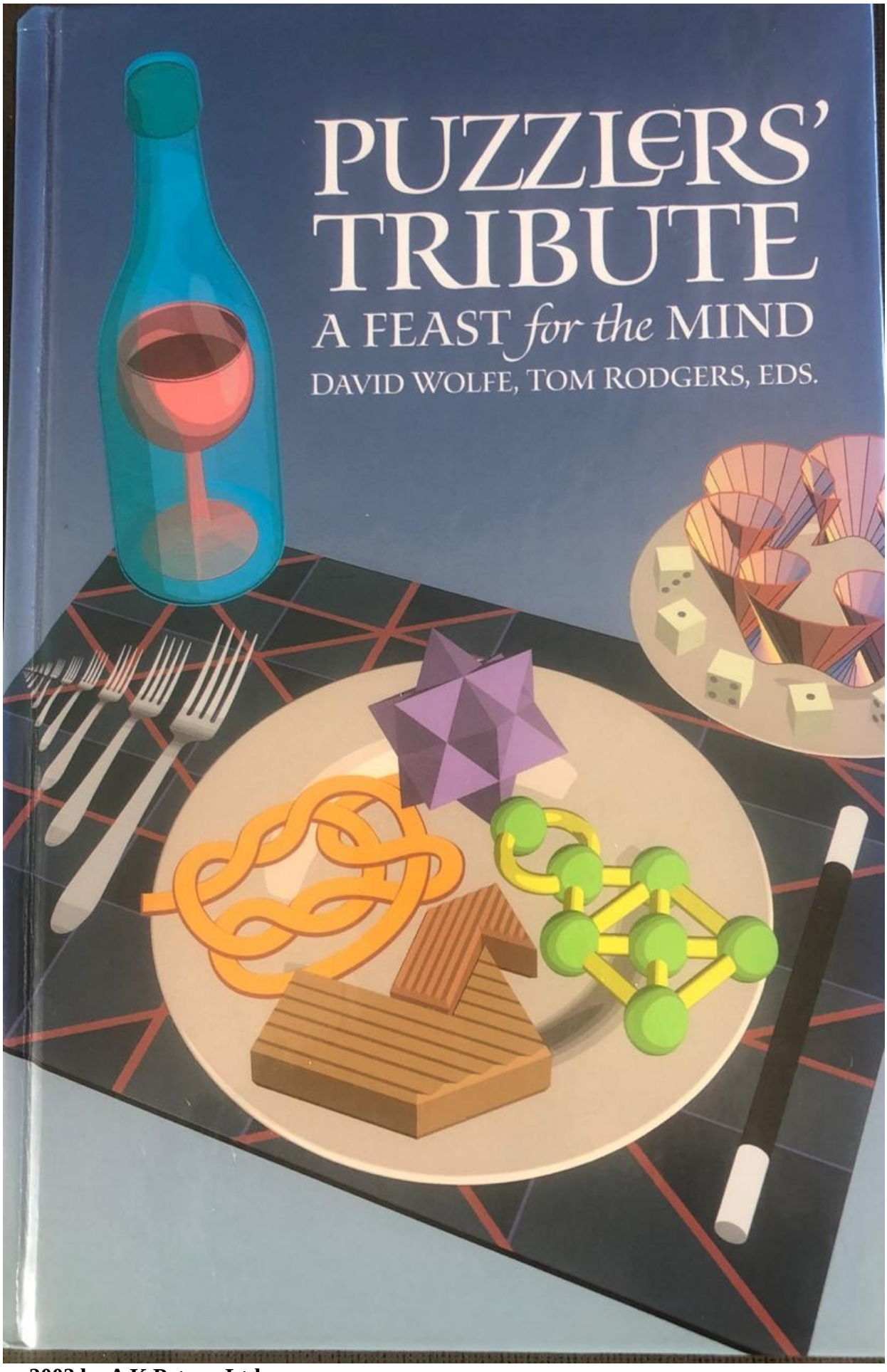

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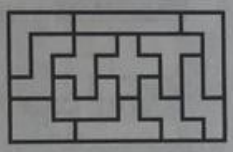
Inflated Pentominoes

Rodolfo Kurchan

In October of 1994, in the first issue of my magazine, *Puzzle Fun*, I presented the "Inflated Pentominoes." I believe this is a very rich topic, still open to investigation.[1]

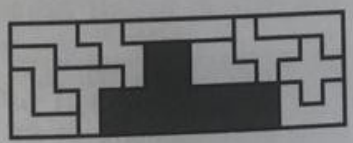
A complete set of 12 pentominoes has a total area of 60 squares and it is possible to make 4 different rectangles, the 3×20, 4×15, 5×12 and 6×10. For example, here is a 6×10 rectangle with the 12 pentominoes.



If some of the pentominoes are inflated, more rectangles are possible. In each of these problems, your goal is to use each of the 12 pentominoes exactly once. (You are free to rotate the pentominoes or flip them over.)

In a *double* inflated pentomino, each square of the pentomino becomes a 2×2 square. For a *triple*, each square becomes a 3×3 square and so on.

1. One Double With one double pentomino and 11 single pentominoes we have an area of 75 squares and we can make some 5×15 rectangles. Here is one example found by Brian Barwell.



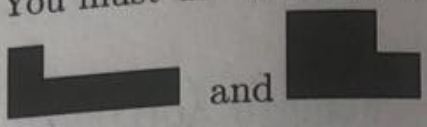
See if you can find others.

Rodolfo Kurchan is the author of *Mesmerizing Math Puzzles*, Sterling Publishing (2001).

[1] The reader will find a large collection of polyomino and other puzzles in issues of my magazine published on-line [Kur].

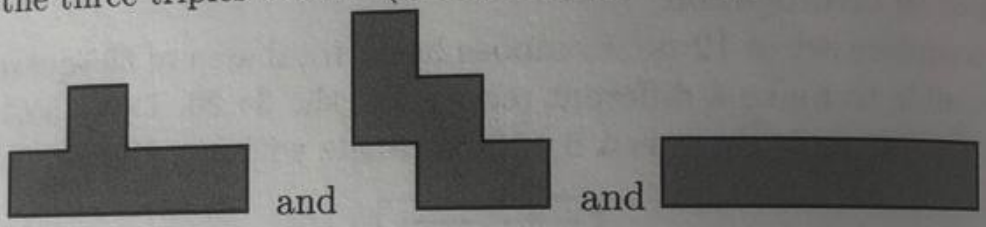
2. More Doubles Maarten Bos found by computer all the different possible solutions for rectangles using single and double pentominoes.

   There is only one solution using 2 double and 10 single pentominoes in a 5×18 rectangle. See if you can find it. (See solution on page 228.) Hint: You must use these two double pentominoes.



3. Single and Triple It is also possible to find solutions using only single and triple pentominoes. See if you can find one. (A 10×10 solution using one triple pentomino is found on page 228.)

4. Double and Triple It is not easy to find solutions using only double and triple pentominoes. See if you can find a 15×21 rectangle using the three triples below. (Solution page 229.)



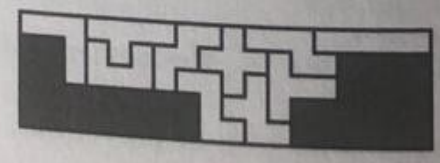
5. Single, Double and Triple See if you can find a rectangle using single, double and triple pentominoes. (Two 10×13 rectangles, one 15×15 and one 15×30 rectangle are shown on page 229)

6. Different sizes The goal here is to make a rectangle using the 12 pentominoes using as many different scaled factors as possible.

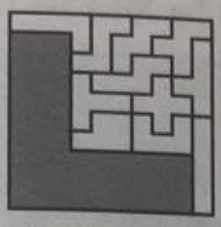
   Michael Reid found a 4-level solution using 1 single, 2 doubles, 8 triples and 1 order 6. I was able to modify his solution to make a 5 level solution using 1 single, 2 doubles, 3 triples, 5 order 6 and 1 order 12. It's an open question whether one can do better. (These two solutions are found on page 230.)

Solutions

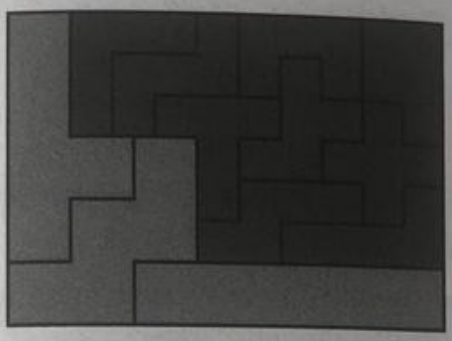
The 5×18 rectangle due to Maarten Bos.



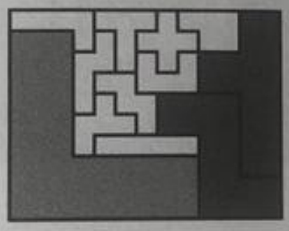
A 10×10 rectangle using one triple pentomino due to Jaime Poniachik.



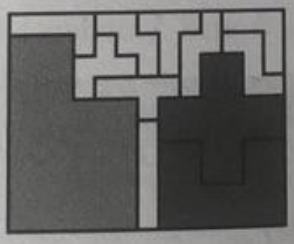
Here is a solution using 9 doubles and 3 triples in a 15×21 rectangle by Federico Di Francesco.



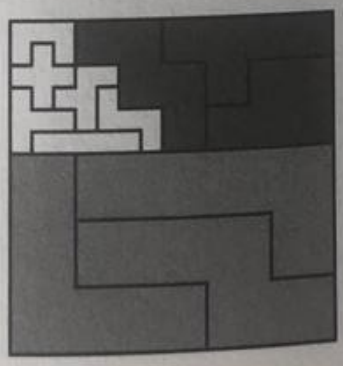
A 10×13 rectangle using 9 singles, 2 doubles and 1 triple pentomino.



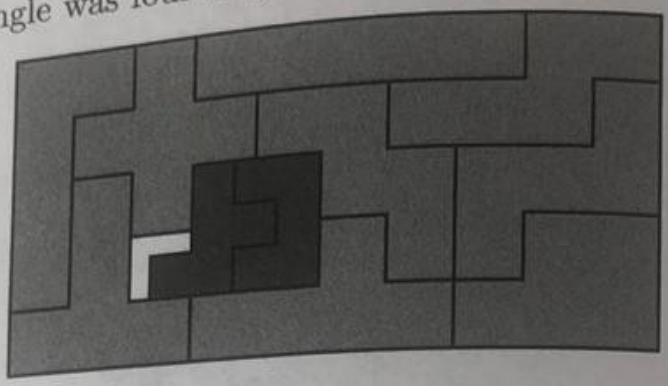
Another solution due to Pieter Trobijn.



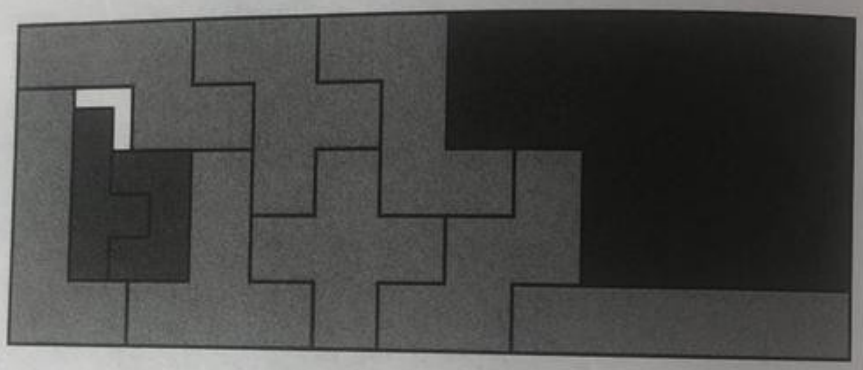
Here is a 15×15 rectangle using 6 singles, 3 doubles and 3 triples.



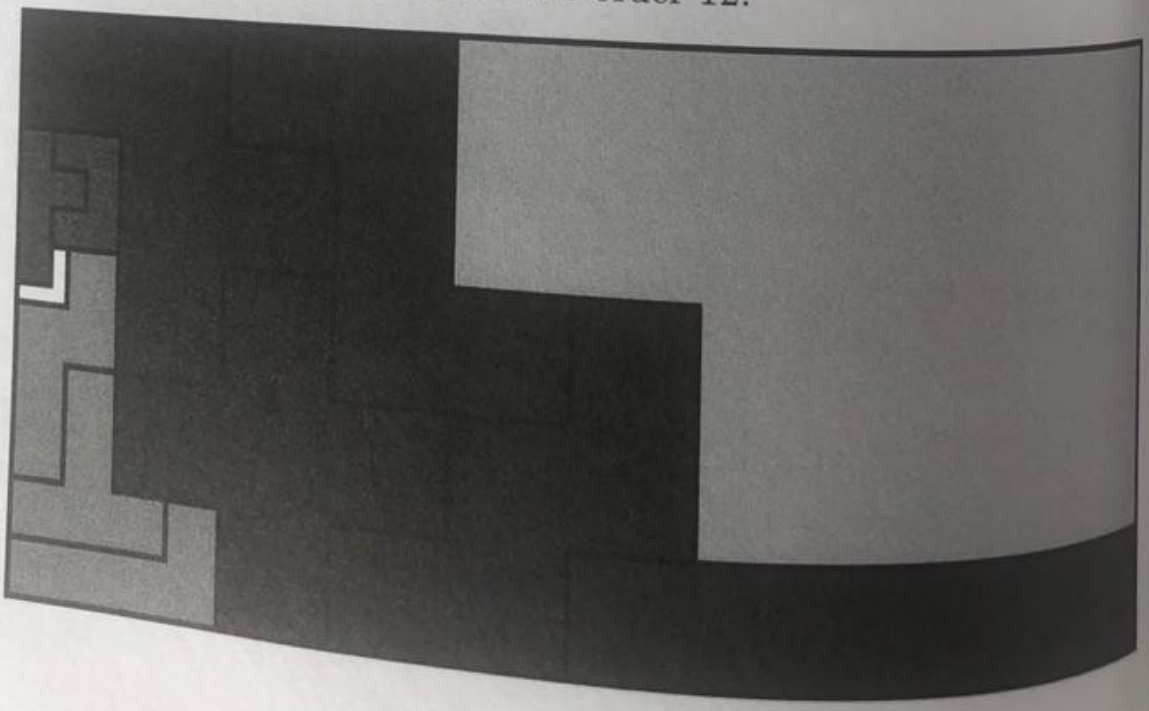
This solution using 1 single, 2 doubles, and 9 triples pentominoes in a 15×30 rectangle was found by Michael Reid.



Michael Reid found a rectangle using four sizes of pentominoes, 1 single, 2 doubles, 8 triples and 1 order 6.



I modified Reid's solution to obtain five sizes of pentominoes, 1 single, 2 doubles, 3 triples, 5 order 6 and 1 order 12.



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[Gol94] Solomon Golomb. *Polyominoes: Puzzles, Patterns, Problems, and Packings.* Princeton University Press, Princeton, New Jersey, 2nd edition, 1994.

[Kur] Rodolfo Kurchan. *Puzzle Fun.* Bulletin. Issues 1–5 and the extra of August 1995 by Maarten Bos discuss inflated pentominoes. http://www.bigfoot.com/~velucchi/pfun/pfun.html.