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## *News & Notes*

**Anthony Dickins,** best known to chess problemists for his Q-Press series of publications, including A Guide to Fairy Chess, The Serieshelpmate, A Short History of Fairy Chess, for his revival of Fairy Chess in The Problemist, and his dissemination of the works of T.R.Dawson in the Five Classics of Fairy Chess (Dover Publications) died on 26 November after a long period of illness, at the age of 73. An obituary has appeared in The Times, concentrating particularly on his work as a musician and as a poetry editor. A biographical note will also be found in his Album of Fairy Chess together with a selection of his chess compositions. Personally I owe a great deal to his influence and inspiration, and BCPS Members will remember with fondness his eloquent and entertaining ability as a lecturer.

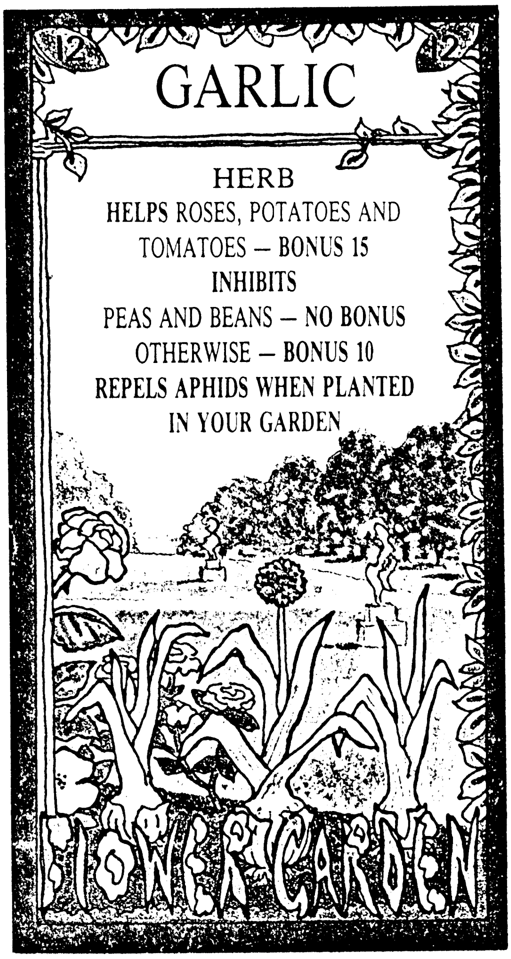
**Magic Knight Tours.** Tom Marlow reports that his computer search (Issue 1, p11) is now complete and he has found a further three new tours. A full account will probably appear in The Problemist. The total of magic tours of the "quartes" type is thus 78 (the figure 72 given on p11 should be 73), and the total overall is 101. Comments from other experts on tours: "I am naturally thrilled to hear of Marlow's new S-tours. To think that the carefully compiled Chessics list is already incomplete and needs supplementing!" T.H.Willcocks. "Congratulations to Mr Marlow. That is the right way for using computers!!" J.Brügge.

**Mathematical Recreations and Essays,** by W.W.Rouse Ball and H.S.M.Coxeter, has now appeared in a 13th edition from Dover Publications. This work is essential reading for anyone interested in puzzles. But if you already have the 12th edition, published by the University of Toronto in 1974, you will be disappointed to find that the new edition is virtually identical to the old, with only a few minor revisions. (Price $8.95.)

**Games Reviews** dominate this issue. The addresses given are those of the manufacturers. If not available in your local games shop most of them can be ordered direct from me. **Chessics. 29+30** and **Chessay 4** are still not quite completed. Apologies for the delays. Lack of time has also prevented me including the list of overseas zines in this issue.

# The Garden Game & The Cooking Game

Variants on the Monopoly principle - a track around which the players travel from GO propelled by dice throws and pick up cards, miss turns, go to Jail, etc according to the instructions written on the various sections of the track - must by now be legion. The Garden Game and The Cooking Game, both invented by Sarah Ponsonby both fall into this category, but are among the best of their kind.




In the Garden Game the track represents the seasons of the year, while in the Cooking Game the participants chase each other around the kitchen. The full colour printing of the boards and cards is very elaborate and the boards are large. The games are distributed by The Garden Game Ltd, New Hertford House, 96 St Albans Road, Watford, WD2 4AB. (Prices £18.50, £20).

Both games also make use of the Rummy principle of collecting matched sets and sequences of cards. In fact, in the case of The Garden Game the pack of cards used can be purchased separately to play Garden Rummy (£4.50). This pack consists of four suits, representing Flower Garden, Fruit Garden, Wild Garden and Kitchen Garden, with 16 cards in each suit. The aim of the game is to collect these cards, representing seed packets when in hand, and to plant them out in sets in your garden. Each player has his own plot consisting of a series of furrows in one quarter of the board in which the cards can be "planted" so that only he can see their faces. Similarly, in the Cooking Game the aim is to collect cards representing the ingredients of various recipes that will make up a two-course meal.

Above: A card from the Garden Game.
Right: A card from the Cooking Game.

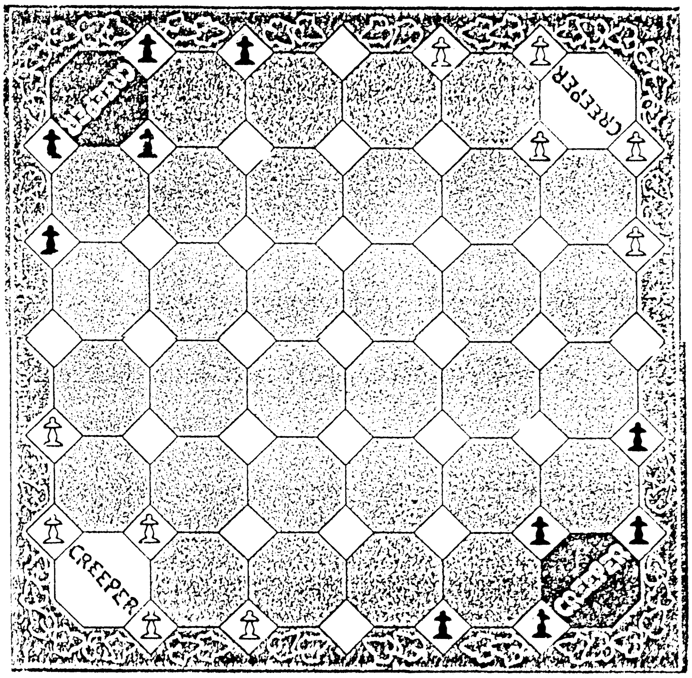

Another feature common to both games is the right, when on an appropriate square, to demand from another player all his cards in hand of a particular suit, provided you have two, in sequence, already. In the Cooking Game this is represented as using the telephone, but in the Garden Game, more picturesquely, one uses a megaphone! If the request is unsuccessful, the person asked can turn the tables and ask for cards to match a pair that he holds.

On the whole, the Garden Game appears much the most successful of the two, and better value for money, despite the fact that the Cooking Game is sponsored by a number of well known companies, whose products are advertised on the board itself.

GAME REVIEWS

## *Creeper*

Creeper, invented by Graham Lipscomb, is the most interesting two-player board game I have seen for a long while. Besides being well conceived it is also well made, with a strong board and box and attractive black and white plastic pieces. It is distributed by GL Games, PO Box 72, Horsham, West Sussex, RH13 5YW. (Priced £8.95.) The board is based on the $4.8^2$ tessellation, a mosaic with two octagons and one square at each vertex. There are 10 Black and 10 White Pawns and 32 Markers, which are flat discs, black on one side, white on the other. The opening position is shown.



Opening position in Creeper.

The object of the game is to take control of a continuous path of octagons across the board from corner to corner. Black permanently owns one pair of corners and White the other pair.

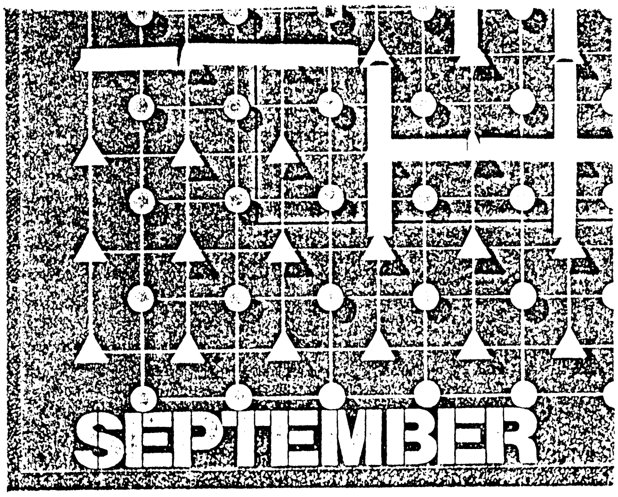
Control of an octagon is achieved by jumping a Pawn across it. from square to square, and placing a marker upon it with the appropriate face up. Ownership of the octagon changes if an opposing Pawn jumps across it, resulting in the Marker turning over. Pawns can also move from square to square along the side of an octagon, and can capture by hopping over an opposing Pawn in an adjacent square to the next square beyond. Moves are only possible to vacant squares and captures are not compulsory.

Except where some form of sacrificial combination is possible it is generally advisable to avoid exchanging any pieces, so that the threat of capture serves more as a limitation on choice of moves rather than an active aspect of the play. On the other hand, reducing the number of Pawns decreases the choice of moves, and may simplify the analysis. The game is a draw if a player captures or hems in all the opposing Pawns, leaving the opponent with no move to make.

The only adverse comment I can find to say about this game is that its name may not immediately spark excited interest, but it may be true that, as it claims on the box, "it grows on you!". The board and pieces are good value, since they can also be used for playing versions of Reversi or Halma as interludes to Creeper.

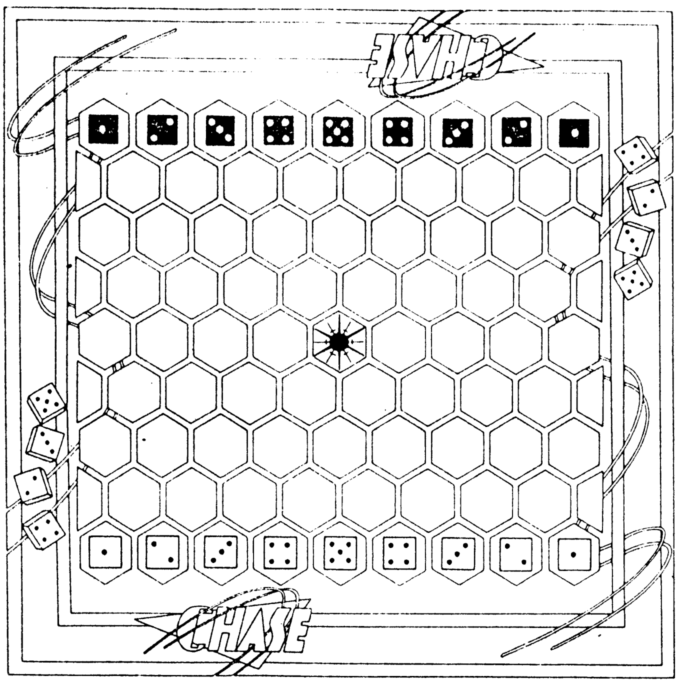
## *September*

A corner of the September board.




This is another game employing the Cross-connection principle - the two players try to form a path across the board, one from top to bottom, the other from left to right, so that only one can succeed. If a line is not formed when all the pieces are placed, the smaller pieces may be moved about. That's all there is to it. The board is a dazzling pattern of red dots and yellow triangles, and the pieces are plastic strips that magically stick to the board. Invented by Danny Kishon, distributed by Paradigm Games, 2 Bradbrook House, Studio Place, Kinnerton Street, London SW1. (Price is given as £5.99, but Argos have it at £4.35.)

## Chase




The most original feature of Chase, invented by Tom Kruszewski, is its use of dice as pieces. The number showing on top of the die determines the exact number of cells it can move, in any of the six directions available on the honeycomb style board. The total of all the spots on a player's dice must be exactly 25. If a die is captured (captures are by eviction, as in Chess) then the total is made up to 25 by "promoting" the dice of least value. If you are reduced to four dice, which can total only 24 you have lost. Dice on adjacent cells can also "swap points". The game is distributed by TSR UK Ltd, The Mill, Rathmore Road, Cambridge, CB1 4AD.
(Price £7.95)

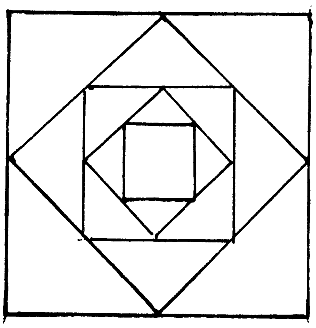
←Opening position for Chase.

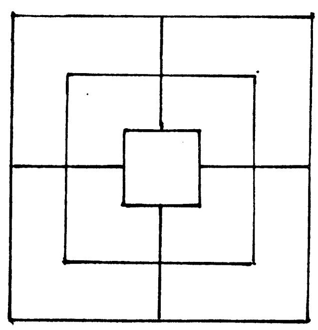
The other notable feature of Chase is the number of different Fairy Chess ideas that have been incorporated into the one game: The board is (in imagination) a cylinder, so that a piece can move off one side of the board and reappear on the opposite side. The pieces moves are allowed to reflect off the top and bottom edges of the board. A piece is allowed to move to a cell occupied by a piece of the same colour and push it to the next cell. A chain reaction of pushes is allowed, possibly ending in a capture.

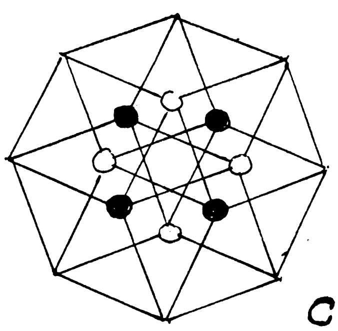
The game is rather spoilt, to my way of thinking, by the somewhat arbitrary rules applying to the central hexagon, known as the "chamber", which seems to have been a last-minute embellishment. The idea is that a piece moving into the chamber splits and comes out as two pieces moving in different directions. It may be that this could be developed into a new game in its own right.

## Square Play & Morris & Hypercube

Square Play is really just a modernised version of Nine Men's Morris. The board used is of the pattern **A**, as compared with **B** for Morris. Each player has 7 men which are placed one at a time on the points of the board, and then moved along the lines. The object is to form a square of four counters. If you form a row of three counters this allows you to remove one of the opponent's men. (If you form two rows simultaneously you can remove two men.) Nine Men's Morris is played with 9 men a side, and captures are made by forming rows of three, the objective being to reduce the opponent to two men, or to block them so that he cannot move. The Square Play board is well made (it has the Design Centre triangle) and it is neatly packaged in record-sleeve style, but the price of £5.95 seems excessive for the content. It is distributed by H.Thiessen, 69 Woodbury Avenue, Petersfield, Hants, GU32 2JB.


A

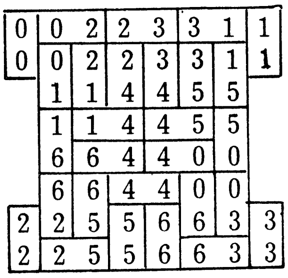

B


C

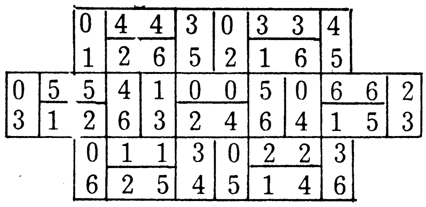
Hypercube is a simple game of my own invention, also of the Morris family. The board, C, represents a "four dimensional cube". Only four men each are used, placed to start alternately round the inner circle, as shown. The object is to get your four men onto a cycle of four connected points of the board (these squares and diamonds are the 24 "faces" of the hypercube). If you can get three onto such a cycle then the fourth point may not be entered by the opponent, and any opposing piece already there is forced to move away immediately on the next move. If such a piece cannot move then it must be removed from the board (i.e. into the fifth dimension!) and replaced next time, removal and replacement each counting as a move.

## *Domino Quadrilles Solutions*

These diagrams solve the two problems on p4 of Issue 1. **A** was given by Henri Delannoy in 1883. **B** is original.



**A.** French Quadrille with [6,6] set.



**B.** English Quadrille with [6,6] set.

## *Solutions to Series-Play Chess Problems*

Excellent sets of solutions were received from: R.Brain, A.W.Ingleton, D.Nixon, T.G.Pollard, R.W.Smook (Canada) and T.H.Willcocks - their comments are interspersed below.

**01.** Nettheim. 3Ke4 4Sf5 7h8=B 9Be3 10Rd4 15b8=B 16Bf4 17Re5 19Sd3 and any ‡.
**02.** Nettheim. 1Rf5 2Sf4 3Rd3 4Se3 9g8=B 11Bf3 12d5 14Ke4 15Bd4 16h8=B 17Be5, any ‡.
**03.** Nettheim. 5e8=R 7Rg1 8Kf1 9Be2 14c8=S 17Sf2 for Rxg1‡
**04.** Nettheim. 4e8=S 8Sh7 9Kh6 10Bg5 15e8=B 16Bh5 and any ‡ (The composer also notes a try by: 4e8=B 5Bh5 6Kg6 7Bg5 12e8=S 16Sh7 17Kh6 any ‡ one move too late).
**05.** Nettheim. 1Kb3 2Bb2 6e8=R 8Ra2 9Ka3 10Bb3 11Sc4 16e8=S 19Sb4 for Pxb4‡.
The composer notes that: (i) each solution ends with a quiet (non-checking) move, as he finds such non-brutality far more pleasing. (ii) each solution contains exactly two promotions, assisting the unity of the suite. Solvers comments: A brilliant set. Masterly control of order and no W check used in finale. D.N. A cleverly constructed set. Move order neatly forced. T.G.P.
**06.** Steudel. 1c2 autostalemate, or 1Kc2 2b1=S 5Sb2 6Kc1 7c2 for Ka1 stalemate.
**07.** Steudel. 1h2 autostalemate, or 1Kh2 12Kxc3 18Kh1 19h2 for c3 stalemate.
**08.** Steudel. 1Kh4 autostalemate, or 1Kh6 6Kd8 for Qc6 stalemate.
**09.** Steudel. 1h2 autostalemate, or 1Kh2 8Rxa6 15Rg2 16Kh1 17h2 for a6 stalemate.
The diagrams for problems **6** to **8** got into the wrong order somehow, but solvers were all able to cope with this extra enigma. Cyclic shift of stipulations - a new theme? R.B.
Note that in the autostalemate parts White has no stalemate-maintaining moves.
**10.** Steudel. Retract Kd1-e1 and play Kc2 mate. There is no retraction that will allow OOO‡. As simple as that - and I spent minutes trying to see how to castle! A 1st April problem! T.G.P. No retraction can preserve the set mate OOO, which would of course be a short cook if the problem were posed as Sm 2. A pity though that key move is not specifically backward. A.W.I.
**11.** Jelliss. 1Kxa5 5Kxa1 10Kxe3 11Kxf4 12Kxg5 13Kxf6 14Kxe7 15Kxd8 18Kxe5 21Kxd2 23Kxe4 24Kxf5 25Kxe6 29Kxa8 31Ka6 for a8=Q mate. Rundlauf knocking out 13 supports and one obstruction (a8) to 3-man finale. D.N. Nice work - brilliant! T.G.P. All 16 W men used. WQ disappears on the first move and reappears on the last. Symbolic arrow pattern. G.P.J. Marvellously contorted trail of destruction! A.W.I.
**12.** Jelliss. 1Kf5 2Bg5 3Kg6 4Kh5 5Rf3 6Rf5 7Kg6 for Sf4‡ or 1Kd4 2Rxb3 3Kc4 4Kb5 5Bd2 6Bb4 7Ka4 forSc3‡.Saw that g6 must be for BK but failed to see 4Kh5 for quite a while. D.N. Very pretty. Fabulous if the extra stip could be avoided. A.W.I. Pawns point the way. T.G.P.

The series movers even exceeded my expectations. D.N. A pleasing selection. T.G.P. Similar comments from R.W.S. and T.H.W. **Solvers' Ladder:** Everyone gets full marks (12 points) except T.H.W. who forgot No 12 (but on the other hand he also solved the cryptarithms. A good set of solutions to the other puzzles were also sent by Clive Palmer). A good start to the ladder.

CHESS VARIANTS



# *Chess with Grasshoppers*

The term **Fairy Chess** is sometimes applied to all deviations from the orthodox, but more usefully it is any variant in which new men are used. There is a whole galaxy of fairy pieces available to choose from - the best introduction to them is still Anthony Dickins's A Guide to Fairy Chess. Any new piece can be introduced into the orthodox game in numerous different ways, thus producing a whole range of variants. In the absence of any other statement of rules the convention among problemists is that any unorthodox piece in a diagram has appeared as the result of promotion of a Pawn. Gamers however would probably prefer the new piece to be present from the start of play. This can be done by substituting the intruder for one or more of the incumbents, resulting in new-King, new-Queen, new-Bishop, new-Knight or new-Rook chesses. Alternatively the new pieces can be added as extras, say at a3 and h3, or at a2 and h2 with the a and h Pawns moved forward.. Other methods are also possible. For example, simply holding them in hand and entering them on the board when required or permitted, the placement being counted as a move, or allowing them to materialise under specified conditions, e.g. on any square under triple guard from existing pieces (other than Pawns). There are many possibilities yet to be investigated.

By far the most popular new piece yet invented is the **Grasshopper.** which made its debut on 3rd July 1913 in the chess column of The Cheltenham Examiner. It was the subject of Part XI of a series by T.R.Dawson on Caissa's Playthings. The definition given there is: "The grasshopper moves queenwise, but only to a square immediately beyond one man in the line." Like all the other chessmen it captures by eviction - i.e. by hopping to the square occupied by the victim - the man hopped over acts only as a hurdle and is not captured. By October 1930 Dawson could talk about "the world's output (of Grasshopper problems) being now well into the second thousand," and the rate shows little signs of slackening even yet. Let us investigate various different Grasshopper Chesses.

For the purpose of investigating the viability of a proposed variant I find that one of the best tests is to try to construct Synthetic Games conforming to the new rules. A **synthetic game** is a help-play game in which the two sides co-operate to reach any specified destination. The first such game to investigate is always the **Fool's mate** - i.e. the shortest possible series of moves leading to checkmate of one of the participants. In **help-play** all the usual rules of Chess are obeyed, except the one that says the two sides should "oppose" - a rule which is in any case impossible to enforce, as evidenced by the phenomenon of the Grandmaster Draw.

# *Synthetic Games in Grasshopper Chesses*

The following are some examples of synthetic games in various Grasshopper Chesses.

(i) **Grasshoppers for Queens.** The Fool's Mate is: 1h3 (or h4) Gb6 2Rh2 (or Rh3) Gxg1 mate. [due to E.Bonsdorff, FIDE tourney 1963]. Shortest game to end up at the Opening Position but with Black to move: 1Gd3 Gb6 2Gd8 Sa6 3Gb8 Gd8 4Gd6 Sb8 5Gd1. How many ways?

(ii) **Grasshoppers for Bishops.** Shortest game to leave all 32 men on the same colour squares. 1a4 h5 2Ra2 Rh7 3h3 a6 4b3 g6 5d3 e6 6f4 c5 7Sf3 Sc6 8Gg5 Gb4 9Gb5 Gg4 10f5 c4 11e4 d5 12Qe2 Qd7 13Kd1. [G.P.Jelliss, Games Castle No 5, 1983].

(iii) **Grasshoppers for Knights, and WK,WQ interchanged.** Shortest game to pin mate, with capture of Queen en route. 1Gd3 Ge6 (not check because the WK happens to be at d1 rather conveniently) 2GxQ d5 3Gd4 Gd8 4Ge3 (pinning the BGe6 against the BK e8) Bd7 5Gxh8 mate. The pinned G cannot interpose at g8. The move order is exact.

(iv) **Grasshoppers for Rooks.** Shortest game to antipin mate (i.e. in which a piece cannot move to a particular square because it would cause check to its own King). Black's moves always imitating White's through the centre point of the board (e.g. 1e4 d5) except when answering a check. White moving only one Pawn. 1Gf3 Gc6 2g3 b6 3Bh3 Ba6 4Be6 Bd3 5g4 b5 6Gh5+ Bg6 7Bxf7 mate. (Bg6 cannot take f7 because of check by Gh5.)

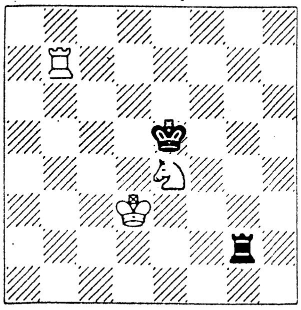
(v) **Grasshopper combined with King.** The K+G is known as a Scorpion (see Chessics 1,8 and 9,7). Combining the G with other pieces is another way of involving it in the play. Shortest game to mate of one K+G by the other! 1f4 Sf6 2f5 Sd5 3g3 Sb4 4(K+G)h4 Sc6 5(K+G)xh8 mate. How many other ways can you find?

# *Helpmates & Grasshoppers*

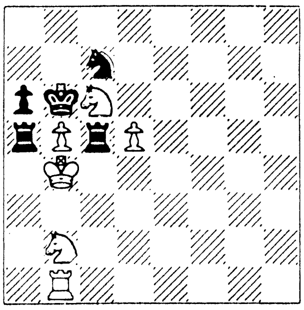
Guide to stipulations: **helpmate** (hm) the players cooperate in reaching a checkmate of Black by White. in the stated number of pairs of moves, thus in hm 2½ there are 5 single moves. ** means "same stipulation as the preceding problem". **duplex** means there is also a solution in which the White King is the one checkmated. **grasshoppers**, explained opposite, have always been denoted by upside down Queen symbols. **seriesmate** (Sm) see the last issue. In **26**(h) the series is played by White. **equimover** (Equi-) means the pairs of moves are equal in length; the mate however is normal. **sensitive Kings** are checked by their own men, thus in **28**(b) Black cannot begin by 1Rc8 (checks the BK).

More original compositions are urgently wanted

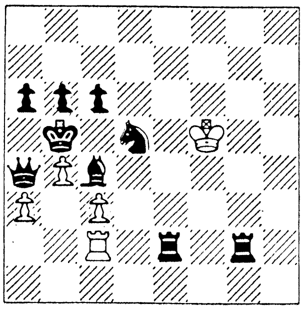
**13.** F.M.MIHALEK
hm2 (2 ways)



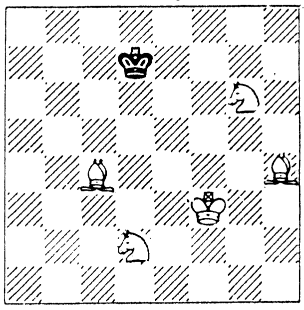
**14.** E.BOGDANOV & V.VLADIMIROV **



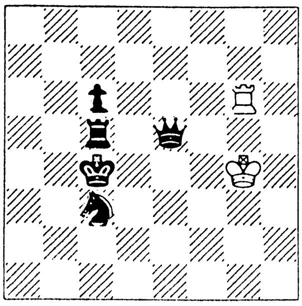
**15.** V.VLADIMIROV & A.OSHEVNEV **



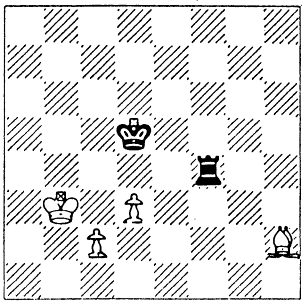
**16.** F.M.MIHALEK
hm 2½ (2 ways)



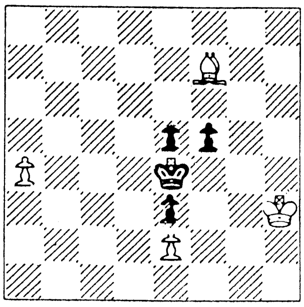
**17.** H.GRUBERT
hm3 (b) c3-d2



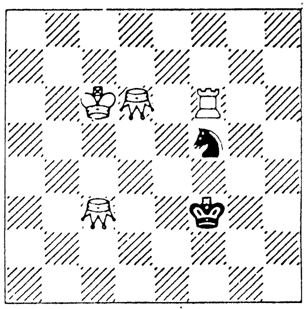
**18.** H.GRUBERT
hm 3½ (2 ways)



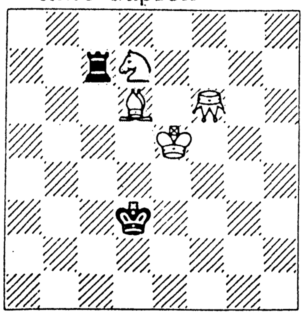
**19.** M.McDOWELL
hm 5



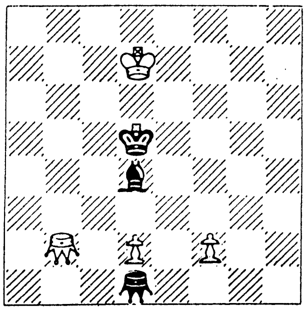
**20.** F.M.MIHALEK
hm 2½



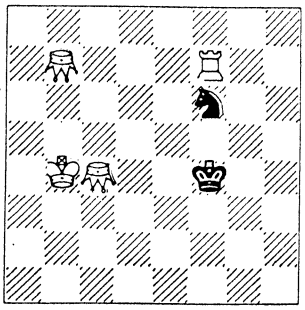
**21.** H.GRUBERT
hm3 duplex



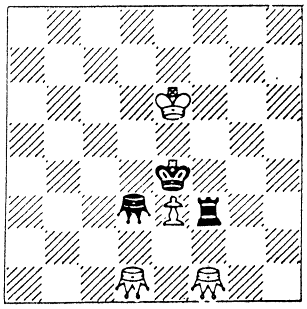
**22.** F.M.MIHALEK
hm 3



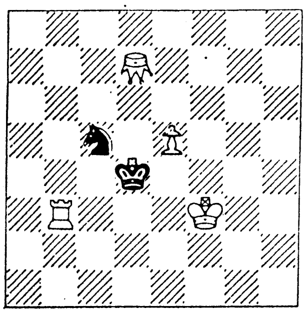
**23.** F.M.MIHALEK
hm 3½



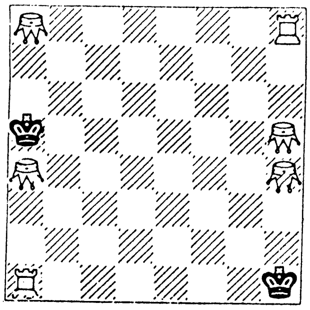
**24.** F.M.MIHALEK
hm 4



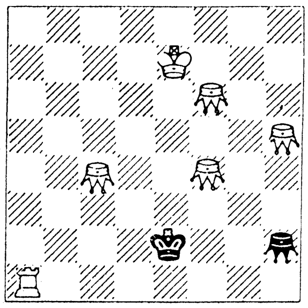
**25.** F.M.MIHALEK
hm 3½



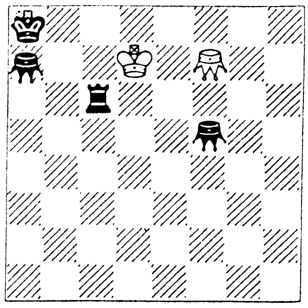
**26.** F.M.MIHALEK
(a) hm 4 (h) Sm 6



**27.** G.P.JELLISS
Equi-hm 3 (b) WK g7



**28.** G.P.JELLISS
hm4 (b) Sensitive Ks



Solutions to reach me by 1st February 1988.

TRANSITIONS



## *Sliding Block Puzzles*

The following are the solutions to the problems in the last issue, concerning transitions on a 2-row 3-column board with the space starting and ending in middle of the top row. Six looping moves are possible, the space moving : a2a1b1b2 or b1c1c2b2 or a2a1b1c1c2b2 or the same clockwise. Denote these 6 circuits by A, B, C and A', B', C' then to transpose a1-a2 and also c1-c2 we play either: C'BAC' or CA'B'C, each of 6+4+4+6 = 20 moves. To transpose a2-c2 and also a1-c1 we play B'AB'AB' or BA'BA'B or AB'AB'A or A'BA'BA', each of 4+4+4+4+4 = 20 moves. More explicitly the first solution in each case is:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (1) | 5 0 1 | – | 1 0 2 | – | 1 0 4 | – | 5 0 4 | – | 4 0 2 |
| | 4 3 2 | | 5 4 3 | | 5 3 2 | | 3 1 2 | | 5 3 1 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (2) | 5 0 1 | – | 5 0 2 | – | 4 0 2 | – | 4 0 3 | – | 1 0 3 | – | 1 0 5 |
| | 4 3 2 | | 4 1 3 | | 1 5 3 | | 1 2 5 | | 2 4 5 | | 2 3 4 |

T.H.Willcocks reports that this was set as a prize competition in New Scientist 28 Sept 1961.

**Problem 3:** Transform

| | |
|---|---|
| 5 0 1 | |
| 4 3 2 | |

to

| | |
|---|---|
| 2 0 4 | |
| 1 3 5 | |

in fewest moves (16 moves, four ways)

## *Sam Loyd & the Fifteen Puzzle*

The chapter on history in Edward Hordern's Sliding Piece Puzzles is mainly concerned with the "15 Puzzle". He provides a wealth of references to articles written on the problem between 1879 and 1884 (and many subsequently) to show that there was a great craze for it around 1880, comparable to that for the Rubik cube 100 years later.

Despite the claim by Sam Loyd (ref 1) that "in the early seventies I drove the entire world crazy over a little box of movable blocks which became known as the 14-15 puzzle" Mr Hordern is unable to cite any description of the puzzle earlier than 1879 (ref 2). He concludes: "From all the information available, it would seem that the likely course of events was that the '15' puzzle was invented in America towards the end of 1878 by an unknown person (not Sam Loyd). The resulting puzzle craze started early in 1879 and spread to Europe in the same year. Sometime later, in either 1880 or early 1881, Sam Loyd proposed his version, the '14-15' puzzle, which gained him immediate notoriety through the enormous reward offered for its solution. The craze then seems to have died sometime in 1881." The case against Loyd is however, I feel, far from proven.

By chance I discovered an earlier source for Loyd's claim of priority (ref 3). He writes of the 15 puzzle: "its history is very simply explained. There was one of the periodical revivals of the ancient Hindu "magic square" problem, and the idea occurred to me to utilize a set of movable blocks, numbered consecutively from 1 to 16, the conditions being to remove one of them and slide the others around until a magic square was formed. The "Fifteen Block Puzzle" was at once developed and became a craze." "I give it as originally promulgated in 1872:-" He then propounds the (insoluble) 14-15 puzzle version. The editor "Sphinx" (H.E.Dudeney) in a postscript chides: "A puzzle inventor cannot be held responsible for the extravagant interest bestowed on his productions by an excitable public, but to propound to the world a problem that looked plausible, but actually had no solution, was a sin for which it is to be hoped Mr Loyd is duly penitent." Note that here Loyd gives a specific date, not just a vague period.

Since 4x4 magic squares existed for centuries before the 15 puzzle arose this story of its origin seems quite plausible. Historical order is not always the same as logical order from simpler to more complex. To prove it though we need to trace the 1872 source.

References: (1) Cyclopedia of 5000 puzzles, tricks and conundrums, 1914, edited by Sam Loyd Jr. (2) American Journal of Mathematics, 1897, articles by W.E.Story and by W.W.Johnson. (3) Tit-Bits, 24 October 1896.

**Problems:** I offer for solution the tasks of converting the following arrays to magic form:

(4)

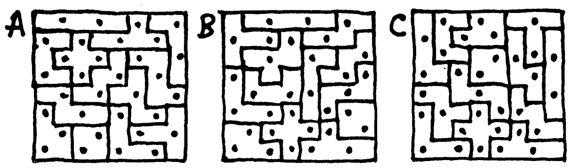
| | | |
|---|---|---|
| 0 | 1 | 2 |
| 3 | 4 | 5 |
| 6 | 7 | 8 |

(5)

| | | | |
|---|---|---|---|
| 0 | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 |
| 12 | 13 | 14 | 15 |

## Chequered Chessboard Dissection

Upon reading Philip COHEN's letter more closely I find that his results for the problem of dissecting the board into the 12 five-square pieces plus the 2x2 make use of a two-sided board, the reverse of a black square being black, so that pieces can be turned over. The following are his results:

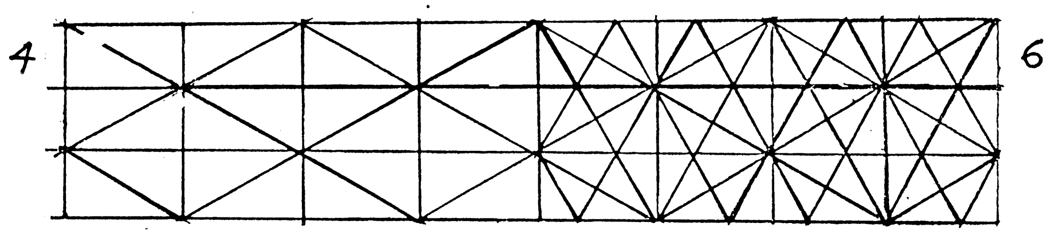



A. Starting dissection.
B. 18 R-connected squares (white).
C. 43 adjacent same-colour squares.

A quick attempt, using a one-sided board, as specified, produced a single colour area of 14 squares and 33 out of the 112 pairs of squares matching, but I expect to be able to report much better results than this later - if you have already found results, let me know.

## Crossing the Parallels

The question was how many beams of equidistant parallel lines could be combined, in different directions, to dissect the plane into areas all alike in size and shape. Cases of 1, 2 and 3 beams were illustrated. Four beams can also easily be combined: one pair of beams must be at right angles to each other (dividing the plane into rectangles) and the other pair equally spaced (thus dividing the plane into diamonds), the edges of the diamonds being the diagonals of the rectangles, and the edges of the rectangles being the diagonals of the diamonds. In a special case the diamonds and rectangles are both squares, and the right angled triangles into which the plane is dissected are then isosceles, i.e. 45°,45°,90° triangles.



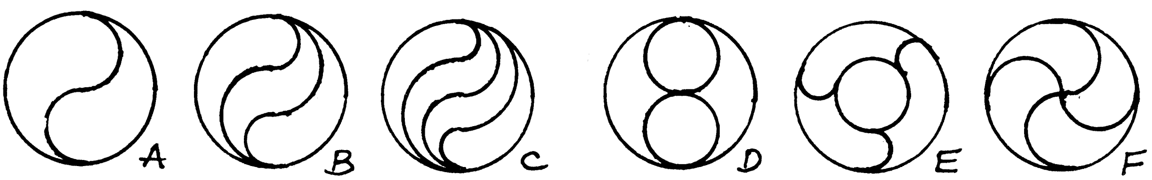

Five sets of parallels cannot be combined in the required manner, but Six can. The six sets of parallels must divide the plane into triangles whose angles are 30°,60°,90°. More than six beams cannot be combined with the required effect: though I must admit that I have not gone to the trouble of writing out a fully rigorous geometrical proof of this, nor have I seen one in the literature (some hints towards such a proof will be found in Rouse Ball's Mathematical Recreations, 13th edn, p105 and in Coxeter's Introduction to Geometry, 2nd edn, p64).

## Squaring the Cube

To dissect a cube into as few pieces as possible to form a square!

## Circular Saws

The pattern of the Yin and Yan (**A**) is an ancient design that divides the circle into two equal parts by cuts along circular arcs. Extensions of this method, dividing the circle into three and four parts all of the same area are shown (**B** and **C**). Some other less elegant four-part dissections of the circle are illustrated (**D**, **E** and **F**). The puzzle offered for solution is: To divide the circle by the minimum number of semi-circular arcs into four pieces of the same area, but all of different shapes. Other numbers could also be tried.

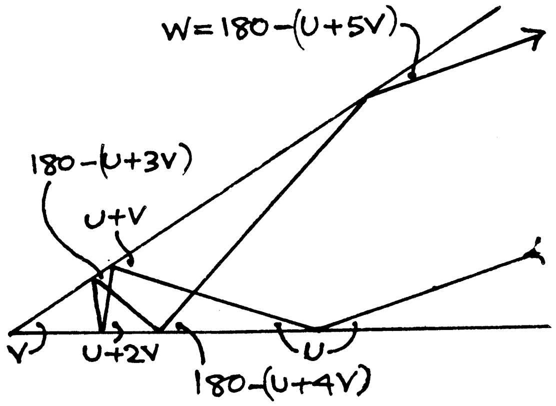


GEOMETRY



# *Triangular Billiards*

Let us call Lewis Carroll's question, whose answer was given last time, **Problem 1.** Then **Problem 2** is to find the angle of exit, W, of a ball cued into a corner of angle V to hit one side at an angle U (where $0<U\leq V$). The angles of the successive impacts on the sides will be related as illustrated below. These angles are found by repeated use of the rule that an "external" angle of a triangle is equal to the sum of the opposite internal angles.




The analysis shows that on the n-th bounce the angle W between the path of the ball and the last side hit is U+(n-1)V on the way in and 180-[U+(n-1)V] on the way out. For the ball to escape from the corner, without hitting one of the sides again we require $0<W\leq V$, that is $0<180-[U+(n-1)V]\leq V$. That is, $U+(n-1)V<180\leq U+nV$. Thus the number of impacts, n, is such that $(n-1)<(180-U)/V\leq n$ that is n=inc[(180-U)/V], where inc stands for "integral completion", i.e. "first whole number not less than".

Using inp for "integral part", i.e. "first whole number not greater than" and x/y for the remainder when x is divided by y, then we find that n=inp(180/V) when $U\geq(180/V)$ and n=inp(180/V)+1 when U<(180/V). Thus inparticular, when V is an aliquot part of 180 (i.e. an exact submultiple) then the number of bounces is the number of Vs in 180. (V=180/n).

**Problem 3.** The question of what happens when the ball hits both sides of the corner simultaneously is difficult to resolve. Professor A.G.Mackie (Dept of Mathematics, University of Edinburgh) who has written a number of papers on the dynamics of snooker, advises: "If the ball and cushions are assumed to be incompressible, the problem is indeterminate when the centre of the ball is aimed at the vertex of the angle unless, of course, some symmetry argument can be invoked as in the example mentioned. To look at it in more detail one would need to develop a model where the cushions 'gave' a little bit and produced a restoring force." Standard school text-book procedures of resolving of forces will provide a sensible solution for cases when $V\geq 90$, but in the absence of a treatment for acute angles I will not go into this any further at present, save to say that in the particular case of a right angled corner the ball will always return along the path of entry.

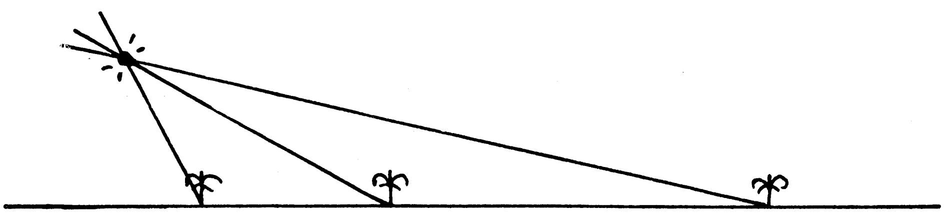
Here are some further questions in Triangular Billiards to puzzle out:

**Problem 4.** At what angle, U, should a ball be projected into a corner of angle V (not hitting both sides simultaneously) so as to return along the same line?

**Problem 5.** If a ball cued from any corner of a triangular table to bisect the angle at that corner returns to the corner along the same path, what are the angles of the table? There is one obvious answer - but are there others?

# *Star Points*

Here we begin another series of geometrical questions.



**Problem 1.** A traveller in the desert saw a star from which six rays emanated regularly, i.e. at 60 degrees to each other. Three of the rays struck the ground at the feet of three palm trees he could see, irregularly spaced along the horizon. Where in the sky exactly did the traveller see the star? (Not where the star is shown in the illustration.) Further, other aspects of the desert scene, revealed in the course of the construction, may tell you what country the desert is in!

NUMBERS

## *Cryptarithms*

The following are the solutions to the cryptarithms in the previous issue.

(1) PUZZLES x 3 = GJELLISS
6944385 x 3 = 20833155
digit 7 is not needed

(2) MIMIC + UNKNOWN + SOLUTION = WILLCOCKS
90903 + 7868418 + 94275048 = 102234369
here M = S

(3) GAMES + PUZZLES = AMUSING
83509 + 3466209 = 3549718
47132 + 7055832 = 7102964
in each case A = P

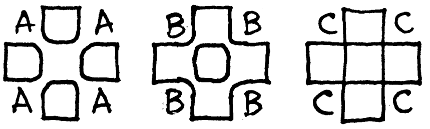
AMAZING (or AMASING or AMUZING)
gives no solution

T.H.WILLCOCKS, who composed the first cryptarithm above, contributes the following: **An Overheard Conversation:** Alison - I am equal to two of you and can prove it! - (4). Rachel - Rubbish! I am equal to two of you and can prove it! - (5). Alison - This is nonsense! Rachel - Not at all. It would merely mean that no-one thought anything of either of us! (If a = b = 0 then a = 2b and b = 2a). But in fact I was being too modest. I am equal to three of you and can prove it! - (6).

(4)
RACHEL
RACHEL
ALISON

(5)
ALISON
ALISON
RACHEL

(6)
ALISON
ALISON
ALISON
RACHEL

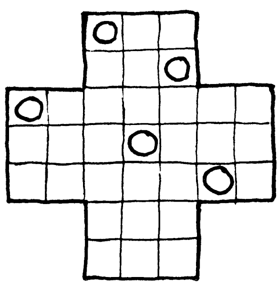



## *Enumerations*

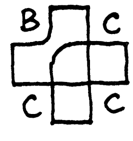
**1.** To enumerate the number of ways one solitaire piece can capture the complete set of 16 pieces observe that the 16 capture moves must form a Greek-Cross-with-inner-square path, so we require the number of ways this figure can be drawn without lifting pen from paper or going over any line twice. There is no choice of route in going through the outer corners, but for each inner corner there are three choices, as shown in the diagrams labelled A, B, and C. The four inner corners cannot all be traversed in the same manner. A can occur at only one corner at most. The other corners can then be freely either B or C. This gives 8 patterns. If A does not occur then we cannot have 2B+2C (try the two possibilities) so we are left with B+3C or C+3B, that is 2 cases. So in all there are 10 possible cases. (See diagrams at the foot of the page.)

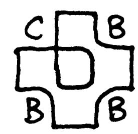
Each of these can be orientated by rotation in 4 ways. We can further choose the first move of the capturing man to be in any one of the 16 lines of the diagram in either of 2 directions. So we get the total: 2x16x4x10 = 1280. This is the answer Dawson gave in 1907 (though his method of solution was quite different).

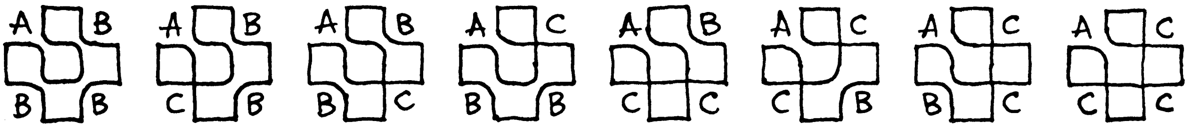
**2.** While we are interested in the Solitaire board let us try the following enumeration: In how many ways may five men (the maximum possible) be placed on the solitaire board so that no two are in line, laterally or diagonally? This was also posed by T.R.Dawson in 1907 (they are parts b and a respectively of problem 70 in a manuscript of puzzles by Dawson in the B.C.P.S. Archive). Dawson's answer to this differs from my own, and our methods of solution are quite different, so I would be glad of independent views.



In the arrangement illustrated it is debatable whether the two corner men (a5 and c7) are in line diagonally or not. But since this pattern is the only case in which this anomaly arises it only makes a difference of 8 to the total if we count it (and its rotations and reflections) or not.



# *Parita*

By Vladimir Pribylinec (Czechoslovakia)

This is a game for two players. A pack of 44 cards is used, consisting of 10,J,Q,K,A in four suits, twice, plus four Jokers. At the start each player is given two Jokers. The players then alternately take two cards from the heap until each has 18 cards in his hand. The remaining 8 cards form a face-down "talon".

The players lay out or pick up cards alternately in the following ways:

1. **Initiation:** We put one card on our own or the opponent's side of the table. A lone Joker takes the value of a Queen of any suit.
2. **Combination:** We put beside an exposed card another of the same suit, to form all or part of the sequence 10,J,Q,K,A. All sequences on the table must have the same orientation (left to right for each player). A Joker may be used in place of any card, but we cannot combine two Jokers in one sequence. For combination of a card on the opponent's side we score 1 point and we can, but need not, take the upper card from the talon.
3. **Duplication.** We put beside any exposed free card (i.e. one not between two others) its twin (same value and suit). Joker can be twinned only with Joker.
4. **Extraction.** After making a duplication on either side of the table it is necessary to extract a free card from the other side of the table. The value (but not the suit) of the extracted card must be the same as the duplicated card. Thus a duplication cannot be made unless a card of the same value is available for extraction. The end cards of a complete sequence however cannot be removed, nor a Joker.

A complete sequence has a value of 5 points, but each duplication in it counts as a point to the opponent. The game is won by the first player to achieve 12 points, or by the player with most points if the game ends due to a player being unable to move. If both players have the same score or they repeat the same moves the game is a draw.

The following is a sample game, which will make things much clearer than any amount of description. The cards are denoted by $J_S$ for Jack of Spades, $Q_D$ for Queen of Diamonds, and so on. The moves are denoted by $I_A$ for initiation on side A, $C_B$ for combination on side B, $D_A$ for duplication on side A, and so on. $X=J_H$ denotes a Joker masquerading as the Jack of Hearts. ($Q_D$) denotes extraction of the Queen of Diamonds, either from a side, after a duplication, or from the talon, after a combination.

The two players, A and B, receive the following hands:

A: Hearts J J K A A  Spades 10 10 Q Q A  Diamonds 10  Clubs 10 J Q A A
B: Hearts 10 10 Q Q K Spades J K  Diamonds J Q Q A A  Clubs J Q K K

In addition each has two Jokers. Play proceeds:

1. $Q_S I_A$ - $K_C I_B$
2. $Q_C C_B(K_D)$ **1:0** - $J_C C_B$
3. $X=10_C C_B(10_D)$ **2:0** - $10_H I_A$
4. $J_H C_A$ - $10_H D_A(X)$
5. $J_C D_B(J_H)$ - $X=J_H C_A(10_C)$ **2;1**
6. $10_C C_B(A_S)$ **3:1** - $J_D I_B$
7. $A_H I_A$ - $X=J_H D_A(J_D)$
8. $A_C C_B(J_S)$ **5:5** - $Q_H C_A(J_D)$ **5:6**
9. $A_C D_B(A_H)$ **6:5** - $Q_D I_B$
10. $K_D C_B(K_D)$ **7:5** - $Q_H D_A(Q_D)$
11. $J_S C_A$ - $Q_D I_B$
12. $10_S C_A$ - $Q_D D_B(Q_S)$
13. $Q_S C_A$ - $Q_S D_A(Q_D)$
14. $X=K_S C_A$ - $X=K_S D_A(K_D)$
15. $K_D C_B(K_S)$ **8:5** - $J_D C_B$
16. $A_S C_A$ **11:7** - $A_D C_B$
17. $K_H I_B$ - $K_H C_A$ **11:8**
18. $A_H C_B$ **12:8** or $A_H C_A$ **13:11** A wins

At move 8. player A combines the Ace of Clubs with a sequence on B's side of the table and draws the top card of the talon (the Jack of Spades) for this move he scores one point, but in addition the move forms a complete sequence 10 to A on B's side. This sequence is worth 5 points, 4 of these points count to B and 1 to A, since there is one duplication in the sequence. Thus the score goes from **3:1** to **5:5** (2 points to A, 4 to B).

At move 9. player A duplicates another of the cards in the sequence of Clubs on B's side and thus transfers one of the points for this sequence from B to himself, **5:6** to **6:5**.

LOGIC

## *Answers to the Questions*

**1. Probable Inequality.** If the probability of $A \neq B$ is P and of $B \neq C$ is Q then the probability of A=B is 1-P and of B=C is 1-Q (since things are either equal or not). If A=B and B=C then also A=C (things equal to the same thing are equal to each other). So the probability of A=B=C is (1-P)(1-Q), the probability of the simultaneous truth of A=B and B=C. So the probability of A,B,C not all equal is 1-(1-P)(1-Q) which is the same as (P+Q)-PQ. This was the formula I had in mind. The data is in fact insufficient to find $p(A \neq C)$.

**2. Wheels within Wheels.** The number of times the wheel of radius r rotates in going round the wheel of radius R is (R/r)+1. The "+1" is liable to be forgotten in the calculation. It can be ascribed to the route being curved rather than straight. The formula applies whether r is less than, equal to or greater than R. When r=R we get the case of the classical conundrum, the answer to which is 2. In the case of a small wheel rolling inside the larger the formula required is (R/r)-1. The negative sign arises since the rotation of the small wheel due to its motion round the closed curve is opposite to its rotation due to rolling. As r gets closer to R this value approaches zero - corresponding to the case r=R when no rolling motion is possible. If r were greater than R the value of (R/r)-1 would be negative. This can be interpreted physically if we consider a hoop rolling round a fixed circle inside it. As the centre of the hoop goes clockwise round the fixed centre, the hoop itself rotates anticlockwise about its own centre. This is a phenomenon no doubt familiar to hoola-hoopists.

**3. Logical Grocers.** The conclusion is that all grocers are non-brave.
Full details of the solution are held over to the next issue due to lack of space here.

**4. Saw Seeing.** The answer of course depends on how we interpret the term "cut". I first came across the problem as No 35 in Geometric Games by Pierre Berloquin (1980) but it was treated earlier by Martin Gardner (Mathematical Puzzles and Diversions, 1959) who attributes it to Frank Hawthorne, Mathematics Magazine, 1950. These sources say 6 cuts is the minimum, one for each face of the inner cube. I say that 2 cuts will do the job. After the first cut of one face of the central cube we have two pieces of wood. All the rest of the cuts can be done in one motion of the saw blade, by using it to cut through both pieces of wood, the main piece first. While the saw is going through the smaller piece the two parts of the first piece can be rearranged for the saw to meet them on passing through the second piece - and so on.

**5. Saw Saying.** The saying "Moderation in all things" also implies "Moderation in logic". The argument given was an example of extremism in logic, so its conclusion is immoderate!

## *Some More Questions*

**6. Cross-Point.** Two poles of heights A and B are separated by a distance C. Tight wires are stretched from the top of each pole to the base of the other pole. What is the height of the point where the wires cross?

**7. Lunar Calendar.** If the Earth travels round the sun in A days and the Moon travels round the Earth in B days, why is the number of months in a year not A/B? What is it?

**8. Exchangeable Operations.** If f(s) and g(s) are expressions involving s (representing a scalar - i.e. a real number) is it possible to have $f(s)*g(s) = f(s)^{\circ}g(s)$ where * and ° are different operations? Oddly enough it is, even with ordinary operations like +, -, x, /.
The problem is: to find suitable, simple, expressions f(s) and g(s).

I have put these three, somewhat algebraic, questions together since, like problem 1 they lead to some surprisingly simple, and pretty, formulae that are not unrelated.

**9. A Singular Riddle.** This is an old chestnut, but one worth preserving

*A man without eyes saw plums on a tree.*
*He neither took plums, nor plums left he.* *Explain.*

The answer ideally should also be in verse.

VERSIFICATION



## *Mnemonics for Pi*

**A**

*How I wish I could recollect of circle round*
*The exact relation Arximedes erfound*

Dennison NIXON, writing to me in April 1983 about Walter STEAD's Grid Chess noted: "This reminds me of another idea of W.S. which I have often thought should have a wider airing. (I am pretty sure that I am the only one who knows it.) It is a mnemonic for Pi. At the time I already knew one (author unknown) [see **A**] W.S.'s is much longer and better, showing some effective alliteration in line 3. [see **B**] (32 digits). I have remembered both these 30 years plus, so they are certainly effective as memory joggers."

**B**

*Sir, I seek a round perimeter*
*Of length exact for given diameter*
*Rigmarole rapidly reinspect*
*And if our teachers don't object*
*We number over all the nonsense*
*And Pi appears! Confusion hence!*

**C**

*Sir, I bear a rhyme excelling*
*In mystic force and magic spelling*
*Celestial sprites elucidate*
*All my few rhymings can't relate*

My own favourite is **C** (again source unknown). Some others are given in chapter 11 of Martin Gardner's Mathematical Puzzles and Diversions. The popularity of Pi for this treatment is probably due in part to the fact that no zero occurs until the 32nd decimal place. Here are some other numbers that deserve the honour, though some convention for dealing with the zero digits will need to be devised.:

e = 2.71828 18284 59045 23536 02874 71352 66249 77572 47093 69995
$\sqrt{2}$ = 1.41421 35623 73095 04880 16887 24209 69807 85696 71875 37694
$\sqrt{3}$ = 1.73205 08075 68877 29352 74463 41505 87236 69428 05253 81038
g = 1.61803 39887 49894 84820 45868 34365 63811 77203 09180 golden ratio

## *Rhyming Verse Forms*

Rhyming verse, as defined last time, has a rhyme at the end of every line, and each rhyme must occur at least twice (that's what makes it a rhyme). Let the first rhyme be A, the second B, the third C, etc, and denote one or more successive Xs by X, then any rhyme scheme can be expressed in the form ABC... An **irreducible** rhyme-scheme is one that cannot be split into two rhyme-schemes. This means that if the rhyme-scheme is broken into two parts at any point then at least one of the parts must contain one of the rhymes once only. As we have seen, with one rhyme the only irreducible schemes are the couplet AA and triplet AAA.

With two rhymes the sequences of rhymes must alternate: ABAB... and in irreducible rhyme-schemes there cannot be more than 7 sequences (since ABABABAB can be split at the centre into two schemes of type ABAB). A little analysis shows that irreducible two-rhyme schemes can be classified as of 14 mutually exclusive forms as follows: ABA, ABAA, AABA; ABAB, AABAB, ABABB, AABABB; ABABA, ABAABA, ABAABA; ABABAB, ABABAB, ABAABBAB; ABABABA.

The best example of a two-rhyme piece of verse that I know is provided by the last 15 lines of the White Knight's Song from Through the Looking Glass, which is of the form ABAAAAAAAAAAAAB (a case of ABAA) with 13 rhymes for "toe".

There are 8 irreducible rhyme-schemes of five lines and 23 of six lines, so it is just as well examples of all possible types were not sent! The five-line cases are in full: ABBBA, ABBAA, AABBA (the Limerick), ABBAB, ABAAB, AABAB, ABABB, ABABAB. The six-line cases with three rhymes are the 10 forms: ABBCCA; ABBCAC, ABCCAB, ABCCBA, ABACCB; ABCABC, ABCACB, ABCBAC, ABCBCA, ABACBC.

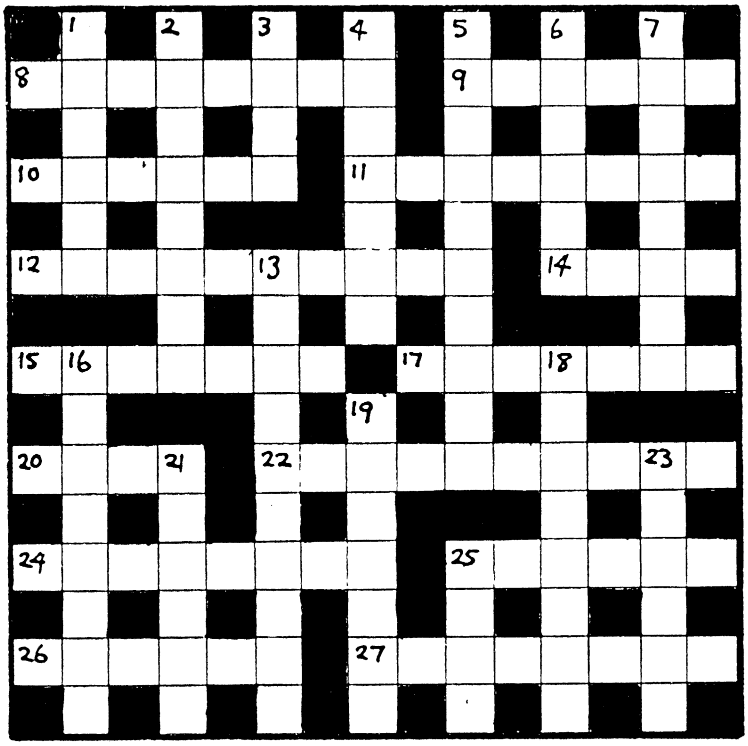
The general case of three or more rhymes is reserved for further study.

Since this page has turned out to be unduly mathematical the theme continues in this quatrain from Michael Crumlish which is offered without apologies to Gerard Manley Hopkins.

*QUADRATIC*

*Sweetlier than to thee Dawn bears the fruit of*
*kicking a brave, ah! bonny a new day,*
*to me x equals minus-b plus -or-minus the root of*
*b-squared minus 4ac all over 2a.*
*M.CRUMLISH*

## *Cryptic Crossword* 2. By Querculus.

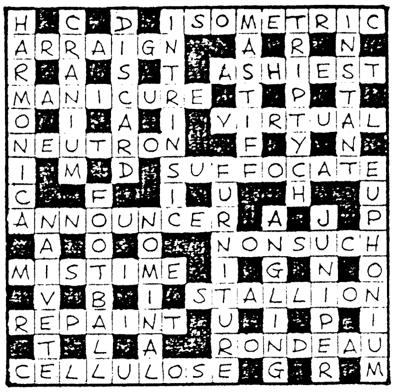


ACROSS
08. —— get-up worn about the year dot. (8)
09. Line becomes clear in fourth reading. (6)
10. Hammer used on runners. (6)
11. —— Lulu laughs about. (8)
12. Builder gives back all different negatives. (10)
14. Vehicle backing into police HQ. (4)
15. Crime concerning partition. (7)
17. Take to the road for a cause. (7)
20. Distinctive taste comes back: insect! (4)
22. Family initiate pop artists in medical class. (5,5)
24. —— about Kew showing a lack of order. (8)
25. Be slow to make arm bends. (6)
26. Of common ancestry with 20 at heart. (6)
27. —— from the laugh prohibition age. (8)

DOWN
01. I'll bet a round quarter. (6)
02. Quick footwork to end a pact. (3, ——)
03. Love returned is painful. (4)
04. Rave about umpteenth used part. (7)
05. City of daring last battle? (10)
06. Monster concealed itself in flower. (6)
07. —— to make learner deceiver gad about. (8)
13. Front man became rear perhaps. (10)
16. —— to make desperate enthusiast depart. (8)
18. —— of an Egyptian in the desert? (8)
19. Idle enough for Aunt Sally? (4-3)
21. Entrap with duplicate letters. (6)
23. Rising protégé of the University Press? (6)
25. Island fit to return to. (4)

The blank —— represents a repeated theme-word. Four other words are related by a secondary theme.

### Crossword 1 SOLUTION



## *Change Chains*

| | | |
|---|---|---|
| **RIGHT** | **BLACK** | **LIGHT** |
| GRIST | CABLE | LITHE |
| RINGS | BEACH | LATHE |
| GROIN | CHEAT | HALVE |
| **WRONG** | WHEAT | **HEAVY** |
| | **WHITE** | |

The latest issue of Jabberwocky (dated Autumn 1985!) relates Lewis Carroll's "doublets" to transformations that occur in Through the Looking Glass. The doublets first appeared as a series of questions in the Vanity Fair from 29 March 1879 onwards. Under change-chain rules of course transformations are much easier to accomplish. For example:

**QUEEN** ENSUE SHEEN **SHEEP**

Others to try might be:

**ALICE - QUEEN**

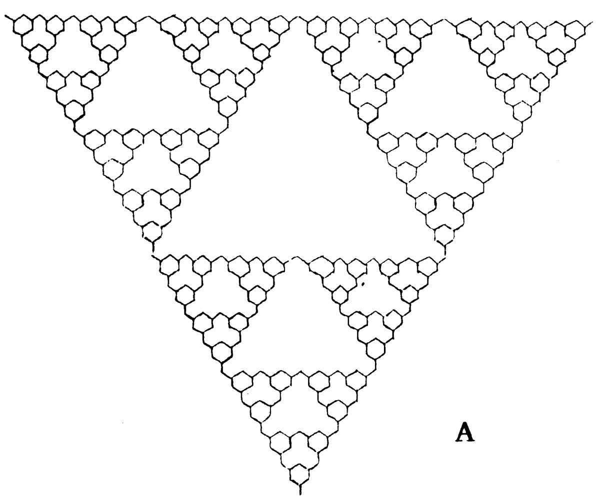
**QUEEN - SNARK**

**SNARK - ALICE**

Those readers who find our cryptic crosswords too easy will find harder fare in Crossword published monthly by The Crossword Club. Hilberry Farm, Awbridge Hill, Romsey, Hampshire, SO51 0HF, UK.

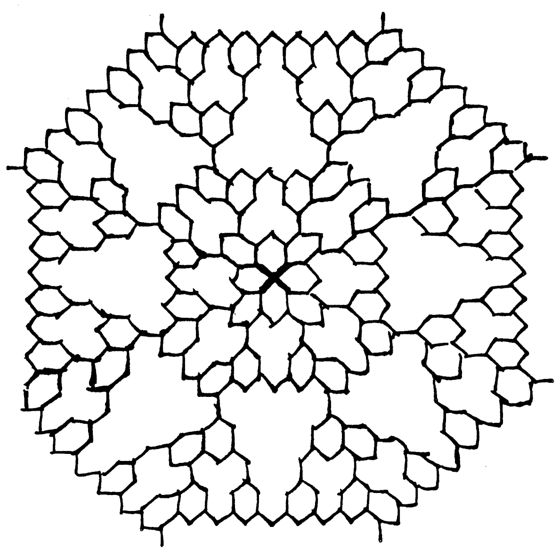
Another address of interest to wordsters is: Leonard Hodge, Scrabble Club Coordinator, 42 Elthiron Road, London, SW6 4BW (s.a.e. for details of clubs).

## Pair Trees & Strewberries



A

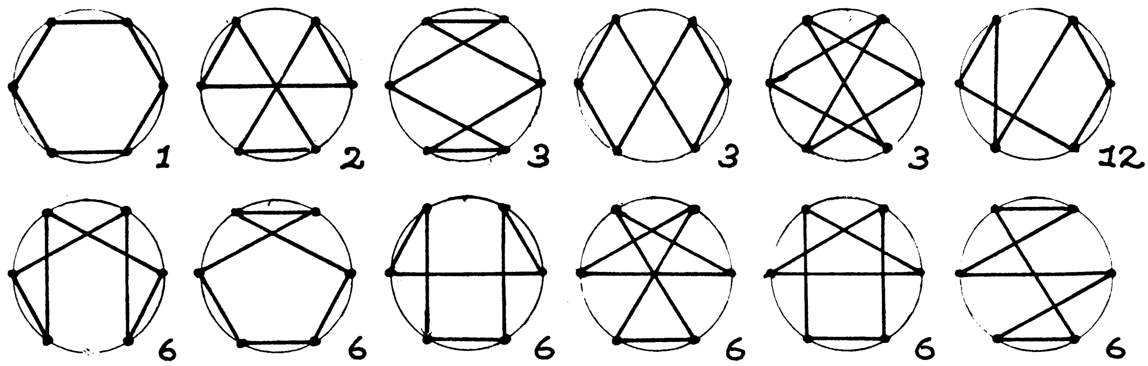
B



The "Pair Tree" **A** is grown from a single shoot. Each shoot sends out two new shoots at 120° to each other. Two shoots fuse if they meet and grow no further. Shoots will not grow towards the ground or an existing part of the tree. After $2^N$-1 years the pattern always has the symmetry of an equilateral triangle. The "Strewberry" **B** is grown similarly from a central cross, the new shoots being at 90° to each other. Readers are invited to experiment with other growth rules. I will publish the most interesting patterns sent.

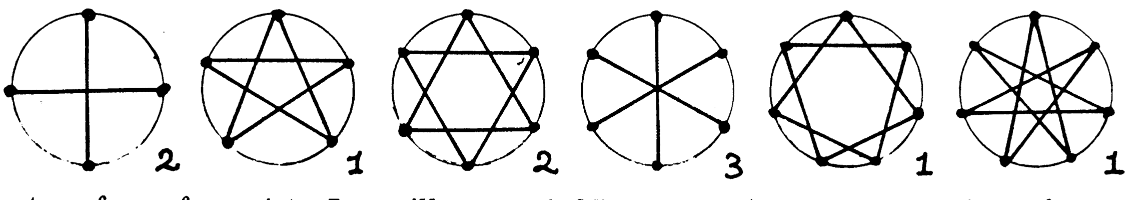
## Polygrams

There are twelve ways of joining six points regularly spaced round a circle, as shown. It is easy to miss the asymmetric case. I thought this was an original result I had found, but in fact it appears as No 51 in The Tokyo Puzzles by K.Fujimura, where it is ascribed to S.Kobayashi (c. 1976). The sum of the suffixes for n points is n!/2n.




## Stars & Asterisks

A related question is that of the regular patterns that can be formed by joining each of n points, regularly arranged around a circle, to the points m steps away in each direction, where m $\leq$ n/2. When m = 1 we have the ordinary **polygons.** When m > 1 we have **stars.** What is the condition for a star to consist of a single circuit like a polygon? How many points of intersection are there within the circle in the (n,m) star?




All the stars for n from 4 to 7 are illustrated. When m = n/2 the star consists of m superimposed diametral lines, intersecting at the centre. I call these stars **asterisks.** How many intersections are there in these if each "digon" is drawn as a long narrow ellipse instead of a straight line? This method of drawing makes the asterisks look like "atoms".