface.

I love Japanese puzzles. For a variety of reasons, including historical, geographical, political and linguistic, our puzzle culture has been developed in relative isolation. Our puzzles tend to have a distinct flavor from those in the west. There, the scene of recreational mathematics is dominated by the work of the Englishman **Henry Ernest Dudeney** and the American **Sam Loyd**, promoted strongly by the great **Martin Gardner**. Their influence is felt in Japan, but not to a great extent. Thus this book may offer a refreshing perspective.

A significant event in the history of recreational mathematics in Japan was the founding of the **Academy of Recreational Mathematics, Japan** in 1979. I was among the founding members, along with the great **Nobuyuki Yoshigahara** (fondly known as just **Nob**) and my close friend **Naioki Takashima**. I am the current president of the Academy.

The Academy holds a monthly meeting to which members bring their latest compositions and acquisitions. *Konwakai News*, which is the monthly bulletin of the Academy, begins every issue with a photographic report of the most recent meeting. The remaining pages contain other contributions from members. It is not a public journal but a private newsletter, as much of its contents have potential commercial value, especially in Japan.

The existence of the Academy and *Konwakai News* is therefore not well-known, even in Japan. **Andy Liu**, one of the few foreign members of the Academy, persuaded my friend **Tadao Kitazawa**, a regular contributor to the *Konwakai News*, to publish some of his creative efforts in English. Andy undertook the task of editing along with **George Sicherman** (of the Sicherman dice fame).

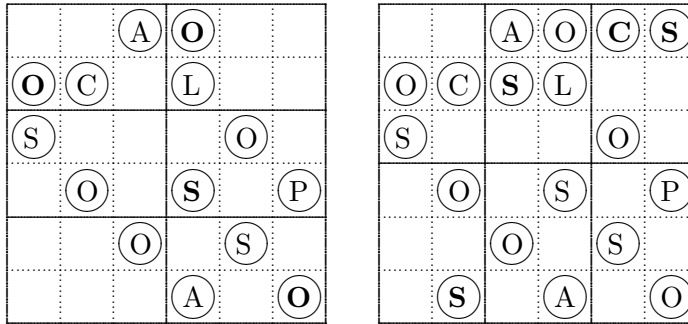
The result is the book *Arithmetical, Geometrical and Combinatorial Puzzles from Japan*, published in 2021 by the American Mathematical Society in partnership with the Mathematical Association of America. Although he has yet to meet Tadao in person, Andy has crossed paths with me many times, at the **International Puzzle Party** and the **Gathering for Gardner**. Discussion began about doing another book, this time based on my puzzles.

Tadao did not join the Academy until 1999, and his book contains his contributions over a twenty-year period. For me, the time span is approximately double that. Eventually, Andy decided to cover my puzzles also from 1999 on. The earlier material may have to wait for another volume.

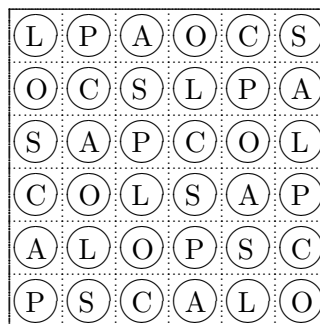
The raw materials for this book are my contributions to *Konwakai News*. Although I have published many puzzle books in Japanese, the present volume is not a straight translation of any of them.

This book is based directly on my contributions to various issues of the bulletin, largely independent of one another, though some themes recur after an interval, perhaps more than once.

I now give the solution to my puzzle about the 36 sushi pieces.



The diagram above on the left shows the partition of the tray into 2×3 sections. Four more pieces may be identified. The diagram above on the right shows the partition of the tray into 3×2 sections. Another four pieces may be identified. It is now easy to complete the identification of the other pieces, as shown in the diagram below.



This puzzle has been well received. Encouraged by its success, I now offer the reader more tasty morsels in a three-course feast of Japanese seafood. See the **Menu** on page v.

I am grateful to Andy Liu who has taken on the enormous task of sorting the material into coherent parts. This often necessitates changing the storyline. He also draws the diagrams.

I am grateful to **George Sicherman** for his meticulous scrutiny of Andy's prose and ironing out various mathematical and linguistic idiosyncrasies. He also employed his superb skill in computer programming to check the answers, improving many of them, as well as generating alternative solutions.

I am grateful to **Toshihiro Kawamata** for an interview which I thoroughly enjoyed. Toshi also contributed significantly in the translation process, along with **Shinto Kai**. Shinto went to Edmonton, Canada as a teenager, completed his high school education, and is currently an undergraduate student in mathematics and finance at the University of Alberta.

I thank **John Lorch** and his Spectrum committee of the Mathematical Association of America for their constructive criticisms and advice. I thank **Tom Sharland, Loretta Bartolini, Sergei Gelfand** and other staff members of the American Mathematical Society, for their encouragement as well as administrative and technical support. In particular, I thank graphic artist **John Brady** for his evocative cover design.

Yoshiyuki Kotani, March, 2024.

Andy Liu
1947–2024

In March 2024, while the proof of this book was being checked, Andy Liu passed away. He loved mathematics and devoted his life to speaking and writing about it. We enjoyed working with him, for he was always respectful of others and open to their ideas. We mourn his loss.

Yoshiyuki Kotani
Toshihiro Kawamata
George Sicherman

Introduction

The puzzles have been organized into three main parts: combinatorial, arithmetical and geometrical. They are presented under **Crab**, **Abalone** and **Lobster** respectively. There are three other chapters. Chapter 0 (**Scallop**) contains nine puzzles to whet the readers' appetite. Chapter 11 (**Prawn**) contains eighteen puzzles to stimulate the readers' thirst for more. Chapter 10 (**Oyster**) presents to the readers eleven puzzles arising from the International Seafood Festival.

The book contains several large blocks of similar puzzles. We have considered trimming them down, but in the end decided against that. These puzzles have appeared in large numbers because there are readers who clamor for more. Those who feel that enough is enough can simply move on. There is no obligation to try every puzzle. For these puzzles, we have supplied only answers, to avoid excessive repetition. Elsewhere, we try to provide complete solutions as far as possible.

The reader can get much more out of this book in the following ways.

1. Where no solution is provided, look for the ideas behind the puzzle.
2. Where a solution is provided, look for other ideas for solving the puzzle.
3. Not all the answers provided are unique. Seek others.
4. Some of the answers may not be optimal. Seek better ones.
5. Try varying the conditions of the puzzle — sizes, limits and rules — to create new puzzles.
6. Try creating wholly new puzzles inspired by the ideas here.

Toshihiro Kawamata,
Andy Liu,
George Sicherman,
March, 2024.