Holey 6-Piece Burr!

A collection and computer analysis of unusual designs.
by Bill Cutler

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Acknowledgements and Dedication

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Acknowledgments

In addition to the contributors who appear in this paper, I would like to thank Jerry Slocum and the other `puzzle nuts' for keeping my interest in puzzles high; Rex Shudde for preparing this document for duplication using PCTeX and PiCTeX; Barbie Cutler for helping with the original piece drawings; and Janice Cutler for putting up with my shenanigans.

Dedication

This paper is dedicated to C. Arthur Cross and Tom O'Beirne. During my earlier research on solid solutions of the 6-piece burr they shared their results with me in numerous letters. I do not know if either of them ever became involved with `holey' 6-piece designs, but their interest spurred me on in years past.

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Introduction

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Although I have long been interested in designing burrs in which removing the first piece can only be done after several other moves have been made, I have not been involved until recently with 6-piece burr designs of this type. A 6-piece burr design which disassembles in such a fashion must of necessity have some internal holes, hence the name `holey 6-piece burr.' I have preferred designing such `non-trivial-to-take-apart' burrs by using larger burr shapes with more pieces and more internal cubes to `play around with.' I had always felt that the 6-piece burr did not have adequate enough internal space with which to make a really interesting design. The contributors to this collection of holey 6-piece designs have seen fit to prove me wrong.

My interest in trying my hand at a holey 6-piece design was started by Stewart Coffin, who by early 1981 had designed three of his own, and challenged his readers to come up with their own designs. The most moves required to remove the first piece in his designs was three. This will be called the `level' of the burr, although the best definition of this number is subject to considerable debate. Stewart offered to produce models of the best design that was submitted. By 1984 he had not received any, so I thought this was a contest that I might be able to win! I began by trying to come up with a level-6 design, but soon retreated to level-5. After a fairly short amount of time, I came up with one, but had to try several variations until I found one with a unique solution. Testing the different possibilities was done accurately and swiftly with a program which I had recently written to disassemble puzzles consisting of pieces built up from cubes.

Stewart declared me the winner of the contest, even though my entry was late, and this eventually led to the appearance in *Scientific American* of Bill's Baffling Burr in October, 1985. Since then, I have received some 30 holey-6 designs from a variety of people.

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Definitions

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6-Piece Burr Design Definitions

Pieces - each piece must be constructed by removing some of the 12 cubes as numbered in Fig. 1, and the piece must be connected. (Note that the numbering of the 12 cubes does not match the numbering in my article in the *Journal of Recreational Mathematics* . I apologize for this inconsistency in my notation. This is compounded by the problem of showing the numbering patterns by `layers.' It may not be clear if the bottom layer is looked at from the top or bottom.) Fig. 1 is for length-6 pieces. Length-8 pieces are one unit longer on each end. The representation of the pieces by which cubes are removed may not be unique. Two pieces are identical if one can be rotated and/or flipped end-for-end so as to match the other piece.

Symmetric Piece - a piece is symmetric if an end-for-end flip results in the same cube configuration. The usual flip would switch cube number pairs (1,8), (2,7), (3,6), (4,5), (9,12), and (10,11). For `ambiguous' pieces (see below), other flips are possible.

Assembly - an assembly, or `legal configuration,' is a way of arranging the six pieces into the 3-dimensional grid of cubes pictured in Fig. 2 without having two or more pieces occupying the same cube. One need not be able to physically do this with wooden (rigid) pieces. Two assemblies are the same if one can be rotated (in three dimensions) so that it matches the other exactly.

Internal Cubes - cubes in Fig. 2 that may belong to more than one piece.

External Cubes - cubes in Fig. 2 that belong to only one piece.

Internal Holes - internal cubes not occupied in an assembly. When discussing the number of `holes' this will be the count referred to.

External Holes - external cubes not occupied in an assembly. For most analyses in this paper, assemblies with external holes will not be allowed.

Ambiguous Piece - a piece which can be rotated around its long axis without creating external holes. In terms of cube numbers from Fig. 1, such a piece must have either both cubes 1 and 4 present, or both cubes 5 and 8 present. These pieces have been a thorn in the side of 6-piece burr analyzers and have led to miscommunications because of different methods of handling.

Solution - a solution is an assembly which can be physically constructed (or disassembled). The method of assembly or disassembly must be theoretically correct when used with rigid pieces. (It may not make use of slightly rounded corners, for example).

`Interesting' Solution - a solution which cannot be split into two sections on the first move.

Definitions Related to BURR6 Disassembly Method

Rectilinear Solution - a method of assembling or disassembling an assembly which is carried out by a sequence of moves, each of which is a linear move of one or more pieces in one of the three directions. The distances the pieces are moved must be multiples of the unit cube in length. Solutions of this type are the only ones that the {\erm BURR6} program can discover. Whether other solutions for holey-6 burrs exist is, as far as I know, an open question. (See Challenge Questions.)

Displacement - three integers representing the number of units in each of the three directions that a piece has been shifted from its initial position. Since constants may have been added to `center' a set of pieces, these numbers are best viewed in relation to the displacements of the other pieces in the set.

State - a set of displacements for the pieces in an assembly. Two states for a set of pieces are the same if the displacements for the pieces, measured relative to the smallest numbered piece, are the same. Each new state represents a different geometrical arrangement to which the pieces of an assembly can be moved.

Subassembly - a set of from two to five pieces that are left together after an earlier assembly or subassembly has been separated.

Level - during a disassembly process, the number of times that the direction of movement has changed in order to reach a particular state. The computer treats all movement in the same direction as being the same level. The level can be looked on as an estimation of difficulty of the assembly. It is similar to what would be called `number of moves,' but is frequently smaller than the count that most people would get when disassembling a burr. More on this later.

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The number of internal cubes in Fig. 2 is 32. Eight of these cubes can be occupied by three different pieces, and 24 of these cubes can be occupied by two pieces. Since each piece has 12 cubes that may be removed, we see that at least 40 (6 x 12 - 32) cubes must be removed in total from the six pieces.

If exactly 40 cubes are removed, then there are no internal holes. Such a design is not `holey,' and cannot have an `interesting' solution. If there is any movement in such a design, then, by continuing the movement in the same direction, separation of the pieces must occur. (This is harder to prove rigorously than one might suspect --- non-linear, or rotational, movement must be shown to be impossible; and then one must use the fact that the burr shape is `convex' in the three directions in which linear movement can occur.) Note that there are `interesting' solutions to the well-known 24-piece burr shape which have no internal holes.

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BURR6 Program

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The BURR6 program has two main sections. The first section determines how many assemblies, or `legal configurations' can be formed with the six pieces in the design. The second section takes each of these assemblies and tries to disassemble them using `rectilinear' movements, as described above.

The general method for the assembly section is as follows:

1. Each of the six pieces is rotated and flipped end-for-end to determine how many different cube configurations result. The piece is checked for symmetry and duplication with previous pieces examined. These results appear on the printout.
2. A non-symmetric piece without duplicates is chosen. This is marked as the `fixed' piece. If no such piece exists, a warning that duplicate assemblies may be produced is printed. This piece is placed first, and its end-for-end flips are not used.
3. The completion of the assembly with the other five pieces is done using a straightforward approach with ten nested loops.

The disassembly section will not be explained in any more detail. The listing of `states,' which appears on some of the output, gives insight into the fundamental logical process in this section. The disassembly portion can be used on much larger and more complicated burrs. It has run successfully on Van der Pol's 18-piece puzzle, for example.

Options Available in the BURR6 Program

Analysis Matrix Size - this is the size of the grid that must hold the assembled burr and any states that may be reached in the process of disassembling the burr. When each new state is analyzed to determine new motion, the pieces are repositioned in this matrix. If this matrix is not large enough, so that some pieces extend beyond the edges, the resulting analysis may contain incorrect movements. The allowable values for matrix size are even numbers from 10 to 14. This will be increased to at least 20, but the runtime for some of the disassembly routines increases as the cube of the matrix size. (See runtimes below.)

Length of Pieces - the pieces may be of length six or eight. There may be some reason to increase this to ten or more. See Challenge Questions.

External Holes - if external holes are allowed, then pieces may be rotated so as to bring their cube holes into places that may not intersect other pieces, and are visible to the outside. Such constructions are usually not allowed. This analysis is allowed as an option to see how many such solutions would be discovered by people who would attempt this type of construction. A sample output with Bill's Baffling Burr and such a solution is included.

Details and Pictures - the pictures (cross-sections of assemblies) and details of the disassembly steps can be shown for (a) all assemblies, (b) only those assemblies that are solutions (See output on `Impossible Second Move' for its limitations), or (c) no assemblies.

Subassembly Details - if desired, the program can print out pictures and details for the subassemblies that must also be disassembled. The program always goes through the subassembly analysis, but will only produce output if this option is selected.

List of States - if desired, the program will print out a list of all states discovered when it has either found a solution or has completed analysis of all movement without finding a solution. Analysis of this listing (included for a few designs in the output section) reveals the logical method which is fundamental to the disassembly portion of the program.

Runtimes

Following are some sample runtimes on an IBM PC AT. The program is written entirely in FORTRAN using all 16-bit integer variables and was compiled using the Microsoft compiler (IBM's marketed version). The operating system is DOS. The computer does not have an 80287 math coprocessor chip, but this is irrelevant as there are no floating point variables in the program.

					Runtimes(seconds)		
Design Name	Matrix Size	Piece Length	External Holes	(#Asmbly, #Soln)	Assembly	Disassembly	Total
BBB	10	6	no	(24, 1)	3	14	17
BBB	14	6	no	(24,1)	3	28	31
BBB	10	6	yes	(66,5)	67	37	104
BBB	14	6	yes	(66,5)	67	81	148
Mar-B	10	6	no	(10,1)	1	10	11
Mar-B	14	6	no	(10,1)	1	19	20
Mourik	12	6	no	(31,30)	3	57	60
Mourik	12	8	no	(31,25)	3	56	59
Love B-5	12	8	no	(508,27)	6	424	430

** For comparison with mainframe times: The same program was compiled for running on IBM mainframes with VS Fortran Optimize(3) using 32-bit integers. The program ran for 4.13 CPU on an IBM 8083, Model J, when running BBB with external holes and matrix size 14. This was about 36 times faster than the run on the IBM PC AT.

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What should 'Level' be?

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Practically everyone with whom I have communicated has had something to say about my use of the word `level.' I agree that the results in the computer output is in many cases smaller than what most people would count as `moves,' which would be used as an estimate of difficulty. The use of `level' is tied directly to the method of disassembly analysis that BURR6 employs. It relates to the tree depth at the point where the first solution was found. Each new level of the tree involves another call to the major subroutine in the program which analyzes all movement in one direction. I would be happy to try and improve the use of this word, but there are some basic questions which need to be answered. The following examples should make clear some of the problems:

1. Everyone will probably agree that Bill's Baffling Burr (BBB) has a level-5, or 5-move solution. Each of the first four moves consists of moving a single piece in one direction one unit in length. The fifth and last move results in separation of one piece from the rest.

2. Most everyone will also agree that the first level movement in Bruce Love #1, Assembly #14, should count as two moves, or levels. The movement listed is for one piece to move one unit in length; a second piece to move one unit in the opposite direction; and the other four pieces to remain in the same place. Furthermore, the next level movement requires that both of these pieces be moved, and an analysis of the list of states reveals that the only solution lies with these first moves, so what the computer lists as a level-5 solution should be called a 6-move solution. (Note that in Bruce Love #1, Assembly #13, a similar first move does not need to be done in the same fashion, with the movement for piece #6 being added to the level-3 movement. However, the same situation now exists with the level-3 movement.)

   Now, for the difficult case -

3. The fourth move in the Gaby Games (GG) burr: In the movement as listed in the output, two pieces are moved the same amount in the same direction. They can also be moved separately, one first, and then the other. In fact, most people, when physically manipulating the puzzle, will make these moves separately. How many `moves' is this? One-and-one-half? How `difficult' is this move? Certainly more difficult than a move from item 1 above, but does it rate the difficulty of item 2 above?

   And more -

4. What about the three moves in Stewart Coffin's Triple Slide? Each of these moves consists of three of the pieces moving as a unit in relation to the other three. Is each of these moves more difficult than one of the single moves in BBB? Are these moves as hard as the fourth move of GG (by computer's output)?

   And still more -

5. What about the first move in Bruce Love's B-4 design? The move is a single piece of only one unit in

length, but the piece is able to move two units, and the second move can only be made if the first move is exactly one unit, so that a `lock-picking' type of movement is made. The first move would surely count as only one move, but is clearly more difficult than other single moves.

My own choice for an estimate of difficulty would focus on the number of `states' that might be encountered prior to disassembly. At this time, my best suggestion is to count all states at a level less than the solution level. This might be modified to (a) add states at the solution level which do not lead on the next step to a solution, or (b) remove states at the level below the solution level which lead on the next step to a solution. In any case, such a count would include `false' moves or `blind alleys' and multiple ways of arriving at a solution; both of which may cause the solver some difficulty.

I await your suggestions. The next version of BURR6 can be changed to produce output that more closely approximates the idea of a `move,' but it must first be decided how to handle the above cases.

The following comments are concerned with the difficulty in implementing changes to the program:

- The program produces a solution with the minimal level (subject to its interpretation of `level'). It does not do any comparison of solutions of the same level in order to find the `simplest.'
- Revising the program to list moves such as Bruce Love #1 first move as two separate moves is not too difficult to do.
- The program makes no attempt, when disassembling the initial assembly, to take into consideration how difficult some subassemblies may be to disassemble. The program minimizes only the level of solution of a particular assembly or subassembly. Assemblies and subassemblies are all treated as separate problems as far as looking for the lowest level. Including code to minimize `level' across the subassemblies that follow may be quite difficult.

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Challenge Questions

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1. Does there exist an assembly using six pieces as defined at the beginning (must be constructable by removing a subset of the 12 cubes) which has a solution, but not a rectilinear solution? Such a design must make use of twisting or slanted movement of some kind. Such designs certainly exist in larger burrs, but can such a design exist in a 6-piece burr? You may use any length pieces. Stewart Coffin's `Convolution' comes to mind as a puzzle with a twist move. The move is actually theoretically impossible to make, but that such movement can take place quite legally in other designs is clear.

2. In this paper are many designs which have solutions when the pieces are of length-6, but have no solutions when using length-8 pieces. One can also construct assemblies which are solvable with length-8 pieces, but are unsolvable with length-10. What is the largest length (even), for which this can happen? That is, determine the even value of n for which (a) there is an assembly which is solvable using length-n pieces but not solvable with length-(n+2) pieces (give example); and (b) every assembly which is solvable using length-(n+2) pieces is also solvable using length-(n+4) pieces (give proof).

3. The BURR6 program analyzes movements that are linear and are a multiple of the unit cube in length. The disassembly portion of the program works on larger burrs or constructions that are `build-ups' of a single cube size. As mentioned in item 1 above, rotational moves can be necessary in some constructions of this type. Here we ask if allowing only moves a multiple of the cube width also causes us to miss some solutions. The problem is to prove or disprove the following:

   Suppose we have an assembly of two or more pieces which satisfies:

   - The assembly can be thought of as occupying a particular set of the cubes in a regular 3-dimensional grid of cubes all the same size. Moreover, each piece is composed of a particular set of these cubes, and is connected. (All pieces are constructed by gluing a number of cubes to each other, face-to-face; and the assembly has these fitted together so that all pieces are subsets of the same regular grid.) The assembly may have any number of holes.
   - There is a way to disassemble the pieces by a finite sequence of linear moves, each of which involves one or more pieces and is in one of the three major axis directions, but need not be an even multiple of the unit cube size in length.

   Does it necessarily follow that there is a way to disassemble the pieces in which all moves are not only linear as above, but are all integral multiples of the unit size in length?

4. The following records (using BURR6 terminology for `level') are waiting to be challenged:

   - level-9 for length-6 designs with a unique solution - Peter J. Marineau Burr `B.'
   - level-10 for length-6 designs with multiple solutions - Edward Hordern's modification of the Marineau burr.
   - level-5 for length-8 (or longer) designs with a unique solution - Bruce Love B-4.

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(Listed chronologically in order of my knowledge of their first design.)

Stewart Coffin, Lincoln, Massachusetts

Interrupted Slide - the first of Stewart's holey-6 designs. It is noteworthy for other reasons as well. With length 6 pieces, is has nine assemblies and two solutions, both of level-3. With length eight pieces, there are still, of course, nine assemblies, but only one of the solutions remains. Computer output with both lengths is included.

Triple Slide - a design with a unique level-3 solution in which all of the splits are three pieces one way and three the other. The length of the pieces can be eight or longer. I have since seen many similar designs.

Coffin's Improved Burr - the first move is level-2, but the second piece is level-3 to remove. The computer output shows the subassembly analysis.

Bill Cutler, Palatine, Illinois

Bill's Baffling Burr (BBB) - the design which appeared in Scientific American (with one piece wrong). It has 24 assemblies, but a unique level-5 solution.

BB43-143M-1 - a level-4, 3-hole design discovered by a computer program which analyzed assemblies made with a fairly limited set of pieces. This is the highest level design I have discovered so far using only the computer. The program only investigated a small fraction of the vast number of designs possible.

BB31-147-1 - a computer discovered level-3 solution with only one hole. A large number of similar designs were found.

BB31-10-40 - another level-3, 1-hole computer discovered design. This one is the `least un-notchable' of the large number of such solutions discovered; it requires only two unit cubes to be glued onto the otherwise notchable pieces.

Bill's Ball Bearing Burr - take the design as shown; add two ball bearings with diameter slightly less than one unit; place one into each of the double cube holes in the solution. The reader can deduce how the puzzle is meant to be taken apart!

Impossible Second Move - this design is only included because it illustrates the computer program's ability to continue disassembling the burr after the first piece or pieces have been removed. The design came up when trying to determine `fitting constraints' for pieces usable in solid solutions. This is as close to a solid solution that the piece numbered `2' can get.

Phillipe DuBois, Israel

Gaby Games 7-move - has two assemblies and one solution. The computer program classifies this as a level-6 solution, although most people would say it has seven moves to take out the first piece.

Victor Goedicke, Athens

Professor Goedicke sent me several very interesting designs, two of which were 6-piece burrs, and the others were more complicated designs with half-notches. The design printed in this booklet has a unique level-3 solution.

Lester Henderson, Danville, California

Lester's design was sent to me by Professor Goedicke. It has more than one solution.

Bruce Love, New Zealand

Bruce sent me no fewer than 15 different holey-6 designs. He also lays claim to a more complicated burr design with a level-13 solution. I include three of his designs in this document:

Love #1 (first design received) - with length six pieces has 14 assemblies with one level-4 solution and five level-5 solutions. With length 8 pieces, there are two level-5 solutions. This design does not have any low-level solutions.

Love Model - The first design I received which the computer classified as level-7. The solution is unique. That the design had this many levels was discovered by Edward Hordern - I had thought this model he had sent me was `just' another one of his level-5 designs!

Love B.4 - I chose this from Bruce's many other designs because it has a unique level-5 solution with length 8 (or longer) pieces. I believe this is the highest level I have received for length-8 piece designs with a unique solution. The solution is also noteworthy because the first move involves a piece which may move more than one unit, but the second move requires the first move be made only one unit in length.

Derwin Brown, Norton, Massachusetts

Derwin sent me two designs, both of which have level-6 solutions. The first has another solution (computer output not included), but for the second the level-6 solution is unique.

William Meek, Hemlock, Michigan

Twist Burr - Bill's design has two pieces with rounded sections. The computer output lists only one assembly, which it cannot take apart. The computer would not be able to take it apart even if the rounded parts were very much smaller, as it cannot rotate pieces.

R. von Randow, West Germany

This design was discovered while trying to make the incorrectly pictured pieces in Scientific American work. The resulting design works essentially the same as does the correct BBB.

Jean Mourik, United Kingdom

Jean's entry has 31 assemblies, only one of which has no solution. The computer output only lists the number of solutions at each level and picture of the highest level solution. The masochistic reader can see if he can duplicate the computer's gyrations (or, worse for me, find that it is in error).

Richard Korsmeyer, Oak Ridge, Tennessee

Dick proposed a slight change to one of the Gaby Games pieces - the resulting design has three level-5 solutions.

Peter Marineau, Troy, New York

Having seen many level-5 designs, a few level-6 designs, and one level-7 design to this point, I was prepared to declare Bruce Love's level-7 design as the best (at least from the program's point of view), when along came two designs from a new source. The first has level-3 and level-4 solutions, but the second has a UNIQUE LEVEL-9 SOLUTION. I am reminded of Bob Beamon's long-jump record in the 1976 Olympics! The complete output from this design is included.

L. Edward Hordern, England

Edward proposed a modification to Peter Marineau's design which increases the level to ten. Unfortunately, 12 new low-level solutions are introduced, so the solution is not unique.

I do not expect the designs to end here. I fully expect that more holey-6 designs will be produced, with many more surprises!

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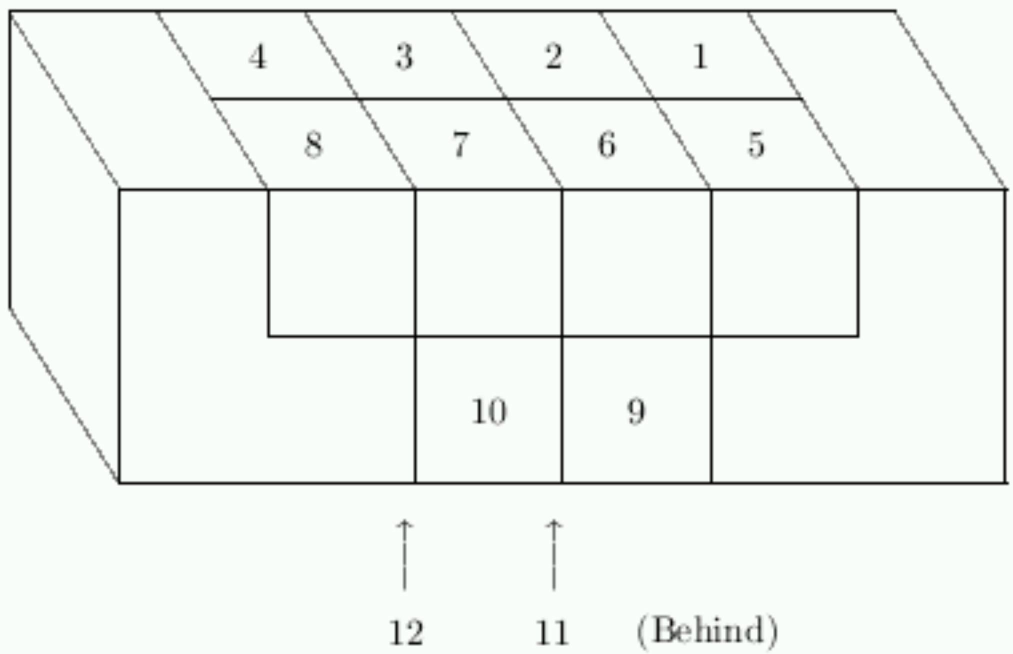

Figure 1.

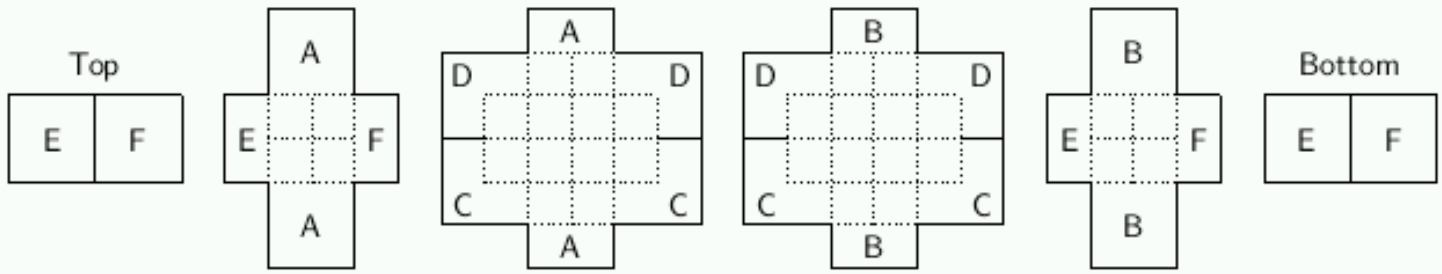

Figure 2.

Drawings of Designs

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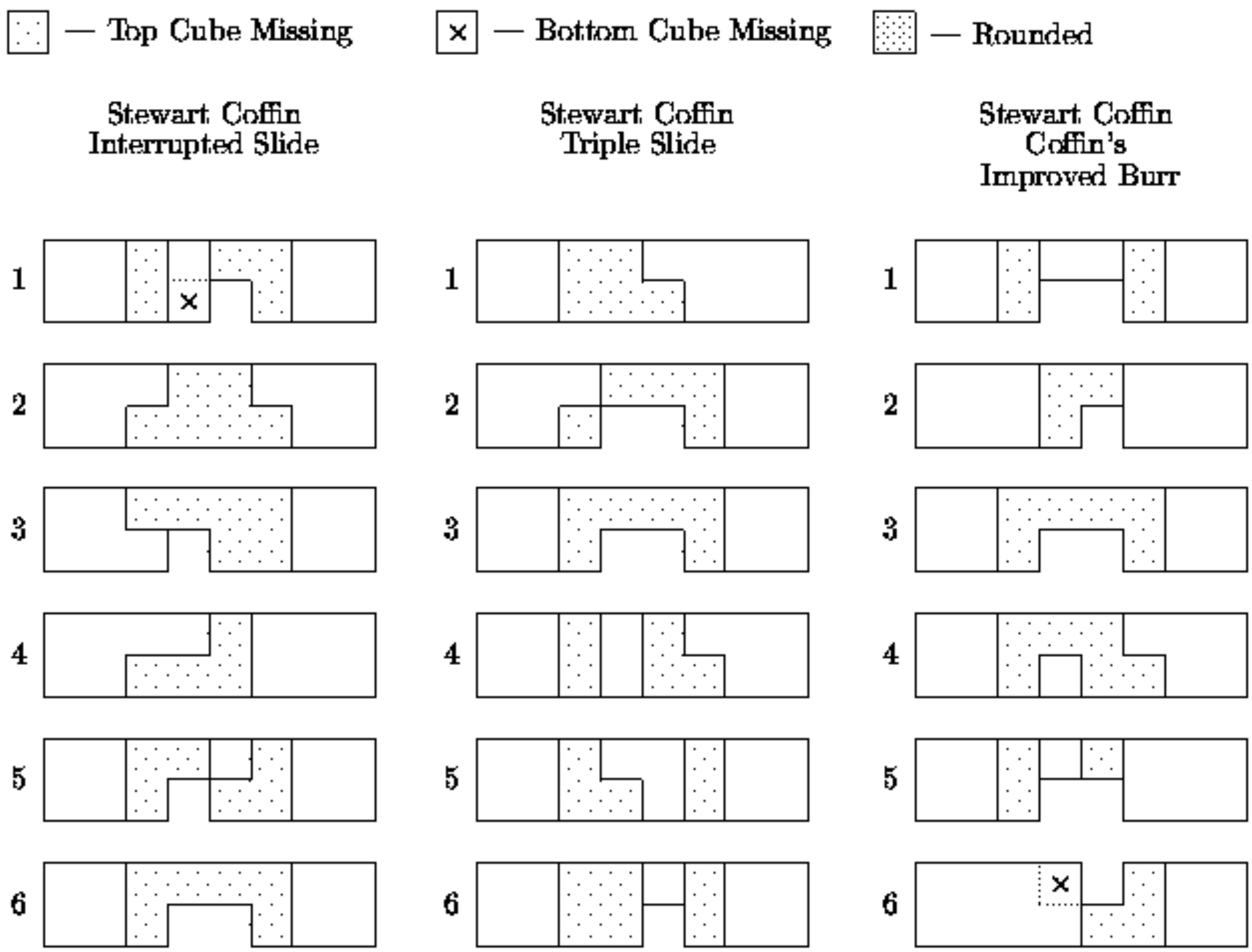
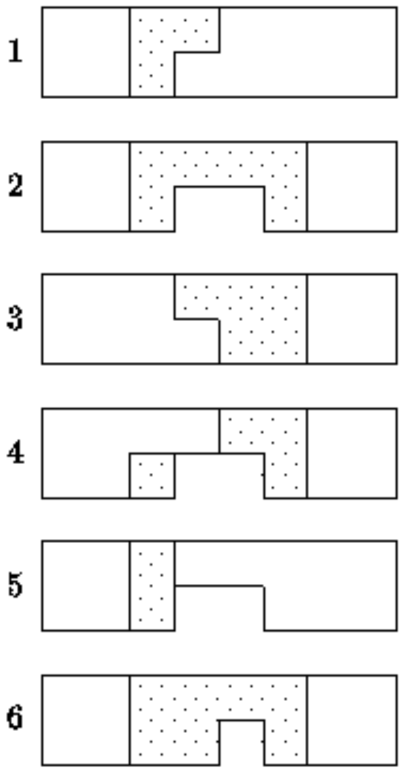
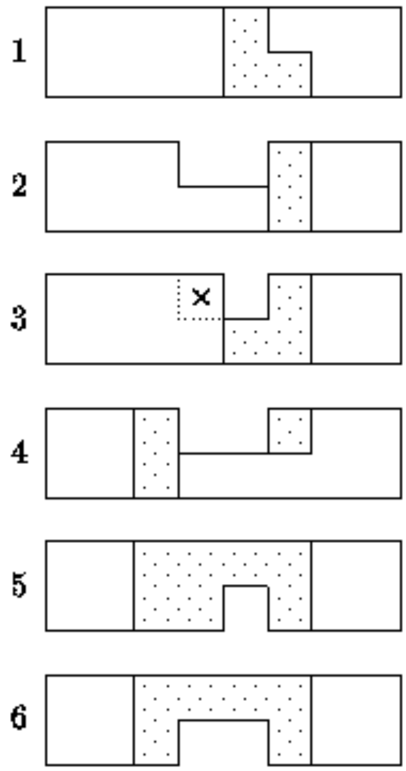


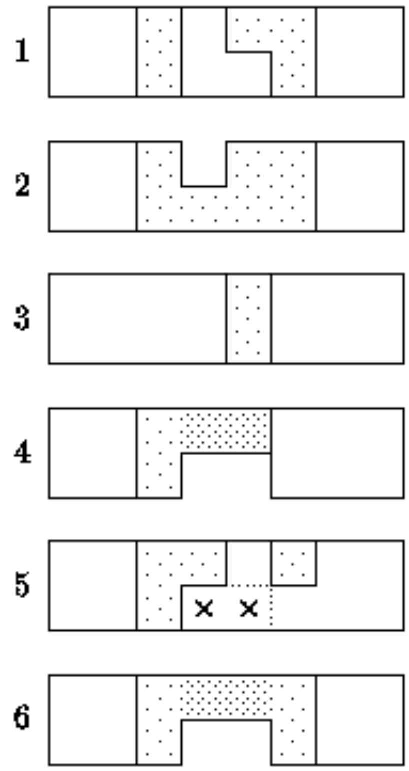
Lester Henderson
Puzzle A



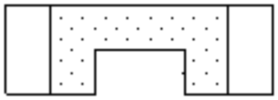
Victor Goedicke
Second Design

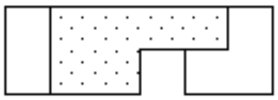


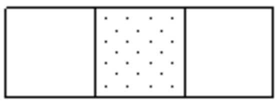
Bill Meek
Twist Burr

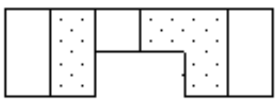


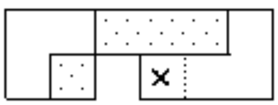
Bill Cutler
Bill's Baffling Burr

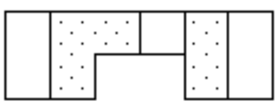
1 

2 

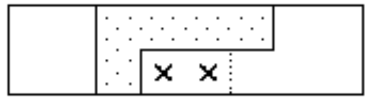
3 

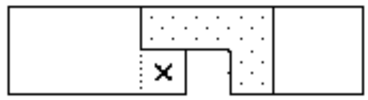
4 

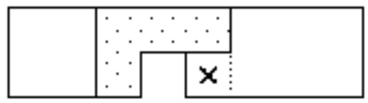
5 

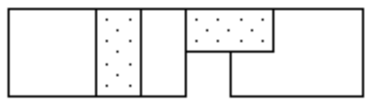
6 

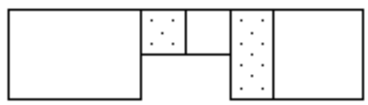
Bill Cutler
BB43-143M-1

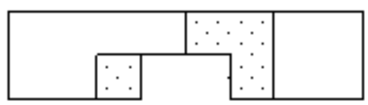
1 

2 

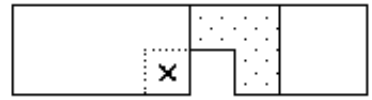
3 

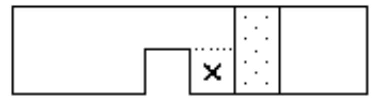
4 

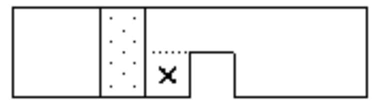
5 

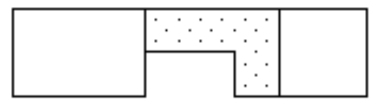
6 

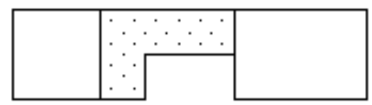
Bill Cutler
BB31-147-1

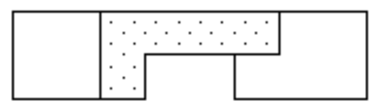
1 

2 

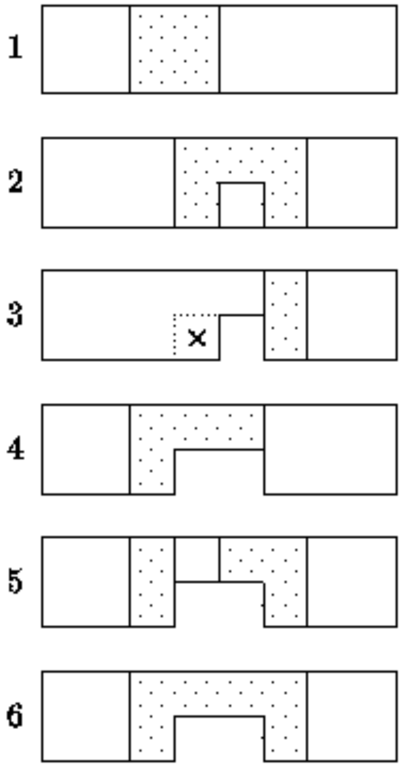
3 

4 

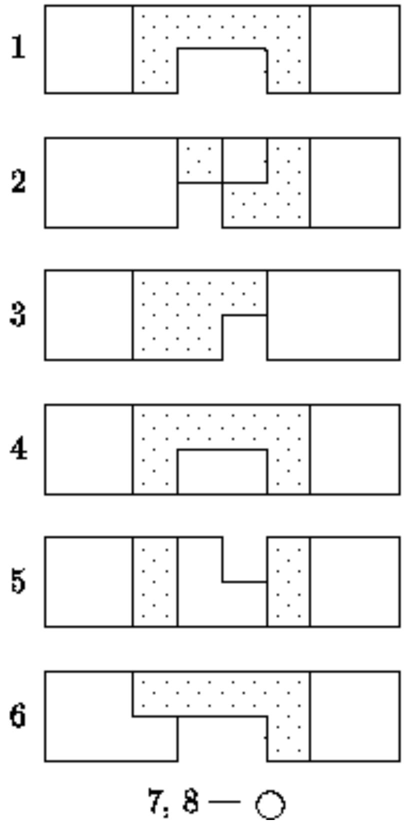
5 

6 

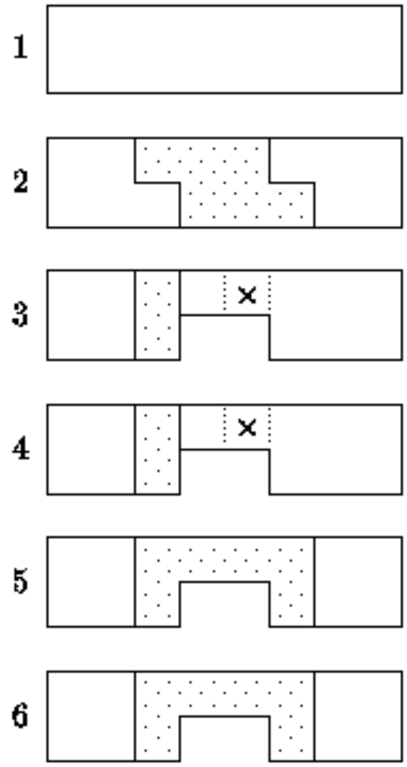
Bill Cutler
BB31-10-40



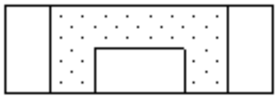
Bill Cutler
Bill's Ball
Bearing Burr

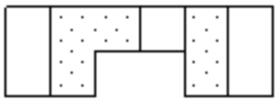


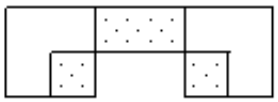
Bill Cutler
Solid Un-notchable
Impossible Second Move

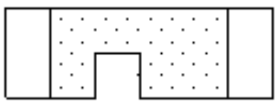


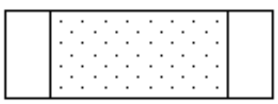
Phillippe DuBois
Gaby Games

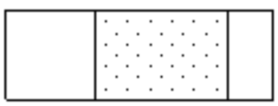
1 

2 

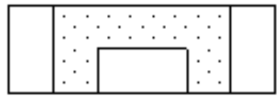
3 

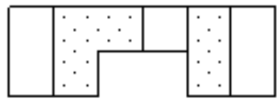
4 

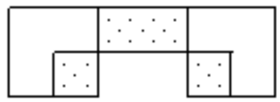
5 

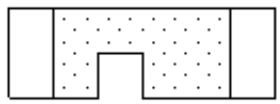
6 

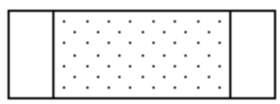
Dick Korsmeyer
Variation of
Gaby Games

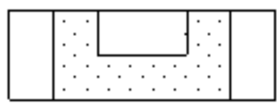
1 

2 

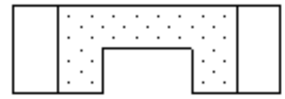
3 

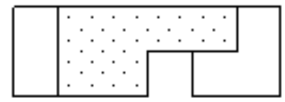
4 

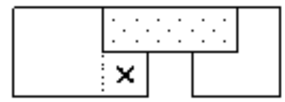
5 

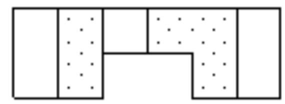
6 

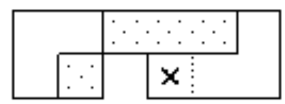
R. von Randow
Variation of BBB

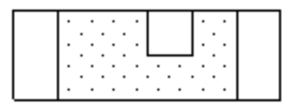
1 

2 

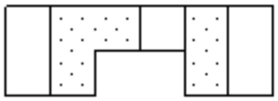
3 

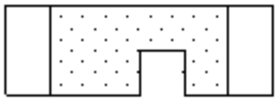
4 

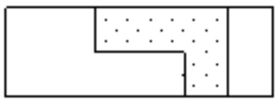
5 

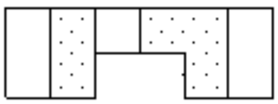
6 

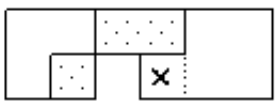
Derwin Brown Puzzle #12

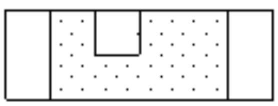
1 

2 

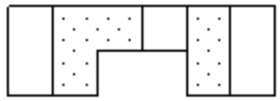
3 

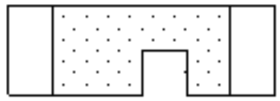
4 

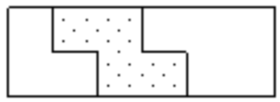
5 

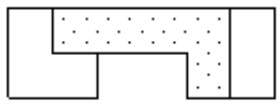
6 

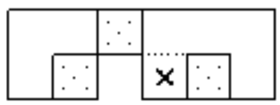
Derwin Brown Puzzle #23

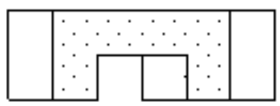
1 

2 

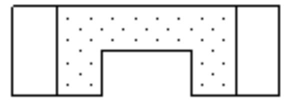
3 

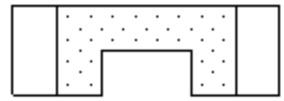
4 

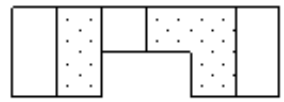
5 

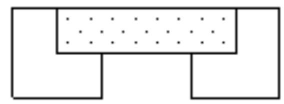
6 

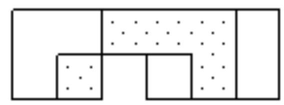
Jean Mourik

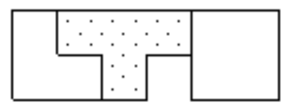
1 

2 

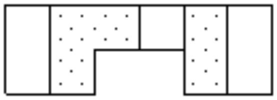
3 

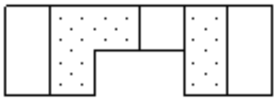
4 

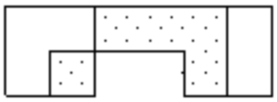
5 

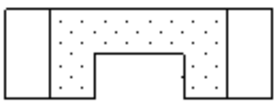
6 

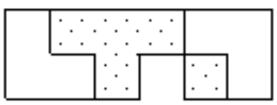
**Bruce Love
Design #1**

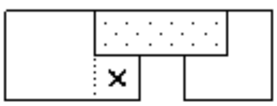
1 

2 

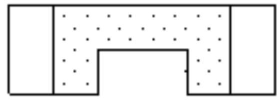
3 

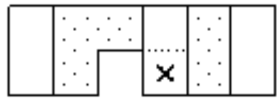
4 

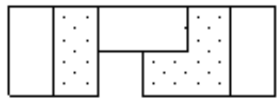
5 

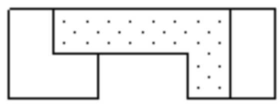
6 

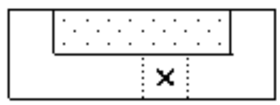
**Bruce Love
Model**

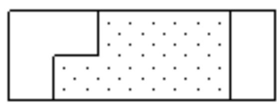
1 

2 

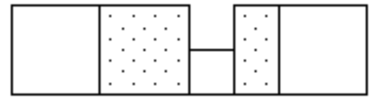
3 

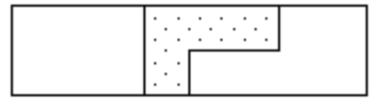
4 

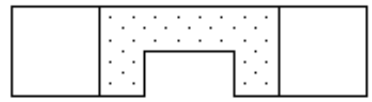
5 

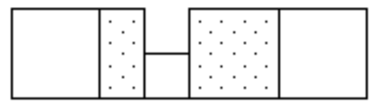
6 

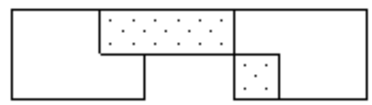
**Bruce Love
B 4**

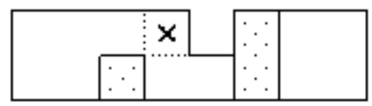
1 

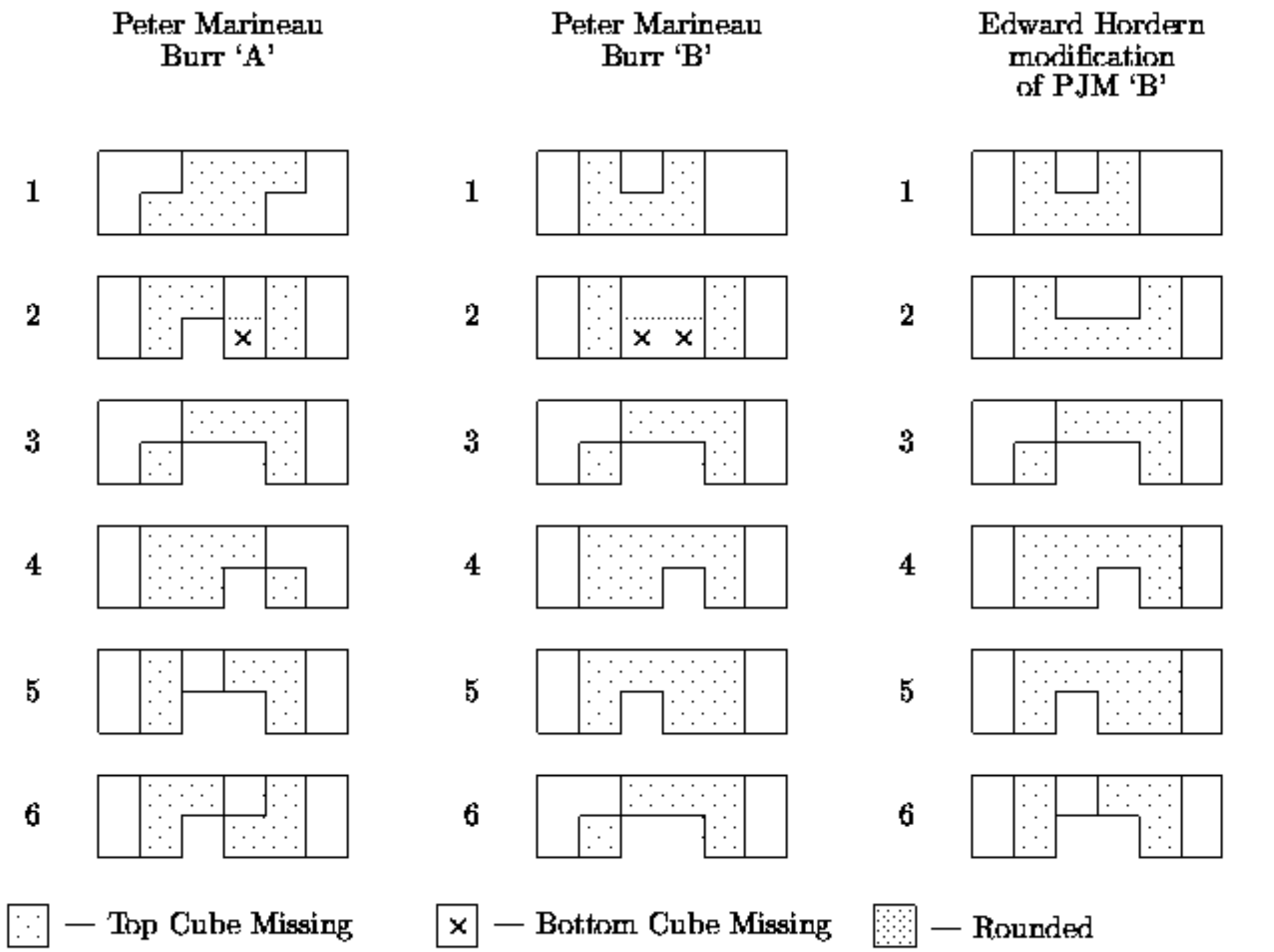
2 

3 

4 

5 

6 



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```
        BURR6 - PC VERSION 2.0 - 6-PIECE BURR ANALYSIS PROGRAM - COPYRIGHT 1986, 1987 BILL CUTL
 OPTIONS IN EFFECT:    LIST OF STATES: NO                      EXTERNAL HOLES IN ASSEMBLIES: NOT
            DETAILS&PICTURES: SOLUTIONS ONLY    SUBASSEMBLY ANALYSIS: NOT INCLUDED IN OUTPUT
            LENGTH OF PIECES: 6    "LEVEL" USAGE: UNLIMITED MOVEMENT IN ONE DIRECTION

  PUZZLE NAME:      Stewart Coffin's  Interrupted Slide


   PIECE   1234 5678 9A BC    SPECIAL PIECE CODES       CUBE NUMBERS  FOR LENGTH 6 PIECES
           ---- ---- -- --                               TOP BOTTOM
    # 1    0010 0010 00 11  FIXED                       X X   X X
    # 2    1001 0000 11 11                              1 5   X X        CUBES LABELLED "X" AR
    # 3    0000 0001 10 11                              2 6   B 9
    # 4    1011 1000 11 11                              3 7   C A        FOR CUBES 0-9,A,B,C,
    # 5    0100 0000 10 11                              4 8   X X              1=PRESENT, 0=AB
    # 6    0000 0000 00 11                              X X   X X

  RESULTS OF ASSEMBLY SECTION:         9 ASSEMBLIES   ("LEGAL CONFIGURATIONS")
  DISASSEMBLY PROGRAM WILL BE CALLED FOR EACH ASSEMBLY





                Stewart Coffin's  Interrupted Slide  - ASSEMBLY #  2     - STARTING POSITION

   TOP
*********************************************************************************************
*         *         *         *         *         *         *         *         *
*         *         *         *         *         *         *         *         *
*         *         *         *         *   2266  *   2266  *         *         *
*         *         *    33   *    33   *   2236  *   2336  *    33   *    33   *
*         *         *    33   * 553555  * 522 65  * 444 44  * 444444  *    33   *
*         *         *    11   * 555555  * 522565  * 4 1144  * 444444  *    11   *
*         *         *    11   *    11   *   2216  *   2 16  *    11   *    11   *
*         *         *         *         *   2266  *   2266  *         *         *
*         *         *         *         *         *         *         *         *
*         *         *         *         *         *         *         *         *
*********************************************************************************************

                         DIR # 2
                           A
                           |
                           |              DIR # 3 < - - - - - - - - - - - - - - - -
                           |
                           +-----> DIR # 1

 LEVEL  3 SOLUTION FOUND:
      LEVEL  1: IN DIR # 1 MOVE PIECES: 4: 1
      LEVEL  2: IN DIR # 3 MOVE PIECES: 6:-1
      LEVEL  3: PIECES SPLIT IN DIRECTION 1 INTO:
                     (NEG DIRECTION) - SUBASSEMBLY # 1 PIECES: 2 3 5
                     (POS DIRECTION) - SUBASSEMBLY # 2 PIECES: 1 4 6

  ALL SUBASSEMBLIES SUCCESSFULLY DISASSEMBLED
```

```
            Stewart Coffin's  Interrupted Slide  - ASSEMBLY #  6     - STARTING POSITION

    TOP
**************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *   2255   *   2255   *          *          *
*          *          *    44    *    44    *   2245   *   2445   *    44    *    44    *
*          *          *    44    *  664466  *  62 456  *  32 433  *  333433  *    44    *
*          *          *    11    *  666666  *  62 556  *  321153  *  333333  *    11    *
*          *          *    11    *    11    *   2215   *   2 15   *    11    *    11    *
*          *          *          *          *   2255   *   2255   *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
**************************************************************************************************

                         DIR # 2
                           A
                           |
                           |               DIR # 3 < - - - - - - - - - - - - - - -
                           |
                           +-----> DIR # 1

 LEVEL  3 SOLUTION FOUND:
      LEVEL  1: IN DIR # 2 MOVE PIECES: 2: 1
      LEVEL  2: IN DIR # 3 MOVE PIECES: 4:-2
      LEVEL  3: PIECES SPLIT IN DIRECTION 2 INTO:
                     (NEG DIRECTION) - SUBASSEMBLY # 1 PIECES: 1 2 3 4 5
                     (POS DIRECTION) - SINGLE PIECE  6

  ALL SUBASSEMBLIES SUCCESSFULLY DISASSEMBLED


  SUMMARY INFORMATION FOR PUZZLE:     Stewart Coffin's  Interrupted Slide         WITH LENGTH  6

            7 WITH NO SOLUTION
            2 LEVEL  3 SOLUTIONS
```

```
           BURR6 - PC VERSION 2.0 - 6-PIECE BURR ANALYSIS PROGRAM - COPYRIGHT 1986, 1987 BILL CUTL
 OPTIONS IN EFFECT:    LIST OF STATES: NO                        EXTERNAL HOLES IN ASSEMBLIES: NOT
             DETAILS&PICTURES: SOLUTIONS ONLY    SUBASSEMBLY ANALYSIS: NOT INCLUDED IN OUTPUT
             LENGTH OF PIECES: 8    "LEVEL" USAGE: UNLIMITED MOVEMENT IN ONE DIRECTION

  PUZZLE NAME:      Stewart Coffin's  Interrupted Slide


   PIECE   1234 5678 9A BC    SPECIAL PIECE CODES       CUBE NUMBERS  FOR LENGTH 6 PIECES
           ---- ---- -- --                               TOP BOTTOM
    # 1    0010 0010 00 11  FIXED                        X X   X X
```

```
  # 2    1001 0000 11 11                              1 5   X X        CUBES LABELLED "X" AR
  # 3    0000 0001 10 11                              2 6   B 9
  # 4    1011 1000 11 11                              3 7   C A        FOR CUBES 0-9,A,B,C,
  # 5    0100 0000 10 11                              4 8   X X              1=PRESENT, 0=AB
  # 6    0000 0000 00 11                              X X   X X
```

RESULTS OF ASSEMBLY SECTION: 9 ASSEMBLIES   ("LEGAL CONFIGURATIONS")
DISASSEMBLY PROGRAM WILL BE CALLED FOR EACH ASSEMBLY

SUMMARY INFORMATION FOR PUZZLE: Stewart Coffin's Interrupted Slide   WITH LENGTH 8

UNIQUE LEVEL 3-1 SOLUTION

```
        BURR6 - PC VERSION 2.0 - 6-PIECE BURR ANALYSIS PROGRAM - COPYRIGHT 1986, 1987 BILL CUTL
 OPTIONS IN EFFECT:    LIST OF STATES: NO                       EXTERNAL HOLES IN ASSEMBLIES: NOT
            DETAILS&PICTURES: SOLUTIONS ONLY    SUBASSEMBLY ANALYSIS: NOT INCLUDED IN OUTPUT
            LENGTH OF PIECES: 6    "LEVEL" USAGE: UNLIMITED MOVEMENT IN ONE DIRECTION

  PUZZLE NAME:      Stewart Coffin's  Triple Slide


   PIECE   1234 5678 9A BC    SPECIAL PIECE CODES       CUBE NUMBERS  FOR LENGTH 6 PIECES
           ---- ---- -- --                               TOP BOTTOM
    # 1    1100 1000 11 11  FIXED                        X X   X X
    # 2    0001 0000 00 11                               1 5   X X        CUBES LABELLED "X" AR
    # 3    0000 0000 00 11                               2 6   B 9
    # 4    1010 0010 11 11                               3 7   C A        FOR CUBES 0-9,A,B,C,
    # 5    0110 0100 11 11                               4 8   X X              1=PRESENT, 0=AB
    # 6    0100 0000 01 11                               X X   X X

  RESULTS OF ASSEMBLY SECTION:         1 ASSEMBLIES   ("LEGAL CONFIGURATIONS")
  DISASSEMBLY PROGRAM WILL BE CALLED FOR EACH ASSEMBLY







           Stewart Coffin's  Triple Slide       - ASSEMBLY #  1     - STARTING POSITION

    TOP
***********************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *   5566   *   5566   *          *          *
*          *          *    44    *    44    *   5446   *   5446   *    44    *    44    *
*          *          *    44    *  222222  *  254422  *  355663  *  33 433  *    44    *
*          *          *    11    *  221122  *  255162  *  355 63  *  333333  *    11    *
*          *          *    11    *    11    *   5116   *   5116   *    11    *    11    *
*          *          *          *          *   5566   *   5566   *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
***********************************************************************************************

                        DIR # 2
                          A
                          |
                          |               DIR # 3 < - - - - - - - - - - - - - - -
                          |
                          +-----> DIR # 1

 LEVEL  3 SOLUTION FOUND:
      LEVEL  1: IN DIR # 3 MOVE PIECES: 2: 1 4: 1 6: 1
      LEVEL  2: IN DIR # 1 MOVE PIECES: 3:-1 4:-1 5:-1
      LEVEL  3: PIECES SPLIT IN DIRECTION 2 INTO:
                     (NEG DIRECTION) - SUBASSEMBLY # 1 PIECES: 1 2 6
                                       SINGLE PIECE  3
                     (POS DIRECTION) - SUBASSEMBLY # 2 PIECES: 4 5

  ALL SUBASSEMBLIES SUCCESSFULLY DISASSEMBLED
```

SUMMARY INFORMATION FOR PUZZLE: Stewart Coffin's Triple Slide   WITH LENGTH 6

UNIQUE LEVEL 3-1 SOLUTION

```
        BURR6 - PC VERSION 2.0 - 6-PIECE BURR ANALYSIS PROGRAM - COPYRIGHT 1986, 1987 BILL CUTL
 OPTIONS IN EFFECT:    LIST OF STATES: NO                        EXTERNAL HOLES IN ASSEMBLIES: NOT
            DETAILS&PICTURES: SOLUTIONS ONLY    SUBASSEMBLY ANALYSIS: INCLUDED IN OUTPUT
            LENGTH OF PIECES: 6    "LEVEL" USAGE: UNLIMITED MOVEMENT IN ONE DIRECTION

  PUZZLE NAME:      Coffin's Improved Burr


   PIECE   1234 5678 9A BC    SPECIAL PIECE CODES       CUBE NUMBERS  FOR LENGTH 6 PIECES
           ---- ---- -- --                               TOP BOTTOM
    # 1    0110 0000 00 11  FIXED                        X X   X X
    # 2    1001 1001 01 11                               1 5   X X        CUBES LABELLED "X" AR
    # 3    0000 0000 00 11                               2 6   B 9
    # 4    1000 0010 11 11                               3 7   C A        FOR CUBES 0-9,A,B,C,
    # 5    1010 1000 00 11                               4 8   X X              1=PRESENT, 0=AB
    # 6    0011 0011 11 00                               X X   X X

  RESULTS OF ASSEMBLY SECTION:         1 ASSEMBLIES   ("LEGAL CONFIGURATIONS")
  DISASSEMBLY PROGRAM WILL BE CALLED FOR EACH ASSEMBLY







              Coffin's Improved Burr              - ASSEMBLY #  1     - STARTING POSITION

   TOP
************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *  4466    *  4466    *          *          *
*          *          *    22    *    22    *  4466    *  4266    *    22    *    22    *
*          *          *    22    *  552255  *  542655  *  342663  *  332233  *    22    *
*          *          *    11    *  555555  *  545155  *  344163  *  333333  *    11    *
*          *          *    11    *    11    *  4 16    *  4 16    *    11    *    11    *
*          *          *          *          *  4466    *  4466    *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
************************************************************************************************

                         DIR # 2
                           A
                           |
                           |              DIR # 3 < - - - - - - - - - - - - - - - -
                           |
                           +-----> DIR # 1

 LEVEL  2 SOLUTION FOUND:
      LEVEL  1: IN DIR # 2 MOVE PIECES: 2: 1 3: 1 4: 1
      LEVEL  2: PIECES SPLIT IN DIRECTION 3 INTO:
                     (NEG DIRECTION) - SINGLE PIECE  3
                     (POS DIRECTION) - SUBASSEMBLY # 1 PIECES: 1 2 4 5 6
```

```
               Coffin's Improved Burr              - ASSEMBLY #  1     - SUBASSEMBLY # 1

    TOP
************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *   44     *   44     *          *          *
*          *          *    22    *    22    *  4466    *   4266   *    22    *    22    *
*          *          *    22    *    22    *  4266    *   4266   *    22    *    22    *
*          *          *          *  55  55  *  54 655  *   4466   *          *          *
*          *          *    11    *  555555  *  545155  *   4 16   *          *    11    *
*          *          *    11    *    11    *  4416    *   4416   *    11    *    11    *
*          *          *          *          *     66   *     66   *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
************************************************************************************************

                         DIR # 2
                           A
                           |
                           |               DIR # 3 < - - - - - - - - - - - - - - -
                           |
                           +-----> DIR # 1

 LEVEL  3 SOLUTION FOUND:
      LEVEL  1: IN DIR # 2 MOVE PIECES: 2:-1 4:-1
      LEVEL  2: IN DIR # 3 MOVE PIECES: 1: 1 5: 1
      LEVEL  3: PIECES SPLIT IN DIRECTION 1 INTO:
                     (NEG DIRECTION) - SINGLE PIECE  4
                                       SUBASSEMBLY # 2 PIECES: 1 2 5
                     (POS DIRECTION) - SINGLE PIECE  6
```

```
               Coffin's Improved Burr              - ASSEMBLY #  1     - SUBASSEMBLY # 2

    TOP
************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *    22    *    22    *          *    2     *    22    *    22    *
*          *          *  552255  *  5 2255  *    2     *    2     *    22    *    22    *
*          *    11    *  555555  *  5 5155  *     1    *          *    11    *          *
*          *    11    *    11    *     1    *     1    *    11    *    11    *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
************************************************************************************************

                         DIR # 2
                           A
                           |
                           |               DIR # 3 < - - - - - - - - - - - - - - -
                           |
                           +-----> DIR # 1

 LEVEL  1 SOLUTION FOUND:
      LEVEL  1: PIECES SPLIT IN DIRECTION 2 INTO:
                     (NEG DIRECTION) - SINGLE PIECE  1
```

```
                                    SINGLE PIECE  5
                  (POS DIRECTION) - SINGLE PIECE  2

DISASSEMBLY COMPLETE


SUMMARY INFORMATION FOR PUZZLE:     Coffin's Improved Burr                      WITH LENGTH  6

     UNIQUE LEVEL  2-3 SOLUTION
       (SECOND LEVEL NOT NECESSARILY MINIMUM)
```

```
        BURR6 - PC VERSION 2.0 - 6-PIECE BURR ANALYSIS PROGRAM - COPYRIGHT 1986, 1987 BILL CUTL
OPTIONS IN EFFECT:    LIST OF STATES: NO                      EXTERNAL HOLES IN ASSEMBLIES: NOT
            DETAILS&PICTURES: SOLUTIONS ONLY    SUBASSEMBLY ANALYSIS: NOT INCLUDED IN OUTPUT
            LENGTH OF PIECES: 6    "LEVEL" USAGE: UNLIMITED MOVEMENT IN ONE DIRECTION

 PUZZLE NAME:      Bill's Baffling Burr


  PIECE   1234 5678 9A BC    SPECIAL PIECE CODES       CUBE NUMBERS  FOR LENGTH 6 PIECES
          ---- ---- -- --                               TOP BOTTOM
   # 1    0000 0000 00 11  FIXED                       X X   X X
   # 2    0000 1000 01 11                              1 5   X X        CUBES LABELLED "X" AR
   # 3    1001 1001 11 11         SYMM                 2 6   B 9
   # 4    0010 0000 00 11                              3 7   C A        FOR CUBES 0-9,A,B,C,
   # 5    0001 1100 00 11                              4 8   X X              1=PRESENT, 0=AB
   # 6    0100 0000 00 11                              X X   X X

 RESULTS OF ASSEMBLY SECTION:        24 ASSEMBLIES   ("LEGAL CONFIGURATIONS")
 DISASSEMBLY PROGRAM WILL BE CALLED FOR EACH ASSEMBLY
```

```
                 Bill's Baffling Burr                - ASSEMBLY #  7     - STARTING POSITION

   TOP
************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *   5566   *   5566   *          *          *
*          *          *    22    *    22    *   5226   *   5526   *    22    *    22    *
*          *          *    22    *  333333  *  33  33  *  45 664  *  442 44  *    22    *
*          *          *    11    *  333333  *  335 33  *  45 464  *  444444  *    11    *
*          *          *    11    *    11    *   5516   *   5 16   *    11    *    11    *
*          *          *          *          *   5566   *   5566   *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
************************************************************************************************

                         DIR # 2
                           A
                           |
                           |               DIR # 3 < - - - - - - - - - - - - - - -
                           |
                           +-----> DIR # 1

LEVEL  5 SOLUTION FOUND:
     LEVEL  1: IN DIR # 1 MOVE PIECES: 3:-1
     LEVEL  2: IN DIR # 2 MOVE PIECES: 5: 1
     LEVEL  3: IN DIR # 3 MOVE PIECES: 2: 1
     LEVEL  4: IN DIR # 2 MOVE PIECES: 5: 1
     LEVEL  5: PIECES SPLIT IN DIRECTION 1 INTO:
                    (NEG DIRECTION) - SINGLE PIECE  1
                    (POS DIRECTION) - SUBASSEMBLY # 1 PIECES: 2 3 4 5 6

 ALL SUBASSEMBLIES SUCCESSFULLY DISASSEMBLED
```

SUMMARY INFORMATION FOR PUZZLE: Bill's Baffling Burr WITH LENGTH 6

UNIQUE LEVEL 5-1 SOLUTION

```
        BURR6 - PC VERSION 2.0 - 6-PIECE BURR ANALYSIS PROGRAM - COPYRIGHT 1986, 1987 BILL CUTL
 OPTIONS IN EFFECT:    LIST OF STATES: NO                       EXTERNAL HOLES IN ASSEMBLIES: ALLO
            DETAILS&PICTURES: SOLUTIONS ONLY    SUBASSEMBLY ANALYSIS: NOT INCLUDED IN OUTPUT
            LENGTH OF PIECES: 6    "LEVEL" USAGE: UNLIMITED MOVEMENT IN ONE DIRECTION

  PUZZLE NAME:      Bill's Baffling Burr


   PIECE   1234 5678 9A BC    SPECIAL PIECE CODES       CUBE NUMBERS  FOR LENGTH 6 PIECES
           ---- ---- -- --                               TOP BOTTOM
    # 1    0000 0000 00 11  FIXED                       X X   X X
    # 2    0000 1000 01 11                              1 5   X X        CUBES LABELLED "X" AR
    # 3    1001 1001 11 11           SYMM               2 6   B 9
    # 4    0010 0000 00 11                              3 7   C A        FOR CUBES 0-9,A,B,C,
    # 5    0001 1100 00 11                              4 8   X X              1=PRESENT, 0=AB
    # 6    0100 0000 00 11                              X X   X X

  RESULTS OF ASSEMBLY SECTION:        66 ASSEMBLIES   ("LEGAL CONFIGURATIONS")
  DISASSEMBLY PROGRAM WILL BE CALLED FOR EACH ASSEMBLY







               Bill's Baffling Burr                - ASSEMBLY #  8     - STARTING POSITION

    TOP
************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *   5544   *   5544   *          *          *
*          *          *    33    *    33    *   5  4   *   55 4   *    33    *    33    *
*          *          *    33    *  2 33 2  *  2233 2  *  653346  *  663366  *    33    *
*          *          *    11    *  222222  *  225222  *  656446  *  666666  *    11    *
*          *          *    11    *    11    *   5514   *   5 14   *    11    *    11    *
*          *          *          *          *   5544   *   5544   *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
************************************************************************************************

                         DIR # 2
                           A
                           |
                           |               DIR # 3 < - - - - - - - - - - - - - - -
                           |
                           +-----> DIR # 1

 LEVEL  2 SOLUTION FOUND:
      LEVEL  1: IN DIR # 2 MOVE PIECES: 2: 1 3: 1 5: 1
      LEVEL  2: PIECES SPLIT IN DIRECTION 3 INTO:
                     (NEG DIRECTION) - SUBASSEMBLY # 1 PIECES: 1 3 4 5 6
                     (POS DIRECTION) - SINGLE PIECE  2

  ALL SUBASSEMBLIES SUCCESSFULLY DISASSEMBLED


  SUMMARY INFORMATION FOR PUZZLE:     Bill's Baffling Burr                         WITH LENGTH  6
```

```
61 WITH NO SOLUTION
 2 LEVEL  2 SOLUTIONS
 2 LEVEL  3 SOLUTIONS
 1 LEVEL  5 SOLUTIONS
```

```
        BURR6 - PC VERSION 2.0 - 6-PIECE BURR ANALYSIS PROGRAM - COPYRIGHT 1986, 1987 BILL CUTL
 OPTIONS IN EFFECT:    LIST OF STATES: NO                        EXTERNAL HOLES IN ASSEMBLIES: NOT
            DETAILS&PICTURES: SOLUTIONS ONLY    SUBASSEMBLY ANALYSIS: NOT INCLUDED IN OUTPUT
            LENGTH OF PIECES: 8    "LEVEL" USAGE: UNLIMITED MOVEMENT IN ONE DIRECTION

  PUZZLE NAME:      BCP/CPU  BB43-143M-1


   PIECE   1234 5678 9A BC    SPECIAL PIECE CODES       CUBE NUMBERS  FOR LENGTH 6 PIECES
           ---- ---- -- --                               TOP BOTTOM
    # 1    0000 1110 00 11  FIXED                        X X   X X
    # 2    0001 0011 00 11                               1 5   X X        CUBES LABELLED "X" AR
    # 3    1000 1100 00 11                               2 6   B 9
    # 4    0010 1010 00 11                               3 7   C A        FOR CUBES 0-9,A,B,C,
    # 5    0101 0001 00 11                               4 8   X X              1=PRESENT, 0=AB
    # 6    0011 0000 00 11                               X X   X X

  RESULTS OF ASSEMBLY SECTION:         2 ASSEMBLIES   ("LEGAL CONFIGURATIONS")
  DISASSEMBLY PROGRAM WILL BE CALLED FOR EACH ASSEMBLY
```

```
                BCP/CPU  BB43-143M-1                 - ASSEMBLY #  2     - STARTING POSITION

    TOP
*************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *   5544   *   5544   *          *          *
*          *          *          *          *   5544   *   5544   *          *          *
*          *    22    *    22    *    22    *   5244   *   52 4   *    22    *    22    *    22
*          *    22    *    22    * 66666666 * 66556666 * 33332433 * 33322333 *    22    *    22
*          *    11    *    11    * 6661 666 * 66514 66 * 33314433 * 33333333 *    11    *    11
*          *    11    *    11    *    11    *   5514   *   5514   *    11    *    11    *    11
*          *          *          *          *   5544   *   5544   *          *          *
*          *          *          *          *   5544   *   5544   *          *          *
*          *          *          *          *          *          *          *          *
*************************************************************************************************

                            DIR # 2
                              A
                              |
                              |               DIR # 3 < - - - - - - - - - - - - - - - -
                              |
                              +-----> DIR # 1

 LEVEL  4 SOLUTION FOUND:
      LEVEL  1: IN DIR # 1 MOVE PIECES: 5:-1 6:-1
      LEVEL  2: IN DIR # 2 MOVE PIECES: 2: 1 3: 1 5: 1
      LEVEL  3: IN DIR # 3 MOVE PIECES: 1: 1 6: 1
      LEVEL  4: PIECES SPLIT IN DIRECTION 1 INTO:
                     (NEG DIRECTION) - SINGLE PIECE  5
                                       SUBASSEMBLY # 1 PIECES: 1 6
                     (POS DIRECTION) - SUBASSEMBLY # 2 PIECES: 2 3 4

  ALL SUBASSEMBLIES SUCCESSFULLY DISASSEMBLED
```

SUMMARY INFORMATION FOR PUZZLE: BCP/CPU BB43-143M-1   WITH LENGTH 8

UNIQUE LEVEL 4-1 SOLUTION

```
        BURR6 - PC VERSION 2.0 - 6-PIECE BURR ANALYSIS PROGRAM - COPYRIGHT 1986, 1987 BILL CUTL
 OPTIONS IN EFFECT:    LIST OF STATES: NO                      EXTERNAL HOLES IN ASSEMBLIES: NOT
            DETAILS&PICTURES: SOLUTIONS ONLY    SUBASSEMBLY ANALYSIS: NOT INCLUDED IN OUTPUT
            LENGTH OF PIECES: 6    "LEVEL" USAGE: UNLIMITED MOVEMENT IN ONE DIRECTION

  PUZZLE NAME:      Bill's Ball Bearing Burr


   PIECE   1234 5678 9A BC    SPECIAL PIECE CODES       CUBE NUMBERS  FOR LENGTH 6 PIECES
           ---- ---- -- --                               TOP BOTTOM
    # 1    0000 0000 00 11  FIXED                       X X   X X
    # 2    0101 0001 10 11                              1 5   X X        CUBES LABELLED "X" AR
    # 3    1000 1000 01 11                              2 6   B 9
    # 4    0000 0110 11 11                              3 7   C A        FOR CUBES 0-9,A,B,C,
    # 5    0010 0110 11 01                              4 8   X X              1=PRESENT, 0=AB
    # 6    0000 0001 00 11                              X X   X X

  RESULTS OF ASSEMBLY SECTION:         3 ASSEMBLIES   ("LEGAL CONFIGURATIONS")
  DISASSEMBLY PROGRAM WILL BE CALLED FOR EACH ASSEMBLY






              Bill's Ball Bearing Burr            - ASSEMBLY #  3     - STARTING POSITION

   TOP
*************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *   3322   *   3322   *          *          *
*          *          *    66    *    66    *   3622   *   3622   *    66    *    66    *
*          *          *    66    *  444444  *  434424  *  535  5  *  555655  *    66    *
*          *          *    11    *  444444  *  4  224  *  535525  *  555555  *    11    *
*          *          *    11    *    11    *   3312   *   3312   *    11    *    11    *
*          *          *          *          *   3322   *   3322   *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*************************************************************************************************

                           DIR # 2
                             A
                             |
                             |               DIR # 3 < - - - - - - - - - - - - - - -
                             |
                             +-----> DIR # 1

 LEVEL  3 SOLUTION FOUND:
      LEVEL  1: IN DIR # 2 MOVE PIECES: 3: 1 5: 1 6: 1
      LEVEL  2: IN DIR # 3 MOVE PIECES: 2:-2 5:-2 6:-2
      LEVEL  3: PIECES SPLIT IN DIRECTION 1 INTO:
                     (NEG DIRECTION) - SUBASSEMBLY # 1 PIECES: 3 4
                                       SINGLE PIECE  1
                     (POS DIRECTION) - SUBASSEMBLY # 2 PIECES: 2 5 6

  ALL SUBASSEMBLIES SUCCESSFULLY DISASSEMBLED
```

SUMMARY INFORMATION FOR PUZZLE: Bill's Ball Bearing Burr   WITH LENGTH 6

UNIQUE LEVEL 3-1 SOLUTION

```
        BURR6 - PC VERSION 2.0 - 6-PIECE BURR ANALYSIS PROGRAM - COPYRIGHT 1986, 1987 BILL CUTL
 OPTIONS IN EFFECT:    LIST OF STATES: NO                    EXTERNAL HOLES IN ASSEMBLIES: NOT
            DETAILS&PICTURES: ALL ASSEMBLIES    SUBASSEMBLY ANALYSIS: NOT INCLUDED IN OUTPUT
            LENGTH OF PIECES: 8    "LEVEL" USAGE: UNLIMITED MOVEMENT IN ONE DIRECTION

  PUZZLE NAME:      Impossible Second Move

 *** NO UNIQUE NON-SYMMETRIC PIECE FOUND, DUPLICATE ASSEMBLIES MAY OCCUR


   PIECE   1234 5678 9A BC    SPECIAL PIECE CODES       CUBE NUMBERS  FOR LENGTH 6 PIECES
           ---- ---- -- --                               TOP BOTTOM
    # 1    1111 1111 11 11  FIXED    SYMM                X X   X X
    # 2    1000 0001 11 11           SYMM                1 5   X X       CUBES LABELLED "X" AR
    # 3    1110 1000 00 01                  DUPPED       2 6   B 9
    # 4    1110 1000 00 01                  DUPS-3       3 7   C A       FOR CUBES 0-9,A,B,C,
    # 5    0000 0000 00 11                  DUPPED       4 8   X X            1=PRESENT, 0=AB
    # 6    0000 0000 00 11                  DUPS-5       X X   X X

  RESULTS OF ASSEMBLY SECTION:         1 ASSEMBLIES   ("LEGAL CONFIGURATIONS")
  DISASSEMBLY PROGRAM WILL BE CALLED FOR EACH ASSEMBLY






              Impossible Second Move              - ASSEMBLY #  1     - STARTING POSITION

   TOP
*************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *   5566   *   5566   *          *          *
*          *          *          *          *   5566   *   5566   *          *          *
*          *    22    *    22    *    22    *   5226   *   5226   *    22    *    22    *    22
*          *    22    *    22    * 33323333 * 33333633 * 44544444 * 44442444 *    22    *    22
*          *    11    *    11    * 33311333 * 33311633 * 44511444 * 44411444 *    11    *    11
*          *    11    *    11    *    11    *   5116   *   5116   *    11    *    11    *    11
*          *          *          *          *   5566   *   5566   *          *          *
*          *          *          *          *   5566   *   5566   *          *          *
*          *          *          *          *          *          *          *          *
*************************************************************************************************

                            DIR # 2
                              A
                              |
                              |               DIR # 3 < - - - - - - - - - - - - - - -
                              |
                              +-----> DIR # 1

 LEVEL  1 SOLUTION FOUND:
      LEVEL  1: PIECES SPLIT IN DIRECTION 3 INTO:
                     (NEG DIRECTION) - SINGLE PIECE  1
                     (POS DIRECTION) - SUBASSEMBLY # 1 PIECES: 2 3 4 5 6

  DISASSEMBLY NOT COMPLETED - SOME SUBASSEMBLY COULD NOT BE DISASSEMBLED
```

SUMMARY INFORMATION FOR PUZZLE: Impossible Second Move WITH LENGTH 8

1 WITH NO SOLUTION

```
        BURR6 - PC VERSION 2.0 - 6-PIECE BURR ANALYSIS PROGRAM - COPYRIGHT 1986, 1987 BILL CUTL
 OPTIONS IN EFFECT:    LIST OF STATES: NO                    EXTERNAL HOLES IN ASSEMBLIES: NOT
             DETAILS&PICTURES: SOLUTIONS ONLY    SUBASSEMBLY ANALYSIS: NOT INCLUDED IN OUTPUT
             LENGTH OF PIECES: 6    "LEVEL" USAGE: UNLIMITED MOVEMENT IN ONE DIRECTION

  PUZZLE NAME:      Gaby Games (by Philippe Dubois)


   PIECE   1234 5678 9A BC    SPECIAL PIECE CODES       CUBE NUMBERS  FOR LENGTH 6 PIECES
           ---- ---- -- --                               TOP BOTTOM
    # 1    0000 0110 11 11  FIXED                        X X   X X
    # 2    0100 0000 00 11                               1 5   X X        CUBES LABELLED "X" AR
    # 3    1001 0000 00 11           SYMM                2 6   B 9
    # 4    0000 0000 10 11                               3 7   C A        FOR CUBES 0-9,A,B,C,
    # 5    0000 0000 11 11           SYMM                4 8   X X              1=PRESENT, 0=AB
    # 6    0001 0001 11 11                               X X   X X

  RESULTS OF ASSEMBLY SECTION:         2 ASSEMBLIES   ("LEGAL CONFIGURATIONS")
  DISASSEMBLY PROGRAM WILL BE CALLED FOR EACH ASSEMBLY







                 Gaby Games (by Philippe Dubois)      - ASSEMBLY #  2     - STARTING POSITION

    TOP
************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *   4422   *   4422   *          *          *
*          *          *    66    *    66    *   4662   *   4662   *    66    *    66    *
*          *          *    66    *  555555  *  54  25  *  34   3  *  336633  *    66    *
*          *          *    11    *  555555  *  541225  *  331 33  *  333333  *    11    *
*          *          *    11    *    11    *   4112   *   4112   *    11    *    11    *
*          *          *          *          *   4422   *   4422   *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
************************************************************************************************

                         DIR # 2
                           A
                           |
                           |               DIR # 3 < - - - - - - - - - - - - - - - -
                           |
                           +-----> DIR # 1

 LEVEL  6 SOLUTION FOUND:
      LEVEL  1: IN DIR # 3 MOVE PIECES: 6: 2
      LEVEL  2: IN DIR # 1 MOVE PIECES: 3:-1
      LEVEL  3: IN DIR # 3 MOVE PIECES: 4:-1
      LEVEL  4: IN DIR # 1 MOVE PIECES: 2: 1 5: 1
      LEVEL  5: IN DIR # 2 MOVE PIECES: 2:-1
      LEVEL  6: PIECES SPLIT IN DIRECTION 3 INTO:
                     (NEG DIRECTION) - SINGLE PIECE  2
                     (POS DIRECTION) - SUBASSEMBLY # 1 PIECES: 1 3 4 5 6
```

ALL SUBASSEMBLIES SUCCESSFULLY DISASSEMBLED

SUMMARY INFORMATION FOR PUZZLE: Gaby Games (by Philippe Dubois) WITH LENGTH 6

UNIQUE LEVEL 6-4 SOLUTION
(SECOND LEVEL NOT NECESSARILY MINIMUM)

```
        BURR6 - PC VERSION 2.0 - 6-PIECE BURR ANALYSIS PROGRAM - COPYRIGHT 1986, 1987 BILL CUTL
 OPTIONS IN EFFECT:    LIST OF STATES: NO                        EXTERNAL HOLES IN ASSEMBLIES: NOT
            DETAILS&PICTURES: SOLUTIONS ONLY    SUBASSEMBLY ANALYSIS: NOT INCLUDED IN OUTPUT
            LENGTH OF PIECES: 6    "LEVEL" USAGE: UNLIMITED MOVEMENT IN ONE DIRECTION

  PUZZLE NAME:      Victor Goedicke - Second


   PIECE   1234 5678 9A BC    SPECIAL PIECE CODES       CUBE NUMBERS  FOR LENGTH 6 PIECES
           ---- ---- -- --                               TOP BOTTOM
    # 1    1011 0011 11 11  FIXED                        X X   X X
    # 2    0001 0111 11 00                               1 5   X X        CUBES LABELLED "X" AR
    # 3    0011 0011 11 00                               2 6   B 9
    # 4    0000 1110 11 00                               3 7   C A        FOR CUBES 0-9,A,B,C,
    # 5    0000 0000 01 11                               4 8   X X              1=PRESENT, 0=AB
    # 6    0000 0000 00 11                               X X   X X

  RESULTS OF ASSEMBLY SECTION:         1 ASSEMBLIES   ("LEGAL CONFIGURATIONS")
  DISASSEMBLY PROGRAM WILL BE CALLED FOR EACH ASSEMBLY






              Victor Goedicke - Second            - ASSEMBLY #  1     - STARTING POSITION

   TOP
************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *   6644   *   6644   *          *          *
*          *          *    55    *    55    *   6544   *   6554   *    55    *    55    *
*          *          *    55    *  333333  *  333443  *  262222  *  222222  *    55    *
*          *          *    11    *  33 133  *  333443  *  261122  *  221122  *    11    *
*          *          *    11    *    11    *   6114   *   6114   *    11    *    11    *
*          *          *          *          *   6644   *   6644   *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
************************************************************************************************

                         DIR # 2
                           A
                           |
                           |              DIR # 3 < - - - - - - - - - - - - - - - -
                           |
                           +-----> DIR # 1

 LEVEL  3 SOLUTION FOUND:
      LEVEL  1: IN DIR # 1 MOVE PIECES: 3: 1 4: 1 5: 1
      LEVEL  2: IN DIR # 2 MOVE PIECES: 2: 1 4: 1 5: 1
      LEVEL  3: PIECES SPLIT IN DIRECTION 1 INTO:
                     (NEG DIRECTION) - SUBASSEMBLY # 1 PIECES: 2 6
                                       SINGLE PIECE  5
                     (POS DIRECTION) - SUBASSEMBLY # 2 PIECES: 1 3 4

  ALL SUBASSEMBLIES SUCCESSFULLY DISASSEMBLED
```

SUMMARY INFORMATION FOR PUZZLE: Victor Goedicke - Second WITH LENGTH 6

UNIQUE LEVEL 3-1 SOLUTION

```
        BURR6 - PC VERSION 2.0 - 6-PIECE BURR ANALYSIS PROGRAM - COPYRIGHT 1986, 1987 BILL CUTL
OPTIONS IN EFFECT:    LIST OF STATES: FIRST ASSEMBLY ONLY    EXTERNAL HOLES IN ASSEMBLIES: NOT
            DETAILS&PICTURES: SOLUTIONS ONLY    SUBASSEMBLY ANALYSIS: NOT INCLUDED IN OUTPUT
            LENGTH OF PIECES: 6    "LEVEL" USAGE: UNLIMITED MOVEMENT IN ONE DIRECTION

 PUZZLE NAME:      Bruce Love # 1


  PIECE   1234 5678 9A BC    SPECIAL PIECE CODES       CUBE NUMBERS  FOR LENGTH 6 PIECES
          ---- ---- -- --                               TOP BOTTOM
   # 1    0100 0000 00 11                 DUPPED       X X   X X
   # 2    0100 0000 00 11                 DUPS-1       1 5   X X       CUBES LABELLED "X" AR
   # 3    0001 0000 00 11  FIXED                       2 6   B 9
   # 4    0000 0000 00 11                              3 7   C A       FOR CUBES 0-9,A,B,C,
   # 5    1000 0001 01 11                              4 8   X X             1=PRESENT, 0=AB
   # 6    0001 1011 00 11                              X X   X X

 RESULTS OF ASSEMBLY SECTION:        14 ASSEMBLIES   ("LEGAL CONFIGURATIONS")

 DISASSEMBLY PROGRAM WILL BE CALLED FOR EACH ASSEMBLY
```

```
                Bruce Love # 1                        - ASSEMBLY # 13     - STARTING POSITION

    TOP
*********************************************************************************
*         *         *         *         *         *         *         *         *
*         *         *         *         *         *         *         *         *
*         *         *         *         *   6622  *   6622  *         *         *
*         *         *   11    *   11    *   6612  *   6612  *   11    *   11    *
*         *         *   11    * 44  44  * 46  24  * 5 6155  * 555555  *   11    *
*         *         *   33    * 444444  * 4  224  * 556  5  * 555355  *   33    *
*         *         *   33    *   33    *   6 32  *   6632  *   33    *   33    *
*         *         *         *         *   6622  *   6622  *         *         *
*         *         *         *         *         *         *         *         *
*         *         *         *         *         *         *         *         *
*********************************************************************************


                        DIR # 2
                          A
                          |
                          |             DIR # 3 < - - - - - - - - - - - - - - - -
                          |
                          +-----> DIR # 1
```

```
 LEVEL  5 SOLUTION FOUND:
      LEVEL  1: IN DIR # 2 MOVE PIECES: 4: 1 6:-1
      LEVEL  2: IN DIR # 3 MOVE PIECES: 3:-1
      LEVEL  3: IN DIR # 2 MOVE PIECES: 5:-1 6:-1
      LEVEL  4: IN DIR # 3 MOVE PIECES: 1: 1 4: 1
      LEVEL  5: PIECES SPLIT IN DIRECTION 2 INTO:
                     (NEG DIRECTION) - SINGLE PIECE  4
                     (POS DIRECTION) - SUBASSEMBLY # 1 PIECES: 1 2 3 5 6
```

LIST OF STATES FOLLOWS:

ALL 10 STATES ARE LISTED

NUM	LV	DR	FRM	NST	ADD	DUP	END	1	2	3	4	5	6
1*	0	0	0	3	3	0	4	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0
2	1	2	1	0	0	0	4	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0-1 0
3*	1	2	1	1	1	0	5	0 0 0	0 0 0	0 0 0	0 1 0	0 0 0	0-1 0
4	1	2	1	1	1	0	6	0 0 0	0 0 0	0 0 0	0 1 0	0 0 0	0 0 0
5*	2	3	3	3	2	1	8	0 0 0	0 0 0	0 0-1	0 1 0	0 0 0	0-1 0
6	2	3	4	3	0	3	8	0 0 0	0 0 0	0 0-1	0 1 0	0 0 0	0 0 0
7*	3	2	5	2	2	0	10	0 0 0	0 0 0	0 0-1	0 1 0	0-1 0	0-2 0
8	3	2	5	0	0	0	10	0 0 0	0 0 0	0 0-1	0 1 0	0-1 0	0-1 0
9	4	3	7	0	0	0	10	0 0 1	0 0 0	0 0-1	0 1 0	0-1 0	0-2 0
10*	4	3	7	***	***	***	***	0 0 1	0 0 0	0 0-1	0 1 1	0-1 0	0-2 0

ALL SUBASSEMBLIES SUCCESSFULLY DISASSEMBLED

```
             Bruce Love # 1                          - ASSEMBLY # 14     - STARTING POSITION

    TOP
***************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *   6622   *   6622   *          *          *
*          *          *    11    *    11    *   6 12   *   6612   *    11    *    11    *
*          *          *    11    *  44  44  *  46  24  *  5  155  *  555555  *    11    *
*          *          *    33    *  444444  *  46 224  *  556  5  *  555355  *    33    *
*          *          *    33    *    33    *   6632   *   6632   *    33    *    33    *
*          *          *          *          *   6622   *   6622   *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
***************************************************************************************************

                            DIR # 2
                              A
                              |
                              |               DIR # 3 < - - - - - - - - - - - - - - - -
                              |
                              +-----> DIR # 1

 LEVEL  5 SOLUTION FOUND:
      LEVEL  1: IN DIR # 2 MOVE PIECES: 4: 1 6:-1
      LEVEL  2: IN DIR # 3 MOVE PIECES: 3:-1
      LEVEL  3: IN DIR # 2 MOVE PIECES: 5:-1 6:-1
      LEVEL  4: IN DIR # 3 MOVE PIECES: 1: 2 4: 1 6: 1
      LEVEL  5: PIECES SPLIT IN DIRECTION 1 INTO:
                        (NEG DIRECTION) - SUBASSEMBLY # 1 PIECES: 1 4 6
                        (POS DIRECTION) - SUBASSEMBLY # 2 PIECES: 2 3 5

       LIST OF STATES FOLLOWS:

  ALL  12 STATES ARE LISTED

  NUM LV DR FRM NST ADD DUP END      1       2       3       4       5       6
   1*  0  0   0   3   3   0   4    0 0 0   0 0 0   0 0 0   0 0 0   0 0 0   0 0 0
   2   1  2   1   0   0   0   4    0 0 0   0 0 0   0 0 0   0 0 0   0 0 0   0-1 0
   3*  1  2   1   1   1   0   5    0 0 0   0 0 0   0 0 0   0 1 0   0 0 0   0-1 0
   4   1  2   1   0   0   0   5    0 0 0   0 0 0   0 0 0   0 1 0   0 0 0   0 0 0
   5*  2  3   3   2   2   0   7    0 0 0   0 0 0   0 0-1   0 1 0   0 0 0   0-1 0
   6*  3  2   5   5   5   0  12    0 0 0   0 0 0   0 0-1   0 1 0   0-1 0   0-2 0
   7   3  2   5   0   0   0  12    0 0 0   0 0 0   0 0-1   0 1 0   0-1 0   0-1 0
   8*  4  3   6 *** *** *** ***    0 0 2   0 0 0   0 0-1   0 1 1   0-1 0   0-2 1
   9   4  3   6                    0 0 2   0 0 0   0 0-1   0 1 2   0-1 0   0-2 1
  10   4  3   6                    0 0 1   0 0 0   0 0-1   0 1 0   0-1 0   0-2 0
  11   4  3   6                    0 0 1   0 0 0   0 0-1   0 1 1   0-1 0   0-2 0
  12   4  3   6                    0 0 0   0 0-1   0 0-2   0 1 0   0-1-1   0-2 0

  ALL SUBASSEMBLIES SUCCESSFULLY DISASSEMBLED


  SUMMARY INFORMATION FOR PUZZLE:     Bruce Love # 1                              WITH LENGTH  6

            8 WITH NO SOLUTION
            1 LEVEL  4 SOLUTIONS
            5 LEVEL  5 SOLUTIONS
```

```
        BURR6 - PC VERSION 2.0 - 6-PIECE BURR ANALYSIS PROGRAM - COPYRIGHT 1986, 1987 BILL CUTL
 OPTIONS IN EFFECT:    LIST OF STATES: NO                       EXTERNAL HOLES IN ASSEMBLIES: NOT
            DETAILS&PICTURES: SOLUTIONS ONLY    SUBASSEMBLY ANALYSIS: NOT INCLUDED IN OUTPUT
            LENGTH OF PIECES: 6    "LEVEL" USAGE: UNLIMITED MOVEMENT IN ONE DIRECTION

  PUZZLE NAME:      Bruce Love Model


   PIECE   1234 5678 9A BC    SPECIAL PIECE CODES       CUBE NUMBERS  FOR LENGTH 6 PIECES
           ---- ---- -- --                               TOP BOTTOM
    # 1    0000 0000 00 11  FIXED                       X X   X X
    # 2    0100 0100 00 11                              1 5   X X        CUBES LABELLED "X" AR
    # 3    0110 0000 10 11                              2 6   B 9
    # 4    0000 0001 00 11                              3 7   C A        FOR CUBES 0-9,A,B,C,
    # 5    0000 1111 01 11                              4 8   X X              1=PRESENT, 0=AB
    # 6    0001 0000 11 11                              X X   X X

  RESULTS OF ASSEMBLY SECTION:         7 ASSEMBLIES   ("LEGAL CONFIGURATIONS")
  DISASSEMBLY PROGRAM WILL BE CALLED FOR EACH ASSEMBLY


             Bruce Love Model                       - ASSEMBLY #  1     - STARTING POSITION

   TOP
*****************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *  4433    *  4433    *          *          *
*          *          *    66    *    66    *  4663    *  4663    *    66    *    66    *
*          *          *    66    *  222222  *  242332  *  555555  *  556555  *    66    *
*          *          *    11    *  22  22  *  242332  *  5   35  *  555555  *    11    *
*          *          *    11    *    11    *  4 13    *  4413    *    11    *    11    *
*          *          *          *          *  4433    *  4433    *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*****************************************************************************************************

                         DIR # 2
                           A
                           |
                           |               DIR # 3 < - - - - - - - - - - - - - - -
                           |
                           +-----> DIR # 1

 LEVEL  7 SOLUTION FOUND:
      LEVEL  1: IN DIR # 2 MOVE PIECES: 2:-1
      LEVEL  2: IN DIR # 3 MOVE PIECES: 6:-1
      LEVEL  3: IN DIR # 1 MOVE PIECES: 5: 3
      LEVEL  4: IN DIR # 3 MOVE PIECES: 6: 1
      LEVEL  5: IN DIR # 2 MOVE PIECES: 2: 1
      LEVEL  6: IN DIR # 3 MOVE PIECES: 1:-1 4:-1
      LEVEL  7: PIECES SPLIT IN DIRECTION 1 INTO:
                       (NEG DIRECTION) - SINGLE PIECE  4
                                         SINGLE PIECE  6
```

(POS DIRECTION) - SUBASSEMBLY # 1 PIECES: 1 2 3 5

ALL SUBASSEMBLIES SUCCESSFULLY DISASSEMBLED

SUMMARY INFORMATION FOR PUZZLE: Bruce Love Model WITH LENGTH 6

UNIQUE LEVEL 7-1 SOLUTION

```
        BURR6 - PC VERSION 2.0 - 6-PIECE BURR ANALYSIS PROGRAM - COPYRIGHT 1986, 1987 BILL CUTL
 OPTIONS IN EFFECT:    LIST OF STATES: NO                    EXTERNAL HOLES IN ASSEMBLIES: NOT
            DETAILS&PICTURES: SOLUTIONS ONLY    SUBASSEMBLY ANALYSIS: NOT INCLUDED IN OUTPUT
            LENGTH OF PIECES: 8    "LEVEL" USAGE: UNLIMITED MOVEMENT IN ONE DIRECTION

  PUZZLE NAME:      Bruce Love B.4


   PIECE   1234 5678 9A BC    SPECIAL PIECE CODES       CUBE NUMBERS  FOR LENGTH 6 PIECES
           ---- ---- -- --                               TOP BOTTOM
    # 1    0000 0100 11 01  FIXED                       X X   X X
    # 2    0001 1101 11 11                              1 5   X X        CUBES LABELLED "X" AR
    # 3    0000 0000 11 00                              2 6   B 9
    # 4    0000 0010 11 10                              3 7   C A        FOR CUBES 0-9,A,B,C,
    # 5    1000 0001 11 00                              4 8   X X              1=PRESENT, 0=AB
    # 6    0011 0110 11 00                              X X   X X

  RESULTS OF ASSEMBLY SECTION:         3 ASSEMBLIES   ("LEGAL CONFIGURATIONS")
  DISASSEMBLY PROGRAM WILL BE CALLED FOR EACH ASSEMBLY







             Bruce Love B.4                       - ASSEMBLY #  3     - STARTING POSITION

    TOP
*************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *   3355   *   3355   *          *          *
*          *          *          *          *   3355   *   3355   *          *          *
*          *    66    *    66    *    66    *   36 5   *   3655   *    66    *    66    *    66
*          *    66    *    66    * 44446444 * 44366544 * 2226  22 * 22222222 *    66    *    66
*          *    11    *    11    * 44444444 * 44314544 * 222 2222 * 22222222 *    11    *    11
*          *    11    *    11    *    11    *   3155   *   3115   *    11    *    11    *    11
*          *          *          *          *   3355   *   3355   *          *          *
*          *          *          *          *   3355   *   3355   *          *          *
*          *          *          *          *          *          *          *          *
*************************************************************************************************

                           DIR # 2
                             A
                             |
                             |              DIR # 3 < - - - - - - - - - - - - - - - -
                             |
                             +-----> DIR # 1

 LEVEL  5 SOLUTION FOUND:
      LEVEL  1: IN DIR # 1 MOVE PIECES: 2:-1
      LEVEL  2: IN DIR # 3 MOVE PIECES: 3:-1
      LEVEL  3: IN DIR # 1 MOVE PIECES: 2:-1 3:-1
      LEVEL  4: IN DIR # 2 MOVE PIECES: 6: 1
      LEVEL  5: PIECES SPLIT IN DIRECTION 1 INTO:
                 (NEG DIRECTION) - SUBASSEMBLY # 1 PIECES: 2 3
                                   SINGLE PIECE  6
                 (POS DIRECTION) - SUBASSEMBLY # 2 PIECES: 1 4 5
```

ALL SUBASSEMBLIES SUCCESSFULLY DISASSEMBLED

SUMMARY INFORMATION FOR PUZZLE: Bruce Love B.4   WITH LENGTH 8

UNIQUE LEVEL 5-1 SOLUTION

```
        BURR6 - PC VERSION 2.0 - 6-PIECE BURR ANALYSIS PROGRAM - COPYRIGHT 1986, 1987 BILL CUTL
 OPTIONS IN EFFECT:    LIST OF STATES: NO                       EXTERNAL HOLES IN ASSEMBLIES: NOT
            DETAILS&PICTURES: SOLUTIONS ONLY    SUBASSEMBLY ANALYSIS: NOT INCLUDED IN OUTPUT
            LENGTH OF PIECES: 6    "LEVEL" USAGE: UNLIMITED MOVEMENT IN ONE DIRECTION

  PUZZLE NAME:      Derwin F. Brown #23


   PIECE   1234 5678 9A BC    SPECIAL PIECE CODES       CUBE NUMBERS  FOR LENGTH 6 PIECES
           ---- ---- -- --                               TOP BOTTOM
    # 1    0100 0000 00 11  FIXED                       X X   X X
    # 2    0000 0000 01 11                              1 5   X X        CUBES LABELLED "X" AR
    # 3    1100 1001 11 11                              2 6   B 9
    # 4    0000 0001 00 11                              3 7   C A        FOR CUBES 0-9,A,B,C,
    # 5    1101 0100 00 11                              4 8   X X              1=PRESENT, 0=AB
    # 6    0000 0100 10 11                              X X   X X

  RESULTS OF ASSEMBLY SECTION:         9 ASSEMBLIES   ("LEGAL CONFIGURATIONS")
  DISASSEMBLY PROGRAM WILL BE CALLED FOR EACH ASSEMBLY
```

```
              Derwin F. Brown #23                 - ASSEMBLY #  3     - STARTING POSITION

   TOP
*************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *   3366   *   3366   *          *          *
*          *          *    55    *    55    *   3356   *   3356   *    55    *    55    *
*          *          *    55    *  222522  *  233 62  *  435544  *  44 544  *    55    *
*          *          *    11    *  222222  *  23 162  *  43 664  *  444444  *    11    *
*          *          *    11    *    11    *   3 16   *   3316   *    11    *    11    *
*          *          *          *          *   3366   *   3366   *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*************************************************************************************************

                           DIR # 2
                             A
                             |
                             |              DIR # 3 < - - - - - - - - - - - - - - - -
                             |
                             +-----> DIR # 1

 LEVEL  6 SOLUTION FOUND:
      LEVEL  1: IN DIR # 2 MOVE PIECES: 3: 1
      LEVEL  2: IN DIR # 3 MOVE PIECES: 5: 1
      LEVEL  3: IN DIR # 2 MOVE PIECES: 2: 1 3: 1
      LEVEL  4: IN DIR # 3 MOVE PIECES: 2: 1 3: 1 5: 1
      LEVEL  5: IN DIR # 1 MOVE PIECES: 2:-1 3:-1 5:-1
      LEVEL  6: PIECES SPLIT IN DIRECTION 2 INTO:
                       (NEG DIRECTION) - SUBASSEMBLY # 1 PIECES: 1 4 6
                                         SINGLE PIECE  2
                       (POS DIRECTION) - SUBASSEMBLY # 2 PIECES: 3 5
```

ALL SUBASSEMBLIES SUCCESSFULLY DISASSEMBLED

SUMMARY INFORMATION FOR PUZZLE: Derwin F. Brown #23   WITH LENGTH 6

UNIQUE LEVEL 6-1 SOLUTION

```
        BURR6 - PC VERSION 2.0 - 6-PIECE BURR ANALYSIS PROGRAM - COPYRIGHT 1986, 1987 BILL CUTL
 OPTIONS IN EFFECT:    LIST OF STATES: NO                         EXTERNAL HOLES IN ASSEMBLIES: NOT
            DETAILS&PICTURES: ALL ASSEMBLIES    SUBASSEMBLY ANALYSIS: NOT INCLUDED IN OUTPUT
            LENGTH OF PIECES: 6    "LEVEL" USAGE: UNLIMITED MOVEMENT IN ONE DIRECTION

  PUZZLE NAME:      Bill Meek's Twist Burr


   PIECE   1234 5678 9A BC    SPECIAL PIECE CODES       CUBE NUMBERS  FOR LENGTH 6 PIECES
           ---- ---- -- --                               TOP BOTTOM
    # 1    0010 0110 11 11  FIXED                       X X   X X
    # 2    0000 0000 11 10                              1 5   X X        CUBES LABELLED "X" AR
    # 3    1011 1011 11 11                              2 6   B 9
    # 4    1000 1000 00 11                              3 7   C A        FOR CUBES 0-9,A,B,C,
    # 5    0100 1110 00 11                              4 8   X X              1=PRESENT, 0=AB
    # 6    0000 0000 00 11                              X X   X X

  RESULTS OF ASSEMBLY SECTION:         1 ASSEMBLIES   ("LEGAL CONFIGURATIONS")
  DISASSEMBLY PROGRAM WILL BE CALLED FOR EACH ASSEMBLY







              Bill Meek's Twist Burr               - ASSEMBLY #  1     - STARTING POSITION

   TOP
************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *   6622   *   6622   *          *          *
*          *          *    33    *    33    *   6332   *   6332   *    33    *    33    *
*          *          *    33    *  553355  *  565555  *  443324  *  443344  *    33    *
*          *          *    11    *  555555  *  561525  *  441124  *  444444  *    11    *
*          *          *    11    *    11    *   6112   *   6112   *    11    *    11    *
*          *          *          *          *   6622   *   6622   *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
************************************************************************************************

                           DIR # 2
                             A
                             |
                             |               DIR # 3 < - - - - - - - - - - - - - - -
                             |
                             +-----> DIR # 1


 DOES NOT DISASSEMBLE


  SUMMARY INFORMATION FOR PUZZLE:     Bill Meek's Twist Burr                      WITH LENGTH  6

          1 WITH NO SOLUTION
```

```
       BURR6 - PC VERSION 2.0 - 6-PIECE BURR ANALYSIS PROGRAM - COPYRIGHT 1986, 1987 BILL CUTLE
OPTIONS IN EFFECT:    LIST OF STATES: NO                      EXTERNAL HOLES IN ASSEMBLIES: NOT
            DETAILS&PICTURES: SOLUTIONS ONLY    SUBASSEMBLY ANALYSIS: NOT INCLUDED IN OUTPUT
            LENGTH OF PIECES: 6    "LEVEL" USAGE: UNLIMITED MOVEMENT IN ONE DIRECTION

 PUZZLE NAME:  Von Randow's Variation of Incorrect BBB


  PIECE   1234 5678 9A BC    SPECIAL PIECE CODES       CUBE NUMBERS  FOR LENGTH 6 PIECES
          ---- ---- -- --                               TOP BOTTOM
   # 1    0000 0000 00 11  FIXED                       X X   X X
   # 2    0000 1000 01 11                              1 5   X X        CUBES LABELLED "X" AR
   # 3    0001 1011 00 11                              2 6   B 9
   # 4    0010 0000 00 11                              3 7   C A        FOR CUBES 0-9,A,B,C,
   # 5    0001 1100 00 11                              4 8   X X              1=PRESENT, 0=AB
   # 6    0100 0000 11 11                              X X   X X

 RESULTS OF ASSEMBLY SECTION:        10 ASSEMBLIES   ("LEGAL CONFIGURATIONS")
 DISASSEMBLY PROGRAM WILL BE CALLED FOR EACH ASSEMBLY




          Von Randow's Variation of Incorrect BBB  - ASSEMBLY #  9     - STARTING POSITION

   TOP
************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *   5544   *   5544   *          *          *
*          *          *    22    *    22    *   5224   *   5524   *    22    *    22    *
*          *          *    22    *  666666  *  65 446  *  335333  *  332 33  *    22    *
*          *          *    11    *  666666  *  65 646  *  3   33  *  333333  *    11    *
*          *          *    11    *    11    *   5514   *   5 14   *    11    *    11    *
*          *          *          *          *   5544   *   5544   *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
************************************************************************************************

                         DIR # 2
                           A
                           |
                           |               DIR # 3 < - - - - - - - - - - - - - - - -
                           |
                           +-----> DIR # 1

LEVEL  4 SOLUTION FOUND:
     LEVEL  1: IN DIR # 2 MOVE PIECES: 5: 1
     LEVEL  2: IN DIR # 1 MOVE PIECES: 3:-1
     LEVEL  3: IN DIR # 2 MOVE PIECES: 5: 1
     LEVEL  4: PIECES SPLIT IN DIRECTION 1 INTO:
                    (NEG DIRECTION) - SINGLE PIECE  1
                    (POS DIRECTION) - SUBASSEMBLY # 1 PIECES: 2 3 4 5 6

 ALL SUBASSEMBLIES SUCCESSFULLY DISASSEMBLED
```

SUMMARY INFORMATION FOR PUZZLE: Von Randow's Variation of Incorrect BBB WITH LENGTH 6

UNIQUE LEVEL 4-2 SOLUTION
(SECOND LEVEL NOT NECESSARILY MINIMUM)

```
        BURR6 - PC VERSION 2.0 - 6-PIECE BURR ANALYSIS PROGRAM - COPYRIGHT 1986, 1987 BILL CUTL
 OPTIONS IN EFFECT:    LIST OF STATES: NO                    EXTERNAL HOLES IN ASSEMBLIES: NOT
            DETAILS&PICTURES: SOL LEVEL >= 6    SUBASSEMBLY ANALYSIS: NOT INCLUDED IN OUTPUT
            LENGTH OF PIECES: 6    "LEVEL" USAGE: UNLIMITED MOVEMENT IN ONE DIRECTION

  PUZZLE NAME:      Jean Mourik


   PIECE   1234 5678 9A BC    SPECIAL PIECE CODES       CUBE NUMBERS  FOR LENGTH 6 PIECES
           ---- ---- -- --                               TOP BOTTOM
    # 1    0000 0000 00 11                 DUPPED       X X   X X
    # 2    0000 0000 00 11                 DUPS-1       1 5   X X        CUBES LABELLED "X" AR
    # 3    0010 0000 00 11  FIXED                       2 6   B 9
    # 4    0000 1001 00 11                              3 7   C A        FOR CUBES 0-9,A,B,C,
    # 5    0001 0100 10 11                              4 8   X X              1=PRESENT, 0=AB
    # 6    1000 1001 01 11                              X X   X X

  RESULTS OF ASSEMBLY SECTION:        31 ASSEMBLIES   ("LEGAL CONFIGURATIONS")
  DISASSEMBLY PROGRAM WILL BE CALLED FOR EACH ASSEMBLY




                 Jean Mourik                          - ASSEMBLY #  7     - STARTING POSITION

    TOP
************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *   5522   *   5522   *          *          *
*          *          *    66    *    66    *   5662   *   5562   *    66    *    66    *
*          *          *    66    *  446 44  *  44  44  *  15  21  *  116611  *    66    *
*          *          *    33    *  444444  *  455  4  *  15 321  *  111111  *    33    *
*          *          *    33    *    33    *   5 32   *   5 32   *    33    *    33    *
*          *          *          *          *   5522   *   5522   *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
************************************************************************************************

                         DIR # 2
                           A
                           |
                           |               DIR # 3 < - - - - - - - - - - - - - - -
                           |
                           +-----> DIR # 1

 LEVEL  6 SOLUTION FOUND:
      LEVEL  1: IN DIR # 1 MOVE PIECES: 4:-1
      LEVEL  2: IN DIR # 2 MOVE PIECES: 5: 1
      LEVEL  3: IN DIR # 3 MOVE PIECES: 6: 1
      LEVEL  4: IN DIR # 2 MOVE PIECES: 5: 1
      LEVEL  5: IN DIR # 1 MOVE PIECES: 4:-1
      LEVEL  6: PIECES SPLIT IN DIRECTION 3 INTO:
                    (NEG DIRECTION) - SUBASSEMBLY # 1 PIECES: 1 3 4 5 6
                    (POS DIRECTION) - SINGLE PIECE  2
```

```
ALL SUBASSEMBLIES SUCCESSFULLY DISASSEMBLED


SUMMARY INFORMATION FOR PUZZLE:     Jean Mourik                                                    WITH LENGTH  6

          1 WITH NO SOLUTION
          3 LEVEL  1 SOLUTIONS
         19 LEVEL  2 SOLUTIONS
          3 LEVEL  3 SOLUTIONS
          4 LEVEL  5 SOLUTIONS
          1 LEVEL  6 SOLUTIONS
```

```
        BURR6 - PC VERSION 2.0 - 6-PIECE BURR ANALYSIS PROGRAM - COPYRIGHT 1986, 1987 BILL CUTL
 OPTIONS IN EFFECT:    LIST OF STATES: NO                      EXTERNAL HOLES IN ASSEMBLIES: NOT
            DETAILS&PICTURES: SOLUTIONS ONLY    SUBASSEMBLY ANALYSIS: NOT INCLUDED IN OUTPUT
            LENGTH OF PIECES: 6    "LEVEL" USAGE: UNLIMITED MOVEMENT IN ONE DIRECTION

  PUZZLE NAME:      Korsmeyer's Variation of Gaby Games


   PIECE   1234 5678 9A BC    SPECIAL PIECE CODES       CUBE NUMBERS  FOR LENGTH 6 PIECES
           ---- ---- -- --                               TOP BOTTOM
    # 1    0000 0110 11 11                 DUPPED       X X   X X
    # 2    0100 0000 00 11  FIXED                       1 5   X X        CUBES LABELLED "X" AR
    # 3    1001 0000 00 11          SYMM                2 6   B 9
    # 4    0000 0000 10 11                              3 7   C A        FOR CUBES 0-9,A,B,C,
    # 5    0000 0000 11 11          SYMM                4 8   X X              1=PRESENT, 0=AB
    # 6    0110 0000 11 11                 DUPS-1       X X   X X

  RESULTS OF ASSEMBLY SECTION:         3 ASSEMBLIES   ("LEGAL CONFIGURATIONS")
  DISASSEMBLY PROGRAM WILL BE CALLED FOR EACH ASSEMBLY







               Korsmeyer's Variation of Gaby Games  - ASSEMBLY #  2     - STARTING POSITION

   TOP
*****************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *   3355   *   3355   *          *          *
*          *          *    44    *    44    *   3345   *   3445   *    44    *    44    *
*          *          *    44    *  111111  *  131151  *  6   56  *  666666  *    44    *
*          *          *    22    *  111111  *  13 251  *  6 6656  *  666666  *    22    *
*          *          *    22    *    22    *   3325   *   3 25   *    22    *    22    *
*          *          *          *          *   3355   *   3355   *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*****************************************************************************************

                        DIR # 2
                          A
                          |
                          |               DIR # 3 < - - - - - - - - - - - - - - -
                          |
                          +-----> DIR # 1

 LEVEL  5 SOLUTION FOUND:
      LEVEL  1: IN DIR # 2 MOVE PIECES: 3: 1
      LEVEL  2: IN DIR # 1 MOVE PIECES: 4:-1
      LEVEL  3: IN DIR # 2 MOVE PIECES: 2:-1 5:-1
      LEVEL  4: IN DIR # 3 MOVE PIECES: 2: 1
      LEVEL  5: PIECES SPLIT IN DIRECTION 1 INTO:
                     (NEG DIRECTION) - SINGLE PIECE  2
                     (POS DIRECTION) - SUBASSEMBLY # 1 PIECES: 1 3 4 5 6

  ALL SUBASSEMBLIES SUCCESSFULLY DISASSEMBLED
```

SUMMARY INFORMATION FOR PUZZLE: Korsmeyer's Variation of Gaby Games WITH LENGTH 6

3 LEVEL 5 SOLUTIONS

```
      BURR6 - PC VERSION 2.0 - 6-PIECE BURR ANALYSIS PROGRAM - COPYRIGHT 1986, 1987 BILL CUTL
OPTIONS IN EFFECT:    LIST OF STATES: FIRST ASSEMBLY ONLY    EXTERNAL HOLES IN ASSEMBLIES: NOT
          DETAILS&PICTURES: SOLUTIONS ONLY    SUBASSEMBLY ANALYSIS: INCLUDED IN OUTPUT
          LENGTH OF PIECES: 6    "LEVEL" USAGE: UNLIMITED MOVEMENT IN ONE DIRECTION

 PUZZLE NAME:      Peter J. Marineau   Burr 'B'


  PIECE   1234 5678 9A BC    SPECIAL PIECE CODES       CUBE NUMBERS  FOR LENGTH 6 PIECES
          ---- ---- -- --                               TOP BOTTOM
   # 1    1010 1000 11 11  FIXED                        X X   X X
   # 2    0110 0110 00 11                               1 5   X X       CUBES LABELLED "X" AR
   # 3    0001 0000 00 11                 DUPPED        2 6   B 9
   # 4    0000 0000 01 11                               3 7   C A       FOR CUBES 0-9,A,B,C,
   # 5    0000 0000 10 11                               4 8   X X             1=PRESENT, 0=AB
   # 6    0001 0000 00 11                 DUPS-3        X X   X X

 RESULTS OF ASSEMBLY SECTION:        10 ASSEMBLIES   ("LEGAL CONFIGURATIONS")
 DISASSEMBLY PROGRAM WILL BE CALLED FOR EACH ASSEMBLY
```

Peter J. Marineau   Burr 'B'   - ASSEMBLY # 10   - STARTING POSITION

```
    TOP
*****************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *   6644   *   6644   *          *          *
*          *          *    22    *    22    *   6 24   *   6624   *    22    *    22    *
*          *          *    22    *  333333  *  3 2233  *  562245  *  555555  *    22    *
*          *          *    11    *  331133  *  3   43  *  56 145  *  55 555  *    11    *
*          *          *    11    *    11    *   6114   *   6114   *    11    *    11    *
*          *          *          *          *   6644   *   6644   *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*****************************************************************************************
```

```
          DIR # 2
            A
            |
            |               DIR # 3 < - - - - - - - - - - - - - - - -
            |
            +-----> DIR # 1
```

```
LEVEL  9 SOLUTION FOUND:
     LEVEL  1: IN DIR # 3 MOVE PIECES: 6: 1
     LEVEL  2: IN DIR # 1 MOVE PIECES: 5: 1
     LEVEL  3: IN DIR # 3 MOVE PIECES: 1:-2
     LEVEL  4: IN DIR # 1 MOVE PIECES: 5:-1
     LEVEL  5: IN DIR # 3 MOVE PIECES: 6:-1
     LEVEL  6: IN DIR # 1 MOVE PIECES: 3: 1
     LEVEL  7: IN DIR # 3 MOVE PIECES: 4: 1
     LEVEL  8: IN DIR # 1 MOVE PIECES: 5:-1 6:-1
     LEVEL  9: PIECES SPLIT IN DIRECTION 3 INTO:
                    (NEG DIRECTION) - SUBASSEMBLY # 1 PIECES: 1 2 3 4 5
                    (POS DIRECTION) - SINGLE PIECE  6
```

LIST OF STATES FOLLOWS:

ALL 13 STATES ARE LISTED

NUM	LV	DR	FRM	NST	ADD	DUP	END	1	2	3	4	5	6
1*	0	0	0	1	1	0	2	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0
2*	1	3	1	2	1	1	3	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 1
3*	2	1	2	3	2	1	5	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 0 1
4	3	3	3	2	0	2	5	0 0-1	0 0 0	0 0 0	0 0 0	1 0 0	0 0 1
5*	3	3	3	3	1	2	6	0 0-2	0 0 0	0 0 0	0 0 0	1 0 0	0 0 1
6*	4	1	5	2	1	1	7	0 0-2	0 0 0	0 0 0	0 0 0	0 0 0	0 0 1
7*	5	3	6	2	1	1	8	0 0-2	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0
8*	6	1	7	2	1	1	9	0 0-2	0 0 0	1 0 0	0 0 0	0 0 0	0 0 0
9*	7	3	8	3	2	1	11	0 0-2	0 0 0	1 0 0	0 0 1	0 0 0	0 0 0
10*	8	1	9	***	***	***	***	0 0-2	0 0 0	1 0 0	0 0 1	-1 0 0	-1 0 0
11	8	1	9					0 0-2	0 0 0	1 0 0	0 0 1	-1 0 0	0 0 0
12	9	2	10					0 0-2	0 0 0	1 0 0	0 0 1	-1 0 0	-1-1 0
13	9	2	10					0 0-2	0 0 0	1 0 0	0 0 1	-1 0 0	-1 1 0

```
              Peter J. Marineau   Burr 'B'        - ASSEMBLY # 10     - SUBASSEMBLY # 1

    TOP
*************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *    44    *    44    *          *          *          *
*          *          *    22    *   224    *    24    *     2    *    22    *    22    *
*          *          *    22    *  333333  *  322433  * 5  225   * 555555   *    22    *
*          *          *          *  33 433  *  3114 3  * 5  115   * 55 555   *     1    *
*          *          *          *     4    *   114    *    11    *    11    *    11    *    11
*          *          *          *    44    *    44    *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*************************************************************************************************

                            DIR # 2
                              A
                              |
                              |               DIR # 3 < - - - - - - - - - - - - - - -
                              |
                              +-----> DIR # 1

 LEVEL  3 SOLUTION FOUND:
      LEVEL  1: IN DIR # 1 MOVE PIECES: 5: 1
      LEVEL  2: IN DIR # 3 MOVE PIECES: 4:-1
      LEVEL  3: PIECES SPLIT IN DIRECTION 2 INTO:
                     (NEG DIRECTION) - SINGLE PIECE  3
                     (POS DIRECTION) - SUBASSEMBLY # 2 PIECES: 1 2 4 5



              Peter J. Marineau   Burr 'B'        - ASSEMBLY # 10     - SUBASSEMBLY # 2

    TOP
*************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *    44    *    44    *          *          *
*          *          *    22    *    22    *    24    *    24    *    22    *    22    *
*          *          *    22    *          *   22     *  5 2245  *  555555  *    22    *
*          *          *          *          *   114    *  5 1145  *  55 555  *     1    *
*          *          *          *          *   114    *    114   *    11    *    11    *    11
*          *          *          *          *    44    *    44    *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*************************************************************************************************

                            DIR # 2
                              A
                              |
                              |               DIR # 3 < - - - - - - - - - - - - - - -
                              |
                              +-----> DIR # 1

 LEVEL  1 SOLUTION FOUND:
      LEVEL  1: PIECES SPLIT IN DIRECTION 3 INTO:
                     (NEG DIRECTION) - SUBASSEMBLY # 3 PIECES: 1 2 5
                     (POS DIRECTION) - SINGLE PIECE  4
```

```
             Peter J. Marineau   Burr 'B'         - ASSEMBLY # 10     - SUBASSEMBLY # 3

    TOP
***************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *    22    *    22    *     2    *     2    *    22    *    22    *
*          *          *    22    *          *    22    *  5 22 5  *  555555  *    22    *
*          *          *          *          *    11    *  5 11 5  *  55 555  *     1    *
*          *          *          *          *    11    *    11    *    11    *    11    *    11
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
***************************************************************************************************

                            DIR # 2
                              A
                              |
                              |               DIR # 3 < - - - - - - - - - - - - - - - -
                              |
                              +-----> DIR # 1

 LEVEL  1 SOLUTION FOUND:
      LEVEL  1: PIECES SPLIT IN DIRECTION 2 INTO:
                     (NEG DIRECTION) - SINGLE PIECE  1
                                       SINGLE PIECE  5
                     (POS DIRECTION) - SINGLE PIECE  2

  DISASSEMBLY COMPLETE


  SUMMARY INFORMATION FOR PUZZLE:     Peter J. Marineau   Burr 'B'                WITH LENGTH  6

       UNIQUE LEVEL  9-3 SOLUTION
         (SECOND LEVEL NOT NECESSARILY MINIMUM)
```

```
       BURR6 - PC VERSION 2.0 - 6-PIECE BURR ANALYSIS PROGRAM - COPYRIGHT 1986, 1987 BILL CUTL
 OPTIONS IN EFFECT:    LIST OF STATES: FIRST ASSEMBLY ONLY    EXTERNAL HOLES IN ASSEMBLIES: NOT
           DETAILS&PICTURES: SOL LEVEL >= 9    SUBASSEMBLY ANALYSIS: NOT INCLUDED IN OUTPUT
           LENGTH OF PIECES: 6    "LEVEL" USAGE: UNLIMITED MOVEMENT IN ONE DIRECTION

  PUZZLE NAME:      E. Hordern's modification of PJM 'B'


   PIECE   1234 5678 9A BC    SPECIAL PIECE CODES       CUBE NUMBERS  FOR LENGTH 6 PIECES
           ---- ---- -- --                               TOP BOTTOM
    # 1    1010 1000 11 11  FIXED                        X X   X X
    # 2    0110 0000 11 11                               1 5   X X        CUBES LABELLED "X" AR
    # 3    0001 0000 00 11                               2 6   B 9
    # 4    0000 0000 01 11                               3 7   C A        FOR CUBES 0-9,A,B,C,
    # 5    0000 0000 10 11                               4 8   X X              1=PRESENT, 0=AB
    # 6    0010 0000 00 11                               X X   X X

  RESULTS OF ASSEMBLY SECTION:        40 ASSEMBLIES   ("LEGAL CONFIGURATIONS")
  DISASSEMBLY PROGRAM WILL BE CALLED FOR EACH ASSEMBLY


  SUMMARY INFORMATION FOR PUZZLE:     E. Hordern's modification of PJM 'B'        WITH LENGTH  6

           27 WITH NO SOLUTION
            6 LEVEL  1 SOLUTIONS
            4 LEVEL  2 SOLUTIONS
            2 LEVEL  3 SOLUTIONS
            1 LEVEL 10 SOLUTIONS
```

E. Hordern's modification of PJM 'B' - ASSEMBLY # 14   - STARTING POSITION

```
    TOP
************************************************************************************************
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *   6644   *   6644   *          *          *
*          *          *    22    *    22    *   6224   *   6224   *    22    *    22    *
*          *          *    22    *  333333  *  3  233  *  566245  *  555555  *    22    *
*          *          *    11    *  331133  *  3   43  *  56 145  *  55 555  *    11    *
*          *          *    11    *    11    *   6114   *   6114   *    11    *    11    *
*          *          *          *          *   6644   *   6644   *          *          *
*          *          *          *          *          *          *          *          *
*          *          *          *          *          *          *          *          *
************************************************************************************************
```

```
                         DIR # 2
                           A
                           |
                           |               DIR # 3 < - - - - - - - - - - - - - - - -
                           |
                           +-----> DIR # 1
```

```
 LEVEL 10 SOLUTION FOUND:
      LEVEL  1: IN DIR # 3 MOVE PIECES: 6: 1
      LEVEL  2: IN DIR # 1 MOVE PIECES: 5: 1
      LEVEL  3: IN DIR # 3 MOVE PIECES: 1:-2
      LEVEL  4: IN DIR # 1 MOVE PIECES: 5:-1
      LEVEL  5: IN DIR # 3 MOVE PIECES: 6:-1
      LEVEL  6: IN DIR # 1 MOVE PIECES: 3: 1
      LEVEL  7: IN DIR # 3 MOVE PIECES: 4: 1
      LEVEL  8: IN DIR # 1 MOVE PIECES: 2:-1 5:-1 6:-1
      LEVEL  9: IN DIR # 2 MOVE PIECES: 3:-1 4:-1
      LEVEL 10: PIECES SPLIT IN DIRECTION 3 INTO:
                     (NEG DIRECTION) - SUBASSEMBLY # 1 PIECES: 1 2 5 6
                                       SINGLE PIECE  4
                     (POS DIRECTION) - SINGLE PIECE  3
```

LIST OF STATES FOLLOWS:

ALL 18 STATES ARE LISTED

NUM	LV	DR	FRM	NST	ADD	DUP	END	1	2	3	4	5	6
1*	0	0	0	1	1	0	2	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0
2*	1	3	1	3	2	1	4	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 1
3*	2	1	2	4	2	2	6	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 0 1
4	2	1	2	2	0	2	6	0 0 0	0 0 0	0 0 0	0 0 0	2 0 0	0 0 1
5	3	3	3	2	0	2	6	0 0-1	0 0 0	0 0 0	0 0 0	1 0 0	0 0 1
6*	3	3	3	3	1	2	7	0 0-2	0 0 0	0 0 0	0 0 0	1 0 0	0 0 1
7*	4	1	6	2	1	1	8	0 0-2	0 0 0	0 0 0	0 0 0	0 0 0	0 0 1
8*	5	3	7	2	1	1	9	0 0-2	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0
9*	6	1	8	2	1	1	10	0 0-2	0 0 0	1 0 0	0 0 0	0 0 0	0 0 0
10*	7	3	9	4	3	1	13	0 0-2	0 0 0	1 0 0	0 0 1	0 0 0	0 0 0
11*	8	1	10	6	3	3	16	0 0-2	-1 0 0	1 0 0	0 0 1	-1 0 0	-1 0 0
12	8	1	10	5	2	3	18	0 0-2	0 0 0	1 0 0	0 0 1	-1 0 0	-1 0 0
13	8	1	10	3	0	3	18	0 0-2	0 0 0	1 0 0	0 0 1	-1 0 0	0 0 0
14*	9	2	11	***	***	***	***	0 0-2	-1 0 0	1-1 0	0-1 1	-1 0 0	-1 0 0

```
15   9  2  11                          0 0-2  -1 1 0   1 0 0   0 0 1  -1 0 0  -1 1 0
16   9  2  11                          0 0-2  -1 1 0   1 0 0   0 0 1  -1 1 0  -1 1 0
17   9  2  12                          0 0-2   0 0 0   1 0 0   0 0 1  -1 0 0  -1-1 0
18   9  2  12                          0 0-2   0 0 0   1 0 0   0 0 1  -1 0 0  -1 1 0

ALL SUBASSEMBLIES SUCCESSFULLY DISASSEMBLED
```