Cubism For Fun

The Silver CFF

CONTEST 4

Hexomino Rectangles

by Rodolfo Marcelo Kurchan

1. *What is the maximum number of rectangles that can be constructed with pieces from the complete set of 35 hexominoes (*)*
   a) If all 35 pieces must be used
   b) If not necessarily all 35 pieces must be used

2. *What is the maximum number of rectangles that can be constructed with pieces from the set of hexominoes from which the straight hexomino is omitted*
   a) If all 34 pieces must be used
   b) If not necessarily all 34 pieces must be used

Each rectangle must at least have *two* pieces, but it is *not* required that all rectangles are of the same size (this in contrast with the conditions for an other problem, recently proposed in *JRM* [1]).

Send your complete solutions before *1 March 1991* to the Editor of CFF.
Correct solutions might be rewarded with one of the following puzzles:

1) "VVV" Puzzle
(a variant of the 12-Magic, the Master Edition of Rubik's Magic)
2) "Intelligence Compass"
(a variant of Rubik's Clock)
3) "Magic 8"
(a variant of "Hungarian Rings")

If the number of correct solutions exceeds the number of available prizes, the winners will be assigned by lot.

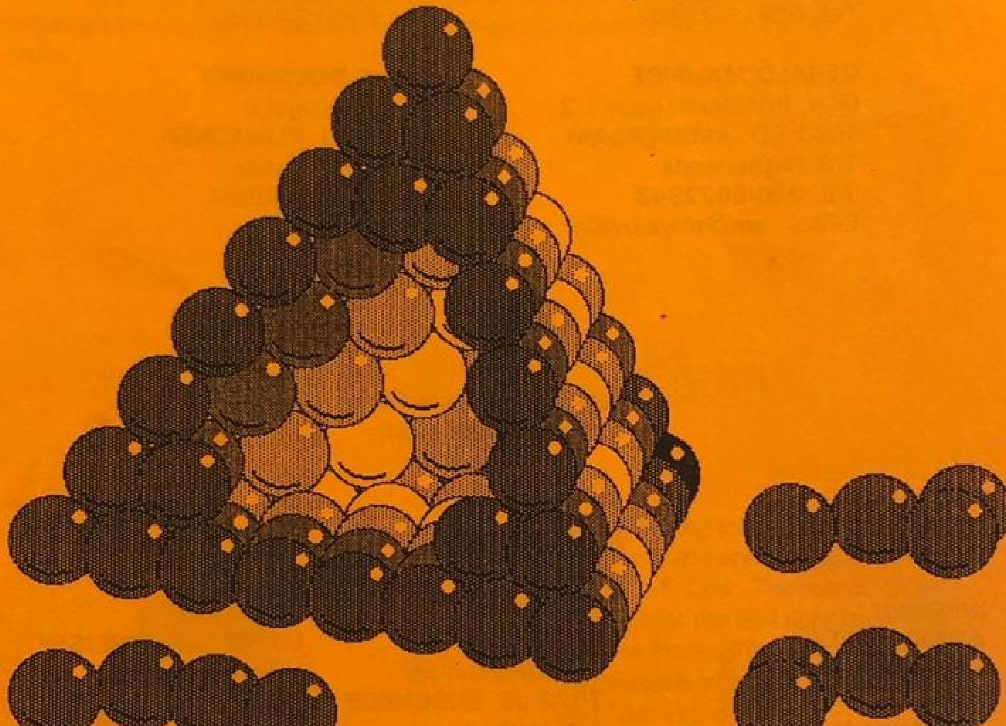
Rodolfo Marcelo Kurchan
Buenos Aires, Argentina

Reference.

[1] Rodolfo Marcelo Kurchan *"Hexomino Rectangles"* Problem 1774. Journal of Recreational Mathematics 22(1990) No 1, pp 65-67

(*) Editors Note. The shapes of the 35 hexominoes are depicted in the rectangle filling shown in Contest 5 on next page.

CFF
CUBISM FOR FUN



31

JUNE 1993

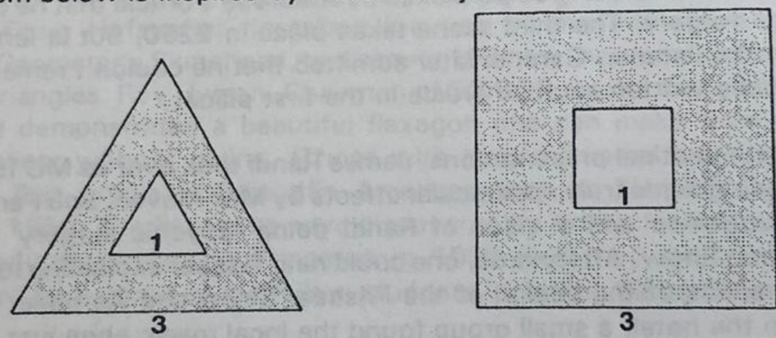
CFF, Heemskerkstraat 9, NL-6662 AL, ELST

NEW CONTEST **21**

Holey Polygons

by Anton Hanegraaf

The problem below is inspired by Pieter Torbijn and Rodolfo Kurchan.



Each of the figures shown above can be dissected into five pieces which can be rearranged to form a similar shape (side $\sqrt{8}$) without a hole.

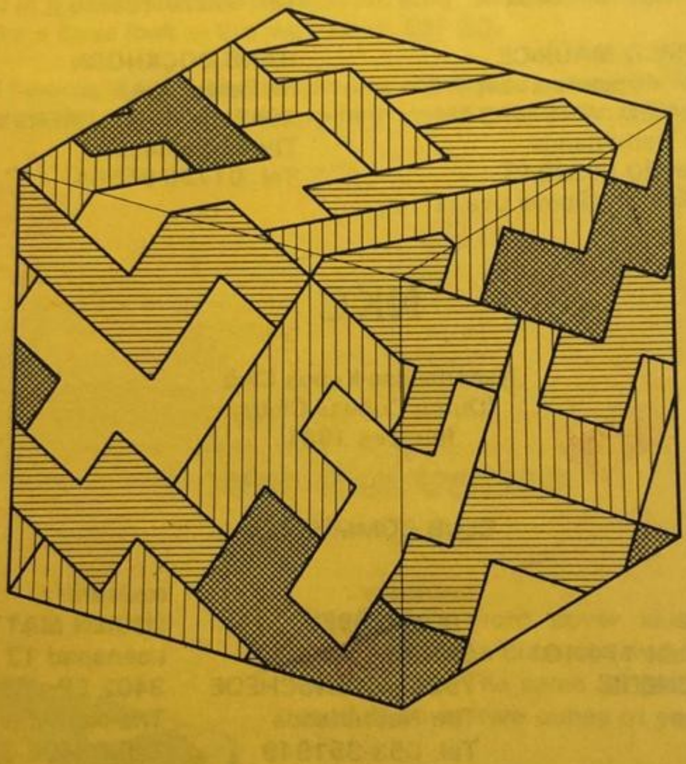
A. How should these dissections be done?
B. For which special ratios can dissections be found that require less than five pieces?

Send your solutions before August 15th to the Editor of CFF. Three prizes are available for the most complete solutions. Prize winners will be invited to choose a prize from CFF's list of attractive prizes.

Anton Hanegraaf
Elst, The Netherlands

Editor's note: The results of contests 16 to 21 will be published in CFF 32. Prize winners will be informed in advance.

CFF
Cubism For Fun



30

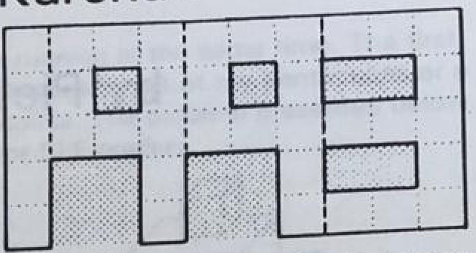
DECEMBER 1992

CFF, Heemskerkstraat 9, NL-6662 AL, ELST

NEW CONTEST 20

A 1993

by Rodolfo Kurchan



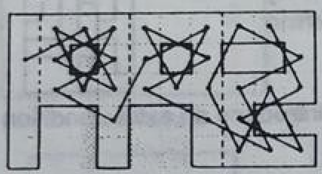
20A. With a bit of imagination, the number 1993 may be seen in the figure on the right. It consists of 36 unit squares. Considering the figure as a connected entity, I suggest the following problems:

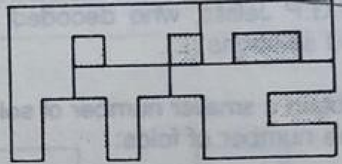
20A1. If we suppose that the unit squares belong to a chess board, what is the maximum number of successive knight's moves?

20A2. What is the minimum number of pieces in which the figure must be dissected in order to rearrange them into a 6x6 square?

I illustrate these questions by giving solutions to the corresponding questions, concerning 1992. The answer to the first question is 27, to the second 4.

28 0





Can these results be equalled or improved upon for the 1993 problem?

Rodolfo Kurchan
Buenos Aires, Argentina

B 1993

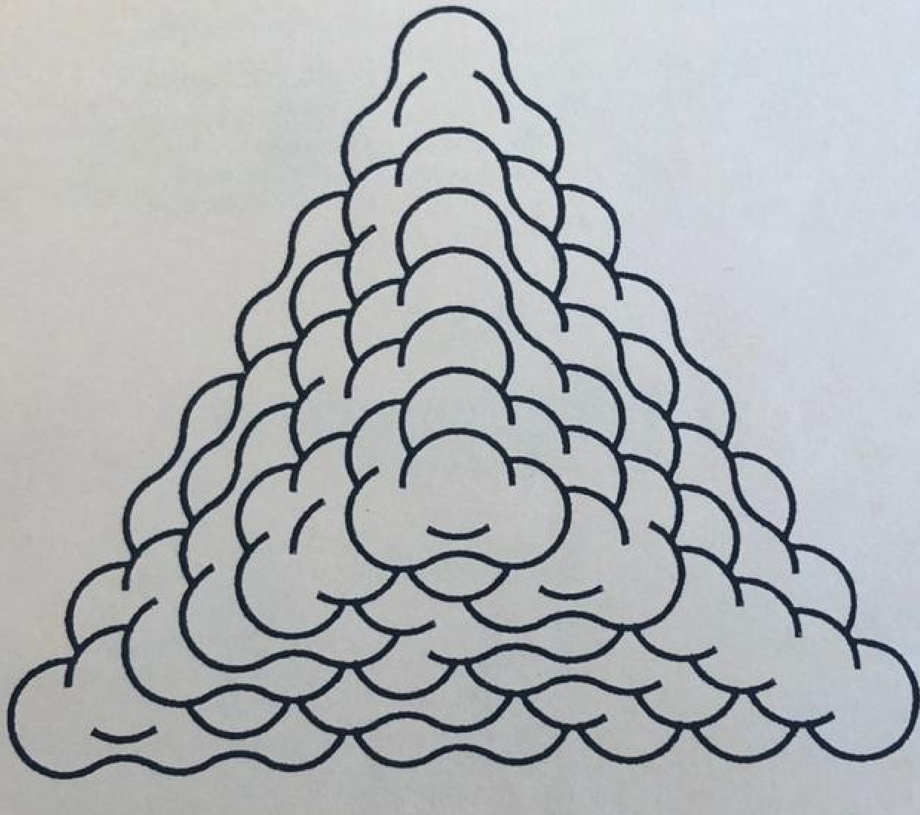
by Bob Kootstra

$$\sqrt{\frac{\bullet\bullet\bullet\bullet}{\bullet\bullet\bullet}} = 1.9931993\text{xxx}$$

20B. Replace the dots by digits, such that the answer is correct for the given decimals. Subsequent decimals may take any arbitrary value.

Bob Kootstra
Roosendaal, The Netherlands

CFF
Cubism For Fun



32

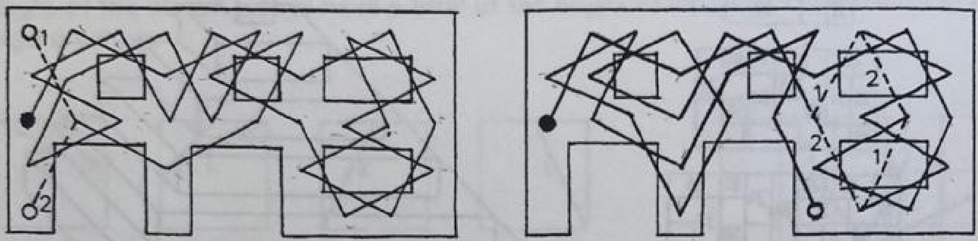
AUGUST 1993

CFF, Heemskerkstraat 9, NL-6662 AL, ELST

1993

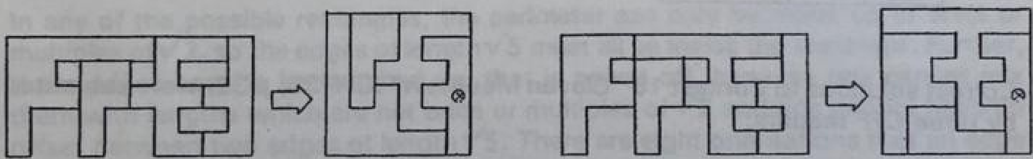
by Rodolfo Kurchan and Bob Kootstra

Part A1. Much to my own surprise I learned that my 1993 knight's moves problem has a maximum of thirty moves. Pieter Torbijn by hand and Hans van der Zijden, Jan de Ruiter and Michael Reid by computer submitted one or more solutions. According to Michael Reid the total number of different solutions is 28 and they all start on the same square. Some of these solutions are shown below.



Hans van der Zijden and Jan de Ruiter both remarked that my solution given for the similar 1992 problem was incorrect: here 30 moves is possible as well.

Part A2. The 1993 dissection problem has two four piece solutions, very similar to each other.



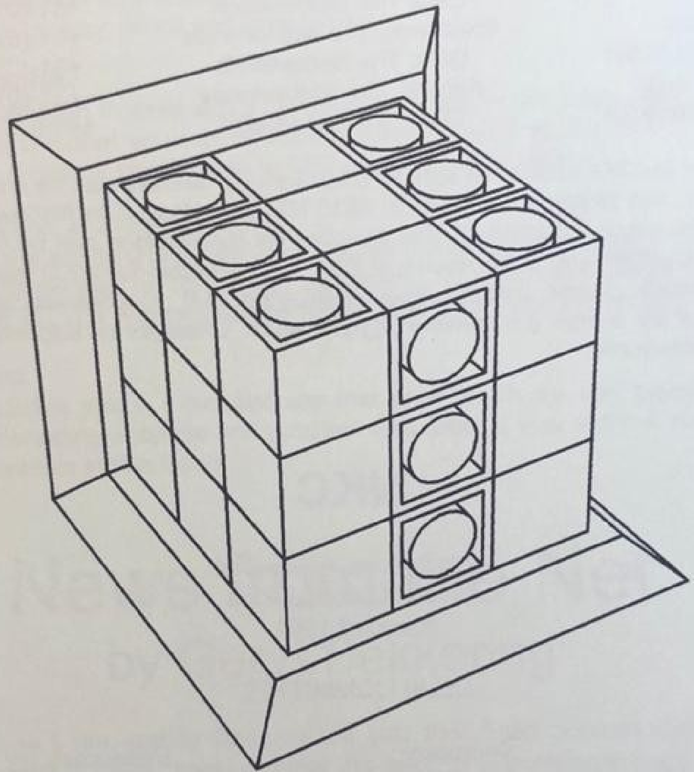
The first was found by Pieter Torbijn, Tony Fisher and Michael Reid. The only one who found the second solution was Jan Slim.

Rodolfo Kurchan

Part B. The solution to the 1993 arithmetic problem is $\sqrt{(2487/626)}$ = 1.9931993... The easiest way to find this is to use continued fractions, but an exhaustive search by hand or on a pocket computer works as well. All competitors solved this part correctly.

Bob Kootstra

CUBISM FOR FUN



42

FEBRUARY 1997

CFF, van Hogendorpstraat 75, 2515 NT Den Haag

NEW CONTEST 30

Pentominoes on an 8×8 Square

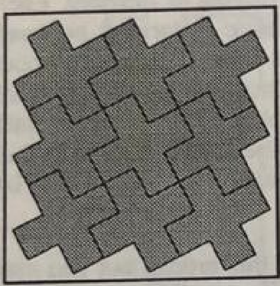
by Pieter Torbijn and Rodolfo Marcelo Kurchan

In this contest we wish to propose the following two problems:

1. Place the *least possible* number of identical pentominoes on an 8×8 square, in such a manner that no other copy of the same pentomino could be added.
2. Place the *maximum* number of identical pentominoes in an 8×8 square.

For both problems one should distinguish the following three cases:

A. The pentominoes may not touch each other, not even at a corner.
B. The pentominoes may touch each other at the corners only.
C. The pentominoes may touch each other completely.



For all these problems, a required condition is that the edges of the pentominoes must be parallel to the sides of the square. An **"oblique"** covering as the one you see here on the left with **X**-pentominoes **is not permitted**. (We found this tricky arrangement for the maximum problems in [1].)

Table 1 gives our optimal results of problems 1.A to 2.C for all twelve pentominoes (see figure 1). For case 2.C the same results have been published earlier in [1].

Pent.	1.A	1.B	1.C	2.A	2.B	2.C
F	3	3	4	5	6	11
I	3	3	8	5	6	12
L	3	3	6	6	6	12
P	3	4	5	6	8	12
N	2	3	6	5	7	12
T	3	3	4	5	6	10
U	3	3	6	6	7	11
V	3	3	4	5	6	12
W	2	4	6	5	7	12
X	2	3	4	4	6	8
Y	2	3	6	5	7	12
Z	2	3	5	5	6	10

Table 1. Optimum results found by the authors

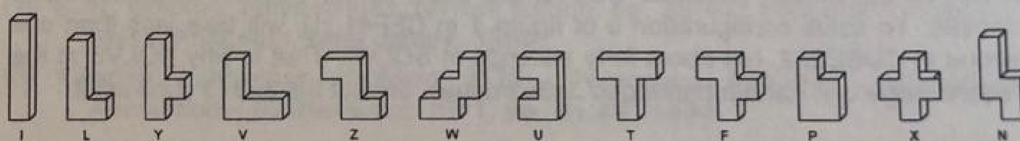


Figure 1. The twelve pentominoes

As an example our solutions for the N-pentomino are shown in figure 2.

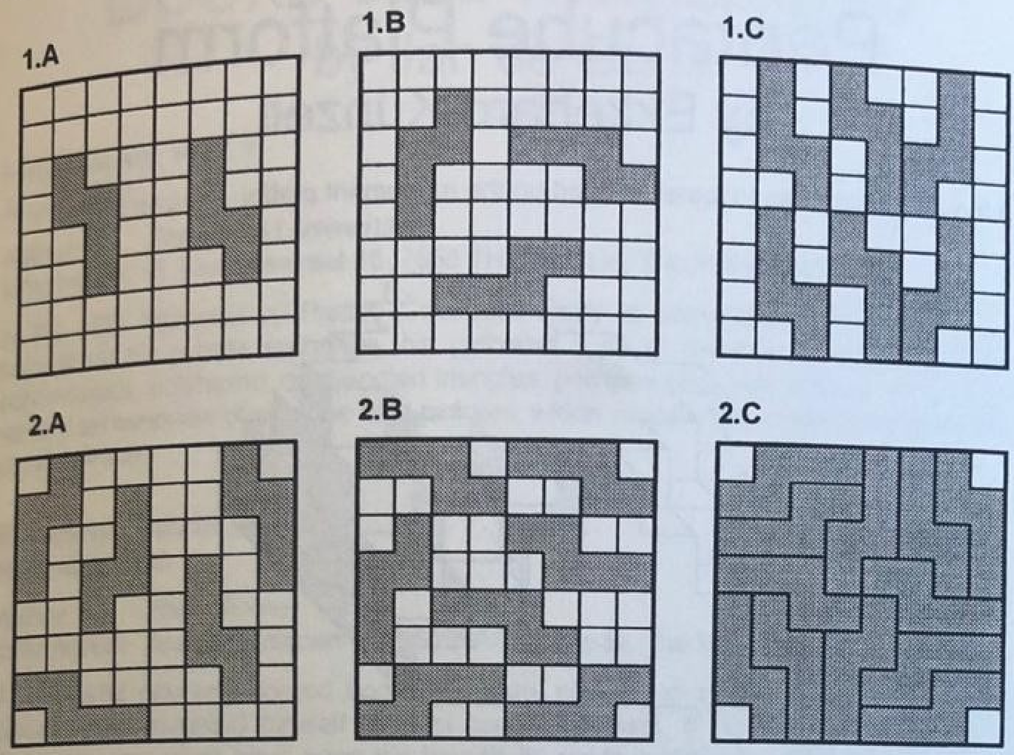


Figure 2. Solutions for the N-pentomino

In this contest you are asked to ***improve or confirm the results in table 1.***

Additional problems

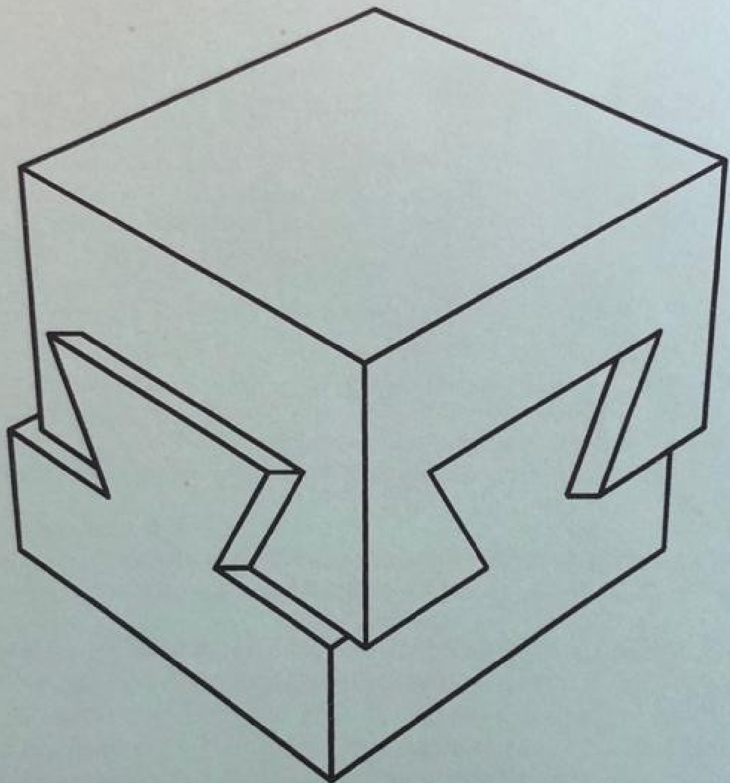
- In the same way as mentioned above, try to fill an *nxn square* with other polyominoes, for instance a 6×6 square with tetrominoes, or an 8×8 square with hexominoes.
- Fill 8×8 squares with as many identical pentominoes as possible, in such a manner that the remaining spaces have the shape of (identical) monominoes, dominoes, trominoes or tetrominoes respectively [2]. In these cases the pentominoes may touch each other, either at corners or completely.

Please submit your results to Rik van Grol, van Hogendorpstraat 75, 2515 NT Den Haag, The Netherlands, before March 31st, 1997. If you have any results for the additional problems, do not hesitate to submit them as well. Three prizes will be available from the CFF prize list. If necessary the prizes will be assigned by lot.

References

[1] Puzzletopia No. 100, Nob's Puzzle Report from Tokyo (1991), p. 100.
[2] Rodolfo Marcelo Kurchan, *Figuras para Divertirse*, Aperiodic Publications/1 (1991), p. 13.

CFF
Cubism For Fun



43

JUNE 1997

CFF, van Hogendorpstraat 75, 2515 NT Den Haag

CONTEST 30 RESULTS

Pentominoes on an 8×8 Square

by Pieter Torbijn and Rodolfo Marcelo Kurchan

The problems posed in contest 30 [1] were to place each of the twelve pentominoes in an 8×8 square under certain conditions. Table 1 of the contest mentioned our results for 72 possible cases. Of these, 69 ones were confirmed, three others could be improved by the three readers who submitted solutions. These three persons arrived at the same conclusions.

All improvements concern to *problem 1.A*, which was stated as follows:

Place the least possible number of identical pentominoes on an 8x8 square, in such a manner that no other copy of the same pentomino could be added. The pentominoes may not touch each other, not even at a corner.

For the F, T and V pentominoes the minimum number of pieces could be reduced from three to two pieces. Solutions are shown in figure 1.

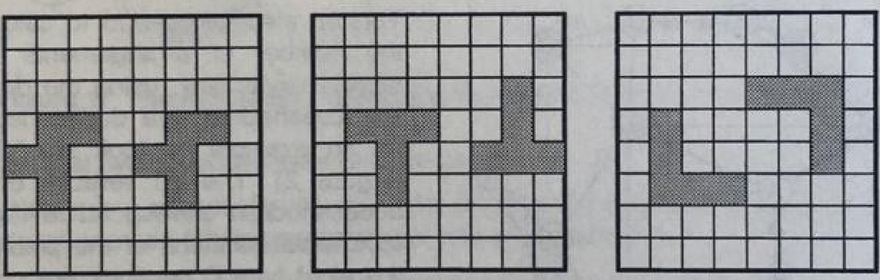


Figure 1. Improved results for the F, T and V pentominoes

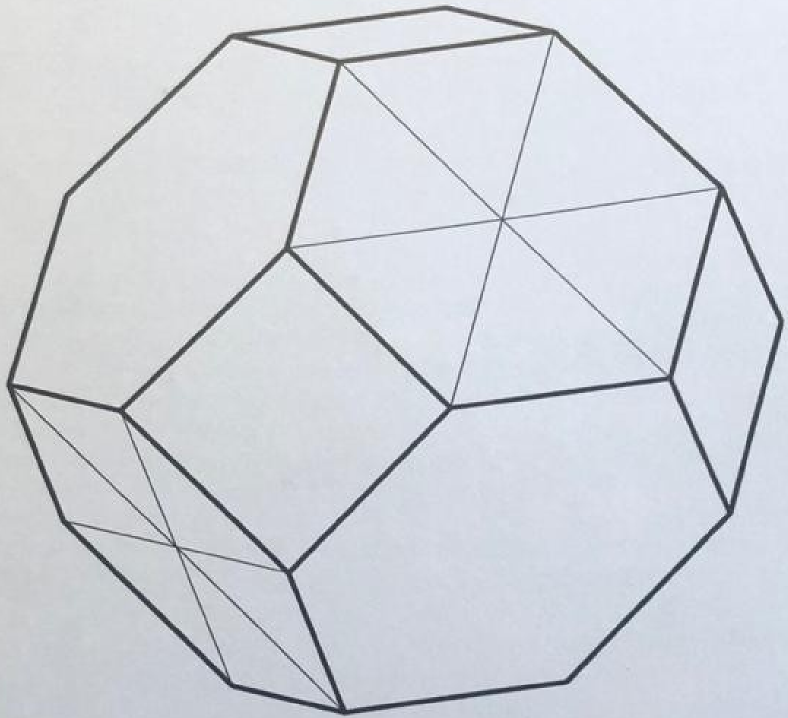
The three readers who sent their results are: Rolf Braun and Christian Holz, both from Hamburg, Germany, and Edward Vanhove from Neeroeteren, Belgium. All three can be considered as the "ex aequo" winners of this contest! Our congratulations to Rolf, Christian and Edward.

Christian Holz has also started to find solutions for the second additional problem mentioned in the contest (filling the 8×8 square with identical pentominoes leaving the remaining space with identical shapes). He announced to send us his results after having finished some further investigations.

Reference:

[1] Pieter Torbijn and Rodolfo Marcelo Kurchan, *Contest 30: Pentominoes on an 8×8 Square*, CFF 42, p. 26

CFF
FOR
CUBISM
FUN



51

FEBRUARY 2000

CFF, Hilvoordestraat 14, 2284 BK Rijswijk

A Natural Triangulation

by Rodolfo Kurchan and Jaime Poniachik

The series of natural numbers is attractive to play with. In search for new challenges we found that the sum of a successive sequence of natural numbers from 1 is equal to the area of a rectangle with edges of natural "length".

For example: the sum of 1, 2 and 3 makes 6, which is in number equal to the area of the rectangle 2×3. Shortly: 2×3 = 1+2+3. So we put ourselves to the task of cutting a 2×3 rectangle in three triangles of respective area 1, 2 and 3 using the intersections of the natural grid as vertices of the triangles. The answer for 2×3 = 1+2+3 as well as for 2×5= 1+2+3+4 can be found in Figure 1.

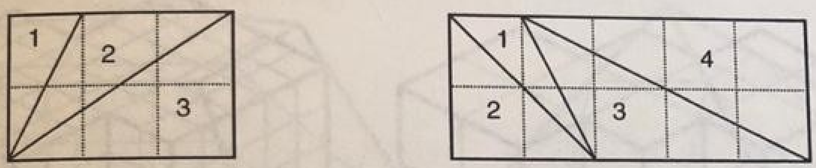


Figure 1. Rectangles 2×3 and 2×5 cut into arithmetical series of triangles

The challenge is taking the following series of triangles up to 9 and finding a natural triangulation for each of their possible rectangles (if it exists — for those underlined we have found a solution), see Table 1.

1+2+3	= <u>2×3</u>
1+2+3+4	= <u>2×5</u>
1+2+3+4+5	= 3×5
1+2+3+4+5+6	= 3×7
1+2+3+4+5+6+7	= <u>4×7</u> = 2×14
1+2+3+4+5+6+7+8	= <u>6×6</u> = 2×18 = 3×12 = <u>4×9</u>
1+2+3+4+5+6+7+8+9	= 5×9 = 3×15

Table 1. The series of triangles from 1 up to 9 and their according rectangles

To raise your enthusiasm a natural cut of a 4×9 rectangle is given in Figure 2.

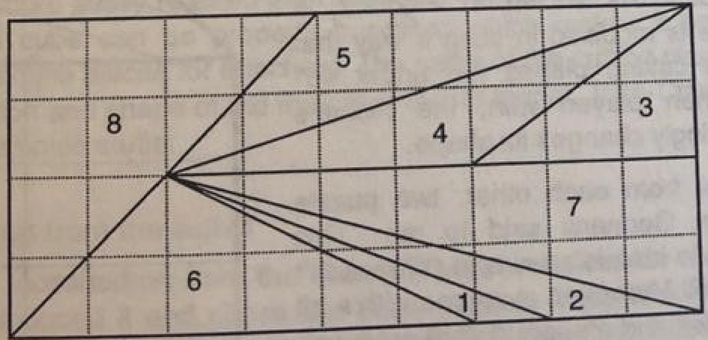


Figure 2. A natural triangulation of the 4×9 rectangle

Have fun!