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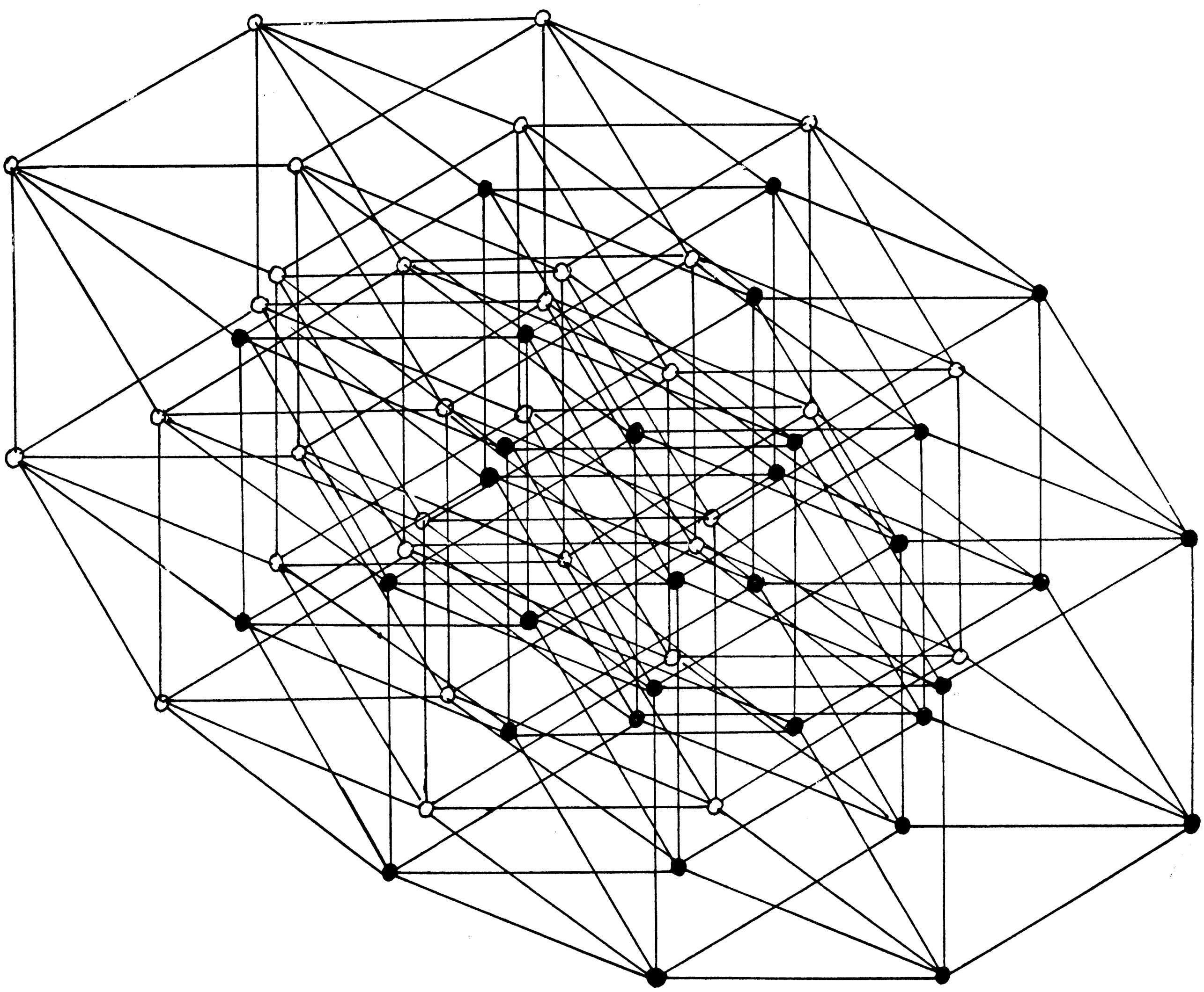
FINAL ISSUE
INCLUDING INDEXES

Regretfully I have come to the conclusion that this will have to be the last issue of the Journal. The number of subscriptions has unfortunately not compensated for the editorial labour expended. I did consider carrying on into a second volume as a series of special issues, but now that I have a word processor it is possible to expand these into more ambitious works, even full-scale books. Details of these will be announced in my new quarterly Variant Chess, and elsewhere, in due course. The chess problems and chess variant games have already been transferred to Variant Chess, which has been appearing regularly and attracting a good readership. I had hoped to tie up all the loose ends, but it will be found that there are still a few items that are incomplete. It has been necessary to avoid any further delay in publication - my apologies for the six month delay in making this issue. Authorship note: All articles that do not carry a by-line are written or compiled by the editor.



Looking back through my notes from Chessics I found this diagram of the 6-dimensional 'cube' with all edges drawn to the same length by means of √65 moves, that is (1,8) or (4,7) moves on a 25x39 board. See Chessics 14 1982.

TYING UP SOME LOOSE ENDS

Counting Verse-Forms. Stefanos Pantazis writes to correct an error: p.94, issue 5+6: "where P. Cohen claims that the Catalan numbers count rhyme schemes. This is false (as explained exactly in the reference given: i.e. M. Gardner's Time Travel and other Math. Perplexities, ch.20). Briefly the sequence is called "the Bell numbers" and is significantly larger. For n=4 (quatrains) we get 4th Catalan no: 14 and 4th Bell no: 15 and then the differences grow larger. The Catalans fail to count all rhymes like ababc or abcab or abbab etc. where the lines joining identical letters have to cross. Thus abab is the difference of 1 for the 4th nos in the sequences." Neither of these two sequences answer the original problem (p.14 of issue 1) of the number of rhyme forms "strictly interpreted" (i.e. a rhyme occurs at least twice) and "irreducible" (i.e. the verse cannot be split into two sepaarate strict verses - see p.30, issue 2).

The Game Invention Competition. This has unfortunately encountered total apathy, so is cancelled. I had several ideas of my own for games on the circular board (p.117) but will save them up for publication elsewhere (hopefully in a book on new games).

Michael Keller reports a game with the black pieces on black and white pieces on white, but on a 10x8 board, called "Ponents" Copyright Reiss Games 1974. This is basically a type of Halma.

Riders on a Torus p162.
Elmar Bartel wrote 26 viii 1989:
"Eight years ago I developed a general formula for (a, b) riders on a (m, m) torus, i.e. a quadratic torus, not the general (m, n) torus. The formula is: z(a, b, m) =

$$4m - 2A/\gcd(a, b) + 3\gcd(2, m, a+b)$$

where $A = \gcd(B, a^2-b^2) + \gcd(B, 2ab) + \gcd(B, a^2+b^2)$ and $B = \gcd(a, b).m$

this is valid when gcd(a, b, m) = 1 and $b > a$. The last two statements are no constraint to the generality of the formula. ... I cannot give a proof of it, but there is no counter-example ... the computer didn't find any up to m = 60.

For special cases the formula gives:
Rook: 2m-1, Bishop: 2m-gcd(m,2)
Queen: 4m-gcd(m,2)-1, Nightrider:
4m-2(gcd(m,3)+gcd(m,4)+gcd(m,5))+3.

The Centres of a Triangle. p142.
The centre of similitude of the medial circle and the incircle is at the Feuerbach point, where they touch. The medial circle also touches all three ex-circles. (K.W.Feuerbach, Eigenschaften einiger merkwurdigen Punkte des geradlinigen Dreiecks, Erlangen 1822).

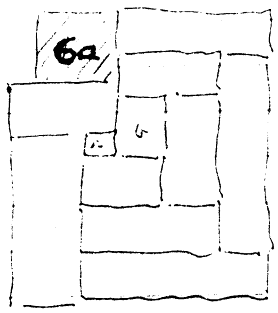
Nimmity. The 'Black Spot' variant can be won in a single move, so further conditions are necessary. Specifying only convex circlets (i.e. no internal angles greater than 180°) may be sufficient. (See p.67).

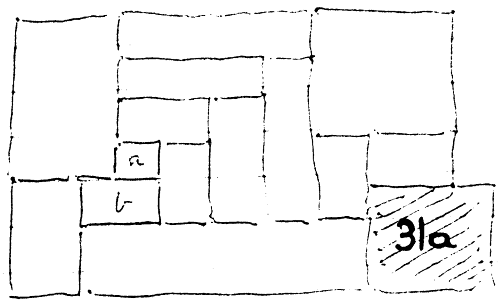
A Gnomonic Question (p140)

T.H.Willcocks notes a correction:
the progression illustrated is

$$u_n = 3u_{n-1} - u_{n-2}$$

Solutions for some multiples seem not to fit into any easily recognisable series. Here are two examples for 6 and 31:





Car Park Patience. The diagram on the right of page 121 shows an illegal position, since the 'horizontal' card missing from the second row could not have got out. This error was introduced by the Editor in combining two diagrams of the original text. The moves illustrated however are all quite legal.

Hubert Phillips. Alan Parr has consulted 'Who Was Who' (1961-1970) which gives his dates as: 13 xii 1891 - 9 i 1964 and much else: "...a remarkably talented man (I either hadn't realised or had forgotten about his political career and also his 200 detective stories...). My local library tracked down Journey to Nowhere [1st and only completed volume of autobiography] but...it covered only the first 20-25 years of his life and gave no insight into his games interests." His detective was Inspector Playfair.

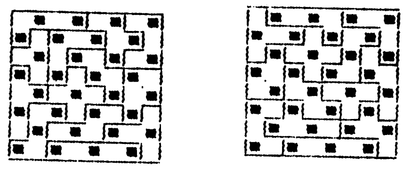
Professor Hoffmann. Len Gordon queries my ascription of the "Bug House Puzzle" to the "Professor", saying that Slocum's compendium does not imply this, and he is probably right. "Hoffmann" was the pen name of a collector, the Rev. Angelo John Lewis, as noted in the Foreword by L. E. Hordern to a reprint of the Puzzles Old and New of 1893 (Published by Martin Breese Ltd, 164 Kensington Park Road, London W11 2ER).

Pentangle Books. The puzzle manufacturers, Pentangle, also have a mail-order book list, which includes Hubert Phillips' My Best Puzzles in Logic and Reasoning, Prof Hoffmann's Modern Magic and a good selection of other standards, including Martin Gardner. Address: Pentangle Mail Order, Over Wallop, Hampshire, SO20 8HT.

Palindromic Powers. (p177).
Gareth Suggett notes that Tom Marlow's piece on palindromic cubes suggests generalisations. The list of palindromic 4th powers starts: 1, 14641, 104060401, 1004006004001, 10004000600040001.
In other number bases, so long as the binomial coefficients nCr are single digits the nth powers of 11, 101, 1001 ... will be palindromic. Reverting to base 10 there are plenty of palindromic squares, but few of these have an even number of digits, the smallest being $698896 = 836^2$ others are: 798644^2, 64030648^2, 83163115486^2, 6360832925898^2 (ref. Keith Devlin's column in Computer Guardian a few years back) and 69800670077028^2 and 98275825201587^2 (ref: Mike Bennett in the "Micromatters" column in IEE News 1988).

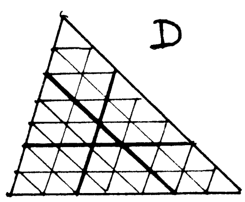
Eddington's Cricket Problem. Answer: Jenkins fell to Speedwell, Bodkins to Tosswell, and Wilkins was not out. Score at the fall of each wicket: 6, 12, 18, 23, 31, 41, 44, 59, 59, 60. For full solution I will have to refer you to Fred Hoyle The Nature of the Universe pages 22-24.

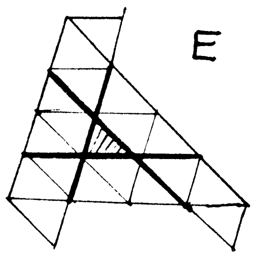
Broken Chessboards. Len Gordon sends the following two examples that have unique solutions. They use the T-piece of 4 squares.



First, Last and Only Numbers. (p138). Michael Keller and Gareth Suggett each recommend David Wells' The Penguin Dictionary of Curious and Interesting Numbers (1986). M.K. mentions that **6** is the only number which is the product of three numbers and also the sum of the same. Also the square root of the sum of their cubes! G.S. mentions that **33** is the largest number that is not the sum of distinct triangular numbers. The other examples they mention are cases of what I defined as "Digitology" rather than of "Numerology" - it is easy to extend the list vastly if we allow digital properties.

Half A Cake. (page 153). An approximate position for the area bisector parallel to the base is 2/7 of the height which divides the triangle into two parts in the ratio 25:24. The exact value is $1 - 1/\sqrt{2}$. A cake that can be cut into six equal parts by three area bisectors is as in diagram E.



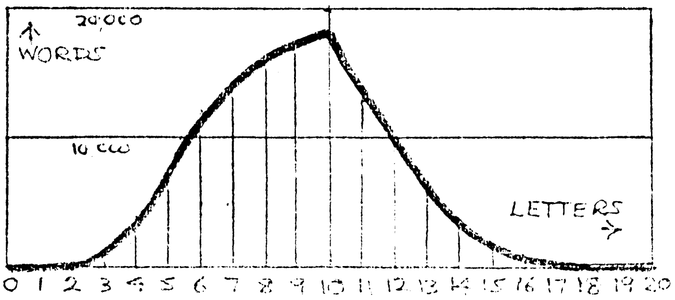


Enigma 1. Further clues. What is:
Gymnastically, an exercise:
Nautically, a measurement:
Physiognomically, a smile.

The Language Simulation Problem

Mathematicians define a 'word' to be any sequence of letters from a given alphabet. Thus if the alphabet has n letters there are n words of one letter, n^2 of two, and in general n^m of m letters. That is, the number of words increases 'exponentially' with the length of the word.

In a real language the number of words of length m increases until m is about 10, but then falls away rapidly until m is about 20, as shown in the following graph, which is based on a rough count of the pages per section in Chambers' Words (which lists English words by length). This list does not include plurals ending in -s, but an adjustment to account for this would not alter the shape of the curve significantly, just increase its height. No doubt other adjustments are necessary for accuracy, but it is just the overall picture we require here.



How can we account for this radical difference between the mathematical idea of a 'word' and the real thing?

First, it is evident that we must introduce some improved pronounceability into our mathematical 'words'. For this we need to separate our alphabet into v vowels and c consonants, v + c = n. Let us pronounce a word "pronounceable" if (a) it contains at least one vowel and (b) it does not contain more than three successive vowels or three successive consonants. This gives us quite a good facsimile of normal words provided we count Y as a vowel.

There are just a few three-vowel and three-consonat combinations that are pronounceable, that could be allowed as exceptions to the general rule if we wished. The short words that fail the above tests are: AEON, ANKH, ARCH, BEAU, CIAO, ECHT, ESTH, ETCH, EUOI, EYAS, EYED, EYES, EYOT, INCH, ITCH, LIEU, MAYA, MOUE, ONST, QUAY, QUEY, SCRY, SHRI, SHWA, SKRY, SOYA, SPRY, THRO, TSHI, UMPH, YAUD, YAUP, YEAD, YEAH, YEAN, YEAR, YEUK, YOOP, YOUD, YOUK, YOUR, YOYO, YUAN, ZOEA (plus plurals like ABBS, ABCS, ACTS). The numbers of pronounceable words of m letters however still increase exponentially with m, viz: 1-letter, v words; 2-letter, $n^2 - c^2 = v^2 + 2vc$; 3-letter, $3v^2c + 3vc^2$; 4-letter, $2v^3c + 6v^2c^2 + 2c^3v$; and so on.

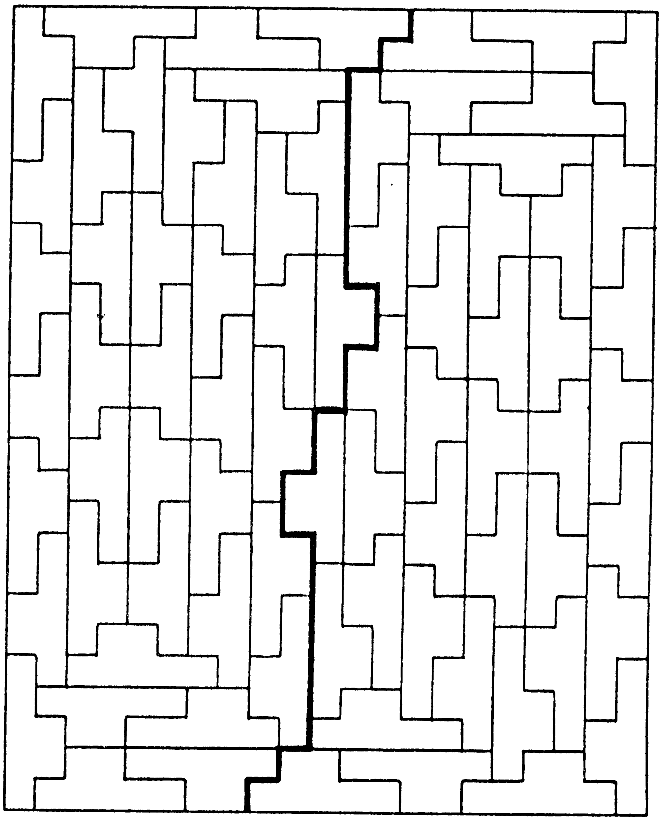
Second, we must drastically reduce the possibilities for forming long words. One obvious way of doing this, though not very verisimilitudinous, is to prohibit the use of any letter twice. Thus the longest words would be of n letters (i.e. using each of the letters of the alphabet once). The longest pronounceable words would be of 3v+2, 3c+2 or v+c letters, whichever expression is the smallest. (If $c > 2v+2$, the normal case, the first expression applies, and with v=6 and c=20 we find the maximum length is 20, as required.) An example long word in this system might be the improbable:

STALDERVINGOMPUZWYCH

(A village somewhere in northern Europe?)

Two incidental puzzle questions emerge here: (1) What is the longest normal word that has no repeated letters? UNCOPYRIGHTABLE, 15 letters, seems plausible but is not explicitly in Chambers. (2) What is the longest that has every letter occurring twice? The best I could think of is UNICONSCIOUS, but again this is not in Chambers, so I must have made it up, but it seems perfectly feasible.

A more structured approach to the question might be to first form mono-syllabic root words, prefixes and suffixes (such as ACT, RE-, EN-, EX-, -ING, -ED, -OR, -IVE, -ION, -LY) and then to form longer words by combining these monosyllables (REACT, ENACT, EXACT, ACTING, ACTED, ACTOR, ACTIVE, ACTION, REACTION, ACTIVELY, REENACT, ENACTED, REACTOR, EXACTLY, and so on). This is more akin to the way longer words are actually formed, but I do not see how to simulate this in a simple quantifiable manner at present. The number of longer words gets less and less presumably because many of the possible combinations have no correspondence to reality, e.g. Bluebells exist and Harebells, but not Redbells or Dogbells.



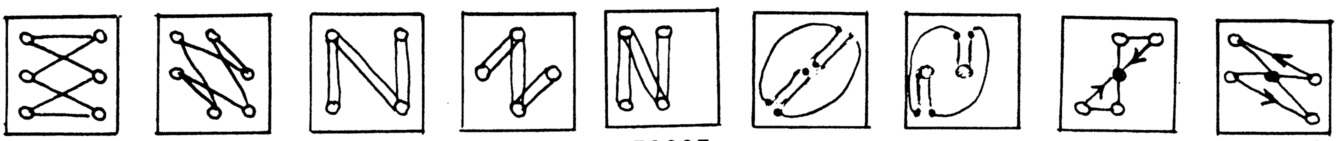
Grid Dissections

An item I contributed to Chessics 23 (page 78) Autumn 1985 dealt with tiling rectangles with the hexomino shape . It gave a solution for the 19x28 rectangle and showed how that solution could be adapted to rectangles of the form (26+7a)x(28+7b) where either a or b or both must be even. (This formula was previously given in a clumsier form.) It was also stated that rectangles up to 28x29 had been checked and no other solutions found. It now emerges that this check overlooked the 21x26 solution shown in the diagram. This was found by Karl A. DAHLKE and published in Science News 132 (20) p310, 14 November 1987. It is quite easy to expand this result to 26x28 by the method shown in Chessics. It thus joins the series of solutions previously found, but has the additional feature of dividing into two congruent parts. The 19x28, using two fewer hexominoes remains the smallest known solution. (December 1989).

Calculator Keyboard Curiosities

By R.J.COOK

The single-line palindromic numbers, first paragraph p173, can be varied sequentially, thus: 591519, 195915, etc, and the same applies to the square and other four-digit patterns; 352536, and so on. After a little experimentation one soon learns to discover new patterns. A few more, contributed by interested friends, are indicated in the diagrams. There are also 'degenerate' sequences using just 2 or even only 1 key, e.g. 133311 or 444444.



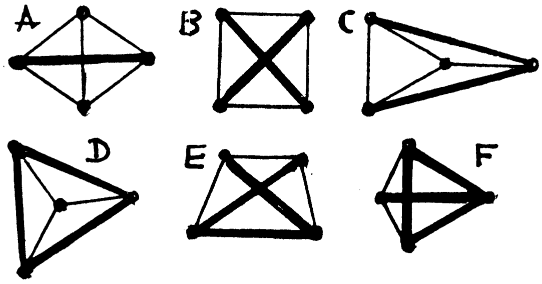
134976 276834 173937 482628 172827 151959 141858 521589 435675

Remember that the sequences can be reversed or circularly permuted to give other cases.

There is scope for number-theoreticians to probe the basis of these patterns, and for group-theoreticians to explore the symmetries, ignoring the key numbers. The 6-digit displays are a subset of the set of integers formed by multiplying the generating numbers 1001, ..., 9009 by 111, and the symmetries of the key-sequences of the generating numbers transform in interesting ways to the symmetries of the 6-digit key patterns. For example, 1321 generates 146631 and its 'image' 1231 generates 136641. Empiricists also soon notice that the palindromic displays like 789987 are also multiples of 11 and therefore of 1221, that 123321 is generated by 1111, and the relation between displays arising from pairs of generating numbers like 4234 and 4324. There are a great many possibilities to discover, and patterns which cannot be recognised without practice. Ron Cook (27 vii 1989).

Swift Solutions to the **Quick Questions** on p175.

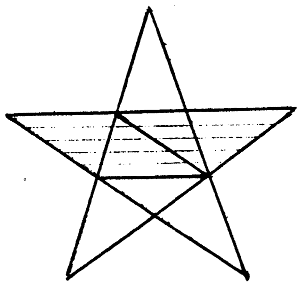
1. There are six arrangements.



The ratio of number of long to number of short lines are: A, 1:5; B, C, 2:4; D, E, 3:3; F, 4:2. In E the four points are vertices of a regular pentagon (cf. **3** below).

2. Dudeney's trick is to fold the paper so that two sides of the square coincide. Then to insert the pencil and draw both lines simultaneously - then open out the paper, keeping the pencil-point in place, and complete the diagram, which is now possible.

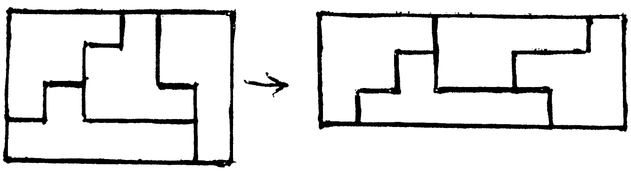
3. Half the star is shaded, as shown by the following dissection:



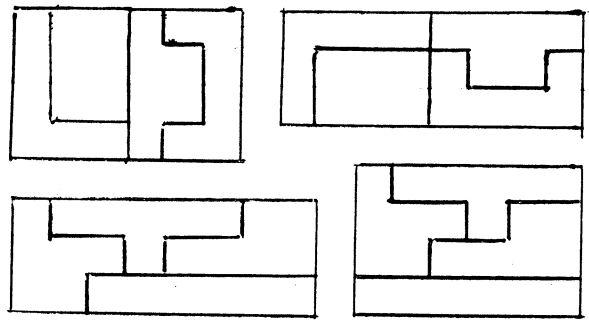
4. The fraction is 4/15. A simple case of simultaneous linear equations: $(a+1)/b=1/3$ and $a/(b+1)=1/4$, i.e. $3a+3=b$, $4a=b+1$.

5. Possible anwers might be:
A 5: only one of the form 5k.
B 7: only one of form 4n-1.
C 13: only one of form $9x+y^2$.
D 17: only one not of the form $a(a+1)\pm 1$.
E 29: only one with an even digit.

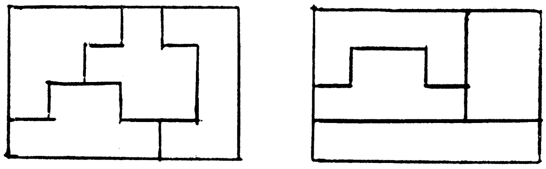
6. Stephen Taylor's solution is:



But other solutions are also possible: (From John Beasley and Gareth Suggett).



7. Stephen Taylor's solution is shown first, but J.D.B. and G.J.S. both found the second.



8. The proof required is: $\sqrt{(a^2+b^2)}\,\sqrt{(c^2+d^2)} = \sqrt{[(a^2+b^2)(c^2+d^2)]} = \sqrt{(a^2c^2+a^2d^2+b^2c^2+b^2d^2)} = \sqrt{[(ac)^2+(ad)^2+(bc)^2+(bd)^2]}$ and this $= \sqrt{[(ac+bd)^2+(ad-bc)^2]}$, or if $ad<bc$ we can substitute $bc-ad$. The set includes all the cardinal numbers since $n = \sqrt{(n^2+0^2)}$.

9. Four elements bracket in 5 ways, and five elements bracket in 14 ways. If B_n is the number of ways of bracketing n elements then $B_n = B_1B_{n-1} + B_2B_{n-2} + B_3B_{n-3} +\cdots+B_rB_{n-r}+\cdots+B_{n-1}B_1$, with $B_1=B_2=1$. This is the required recurrence relation. To prove it we note that any bracketing of $a_1oa_2o\ldots oa_n$ must be in the form AoA' where A is an expression with r elements and A' has n-r elements. The number of ways of bracketing A is B_r and of A' is B_{n-r} so of AoA', without disturbing the leading o is B_rB_{n-r}, and we must sum these over all the n-1 positions of the leading o. An explicit formula is: $B_n = (2n-2)!/n!(n-1)!$ but it is easier to calculate by iteration.

10. The very neat proof is:
(xo(aob))oy =
((xoa)ob)oy [by associativity of a] =
(xoa)o(boy) [by associativity of b] =
xo(ao(boy)) [by associativity of a] =
xo((aob)oy) [by associativity of b]

and equality of the first and last expressions shows that aob is associative. It is interesting that all five methods of bracketing the four elements occur in this proof

11. **Snakes & Ladders.** The following treatment was supplied by Rev. R.A.Dearman: The greatest obstacle would be 6 squares ahead of us. Let p_n denote the probability that we will land on the square n ahead of where we are now. Thus $p_n=0$ for $n<0$, and $p_0=1$. If we are to land on a given square we must come to it from one of the six preceding squares, with the appropriate dice-throw. So $p_n=\mathbf{sum}_{r=1...6}(p_{n-r}/6)$, for all $n>0$. For $n=1...6$ this gives a geometric sequence with $p_1=1/6$ and $p_n=(7/6)p_{n-1}$ $(1<n<7)$, so $p_6= (1/6)(7/6)^5 = 16807/46656$, which is just over 36.0%. After that p_n goes up and down by ever-decreasing amounts (measured from peak to trough and vice versa) and approaches the limit 2/7, which is the reciprocal of the average number of steps moved at each throw.

12. Bridge Hands. The following treatment is also that of Rev. R.A.Dearman (with the notation simplified to suit my type-writer). 4-4-3-2 is the most probable distribution, not 4-3-3-3. And 7-5-1-0 and 8-3-2-0 are equally improbable. These results are fairly well known. Let N(a-b-c-d) denote the number of hands with a of one suit, b of another, c of a third and d of the fourth. Then N(4-4-3-2)/N(4-3-3-3)

$$= \frac{12(13C4)(13C4)(13C3)(13C2)}{4(13C4)(13C3)(13C3)(13C3)}$$

$$= 3\ (10/4)\ (3/11) = 45/22$$

so 4-4-3-2 is more than twice as likely as 4-3-3-3, mainly because there are 3 times as many possibilities of allocating the four numbers to the four suits. Similarly: N(8-3-2-0)/N(7-5-1-0) =

$$= \frac{24(13C8)(13C3)(13C2)(13C0)}{24(13C7)(13C5)(13C1)(13C0)}$$

$$= (6/8)\ (4/10)\ (5/9)\ (12/2) = 1$$

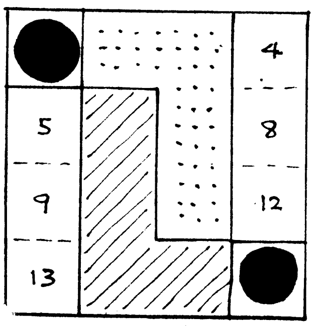
so these two shapes are equally likely.

Enigma 1. Yet further clues. What is:
Architecturally, an architrave:
Potably, a brew:
Electrically, illuminating.

de Bono's L-Game

By Malcolm HORNE

This is a two-player game (due to Edward de Bono) using a 4x4 board. Each player has an L-shaped piece (a tetromino) and there are two other 1-cell pieces (monominoes) marked with a black spot.



Starting Position.

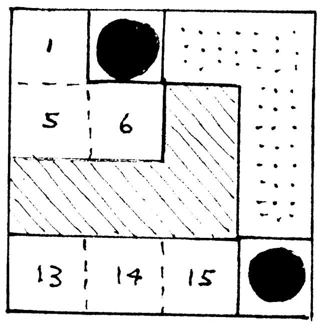
A go consists in a move of your L-piece to a new position (these pieces can slide, turn or pick up and flip into any open position other than the current position). This may be followed by an optional move of just one of the neutral monominoes to any open square.

Two players who have worked out (and remembered) all the possible final winning positions might find the game rather long-winded as they could possibly avoid these positions! But it's quite a nice game if not played at that serious level.

Example game: (postal, 1986):
Malcolm Horne v. Andy Skinner

1.	Flip L-piece to 5/6/10/14 and (Spot 1 to 8).	L-piece to 3/7/11/12 (Spot 8 to 2)
2.	6/10/14/15 (16-4)	7/8/12/16 (4-5)
3.	9/10/11/15 (5-6)	3/4/8/12 (2-16)
4.	7/9/10/11 (6-2)	**1-0**

Beta has nowhere to move his L-piece.

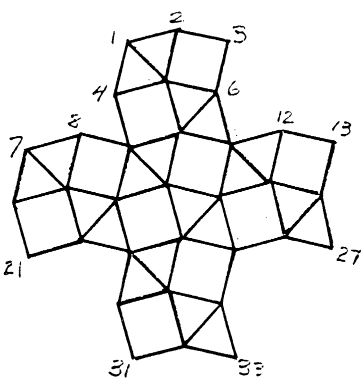


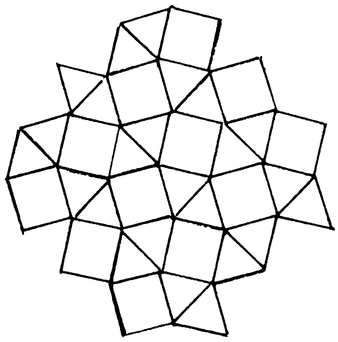
Final Position.

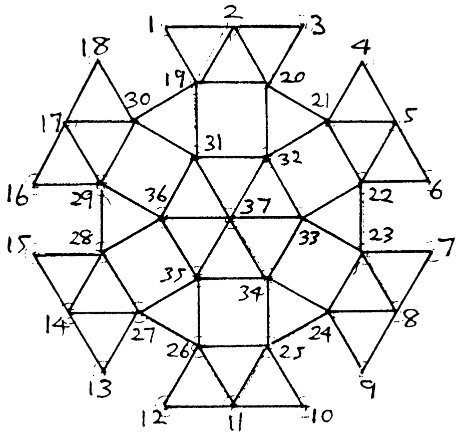
ZIGZAG SOLITAIRES

By Leonard J. GORDON

Here is what the classic 33 and 37 cell cross-shaped solitaire boards look like zig-zagged. And also the circular board, shown on the front of the double issue 8+9 of G&P Journal.







ZIGZAG CROSS SOLITAIRE

For a starter, here are two solutions to the 33 cell board. Be careful to note that there is no line from 4 to 8:

6-17, 8-10, 1-6-9, 12-10-8, 7-9, 24-10-8, 21-7-9, 22-8-10, 26-24-11-26, 27-25,
13-26-24, 33-25, 31-30-18, 28-25-11, 3-1-9-6-18-29-22-17. (15 moves, center-center).
27-25, 24-26, 22-24, 13-27-25-23, 11-20, 7-22-24, 31-23-25, 9-11-13-26-24, 1-10,
3-11-25-23-9-6, 21-7-9-1-3-10-24, 30-28, 33-31-23-25. (13 moves)

I wonder how the type of field I have described in these zigzag solitaire articles would function as a base for a war-game. I would be pleased to hear from anyone who tries it. It differs from the "Leapfrog" board pattern in that all intersections (except those on the edges of course) are of equal value. I have also experimented with this field for plane tiling puzzles. The pieces are nice looking "animals".

Another way to allow jumping pieces to escape from a limited set of cells on an orthogonal board is to allow a jump over either one or two (or more) pieces in a row. I employed this rule in a puzzle-game sold as "Leaps-N-Bounds" several years ago.

Len Gordon (9 iii 1989)

ZIGZAG CIRCULAR SOLITAIRE

If jumps 1-31, 2-21, 19-37, etc are allowed, but jumps 1-20, 31-33 are not allowed, an example solution is as follows. I'm not sure just how good this is.

24-37, 31-34, 23-37, 36-33, 27-37-23, 11-27, 25-37, 32-35 (8 moves so far)
13-11, 15-13, 17-15, 1-17, 3-1, 5-3, 7-5, 9-7 (16 moves so far)
10-12-14-16-18-2-4-6-8-33-5-32-2-31-17-36-14-26-37. (17 total)

If we allow 31-33 type jumps, I have a 15 move solution. Maybe the solution can be shortened to 15 moves using the above rules. The final sweep is spectacular, but being able to circle the field like that sort of weakens the puzzle; hence I suggest ... breaks in the outer circle. (See above) This seems to be a difficult puzzle. Remember, jumps 31-33 etc are not allowed.

Len Gordon (27 iii 1989)

Quick Questions SOLUTIONS on p.194.

13. Wazir Tours. Construct a Wazir tour of the 4x4 board, showing the square numbers, 1, 4, 9, 16, in a "satin" (i.e. one in each rank and one in each file). Two solutions. (G.P.J.)

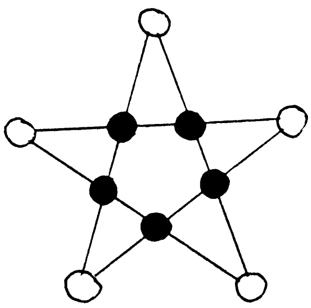
14. Numbering Formulas. If the squares of the chessboard are specified by coordinates (x, y) ranging from (1,1) to (8,8), find formulas for each of the eight possible "natural" numberings of the board (e.g. 1 at (8,8), 2 at (8,7) ... 8 at (8,1), 9 at (7,8), 10 at (7,7) ... 64 at (1,1) is a natural numbering). (G. P. J.)

15. A Cryptarithm. Another by T. H. WILLCOCKS, "composed to mark a young brother's 70th birthday" (!)

```
 THIRTY
 TWENTY
    TEN
  SEVEN
  THREE
-------
SEVENTY
```

16. +/- Permutations. From a sequence (a, b, c, ...) of numbers we are allowed to form other sequences by adding one element to another, or subtracting it from another. By this process we can give the sequence any "even" permutation, but not an "odd" permutation. We can also negative any even number of elements. We can combine an odd permutation with an odd number of negatives however, e.g. (a, b)> (a+b, b)> (a+b, -a)> (b, -a) in three steps, also solved by: (a, b)> (a, b-a)> (b, b-a)> (b, -a). Solve (a, b, c) to (c, a, b). (G.P.J.)

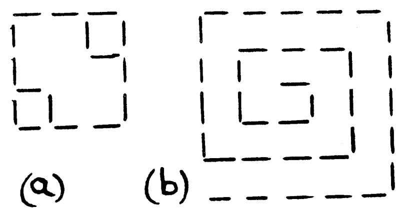
17. Pied Pentagram. Five white and five black counters are placed at the inner and outer points of a pentagram. How many geometrically different arrangements are there? How many have two of each colour in each line? (G.P.J)



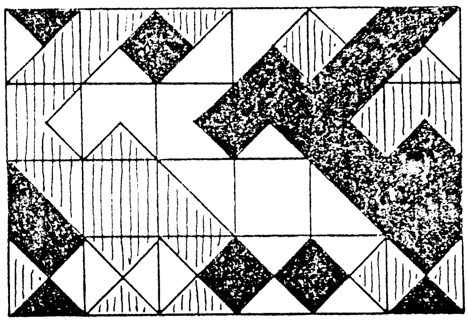
18. All Out Cricket. If all 11 players in a cricket team bat in an innings and they are all out, in how many different sequences can they be dismissed? (G.P.J)

19. Squaring the Rectangle. On page 81 we gave diagrams of a "golden" rectangle, with the property that if a square is removed at one end the residue has the same ratio of sides as the whole. What rectangle has the similar property that a square removed from it centrally leaves two rectangles like itself?

20. Matchstick Manoeuvres. Move as few matches as little as possible to convert (a) One large and two small squares to two large and one small; (b) A clockwise spiral to an anticlockwise spiral. (G.P.J.)



21. Super-dominoes. Arrange the 24 three-colour squares in a 4x6 rectangle, with adjacent edges matching, and all the border edges the same colour. Here is a solution, not satisfying the border condition, but showing the three colours in the same pattern when the board is wrapped round a cylinder. This was published in the IMA Bulletin in 1987.



22. Pentomino Sequence. Arrange the 12 5-square pieces in sequence so that each piece is derived from its predecessor by moving one square one step, either orthoganally or diagonally (i.e. a King move). The solution is unique! (G.P.J.)

23. Modern Art. Arrange the 35 6-square pieces to form three squares, 11x11, 8x8, 5x5 arranged one on top of another in a stepped formation. (This was item 8559 by H. D. Benjamin in Fairy Chess Review February 1950. No solution was given.)

24. Blast Off! Arrange the 56 pieces of all sizes 1 to 6 in a 13x23 rectangle, with the smaller pieces forming a "stepped pyramid" shape and the hexominoes the surrounding space and border. (G.P.J.)

ON LIBRARY RESEARCH

My article on this subject in the last issue, copies of which I circulated to all the organisations mentioned there, has elicited quite a lot of response - summarised here.

The replies received from the BODLEIAN Library, Oxford, the CAMBRIDGE University Library and the BRITISH Library were brief and polite but not particularly helpful.

Mathematical Collections

The review editors of the Mathematical Gazette are reluctant to ask reviewers to donate the books to the Mathematical Association Library because the reviewing job is purely voluntary and keeping the book, which the reviewer may have spent several months getting to grips with, seems the only tangible way of saying 'thank you' to the reviewers. Access to the MA Collection also allows access to the Leicester University Library, which has an extensive mathematical section. Membership of the London Mathematical Society allows access to the mathematical collection at University College London.

STRENS Collection (University of Calgary, Canada): Richard K.Guy writes: 'You and your readers are very welcome to 'use' the collection, in the sense that we will try to answer any queries in the area of recreational mathematics, and can photocopy reasonable amounts of material at cost (usually about 10¢ a sheet). In the other direction, as you kindly imply in the article, we very much welcome gifts and donations to the Collection./ Since it's been here, Martin Gardner has donated a few hundred items, and Wade Philpott's widow has donated his collection, and there have been numerous smaller gifts.'

Chess & Chess Problem Collections

ANDERSON Collection, State Library of Victoria: Ken Fraser, Chess Librarian, writes: 'Your experience at Cambridge with loose covers on a book lifted our spirits here; it has a familiar ring in a librarian's ears./ We were honoured to be ranked no. 2 among chess libraries but the facts are different. On our latest information (Hans Bohm's book Schaken, 1988) the Van der Linde-Niemeijer Collection stands at 25000 books with an annual intake of 500. We do not have any recent figures on Cleveland but it is at least as large as the collection at the Hague./ Ours is a much smaller (and younger) collection than either of these two. We now number about 10,000 volumes with an annual increase of about 300 new titles. Even at that figure we are happy to be listed as the third of the world's public chess libraries. Were Lothar Schmid's collection at Bamberg to be included the rankings would change again. By all reports it is a superb library.'

WHITE Collection, Cleveland Public Library, Ohio: an interesting reply: The covering letter reads: 'The Library has completed a reference search on your question. A maximum of 15 minutes research can be devoted to each request. Included is the information found within the scope of this research policy./ If you require more extensive research, please write or call the Cleveland Research Center, a fee-based service of this Library./ If you should need further information do not hesitate to contact Mrs Alice N. Loranth, Head of Fine Arts and Special Collections.' Also included was a copy of an article about the collection from Michigan Chess August/September 1975. This notes: "The White endowment has been eroded by inflation to the point that it no longer provides for the essentials of the Department. The income from the White Trust Fund was $10,414 in 1973 and $13,560 in 1974. With the cost of books more than doubling recently and the number of chess publications of all kinds multiplying beyond all expectations, this income has fallen seriously behind the needs."

VAN DER LINDE - NIEMEIJER Collection, Koninklijke Bibliotheek: From this source I was sent copies of interesting articles from New in Chess, No. 8 1985 and No. 4 1986 in the form of interviews of Lothar Schmid and Meindert Niemeijer, two great chess book collectors. I even received a telephone call, and subsequently a copy of the section of the catalogue of the collection (1955) dealing with Mathematics - which includes Knight's Tours.

I have just (July 1990) completed a first draft (30 A4 pages closely printed) of a bibliography of Knight's Tours (and other chessic paths). Having a word processor now makes it so much easier to compile such a work. A copy will be sent to anyone who can provide further information on the subject, particularly references to obscure sources in unfamiliar languages.

Solutions to Chess Problems in Issue 11.

133. EBERT. (a) 1Kg2 f3+ 2Kf2 Sg4+ 3Kg1 f2+ 4Kh1 f1=Q‡ (b) 1Kg2 f3+ 2Kg1 f2+ 3Kh2 f1=S+ 4Kh3 Sf4‡. WK circuit in (a). Economical and neat. [A.W.I.] Not a real 'reflex' but only a 'semi-reflex' as there's no possibility for White to checkmate. [E.B.]

134. EBERT. (a) 1Kc8 c7 2Kb7 c8=Q+ 3Ka7 Qb7‡ (b) 1Kc8 d7 2Kb7 d8=Q 3Ka6 Qb6‡ (c) 1Kc7 e7 2Kb6 e8=Q 3Ka5 Qb5‡. Exact echoes.

135. EBERT. 1b7 Ke7/Kd7/Kd5 2b8=Q Kd7/Ge8/Gc4 3Qd8/Qc7/Qe5‡. Why go to such extremes just to have a line problem? [S.P.] 3-fold Echo. For comparison: Erich Bartel & Hans Gruber, Feenschach xii 1983: WPa7, BKd6, BRs d7,e7. H‡2. 4 ways. Captureless play. 1Rb7/e5/e6/d8 a8=Q 2Rbc7/Rde7/Ke7/Kd7 Qd5/c6/f8/c6‡ 4-fold Echo. [E.B.]

136. WONG. The BK should be at e3 for: Retract 1Ke8xQd8(Ke1) and second Black Qd2xQd1 for Play: 1Q8d4 Qf3‡. In the original setting with BKe4 the intention was 1Kd8xBc8(Ke1) Q(or B)f3xQd1 for 1Bf5 Qd4. This is a Circe Mate but not a Kamikaze-Circe Mate. One point for this solution, or for claim of no solution.

137. HOLLADAY. 1Kc3 Rb5 2Sb4 Ka5 3Kb3= (b) 1Rc3 Rb3 2Sb2+ Ka3 3Kb1=. Exact echo pin ideal stalemates. [E.H.] Please note stipulation should be STALEMATE, else 1...Ra5‡.

138. STEUDEL. 1a1=C Ka2 2b1=C Kxa1 3c1=C Kxb1 4d1=C Kxc1 ... 8h1=C Kxg1 9Cg4 Cxg4= Very droll! [A.W.I.] Wonderful idea. [E,B,] Nicely forced sequence. [D.N.]

139. BARTEL. 1NPb2 b8=NC 2a5 cxb8=NG(NCb1)‡ and 1Ka5 b8=NG 2a6 cxb8=NC(NGb1)‡ BK in check in diagram. Nice switch. [A.W.I.]

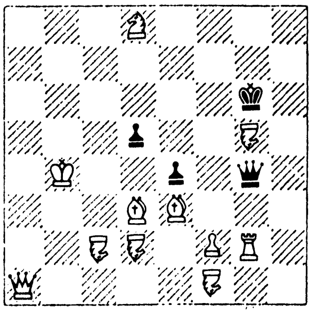
140. BARTEL. 1d1=NC b8=NN 2exd1=NG(NCd8) cxb8=NZ(NNb1)‡. Promotion to 4 fairy neutrals.

141. BARTEL. 1b1=NB d8=NB 2cxb1=NN(NBc8) cxd8=NN(NBc1)‡.

Solvers and Scores: A.W.Ingleton & S.Pantazis 16 (maximum), E.Bartel 15, D.Nixon 11.

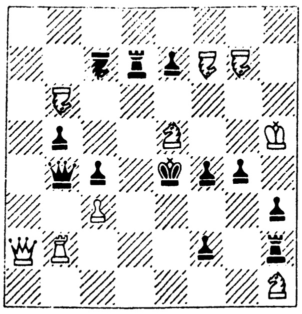
T. R. Dawson Centenary Nightrider Tourney

N5. E. HOLLADAY



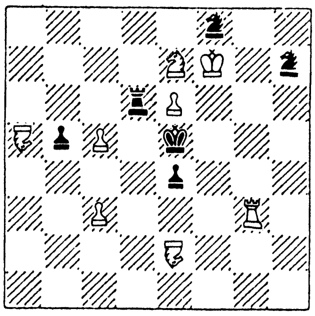
Mate in 2.

N6. A. MOCHALKIN



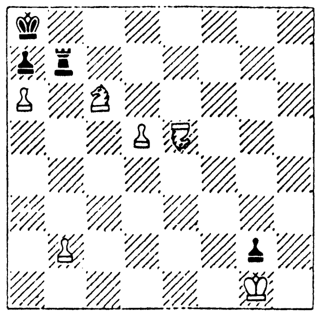
‡2 (b) Qa2<—>Rb2

N7. Z. HERNITZ



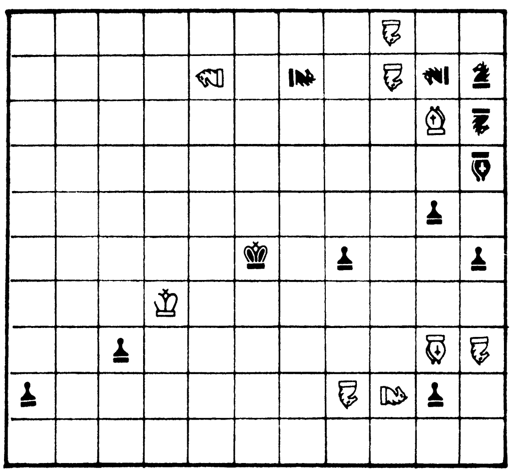
‡2 (version B also)

N8. Z. HERNITZ



‡2 (b) Ne5—>e3

N9. D. MULLER



Mate in 2 Board 11x10

h2, i9, i10, k3; k8 = (1, 2)R e9; j9 = (2, 3)R
j3; k7 = (0, 2)R i2; g9 = (1, 3)R

Zvonimir Hernitz sent an alternative version of **N7:** Move WK-g7, BSh7-f7, make Pe6 Black, then move the whole position one file right, for ‡2. The solution is the same - which setting is best?

Romeo Bedoni corrects **N2:** Add WPi15 to stop 1Bi15+ (2,6)Rh14 2Bxh14‡.

Solutions and comments are invited as usual. These will be published in Variant Chess, together with the Award for the Tourney.

Mathematics in Music - The Reversed Keyboard and a Revised Stave Notation

by Graham LIPSCOMB

My synthesizer can be programmed to play any note on any key, which led me to setting it up so that all the notes were backwards or "mirror-image". Obviously if you look at a keyboard in a mirror "D" and "A flat" are interchanged, C = E, F = B, G = A, etc. Playing the reversed keyboard while standing behind the synthesizer is not too difficult since the notes are effectively as normal, but playing from the front leads to some interesting realizations.

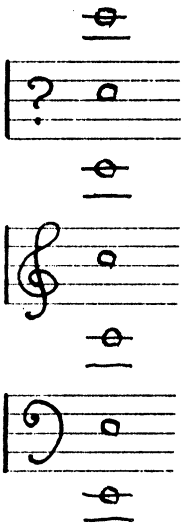
Now of course C Major scale is symmetrical about D (our mirror note) since all the white notes in the mirror still equal all the white notes. But what about G major scale (F sharp instead of F). F sharp is B flat in the mirror so now we've got F major in the mirror as a reflection of G major. So the key with one sharp becomes the key with one flat. Similarly with two sharps (D), three sharps (A), etc. becoming two flats (B flat), three flats (E flat) and so on.

Furthermore, the forming of chords is quite interesting: All major triads become minor triads (and vice versa). Dominant sevenths become minor sevenths with flattened fifth. Major sevenths become other major sevenths. Minor sevenths also become other minor sevenths. Ninths become other ninths. Diminished and Augmented chords are mathematical chords anyway as they consist of repeated minor thirds or major thirds respectively up and down the keyboard. This pattern is obviously unchanged in the mirror.

In all of these cases the new chord will be rooted on a different note depending on the type of chord: C major = A minor, C minor = A major, C7 = F sharp minor 7 flats, C major 7th = F major 7th, C minor 7th = F sharp minor 7th, C9 = D9, C major 9th = D minor 9th, C minor 9th = D major 9th, C diminished = A diminished, C augmented = A flat augmented.

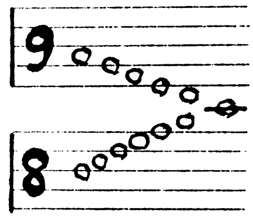
All of this is fairly easy to see on the piano, but very hidden on the staves because musical notation on staves only allows for seven notes and not all twelve. The reason of course is that a key can only contain seven notes naturally, the use of accidentals in a piece is effectively a change of key (i.e. a new set of seven notes). Using lines and spaces enables many notes to be crammed into a small space.

However, it is annoying that the two staves have notes in slightly different positions. Also, having to deal with up to nine leger lines is difficult. My thoughts on a better system are as follows: (a) Two leger lines between staves instead of one. (b) Treble stave pattern (E, G, B, D, F) is then repeated for bass stave (the two leger lines are A and C). (c) There are enough lines above the treble stave for an additional stave making top C conveniently sit two leger lines above it. If another stave were added below the bass end and two leger lines below it you would have a very neat range of four staves and five pairs of legers, giving $8\frac{1}{4}$ octaves A - C. Unfortunately grand piano range is only $7\frac{1}{4}$ octaves A - C!



Footnote by G. P. JELLISS:

Years ago, when I was an unsuccessful clarinet player, I devised a simplified scheme of notation for chromatic (12-note scale) music, doing away with the sharps and flats. Instead of the usual key signatures, a number is placed on the centre stave, 8 indicating a frequency of 2 to the power 8 = 256 cyles per second, which, if I remember right, is the frequency of middle C (or near enough to it). Thus 9 signifies 2 to the 9th = 512, i.e. the octave above. Notes on and between the lines, including one intermediate leger line, give the 12.

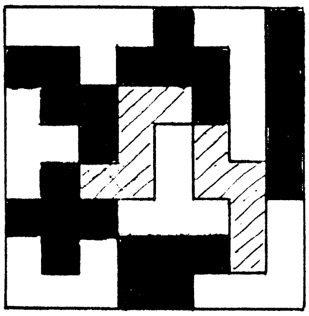


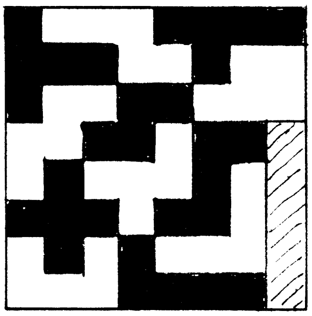
THE ART OF THE STATE

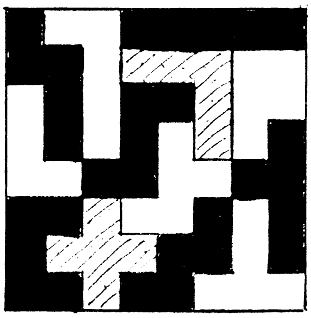
By Leonard J. GORDON

Elbridge's last name was Gerry of course. Elbridge Gerry was governor of Massachusetts in 1812, when the method of creating voting districts so as to be favourable to one political party was used. A political cartoonist of that time noted that the shape of one district looked like a salamander, so coined the name gerrymander. Gerry was not responsible for the process since known as gerrymandering. American political cartoonists have never been known for fairness.

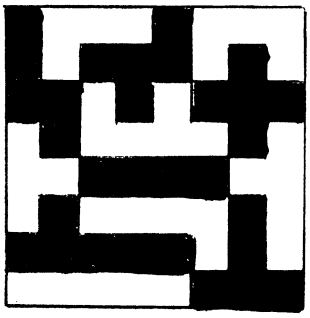
The solution to the problem can be improved by changing the 2x2 square to an 'S'. Changing to a 'T' or 'L' shape doesn't help.

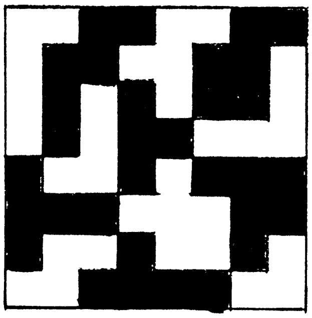






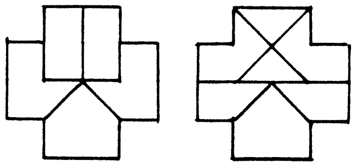
It is impossible to make a 2-colour map with 12 5-district states as long as the 1x5 shape is used. Below are two examples of dividing the 8x8 into 13 different parts (with sizes 3 to 6).





L.J.G. 11 x 1989.

Solution to Tangram E, p123.



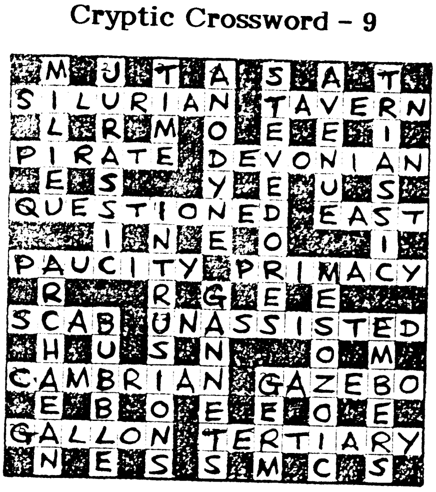
Solutions to Word Puzzles

Edinburghisms. (p.147) This item was so named since the question came from R.M.W.M. in Edinburgh. Examples of def hij mno stu were offered. Others are: afghan, first, calmness, canopy. The lack of a tuv example is surprising. Fourfold examples are understudy and gymnopterous (bare-winged, not in Chambers).

Autological Anagrams 1.

ACT CAT
NILE LINE
DREAD ADDER
ERNEST ENTERS
BRAISED SEABIRD
EDITRESS RESISTED
ARGENTINE TANGERINE

Cryptic Crossword - 9



Enigma 1. BEAM

Swift Solutions to the **Quick Questions** on p189.

13. Wazir Tours.

2	1	10	11
3	8	9	12
4	7	14	13
5	6	15	16

7	6	5	4
8	1	2	3
9	12	13	14
10	11	16	15

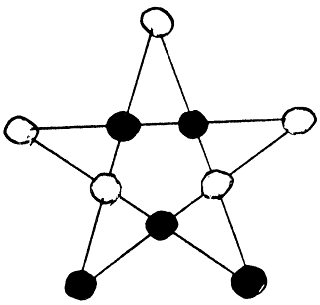
14. Numbering Formulas. The eight formulas required are: 8x+y-8, 8y+x-8, 64+y-8x, 64+x-8y, 73-8y-x, 73-8x-y, 8x+1-y, 8y+1-x.

15. A Cryptarithm.

```
 864583
 827083
    870
  17970
  86577
1797083
```

16. +/- Permutations. The solution takes six steps: (a, b, c) > (a+c, b, c) > (a+c, a+b+c, c) > (a+c, a+b, c) > (a+c, a+b, -a) > (c, a+b, -a) > (c, a+b, b) > (c, a, b).

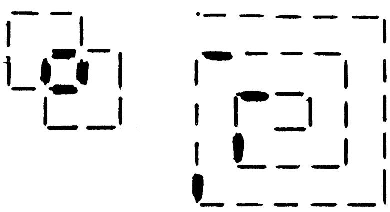
17. Pied Pentagram. I find 32 arrangements of which 4 have 2 of each in each line: the one shown below, the one shown in the question, and their complements (formed by changing white to black and black to white).



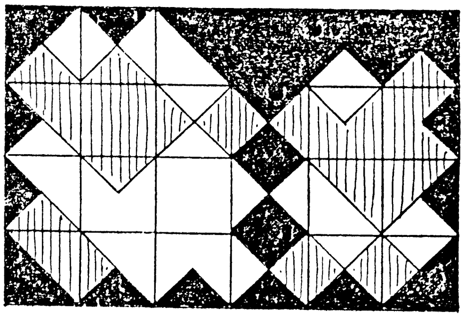
18. All Out Cricket. There are 1024 orders, i.e. 2^{10} (since actually there are only 10 dismissals, one always remains "not out").

19. Squaring the Rectangle. A 2x1 rectangle.

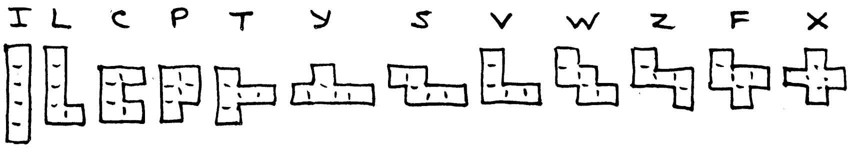
20. Matchstick Manoeuvres. 4 in each.



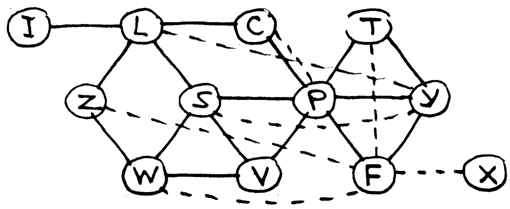
21. Super-dominoes.



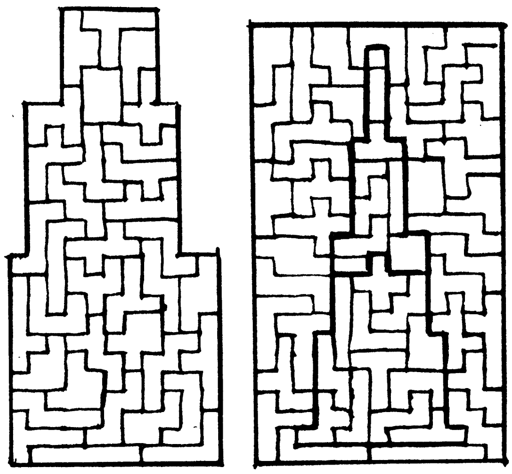
22. Pentomino Sequence. The only order possible is the following or its reverse:



The possible transformations form the network shown below (—— Fers move, - - - Wazir move). The sequence is a Hamiltonian Path (i.e. Tour) of this net.



23 & 24. Hexominos. Solutions below.



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