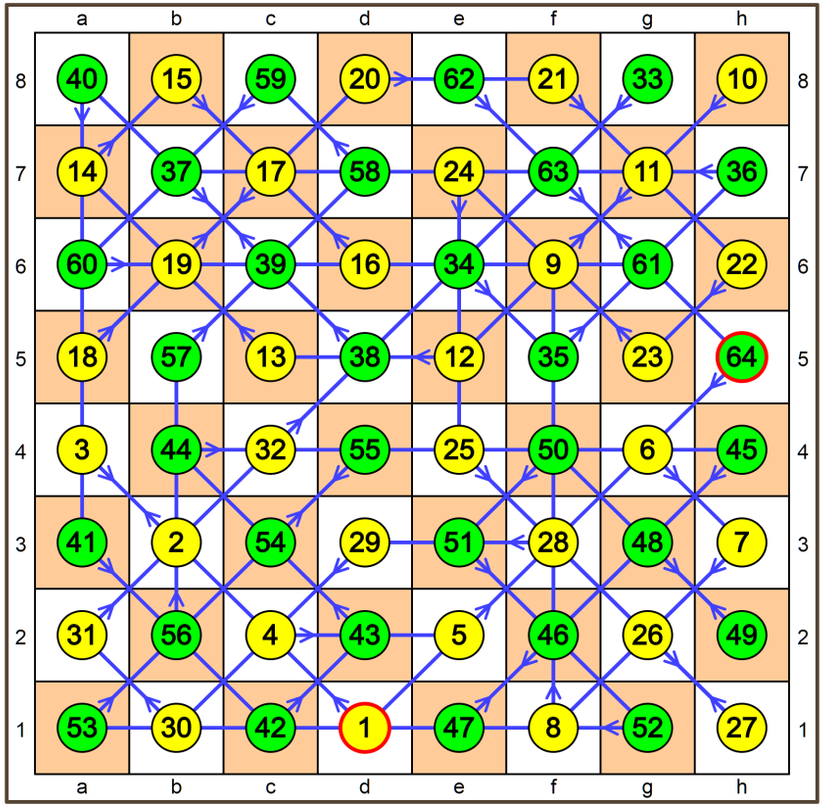
106 Bimagic Queen's Tours on an 8x8 Board

Walter Trump and William Walkington

24th August 2020

Erratum: 7th September 2020 - Please refer to the appendix.



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Some Important definitions

A standard chess board is an 8 x 8 square grid upon which the queen can move any number of squares, either orthogonally, or along ± 1 / ± 1 diagonals. A queen's tour is a sequence of queen's moves in which she visits each of the 64 squares exactly once. If the queen ends her tour on a square which is at a single queen's move from the starting square, the tour is closed; otherwise the queen's tour is open.

Here it is useful to clarify the definition of a bimagic queen's tour, which is different to that of a bimagic square: In chess literature, as confirmed by George Jelliss, the term magic is commonly used for all tours in which the successively numbered positions of the chess piece in each rank and file add up to the same orthogonal total (the magic constant S1), and should the entries on the two long diagonals also add up to the same magic constant, the tour is deemed to be diagonally magic.

(In fact, it is now known, thanks to the work of G. Stertenbrink, J-C. Meyrignac and H. Mackay, who have completed the list of all of the 140 magic knight tours on an 8 x 8 board, that none of these have two long magic diagonals).

Extending the above definition of a magic tour to that of a bimagic queen's tour, not only the successively numbered positions of the queen in each rank and file should add up to a same orthogonal total (the magic constant S1), but also the squared entries of each rank and file should add up to an additional total which is the bimagic constant S2.

For a n x n board, when n = 8, the magic constant S1 = 260.

For a n x n board, when n = 8, the bimagic constant S2 = 11180.

The chronology of the findings

Joachim Brügge was the first to have the idea of bimagic queen's tours.

On the 6th July 2020, Awani Kumar sent Joachim Brügge's notes to our circle of magic square enthusiasts asking us to "settle the question."

On the 23rd July 2020, William Walkington found the first bimagic queen's tour on an 8x8 board. This open tour is now listed below, indexed o-25.

On the 3rd August 2020, Walter Trump ran a computer check on the 26,158,848 (or 136,244 essentially different) bimagic squares of order-8, and found that none of these hosted bimagic tours (whatever the chess piece). There are therefore no diagonally bimagic queen's tours.

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On the 8th August 2020, testing a program that he had devised on William Walkington's first bimagic queen's tour, Walter Trump found a second example, which turned out to be a complementary bimagic queen's tour. This open tour is now listed below, indexed o-56.

On the 11th August 2020, continuing to search with his program, Walter Trump was able to find a total of 44 closed and 62 open bimagic queen's tours. He conjectures that, up to symmetry, there are no further bimagic queen's tours to be found on an 8x8 board. The program searched within the semi-bimagic 8x8 squares which were found by Walter Trump and Francis Gaspalou in 2014.

Essentially different means up to symmetry and permutations of rows and columns. Unique means up to symmetry. Considering that there are more than 715 quadrillion unique semi-bimagic squares of order-8, the 106 unique queen's tours are quite rare!

How the 106 bimagic queen's tours are presented

Due to rotations and reflections there are 8 different aspects of each tour.

Wishing to present the tours in a chess-wise fashion, when possible we choose to orientate the tour so that the queen's first position 1 is on square d1. In these cases, the bimagic tour begins with a classic white queen's opening move.

For a standard representation of the tours we therefore use the aspect where d1 < e1, h4, h5, e8, d8, a5, a4.

	a	b	c	d	e	f	g	h
8	a8			d8	e8			
7								
6								
5	a5							h5
4	a4							h4
3								
2								
1				**d1**	e1	f1	g1	h1

These standard representations of the tours are ordered lexicographically according to the entries d1, e1, f1, g1, h1, a8.

We take a8 into account because the tours o-50 and o-51 have exactly the same entries in the lower half of the board.

We create two separate lists for the closed (index c) and open (index o) bimagic queen's tours.

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Other information given for each bimagic tour

The first position of the queen

We indicate the first position of the queen using standard chess notation. Using the standard representations discussed above we are able to present some of the tours with a classic white queen's opening move from the square d1.

Dudeney Groups

For his classification of the magic squares of order-4, presented in "The Queen" on the 15th January 1910, Henry Ernest Dudeney identified 12 complementary number patterns. We indicate the Dudeney patterns that can be identified in the bimagic queen's tours.

S1 Magic Diagonals

Although none of the bimagic queen's tours on an 8x8 board are S2 diagonally *bimagic* (S2 = 11180), there are cases where the bimagic queen's tours are S1 diagonally magic (S1 = 260). Details of the S1 magic diagonals are given for each bimagic queen's tour.

Complementary ranks (rows) and files (columns)

We indicate the number of complementary pairs of ranks (rows) and files (columns) of each bimagic queen's tour.

Complementary bimagic queen's tours

We state the index number of the complementary bimagic tours that are found by the subtraction of the tour's entries from $n^2+1 = 65$. Sometimes the tours are self-complementary, and if so, we indicate this. The self-complementary tours are associative (centrally symmetrical).

Counts and directions of the queen's moves

As the definition of the bimagic tours states that the queen visits each square exactly once, there are 63 moves in each bimagic queen's tour. For the closed tours, the queen's closing move from position 64 to position 1 is counted separately. We give the additions of the two sets of perpendicular moves, whether these be orthogonal or diagonal. For example, Orthogonal 4 + 0 signifies that there are 4 parallel orthogonal moves.

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Transformations of the bimagic queen's tours

By the permutation of their ranks (rows) and files (columns) the tours can be transformed into other unique bimagic queen's tours, and we list these other tours by their index numbers.

Path lengths

The path lengths are given for the orthogonals and the diagonals. The diagonal path lengths are expressed as multiples of $\sqrt{2}$. For the closed tours, we also state the length of the queens closing move from position 64 to position 1.

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44 Closed Bimagic Queen's Tours

33	13	23	59	62	18	12	40
52	32	6	42	47	3	25	53
22	58	36	16	9	37	63	19
7	43	49	29	28	56	46	2
61	17	11	39	34	14	24	60
48	4	26	54	51	31	5	41
10	38	64	20	21	57	35	15
27	55	45	1	8	44	50	30

Closed Bimagic Queen's Tour c-01

The queen's opening move is from square d1.

Dudeney Group II

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

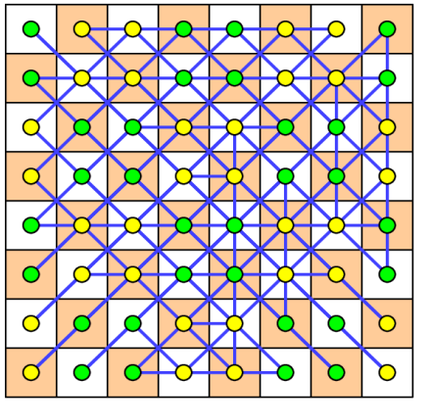
4 pairs of complementary rows

Index of complementary tour: c-10

Moves: orthogonal 8 + 4, diagonal 26 + 25 + 1 closing move.

Transformable into c-2, 8, 10, 18, 19, 22, 25, 32, 33, 34, 35, 37, 38, 39, 40

Path length: 48 + 165√2 = 281.3 + closing move √2.



18	40	13	59	62	12	33	23
37	19	58	16	9	63	22	36
14	60	17	39	34	24	61	11
57	15	38	20	21	35	10	64
3	53	32	42	47	25	52	6
56	2	43	29	28	46	7	49
31	41	4	54	51	5	48	26
44	30	55	1	8	50	27	45

Closed Bimagic Queen's Tour c-02

The queen's opening move is from square d1.

Dudeney Group I

S1 Diagonally magic? Yes: pandiagonal

4 pairs of complementary columns

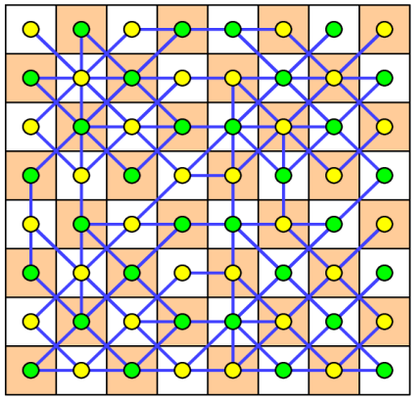
4 pairs of complementary rows

Index of complementary tour: c-08

Moves: orthogonal 8 + 4, diagonal 24 + 27 + 1 closing move.

Transformable into c-1, 8, 10, 18, 19, 22, 25, 32, 33, 34, 35, 37, 38, 39, 40

Path length: 48 + 86√2 = 169.6 + closing move 4√2.



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62	37	51	8	9	18	31	44
40	63	5	50	19	12	41	30
21	14	47	28	34	57	3	56
15	24	25	46	60	35	53	2
10	17	32	43	61	38	52	7
20	11	42	29	39	64	6	49
33	58	4	55	22	13	48	27
59	36	54	1	16	23	26	45

Closed Bimagic Queen's Tour c-03

The queen's opening move is from square d1.

S1 Diagonally magic? No: but 2+2 broken magic diag.

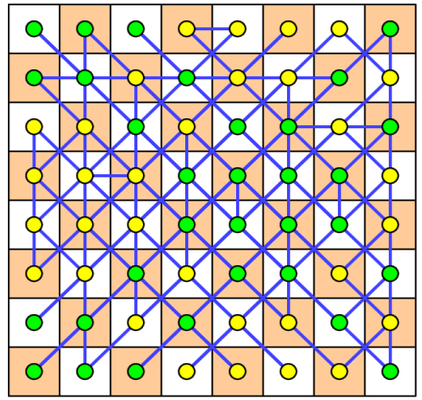
4 pairs of complementary rows

Index of complementary tour: c-44

Moves: orthogonal 8 + 4, diagonal 25 + 26 + 1 closing move.

Transformable into c-13, 31, 36, 42, 43

Path length: 42 + 150√2 = 254.1 + closing move 2√2.



25	51	5	47	62	24	34	12
50	28	46	8	21	63	9	35
6	48	26	52	33	11	61	23
45	7	49	27	10	36	22	64
3	41	31	53	40	14	60	18
44	2	56	30	15	37	19	57
32	54	4	42	59	17	39	13
55	29	43	1	20	58	16	38

Closed Bimagic Queen's Tour c-04

The queen's opening move is from square d1.

Dudeney Group I

S1 Diagonally magic? Yes: pandiagonal

4 pairs of complementary columns

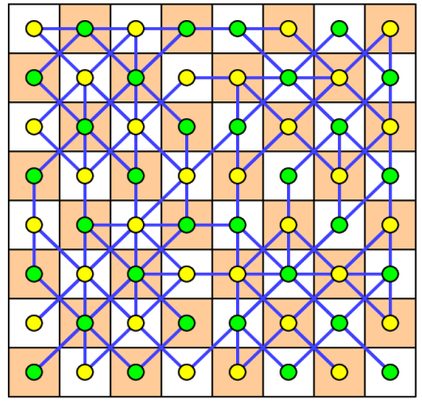
4 pairs of complementary rows

Index of complementary tour: c-05

Moves: orthogonal 8 + 4, diagonal 26 + 25 + 1 closing move.

Transformable into c-5, 6, 11, 12, 14, 15, 16, 17, 20, 21, 23, 26, 27, 28, 29

Path length: 48 + 86√2 = 169.6 + closing move 4√2.



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40	15	59	20	62	21	33	10
14	37	17	58	24	63	11	36
60	19	39	16	34	9	61	22
18	57	13	38	12	35	23	64
3	44	32	55	25	50	6	45
41	2	54	29	51	28	48	7
31	56	4	43	5	46	26	49
53	30	42	1	47	8	52	27

Closed Bimagic Queen's Tour c-05

The queen's opening move is from square d1.

Dudeney Group I

S1 Diagonally magic? Yes: pandiagonal

4 pairs of complementary columns

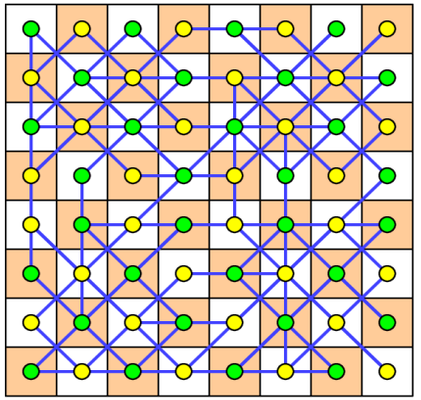
4 pairs of complementary rows

Index of complementary tour: c-04

Moves: orthogonal 8 + 4, diagonal 26 + 25 + 1 closing move.

Transformable into c-4, 6, 11, 12, 14, 15, 16, 17, 20, 21, 23, 26, 27, 28, 29

Path length: 48 + 86√2 = 169.6 + closing move 4√2.



33	59	10	20	62	40	21	15
6	32	45	55	25	3	50	44
11	17	36	58	24	14	63	37
48	54	7	29	51	41	28	2
61	39	22	16	34	60	9	19
26	4	49	43	5	31	46	56
23	13	64	38	12	18	35	57
52	42	27	1	47	53	8	30

Closed Bimagic Queen's Tour c-06

The queen's opening move is from square d1.

Dudeney Group II

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

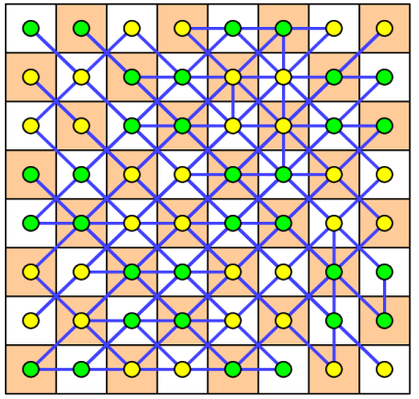
4 pairs of complementary rows

Index of complementary tour: c-11

Moves: orthogonal 8 + 4, diagonal 24 + 27 + 1 closing move.

Transformable into c-4, 5, 11, 12, 14, 15, 16, 17, 20, 21, 23, 26, 27, 28, 29

Path length: 40 + 165√2 = 273.3 + closing move √2.



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62	12	13	59	17	39	34	24
9	63	58	16	38	20	21	35
44	50	55	45	32	6	3	25
51	41	48	54	7	29	28	2
18	40	33	23	61	11	14	60
37	19	22	36	10	64	57	15
31	5	4	26	43	49	56	46
8	30	27	1	52	42	47	53

Closed Bimagic Queen's Tour c-07

The queen's opening move is from square d1.

S1 Diagonally magic? No: but 2+2 broken magic diag.

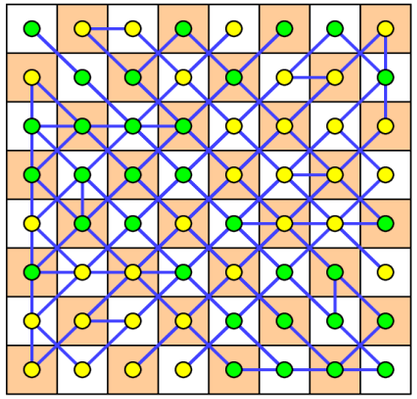
4 pairs of complementary columns

Index of complementary tour: c-13

Moves: orthogonal 8 + 4, diagonal 25 + 26 + 1 closing move.

Transformable into c-9, 24, 30, 41, 44

Path length: 26 + 150√2 = 238.1 + closing move 2√2.



47	28	51	8	62	9	34	21
25	46	5	50	12	63	24	35
52	7	48	27	33	22	61	10
6	49	26	45	23	36	11	64
3	56	31	44	18	37	14	57
53	2	41	30	40	19	60	15
32	43	4	55	13	58	17	38
42	29	54	1	59	16	39	20

Closed Bimagic Queen's Tour c-08

The queen's opening move is from square d1.

Dudeney Group I

S1 Diagonally magic? Yes: pandiagonal

4 pairs of complementary columns

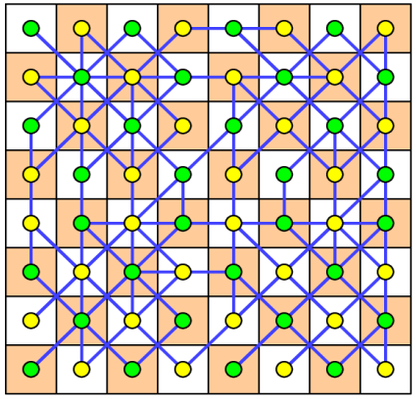
4 pairs of complementary rows

Index of complementary tour: c-02

Moves: orthogonal 8 + 4, diagonal 24 + 27 + 1 closing move.

Transformable into c-1, 2, 10, 18, 19, 22, 25, 32, 33, 34, 35, 37, 38, 39, 40

Path length: 48 + 86√2 = 169.6 + closing move 4√2.



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63	9	35	21	20	38	16	58
12	62	24	34	39	17	59	13
30	8	53	47	42	52	1	27
5	31	46	56	49	43	26	4
19	37	15	57	64	10	36	22
40	18	60	14	11	61	23	33
41	51	2	28	29	7	54	48
50	44	25	3	6	32	45	55

Closed Bimagic Queen's Tour c-09

The queen starts her tour from square g6.

S1 Diagonally magic? No: but 2+2 broken magic diag.

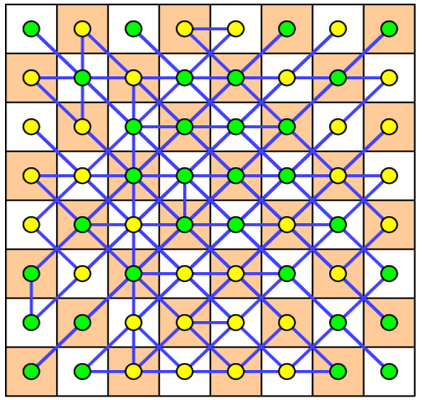
4 pairs of complementary columns

Index of complementary tour: c-43

Moves: orthogonal 8 + 4, diagonal 25 + 26 + 1 closing move.

Transformable into c-7, 24, 30, 41, 44

Path length: 42 + 150√2 = 254.1 + closing move 2√2.



35	15	21	57	64	20	10	38
50	30	8	44	45	1	27	55
24	60	34	14	11	39	61	17
5	41	51	31	26	54	48	4
63	19	9	37	36	16	22	58
46	2	28	56	49	29	7	43
12	40	62	18	23	59	33	13
25	53	47	3	6	42	52	32

Closed Bimagic Queen's Tour c-10

The queen starts her tour from square f7.

Dudeney Group II

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

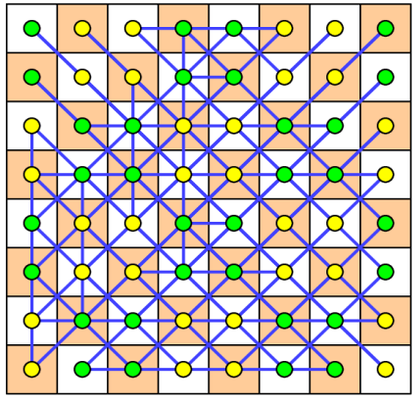
4 pairs of complementary rows

Index of complementary tour: c-01

Moves: orthogonal 8 + 4, diagonal 26 + 25 + 1 closing move.

Transformable into c-1, 2, 8, 18, 19, 22, 25, 32, 33, 34, 35, 37, 38, 39, 40

Path length: 48 + 165√2 = 281.3 + closing move √2.



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35	57	12	18	64	38	23	13
8	30	47	53	27	1	52	42
9	19	34	60	22	16	61	39
46	56	5	31	49	43	26	4
63	37	24	14	36	58	11	17
28	2	51	41	7	29	48	54
21	15	62	40	10	20	33	59
50	44	25	3	45	55	6	32

Closed Bimagic Queen's Tour c-11

The queen starts her tour from square f7.

Dudeney Group II

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

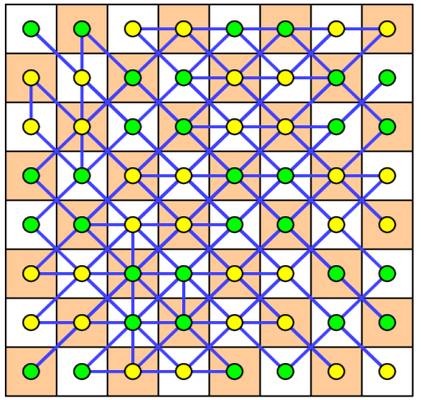
4 pairs of complementary rows

Index of complementary tour: c-06

Moves: orthogonal 8 + 4, diagonal 24 + 27 + 1 closing move.

Transformable into c-4, 5, 6, 12, 14, 15, 16, 17, 20, 21, 23, 26, 27, 28, 29

Path length: 40 + 165√2 = 273.3 + closing move √2.



38	1	16	43	58	29	20	55
64	27	22	49	36	7	10	45
13	42	39	4	17	54	59	32
23	52	61	26	11	48	33	6
57	30	19	56	37	2	15	44
35	8	9	46	63	28	21	50
18	53	60	31	14	41	40	3
12	47	34	5	24	51	62	25

Closed Bimagic Queen's Tour c-12

The queen starts her tour from an edge of the board. (Square b8)

Dudeney Group II

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

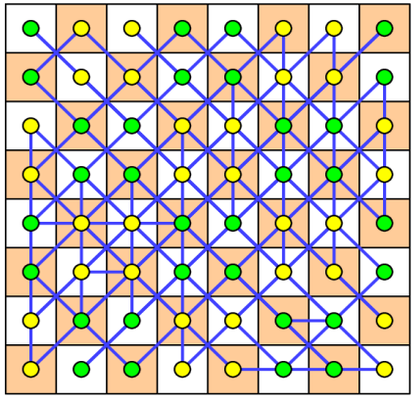
4 pairs of complementary rows

Index of complementary tour: c-16

Moves: orthogonal 8 + 4, diagonal 26 + 25 + 1 closing move.

Transformable into c-4, 5, 6, 11, 14, 15, 16, 17, 20, 21, 23, 26, 27, 28, 29

Path length: 40 + 165√2 = 273.3 + closing move √2.



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57	34	28	47	14	21	56	3
35	60	46	25	24	15	2	53
38	61	43	32	17	10	7	52
64	39	29	42	11	20	49	6
13	22	55	4	58	33	27	48
23	16	1	54	36	59	45	26
18	9	8	51	37	62	44	31
12	19	50	5	63	40	30	41

Closed Bimagic Queen's Tour c-13

The queen starts her tour from square c3.

S1 Diagonally magic? No: but 2+2 broken magic diag.

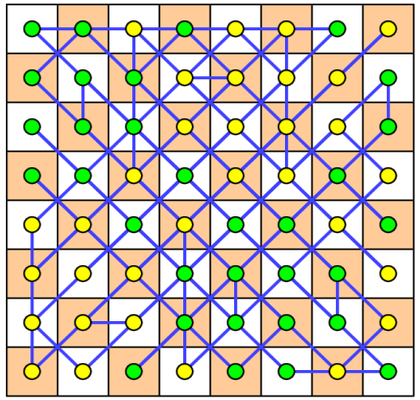
4 pairs of complementary rows

Index of complementary tour: c-07

Moves: orthogonal 8 + 4, diagonal 25 + 26 + 1 closing move.

Transformable into c-3, 31, 36, 42, 43

Path length: 26 + 150√2 = 238.1 + closing move 2√2.



30	56	2	44	57	19	37	15
53	31	41	3	18	60	14	40
1	43	29	55	38	16	58	20
42	4	54	32	13	39	17	59
8	46	28	50	35	9	63	21
47	5	51	25	12	34	24	62
27	49	7	45	64	22	36	10
52	26	48	6	23	61	11	33

Closed Bimagic Queen's Tour c-14

The queen starts her tour from an edge of the board. (Square a6)

Dudeney Group I

S1 Diagonally magic? Yes: pandiagonal

4 pairs of complementary columns

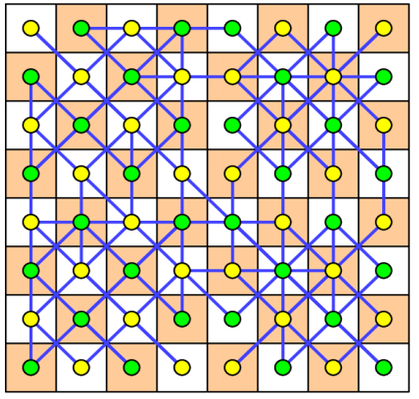
4 pairs of complementary rows

Index of complementary tour: c-15

Moves: orthogonal 8 + 4, diagonal 24 + 27 + 1 closing move.

Transformable into c-4, 5, 6, 11, 12, 15, 16, 17, 20, 21, 23, 26, 27, 28, 29

Path length: 48 + 86√2 = 169.6 + closing move 4√2.



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35	12	64	23	57	18	38	13
9	34	22	61	19	60	16	39
63	24	36	11	37	14	58	17
21	62	10	33	15	40	20	59
8	47	27	52	30	53	1	42
46	5	49	26	56	31	43	4
28	51	7	48	2	41	29	54
50	25	45	6	44	3	55	32

Closed Bimagic Queen's Tour c-15

The queen starts her tour from square g4.

Dudeney Group I

S1 Diagonally magic? Yes: pandiagonal

4 pairs of complementary columns

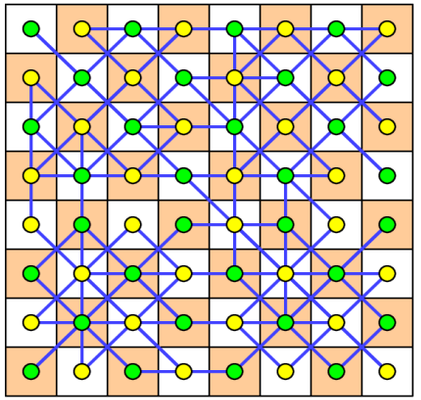
4 pairs of complementary rows

Index of complementary tour: c-14

Moves: orthogonal 8 + 4, diagonal 24 + 27 + 1 closing move.

Transformable into c-4, 5, 6, 11, 12, 14, 16, 17, 20, 21, 23, 26, 27, 28, 29

Path length: 48 + 86√2 = 169.6 + closing move 4√2.



40	3	14	41	60	31	18	53
62	25	24	51	34	5	12	47
15	44	37	2	19	56	57	30
21	50	63	28	9	46	35	8
59	32	17	54	39	4	13	42
33	6	11	48	61	26	23	52
20	55	58	29	16	43	38	1
10	45	36	7	22	49	64	27

Closed Bimagic Queen's Tour c-16

The queen starts her tour from an edge of the board. (Square h2)

Dudeney Group II

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

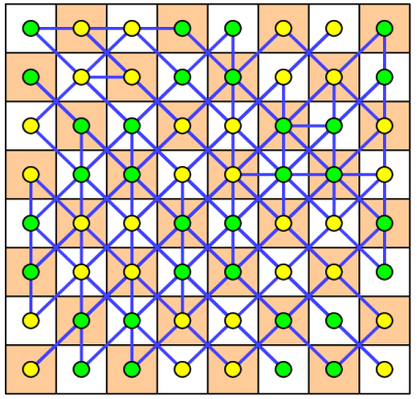
4 pairs of complementary rows

Index of complementary tour: c-12

Moves: orthogonal 8 + 4, diagonal 26 + 25 + 1 closing move.

Transformable into c-4, 5, 6, 11, 12, 14, 15, 17, 20, 21, 23, 26, 27, 28, 29

Path length: 40 + 165√2 = 273.3 + closing move √2.



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42	13	4	39	54	17	32	59
52	23	26	61	48	11	6	33
1	38	43	16	29	58	55	20
27	64	49	22	7	36	45	10
53	18	31	60	41	14	3	40
47	12	5	34	51	24	25	62
30	57	56	19	2	37	44	15
8	35	46	9	28	63	50	21

Closed Bimagic Queen's Tour c-17

The queen starts her tour from an edge of the board. (Square a6)

Dudeney Group II

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

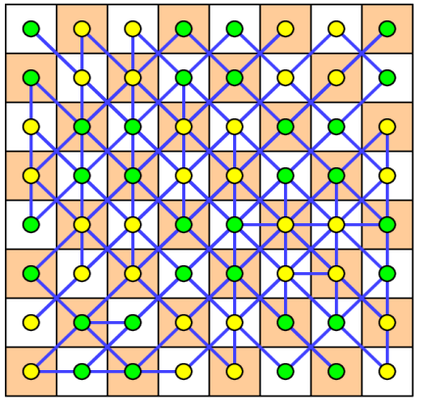
4 pairs of complementary rows

Index of complementary tour: c-23

Moves: orthogonal 8 + 4, diagonal 26 + 25 + 1 closing move.

Transformable into c-4, 5, 6, 11, 12, 14, 15, 16, 20, 21, 23, 26, 27, 28, 29

Path length: 40 + 165√2 = 273.3 + closing move √2.



42	59	29	16	54	39	1	20
6	23	49	36	26	11	45	64
32	13	43	58	4	17	55	38
52	33	7	22	48	61	27	10
53	40	2	19	41	60	30	15
25	12	46	63	5	24	50	35
3	18	56	37	31	14	44	57
47	62	28	9	51	34	8	21

Closed Bimagic Queen's Tour c-18

The queen starts her tour from an edge of the board. (Square g8)

Dudeney Group II

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

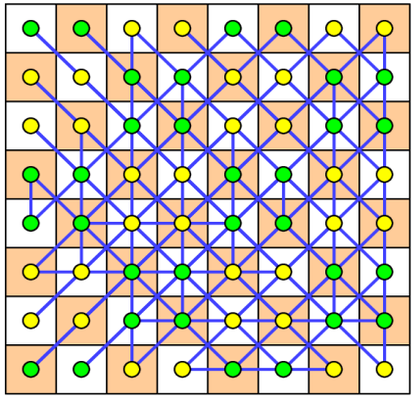
4 pairs of complementary rows

Index of complementary tour: c-25

Moves: orthogonal 8 + 4, diagonal 24 + 27 + 1 closing move.

Transformable into c-1, 2, 8, 10, 19, 22, 25, 32, 33, 34, 35, 37, 38, 39, 40

Path length: 48 + 165√2 = 281.3 + closing move √2.



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Closed Bimagic Queen's Tour c-19

25	47	6	52	53	3	42	32
46	28	49	7	2	56	29	43
5	51	26	48	41	31	54	4
50	8	45	27	30	44	1	55
12	62	23	33	40	18	59	13
63	9	36	22	19	37	16	58
24	34	11	61	60	14	39	17
35	21	64	10	15	57	20	38

The queen starts her tour from square g5.

Dudeney Group I

S1 Diagonally magic? Yes: pandiagonal

4 pairs of complementary columns

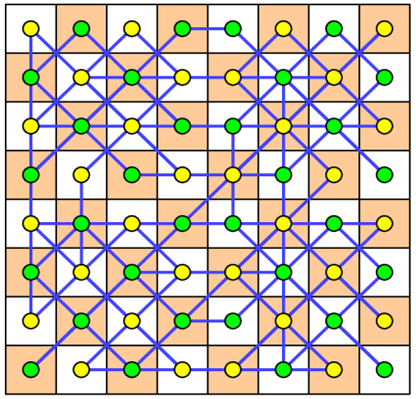
4 pairs of complementary rows

Index of complementary tour: c-22

Moves: orthogonal 8 + 4, diagonal 26 + 25 + 1 closing move.

Transformable into c-1, 2, 8, 10, 18, 22, 25, 32, 33, 34, 35, 37, 38, 39, 40

Path length: 48 + 86√2 = 169.6 + closing move 4√2.



Closed Bimagic Queen's Tour c-20

18	60	14	40	53	31	41	3
57	19	37	15	30	56	2	44
13	39	17	59	42	4	54	32
38	16	58	20	1	43	29	55
12	34	24	62	47	5	51	25
35	9	63	21	8	46	28	50
23	61	11	33	52	26	48	6
64	22	36	10	27	49	7	45

The queen starts her tour from square e5.

Dudeney Group I

S1 Diagonally magic? Yes: pandiagonal

4 pairs of complementary columns

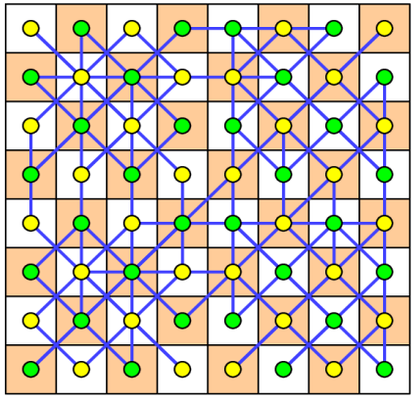
4 pairs of complementary rows

Index of complementary tour: c-21

Moves: orthogonal 8 + 4, diagonal 24 + 27 + 1 closing move.

Transformable into c-4, 5, 6, 11, 12, 14, 15, 16, 17, 21, 23, 26, 27, 28, 29

Path length: 48 + 86√2 = 169.6 + closing move 4√2.



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47	8	52	27	53	30	42	1
5	46	26	49	31	56	4	43
51	28	48	7	41	2	54	29
25	50	6	45	3	44	32	55
12	35	23	64	18	57	13	38
34	9	61	22	60	19	39	16
24	63	11	36	14	37	17	58
62	21	33	10	40	15	59	20

Closed Bimagic Queen's Tour c-21

The queen starts her tour from a corner of the board. (Square h8)

Dudeney Group I

S1 Diagonally magic? Yes: pandiagonal

4 pairs of complementary columns

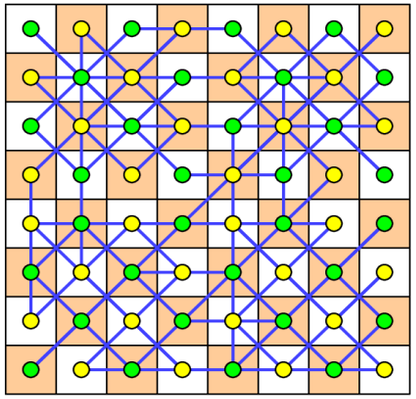
4 pairs of complementary rows

Index of complementary tour: c-20

Moves: orthogonal 8 + 4, diagonal 24 + 27 + 1 closing move.

Transformable into c-4, 5, 6, 11, 12, 14, 15, 16, 17, 20, 23, 26, 27, 28, 29

Path length: 48 + 86√2 = 169.6 + closing move 4√2.



40	19	60	15	53	2	41	30
18	37	14	57	3	56	31	44
59	16	39	20	42	29	54	1
13	58	17	38	32	43	4	55
12	63	24	35	25	46	5	50
62	9	34	21	47	28	51	8
23	36	11	64	6	49	26	45
33	22	61	10	52	7	48	27

Closed Bimagic Queen's Tour c-22

The queen starts her tour from an edge of the board. (Square h6)

Dudeney Group I

S1 Diagonally magic? Yes: pandiagonal

4 pairs of complementary columns

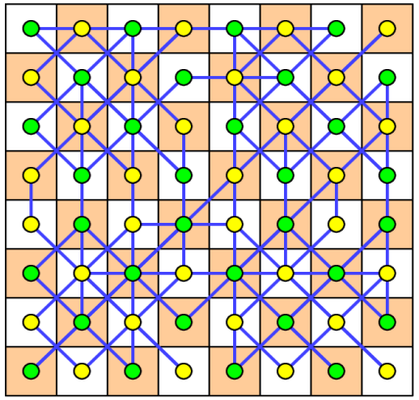
4 pairs of complementary rows

Index of complementary tour: c-19

Moves: orthogonal 8 + 4, diagonal 26 + 25 + 1 closing move.

Transformable into c-1, 2, 8, 10, 18, 19, 25, 32, 33, 34, 35, 37, 38, 39, 40

Path length: 48 + 86√2 = 169.6 + closing move 4√2.



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44	15	2	37	56	19	30	57
50	21	28	63	46	9	8	35
3	40	41	14	31	60	53	18
25	62	51	24	5	34	47	12
55	20	29	58	43	16	1	38
45	10	7	36	49	22	27	64
32	59	54	17	4	39	42	13
6	33	48	11	26	61	52	23

Closed Bimagic Queen's Tour c-23

The queen starts her tour from square g4.

Dudeney Group II

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

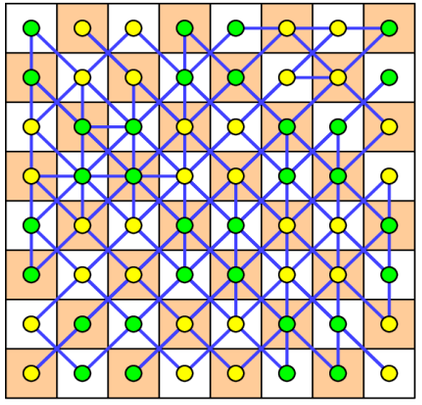
4 pairs of complementary rows

Index of complementary tour: c-17

Moves: orthogonal 8 + 4, diagonal 26 + 25 + 1 closing move.

Transformable into c-4, 5, 6, 11, 12, 14, 15, 16, 17, 20, 21, 26, 27, 28, 29

Path length: 40 + 165√2 = 273.3 + closing move √2.



47	56	57	14	28	3	21	34
53	46	15	60	2	25	35	24
8	31	37	18	51	44	9	62
30	5	19	40	41	50	63	12
27	4	22	33	48	55	58	13
1	26	36	23	54	45	16	59
52	43	10	61	7	32	38	17
42	49	64	11	29	6	20	39

Closed Bimagic Queen's Tour c-24

The queen starts her tour from an edge of the board. (Square a3)

S1 Diagonally magic? No: but 2+2 broken magic diag.

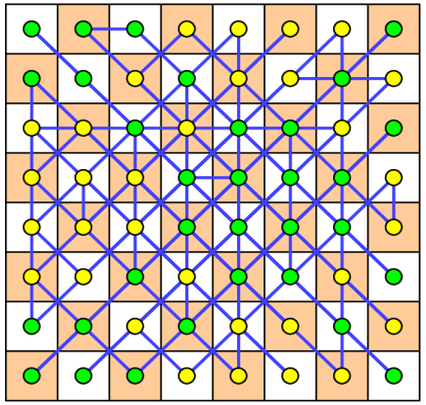
4 pairs of complementary rows

Index of complementary tour: c-42

Moves: orthogonal 8 + 4, diagonal 25 + 26 + 1 closing move.

Transformable into c-7, 9, 30, 41, 44

Path length: 42 + 150√2 = 254.1 + closing move 2√2.



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44	57	31	14	56	37	3	18
8	21	51	34	28	9	47	62
30	15	41	60	2	19	53	40
50	35	5	24	46	63	25	12
55	38	4	17	43	58	32	13
27	10	48	61	7	22	52	33
1	20	54	39	29	16	42	59
45	64	26	11	49	36	6	23

Closed Bimagic Queen's Tour c-25

The queen starts her tour from an edge of the board. (Square a2)

Dudeney Group II

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

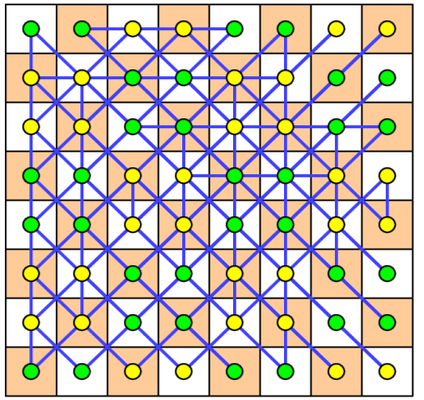
4 pairs of complementary rows

Index of complementary tour: c-18

Moves: orthogonal 8 + 4, diagonal 24 + 27 + 1 closing move.

Transformable into c-1, 2, 8, 10, 18, 19, 22, 32, 33, 34, 35, 37, 38, 39, 40

Path length: 48 + 165√2 = 281.3 + closing move 1√2.



21	63	9	35	50	28	46	8
62	24	34	12	25	51	5	47
10	36	22	64	45	7	49	27
33	11	61	23	6	48	26	52
15	37	19	57	44	2	56	30
40	14	60	18	3	41	31	53
20	58	16	38	55	29	43	1
59	17	39	13	32	54	4	42

Closed Bimagic Queen's Tour c-26

The queen starts her tour from an edge of the board. (Square h2)

Dudeney Group I

S1 Diagonally magic? Yes: pandiagonal

4 pairs of complementary columns

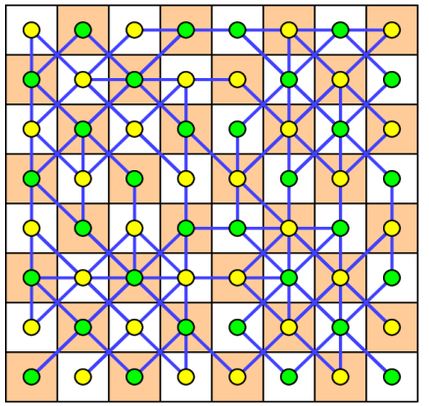
4 pairs of complementary rows

Index of complementary tour: c-27

Moves: orthogonal 8 + 4, diagonal 26 + 25 + 1 closing move.

Transformable into c-4, 5, 6, 11, 12, 14, 15, 16, 17, 20, 21, 23, 27, 28, 29

Path length: 48 + 86√2 = 169.6 + closing move 4√2.



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44	3	55	32	50	25	45	6
2	41	29	54	28	51	7	48
56	31	43	4	46	5	49	26
30	53	1	42	8	47	27	52
15	40	20	59	21	62	10	33
37	14	58	17	63	24	36	11
19	60	16	39	9	34	22	61
57	18	38	13	35	12	64	23

Closed Bimagic Queen's Tour c-27

The queen starts her tour from square c5.

Dudeney Group I

S1 Diagonally magic? Yes: pandiagonal

4 pairs of complementary columns

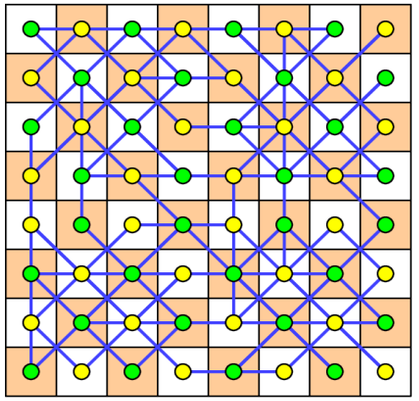
4 pairs of complementary rows

Index of complementary tour: c-26

Moves: orthogonal 8 + 4, diagonal 26 + 25 + 1 closing move.

Transformable into c-4, 5, 6, 11, 12, 14, 15, 16, 17, 20, 21, 23, 26, 28, 29

Path length: 48 + 86√2 = 169.6 + closing move 4√2.



45	55	6	32	50	44	25	3
10	20	33	59	21	15	62	40
7	29	48	54	28	2	51	41
36	58	11	17	63	37	24	14
49	43	26	4	46	56	5	31
22	16	61	39	9	19	34	60
27	1	52	42	8	30	47	53
64	38	23	13	35	57	12	18

Closed Bimagic Queen's Tour c-28

The queen starts her tour from square b2.

Dudeney Group II

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

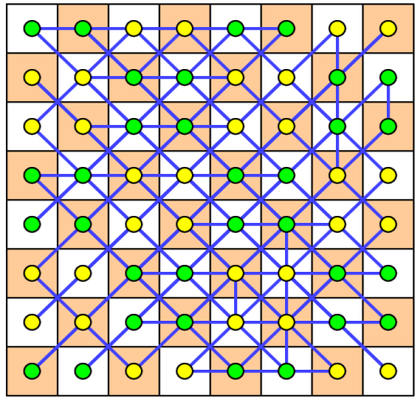
4 pairs of complementary rows

Index of complementary tour: c-29

Moves: orthogonal 8 + 4, diagonal 24 + 27 + 1 closing move.

Transformable into c-4, 5, 6, 11, 12, 14, 15, 16, 17, 20, 21, 23, 26, 27, 29

Path length: 40 + 165√2 = 273.3 + closing move √2.



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47	53	8	30	52	42	27	1
12	18	35	57	23	13	64	38
5	31	46	56	26	4	49	43
34	60	9	19	61	39	22	16
51	41	28	2	48	54	7	29
24	14	63	37	11	17	36	58
25	3	50	44	6	32	45	55
62	40	21	15	33	59	10	20

Closed Bimagic Queen's Tour c-29

The queen starts her tour from a corner of the board. (Square h8)

Dudeney Group II

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

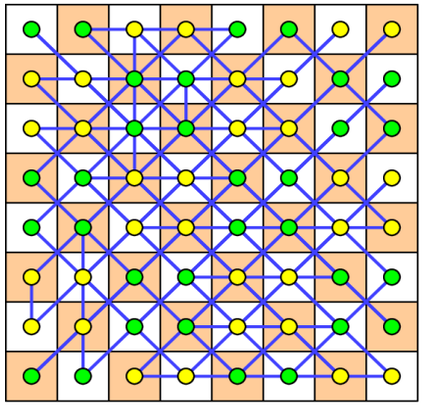
4 pairs of complementary rows

Index of complementary tour: c-28

Moves: orthogonal 8 + 4, diagonal 24 + 27 + 1 closing move.

Transformable into c-4, 5, 6, 11, 12, 14, 15, 16, 17, 20, 21, 23, 26, 27, 28

Path length: 40 + 165√2 = 273.3 + closing move √2.



44	51	18	37	31	8	62	9
50	41	40	19	5	30	12	63
55	48	33	22	4	27	13	58
45	54	23	36	26	1	59	16
32	7	61	10	43	52	17	38
6	29	11	64	49	42	39	20
3	28	14	57	56	47	34	21
25	2	60	15	46	53	24	35

Closed Bimagic Queen's Tour c-30

The queen starts her tour from square f5.

S1 Diagonally magic? No: but 2+2 broken magic diag.

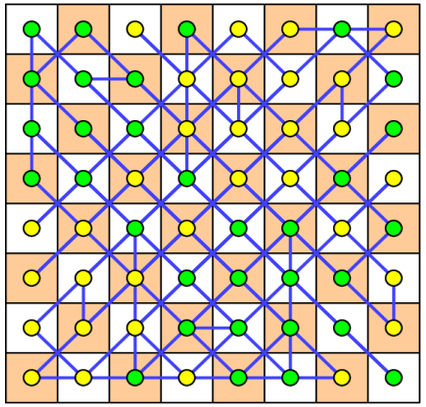
4 pairs of complementary rows

Index of complementary tour: c-36

Moves: orthogonal 8 + 4, diagonal 25 + 26 + 1 closing move.

Transformable into c-7, 9, 24, 41, 44

Path length: 26 + 150√2 = 238.1 + closing move 2√2.



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53	2	15	24	25	46	60	35
3	56	21	14	47	28	34	57
41	30	40	63	5	50	19	12
31	44	62	37	51	8	9	18
26	45	59	36	54	1	16	23
48	27	33	58	4	55	22	13
6	49	20	11	42	29	39	64
52	7	10	17	32	43	61	38

Closed Bimagic Queen's Tour c-31

The queen starts her tour from square f4.

S1 Diagonally magic? No: but 2+2 broken magic diag.

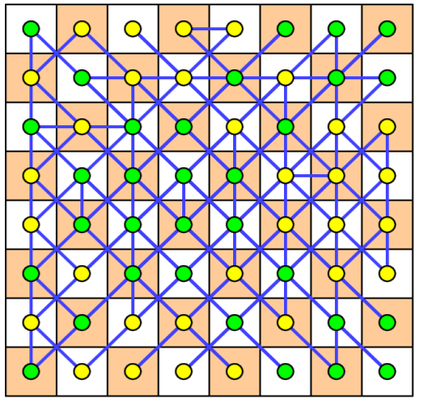
4 pairs of complementary rows

Index of complementary tour: c-41

Moves: orthogonal 8 + 4, diagonal 25 + 26 + 1 closing move.

Transformable into c-3, 13, 36, 42, 43

Path length: $42 + 150\sqrt{2} = 254.1$ + closing move $2\sqrt{2}$.



50	35	5	24	46	63	25	12
30	15	41	60	2	19	53	40
8	21	51	34	28	9	47	62
44	57	31	14	56	37	3	18
45	64	26	11	49	36	6	23
1	20	54	39	29	16	42	59
27	10	48	61	7	22	52	33
55	38	4	17	43	58	32	13

Closed Bimagic Queen's Tour c-32

The queen starts her tour from an edge of the board. (Square a3)

Dudeney Group II

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

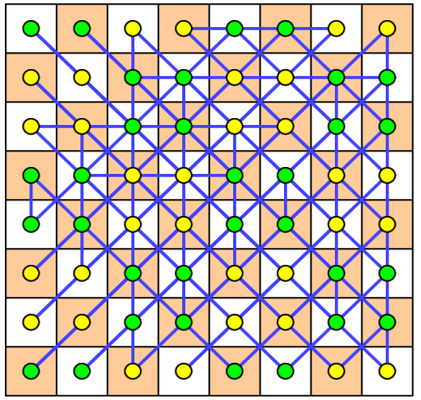
4 pairs of complementary rows

Index of complementary tour: c-35

Moves: orthogonal 8 + 4, diagonal 24 + 27 + 1 closing move.

Transformable into c-1, 2, 8, 10, 18, 19, 22, 25, 33, 34, 35, 37, 38, 39, 40

Path length: $48 + 165\sqrt{2} = 281.3$ + closing move $\sqrt{2}$.



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1	55	30	44	45	27	50	8
54	4	41	31	26	48	5	51
29	43	2	56	49	7	46	28
42	32	53	3	6	52	25	47
20	38	15	57	64	10	35	21
39	17	60	14	11	61	24	34
16	58	19	37	36	22	63	9
59	13	40	18	23	33	12	62

Closed Bimagic Queen's Tour c-33

The queen starts her tour from a corner of the board. (Square a8)

Dudeney Group I

S1 Diagonally magic? Yes: pandiagonal

4 pairs of complementary columns

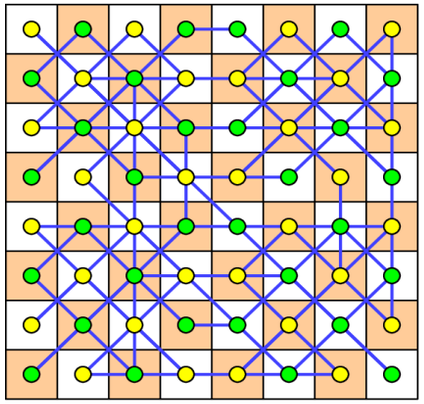
4 pairs of complementary rows

Index of complementary tour: c-34

Moves: orthogonal 8 + 4, diagonal 26 + 25 + 1 closing move.

Transformable into c-1, 2, 8, 10, 18, 19, 22, 25, 32, 34, 35, 37, 38, 39, 40

Path length: 48 + 86√2 = 169.6 + closing move 4√2.



64	11	36	23	45	26	49	6
10	61	22	33	27	48	7	52
35	24	63	12	50	5	46	25
21	34	9	62	8	51	28	47
20	39	16	59	1	54	29	42
38	17	58	13	55	4	43	32
15	60	19	40	30	41	2	53
57	14	37	18	44	31	56	3

Closed Bimagic Queen's Tour c-34

The queen starts her tour from square e4.

Dudeney Group I

S1 Diagonally magic? Yes: pandiagonal

4 pairs of complementary columns

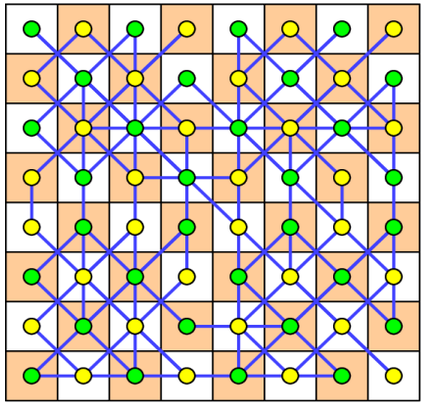
4 pairs of complementary rows

Index of complementary tour: c-33

Moves: orthogonal 8 + 4, diagonal 26 + 25 + 1 closing move.

Transformable into c-1, 2, 8, 10, 18, 19, 22, 25, 32, 33, 35, 37, 38, 39, 40

Path length: 48 + 86√2 = 169.6 + closing move 4√2.



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52	33	7	22	48	61	27	10
32	13	43	58	4	17	55	38
6	23	49	36	26	11	45	64
42	59	29	16	54	39	1	20
47	62	28	9	51	34	8	21
3	18	56	37	31	14	44	57
25	12	46	63	5	24	50	35
53	40	2	19	41	60	30	15

Closed Bimagic Queen's Tour c-35

The queen starts her tour from square g5.

Dudeney Group II

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

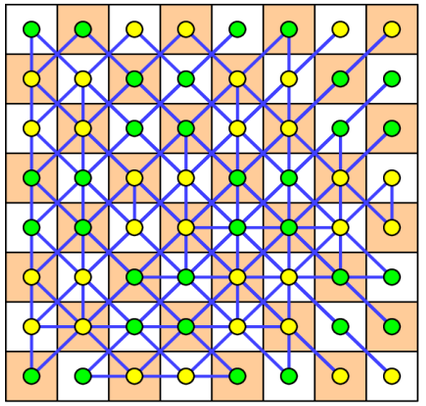
4 pairs of complementary rows

Index of complementary tour: c-32

Moves: orthogonal 8 + 4, diagonal 24 + 27 + 1 closing move.

Transformable into c-1, 2, 8, 10, 18, 19, 22, 25, 32, 33, 34, 37, 38, 39, 40

Path length: 48 + 165√2 = 281.3 + closing move √2.



56	3	57	34	28	47	14	21
2	53	35	60	46	25	24	15
7	52	38	61	43	32	17	10
49	6	64	39	29	42	11	20
27	48	13	22	55	4	58	33
45	26	23	16	1	54	36	59
44	31	18	9	8	51	37	62
30	41	12	19	50	5	63	40

Closed Bimagic Queen's Tour c-36

The queen starts her tour from square e3.

S1 Diagonally magic? No: but 2+2 broken magic diag.

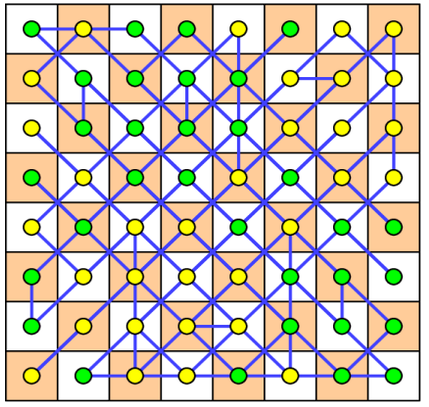
4 pairs of complementary rows

Index of complementary tour: c-30

Moves: orthogonal 8 + 4, diagonal 25 + 26 + 1 closing move.

Transformable into c-3, 13, 31, 42, 43

Path length: 26 + 150√2 = 238.1 + closing move 2√2.



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10	64	21	35	38	20	57	15
61	11	34	24	17	39	14	60
22	36	9	63	58	16	37	19
33	23	62	12	13	59	18	40
27	45	8	50	55	1	44	30
48	26	51	5	4	54	31	41
7	49	28	46	43	29	56	2
52	6	47	25	32	42	3	53

Closed Bimagic Queen's Tour c-37

The queen starts her tour from square f4.

Dudeney Group I

S1 Diagonally magic? Yes: pandiagonal

4 pairs of complementary columns

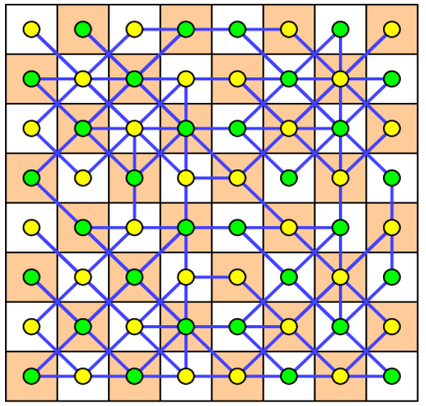
4 pairs of complementary rows

Index of complementary tour: c-39

Moves: orthogonal 8 + 4, diagonal 24 + 27 + 1 closing move.

Transformable into c-1, 2, 8, 10, 18, 19, 22, 25, 32, 33, 34, 35, 38, 39, 40

Path length: 48 + 86√2 = 169.6 + closing move 4√2.



57	21	15	35	38	10	20	64
44	8	30	50	55	27	1	45
14	34	60	24	17	61	39	11
31	51	41	5	4	48	54	26
37	9	19	63	58	22	16	36
56	28	2	46	43	7	29	49
18	62	40	12	13	33	59	23
3	47	53	25	32	52	42	6

Closed Bimagic Queen's Tour c-38

The queen starts her tour from square g7.

Dudeney Group II

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

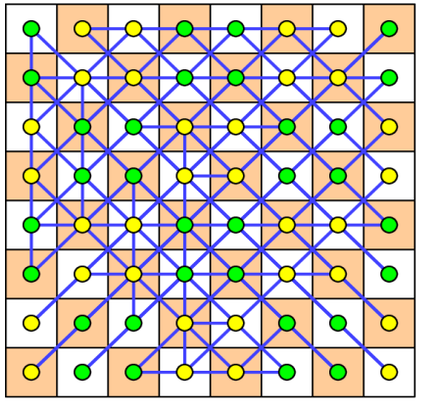
4 pairs of complementary rows

Index of complementary tour: c-40

Moves: orthogonal 8 + 4, diagonal 26 + 25 + 1 closing move.

Transformable into c-1, 2, 8, 10, 18, 19, 22, 25, 32, 33, 34, 35, 37, 39, 40

Path length: 48 + 165√2 = 281.3 + closing move √2.



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55	4	43	32	38	17	58	13
1	54	29	42	20	39	16	59
44	31	56	3	57	14	37	18
30	41	2	53	15	60	19	40
27	48	7	52	10	61	22	33
45	26	49	6	64	11	36	23
8	51	28	47	21	34	9	62
50	5	46	25	35	24	63	12

Closed Bimagic Queen's Tour c-39

The queen starts her tour from an edge of the board. (Square a7)

Dudeney Group I

S1 Diagonally magic? Yes: pandiagonal

4 pairs of complementary columns

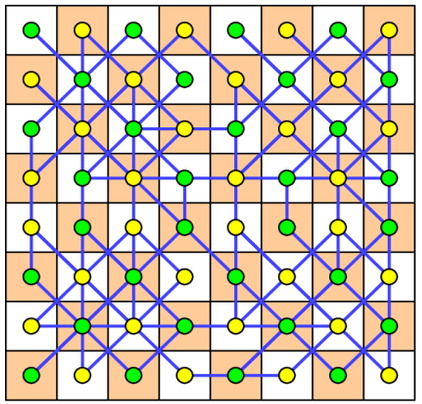
4 pairs of complementary rows

Index of complementary tour: c-37

Moves: orthogonal 8 + 4, diagonal 24 + 27 + 1 closing move.

Transformable into c-1, 2, 8, 10, 18, 19, 22, 25, 32, 33, 34, 35, 37, 38, 40

Path length: 48 + 86√2 = 169.6 + closing move 4√2.



59	23	13	33	40	12	18	62
42	6	32	52	53	25	3	47
16	36	58	22	19	63	37	9
29	49	43	7	2	46	56	28
39	11	17	61	60	24	14	34
54	26	4	48	41	5	31	51
20	64	38	10	15	35	57	21
1	45	55	27	30	50	44	8

Closed Bimagic Queen's Tour c-40

The queen starts her tour from a corner of the board. (Square a1)

Dudeney Group II

S1 Diagonally magic? Yes: semi-pandiagonal and 2+2 broken magic diag.

4 pairs of complementary columns

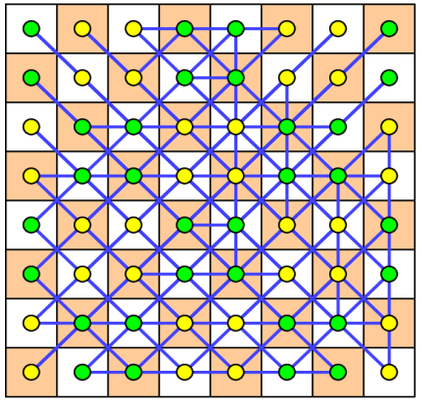
4 pairs of complementary rows

Index of complementary tour: c-38

Moves: orthogonal 8 + 4, diagonal 26 + 25 + 1 closing move.

Transformable into c-1, 2, 8, 10, 18, 19, 22, 25, 32, 33, 34, 35, 37, 38, 39

Path length: 48 + 165√2 = 281.3 + closing move √2.



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30	5	19	40	41	50	63	12
8	31	37	18	51	44	9	62
53	46	15	60	2	25	35	24
47	56	57	14	28	3	21	34
42	49	64	11	29	6	20	39
52	43	10	61	7	32	38	17
1	26	36	23	54	45	16	59
27	4	22	33	48	55	58	13

Closed Bimagic Queen's Tour c-41

The queen starts her tour from an edge of the board. (Square a2)

S1 Diagonally magic? No: but 2+2 broken magic diag.

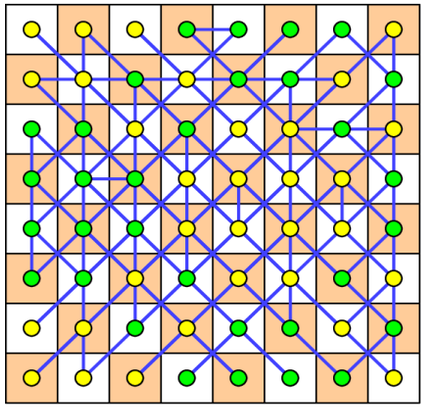
4 pairs of complementary rows

Index of complementary tour: c-31

Moves: orthogonal 8 + 4, diagonal 25 + 26 + 1 closing move.

Transformable into c-7, 9, 24, 30, 44

Path length: 42 + 150√2 = 254.1 + closing move 2√2.



31	41	3	53	52	6	48	26
44	30	56	2	7	49	27	45
62	40	21	15	10	20	33	59
37	63	14	24	17	11	58	36
51	5	47	25	32	42	4	54
8	50	28	46	43	29	55	1
9	19	34	60	61	39	22	16
18	12	57	35	38	64	13	23

Closed Bimagic Queen's Tour c-42

The queen starts her tour from an edge of the board. (Square h3)

S1 Diagonally magic? No: but 2+2 broken magic diag.

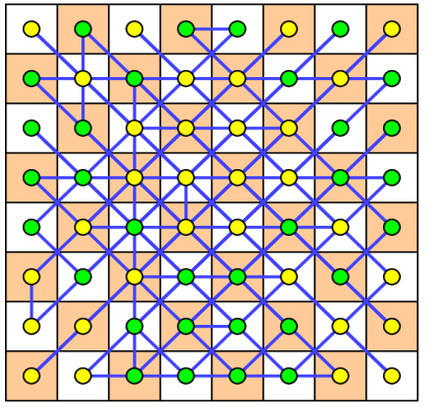
4 pairs of complementary columns

Index of complementary tour: c-24

Moves: orthogonal 8 + 4, diagonal 25 + 26 + 1 closing move.

Transformable into c-3, 13, 31, 36, 43

Path length: 42 + 150√2 = 254.1 + closing move 2√2.



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15	24	25	46	60	35	53	2
21	14	47	28	34	57	3	56
40	63	5	50	19	12	41	30
62	37	51	8	9	18	31	44
59	36	54	1	16	23	26	45
33	58	4	55	22	13	48	27
20	11	42	29	39	64	6	49
10	17	32	43	61	38	52	7

Closed Bimagic Queen's Tour c-43

The queen starts her tour from square d4.

S1 Diagonally magic? No: but 2+2 broken magic diag.

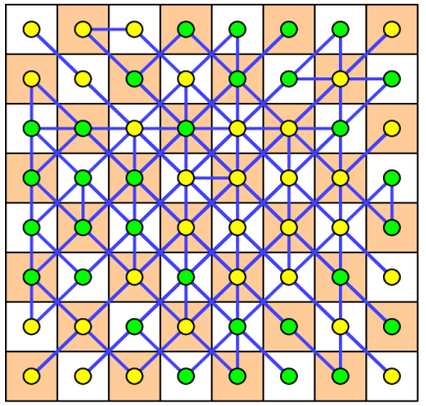
4 pairs of complementary rows

Index of complementary tour: c-09

Moves: orthogonal 8 + 4, diagonal 25 + 26 + 1 closing move.

Transformable into c-3, 13, 31, 36, 42

Path length: 42 + 150√2 = 254.1 + closing move 2√2.



21	34	47	56	57	14	28	3
35	24	53	46	15	60	2	25
9	62	8	31	37	18	51	44
63	12	30	5	19	40	41	50
58	13	27	4	22	33	48	55
16	59	1	26	36	23	54	45
38	17	52	43	10	61	7	32
20	39	42	49	64	11	29	6

Closed Bimagic Queen's Tour c-44

The queen starts her tour from square c3.

S1 Diagonally magic? No: but 2+2 broken magic diag.

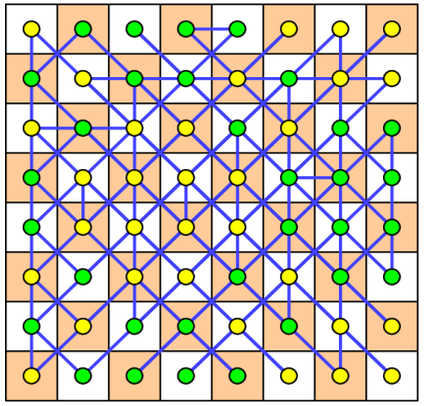
4 pairs of complementary rows

Index of complementary tour: c-03

Moves: orthogonal 8 + 4, diagonal 25 + 26 + 1 closing move.

Transformable into c-7, 9, 24, 30, 41

Path length: 42 + 150√2 = 254.1 + closing move 2√2.



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62 Open Bimagic Queen's Tours

10	20	64	38	35	57	21	15
17	11	39	61	60	34	14	24
45	6	49	26	31	56	3	44
7	48	27	52	53	30	41	2
36	58	22	16	9	19	63	37
59	33	13	23	18	12	40	62
32	55	4	43	46	5	50	25
54	29	42	1	8	47	28	51

Open Bimagic Queen's Tour o-01

The queen's opening move is from square d1.

S1 Diagonally magic? No.

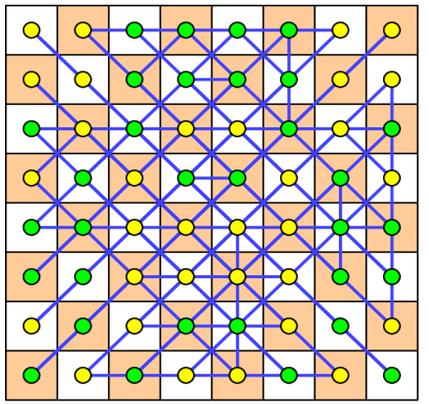
4 pairs of complementary columns

Index of complementary tour: o-54

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-28, 46

Path length: 44 + 149√2 = 254.7



10	59	33	20	21	40	62	15
45	32	6	55	50	3	25	44
36	17	11	58	63	14	24	37
7	54	48	29	28	41	51	2
22	39	61	16	9	60	34	19
49	4	26	43	46	31	5	56
64	13	23	38	35	18	12	57
27	42	52	1	8	53	47	30

Open Bimagic Queen's Tour o-02

The queen's opening move is from square d1.

S1 Diagonally magic? No.

4 pairs of complementary columns

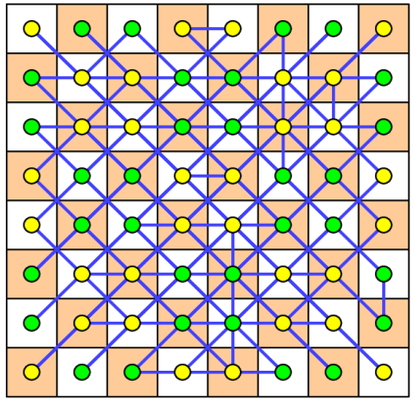
4 pairs of complementary rows

Index of complementary tour: o-62

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-3, 14, 18, 24, 26, 36, 37, 39, 57, 58, 62

Path length: 40 + 165√2 = 273.3



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35	13	12	38	64	18	23	57
50	32	25	55	45	3	6	44
9	39	34	16	22	60	61	19
28	54	51	29	7	41	48	2
63	17	24	58	36	14	11	37
46	4	5	43	49	31	26	56
21	59	62	20	10	40	33	15
8	42	47	1	27	53	52	30

Open Bimagic Queen's Tour o-03

The queen's opening move is from square d1.

Dudeney Group III (original symmetric)

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

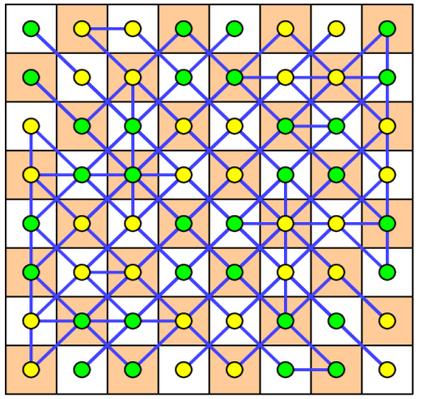
4 pairs of complementary rows

Index of complementary tour: o-03 (self-complementary)

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-2, 14, 18, 24, 26, 36, 37, 39, 57, 58, 62

Path length: $32 + 169\sqrt{2} = 271.0$



34	57	13	22	64	39	19	12
60	35	23	16	38	61	9	18
14	21	33	58	20	11	63	40
24	15	59	36	10	17	37	62
3	28	48	55	29	6	50	41
25	2	54	45	7	32	44	51
47	56	4	27	49	42	30	5
53	46	26	1	43	52	8	31

Open Bimagic Queen's Tour o-04

The queen's opening move is from square d1.

Dudeney Group III (original symmetric)

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

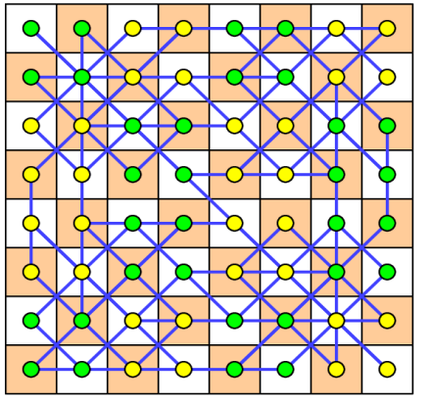
4 pairs of complementary rows

Index of complementary tour: o-04 (self-complementary)

Moves: orthogonal 8 + 4, diagonal 27 + 24

Transformable into o-9, 10, 17, 19, 30, 42, 49

Path length: $48 + 87\sqrt{2} = 171.0$



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35	38	21	20	64	57	10	15
25	32	47	42	6	3	52	53
24	17	34	39	11	14	61	60
46	43	28	29	49	56	7	2
63	58	9	16	36	37	22	19
5	4	51	54	26	31	48	41
12	13	62	59	23	18	33	40
50	55	8	1	45	44	27	30

Open Bimagic Queen's Tour o-05

The queen's opening move is from square d1.

Dudeney Group III (original symmetric)

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

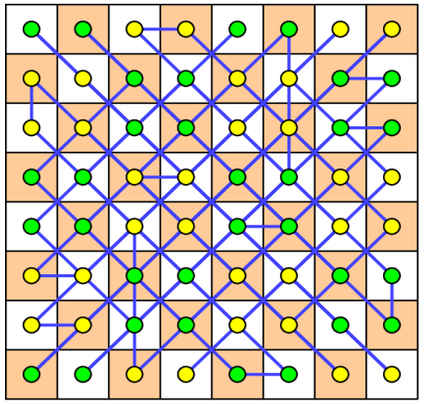
4 pairs of complementary rows

Index of complementary tour: o-05 (self-complementary)

Moves: orthogonal 8 + 4, diagonal 27 + 24

Transformable into o-7, 15, 20, 22, 27, 29, 31, 38, 47, 52, 60

Path length: $16 + 169\sqrt{2} = 255.0$



18	57	64	23	36	11	14	37
60	19	22	61	10	33	40	15
53	47	42	52	32	6	3	25
46	56	49	43	7	29	28	2
35	12	13	38	17	58	63	24
9	34	39	16	59	20	21	62
31	5	4	26	54	48	41	51
8	30	27	1	45	55	50	44

Open Bimagic Queen's Tour o-06

The queen's opening move is from square d1.

S1 Diagonally magic? No.

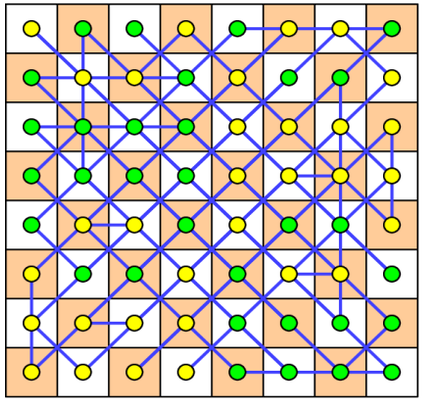
4 pairs of complementary columns

Index of complementary tour: o-46

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-33, 54

Path length: $28 + 149\sqrt{2} = 238.7$



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23	13	33	59	12	18	62	40
6	32	52	42	25	3	47	53
36	58	22	16	63	37	9	19
49	43	7	29	46	56	28	2
11	17	61	39	24	14	34	60
26	4	48	54	5	31	51	41
64	38	10	20	35	57	21	15
45	55	27	1	50	44	8	30

Open Bimagic Queen's Tour o-07

The queen's opening move is from square d1.

S1 Diagonally magic? No.

4 pairs of complementary columns

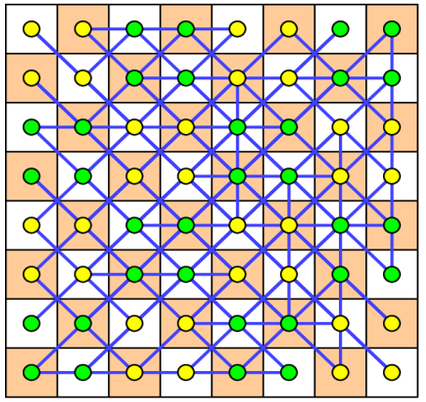
4 pairs of complementary rows

Index of complementary tour: o-20

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-5, 15, 20, 22, 27, 29, 31, 38, 47, 52, 60

Path length: 48 + 165√2 = 281.3



18	40	33	23	61	11	14	60
37	19	22	36	10	64	57	15
44	50	55	45	32	6	3	25
51	41	48	54	7	29	28	2
62	12	13	59	17	39	34	24
9	63	58	16	38	20	21	35
31	5	4	26	43	49	56	46
8	30	27	1	52	42	47	53

Open Bimagic Queen's Tour o-08

The queen's opening move is from square d1.

S1 Diagonally magic? No: but 1 long, and 1+2 broken magic diag.

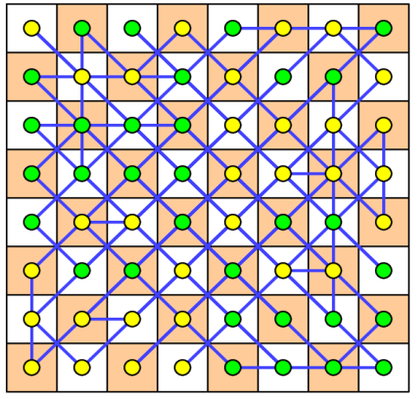
4 pairs of complementary columns

Index of complementary tour: o-13

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-34, 40, 55

Path length: 28 + 150√2 = 240.1



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63	19	8	44	37	9	30	50
20	64	43	7	10	38	49	29
33	13	26	54	59	23	4	48
14	34	53	25	24	60	47	3
40	12	31	51	62	18	5	41
11	39	52	32	17	61	42	6
58	22	1	45	36	16	27	55
21	57	46	2	15	35	56	28

Open Bimagic Queen's Tour o-09

The queen starts her tour from square c2.

Dudeney Group III (translated symmetric)

S1 Diagonally magic? No: but 2+2 broken magic diag.

4 pairs of complementary columns

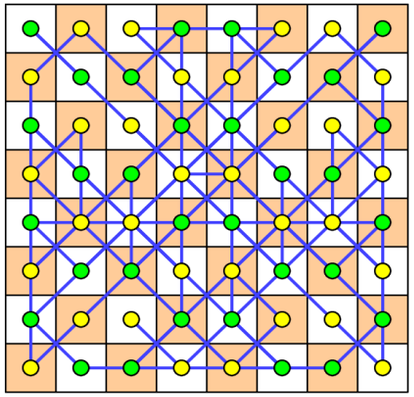
4 pairs of complementary rows

Index of complementary tour: o-49

Moves: orthogonal 8 + 4, diagonal 27 + 24

Transformable into o-4, 10, 17, 19, 30, 42, 49

Path length: $48 + 101\sqrt{2} = 190.8$



30	8	50	44	63	37	19	9
5	31	41	51	40	62	12	18
49	43	29	7	20	10	64	38
42	52	6	32	11	17	39	61
4	26	48	54	33	59	13	23
27	1	55	45	58	36	22	16
47	53	3	25	14	24	34	60
56	46	28	2	21	15	57	35

Open Bimagic Queen's Tour o-10

The queen starts her tour from square b3.

Dudeney Group III (original symmetric)

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

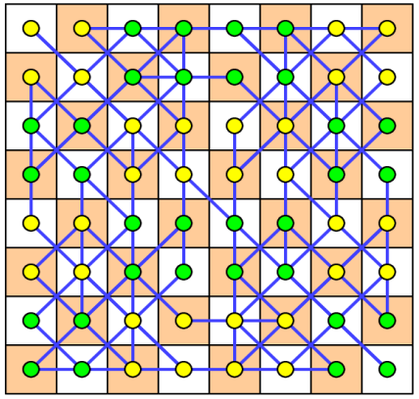
4 pairs of complementary rows

Index of complementary tour: o-10 (self-complementary)

Moves: orthogonal 8 + 4, diagonal 27 + 24

Transformable into o-4, 9, 17, 19, 30, 42, 49

Path length: $48 + 85\sqrt{2} = 168.2$



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63	12	40	19	5	50	30	41
11	64	20	39	49	6	42	29
33	22	58	13	27	48	4	55
21	34	14	57	47	28	56	3
8	51	31	44	62	9	37	18
52	7	43	32	10	61	17	38
26	45	1	54	36	23	59	16
46	25	53	2	24	35	15	60

Open Bimagic Queen's Tour o-11

The queen starts her tour from square c2.

Dudeney Group III (translated symmetric)

S1 Diagonally magic? No: but 2+2 broken magic diag.

4 pairs of complementary columns

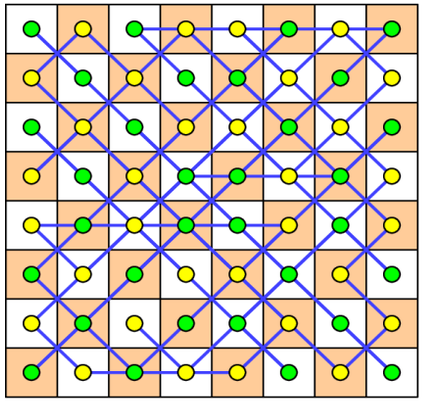
4 pairs of complementary rows

Index of complementary tour: o-61

Moves: orthogonal 4 + 0, diagonal 31 + 28

Transformable into o-61

Path length: 16 + 117√2 = 181.5



30	8	47	53	19	9	34	60
5	31	56	46	12	18	57	35
48	54	29	7	33	59	20	10
55	45	6	32	58	36	11	17
4	26	49	43	13	23	64	38
27	1	42	52	22	16	39	61
50	44	3	25	63	37	14	24
41	51	28	2	40	62	21	15

Open Bimagic Queen's Tour o-12

The queen starts her tour from square b3.

S1 Diagonally magic? No.

4 pairs of complementary columns

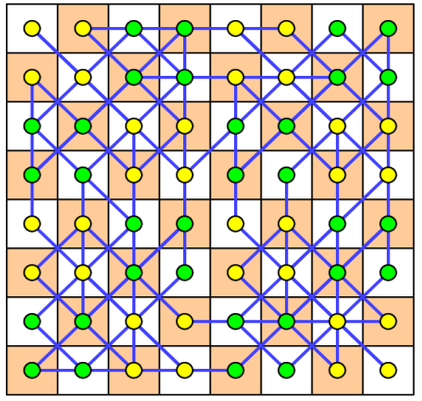
4 pairs of complementary rows

Index of complementary tour: o-32

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-32

Path length: 48 + 85√2 = 168.2



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12	19	30	41	63	40	50	5
18	9	44	31	37	62	8	51
23	16	45	26	36	59	1	54
13	22	27	48	58	33	55	4
64	39	49	6	11	20	29	42
38	61	7	52	17	10	43	32
35	60	2	53	24	15	46	25
57	34	56	3	14	21	28	47

Open Bimagic Queen's Tour o-13

The queen starts her tour from square g6.

S1 Diagonally magic? No: but 1 long and 1+2 broken magic diag.

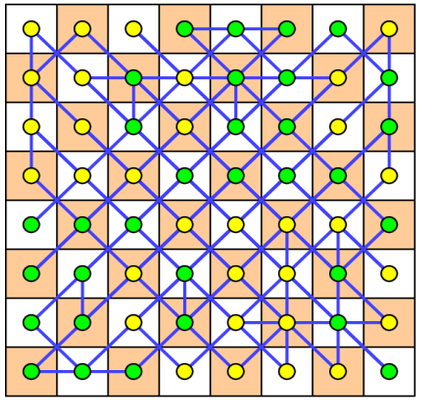
4 pairs of complementary rows

Index of complementary tour: o-08

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-43, 50, 53

Path length: $28 + 150\sqrt{2} = 240.1$



33	15	10	40	62	20	21	59
52	30	27	53	47	1	8	42
11	37	36	14	24	58	63	17
26	56	49	31	5	43	46	4
61	19	22	60	34	16	9	39
48	2	7	41	51	29	28	54
23	57	64	18	12	38	35	13
6	44	45	3	25	55	50	32

Open Bimagic Queen's Tour o-14

The queen starts her tour from square f7.

Dudeney Group III (original symmetric)

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

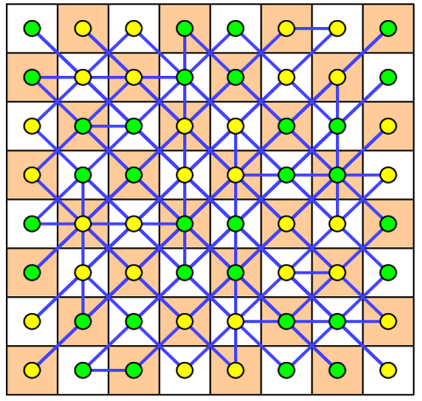
4 pairs of complementary rows

Index of complementary tour: o-14 (self-complementary)

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-2, 3, 18, 24, 26, 36, 37, 39, 57, 58, 62

Path length: $32 + 171\sqrt{2} = 273.8$



BY-NC-SA

33	40	23	18	62	59	12	13
27	30	45	44	8	1	50	55
22	19	36	37	9	16	63	58
48	41	26	31	51	54	5	4
61	60	11	14	34	39	24	17
7	2	49	56	28	29	46	43
10	15	64	57	21	20	35	38
52	53	6	3	47	42	25	32

Open Bimagic Queen's Tour o-15

The queen starts her tour from square f7.

Dudeney Group III (original symmetric)

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

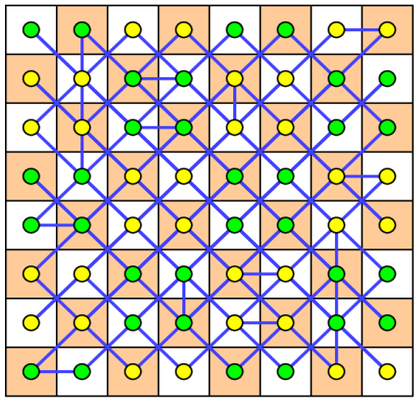
4 pairs of complementary rows

Index of complementary tour: o-15 (self-complementary)

Moves: orthogonal 8 + 4, diagonal 27 + 24

Transformable into o-5, 7, 20, 22, 27, 29, 31, 38, 47, 52, 60

Path length: $16 + 171\sqrt{2} = 257.8$



35	60	61	23	16	38	18	9
57	34	22	64	39	13	12	19
36	59	15	37	62	24	17	10
58	33	40	14	21	63	11	20
32	7	51	25	2	44	45	54
6	29	28	50	41	3	55	48
31	8	1	43	52	26	46	53
5	30	42	4	27	49	56	47

Open Bimagic Queen's Tour o-16

The queen starts her tour from square c2.

S1 Diagonally magic? No.

4 pairs of complementary columns

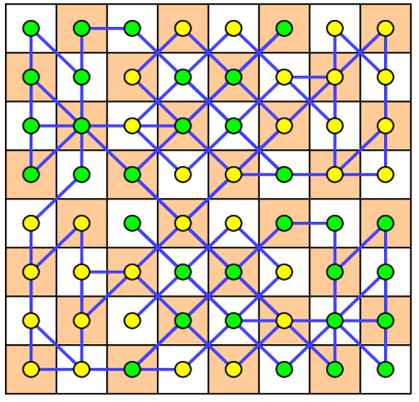
4 pairs of complementary rows

Index of complementary tour: o-23

Moves: orthogonal 16 + 8, diagonal 20 + 19

Transformable into o-23

Path length: $48 + 69\sqrt{2} = 145.6$



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34	14	3	47	60	24	25	53
13	33	48	4	23	59	54	26
64	20	29	49	38	10	7	43
19	63	50	30	9	37	44	8
57	21	28	56	35	15	2	46
22	58	55	27	16	36	45	1
39	11	6	42	61	17	32	52
12	40	41	5	18	62	51	31

Open Bimagic Queen's Tour o-17

The queen starts her tour from an edge of the board. (Square h3)

Dudeney Group III (original symmetric)

S1 Diagonally magic? Yes: and 1 + 1 broken magic diagonals

4 pairs of complementary columns

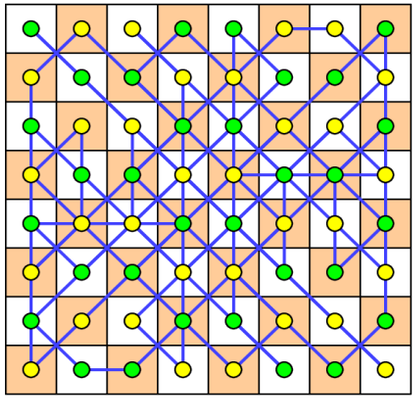
4 pairs of complementary rows

Index of complementary tour: o-17 (self-complementary)

Moves: orthogonal 8 + 4, diagonal 27 + 24

Transformable into o-4, 9, 10, 19, 30, 42, 49

Path length: 40 + 103√2 = 185.7



18	53	60	31	14	41	40	3
64	27	22	49	36	7	10	45
57	30	19	56	37	2	15	44
23	52	61	26	11	48	33	6
13	42	39	4	17	54	59	32
35	8	9	46	63	28	21	50
38	1	16	43	58	29	20	55
12	47	34	5	24	51	62	25

Open Bimagic Queen's Tour o-18

The queen starts her tour from square b2.

S1 Diagonally magic? No.

4 pairs of complementary columns

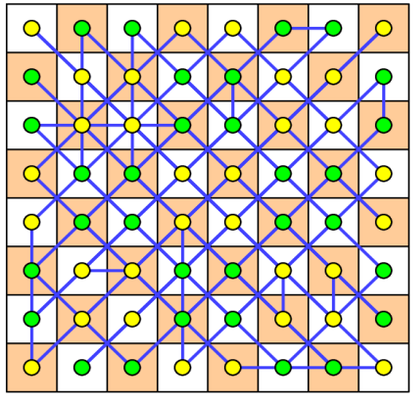
4 pairs of complementary rows

Index of complementary tour: o-57

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-2, 3, 14, 24, 26, 36, 37, 39, 57, 58, 62

Path length: 24 + 165√2 = 257.3



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35	16	61	18	60	23	38	9
15	36	17	62	24	59	10	37
2	45	32	51	25	54	7	44
46	1	52	31	53	26	43	8
57	22	39	12	34	13	64	19
21	58	11	40	14	33	20	63
28	55	6	41	3	48	29	50
56	27	42	5	47	4	49	30

Open Bimagic Queen's Tour o-19

The queen starts her tour from square b5.

Dudeney Group III (original symmetric)

S1 Diagonally magic? Yes: and 1 + 1 broken magic diagonals

4 pairs of complementary columns

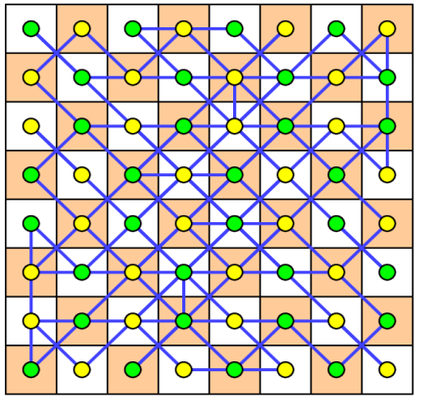
4 pairs of complementary rows

Index of complementary tour: o-19 (self-complementary)

Moves: orthogonal 8 + 4, diagonal 27 + 24

Transformable into o-4, 9, 10, 17, 30, 42, 49

Path length: $40 + 101\sqrt{2} = 182.8$



20	1	39	54	16	29	59	42
10	27	61	48	22	7	33	52
38	55	17	4	58	43	13	32
64	45	11	26	36	49	23	6
15	30	60	41	19	2	40	53
21	8	34	51	9	28	62	47
57	44	14	31	37	56	18	3
35	50	24	5	63	46	12	25

Open Bimagic Queen's Tour o-20

The queen starts her tour from an edge of the board. (Square b8)

S1 Diagonally magic? No.

4 pairs of complementary columns

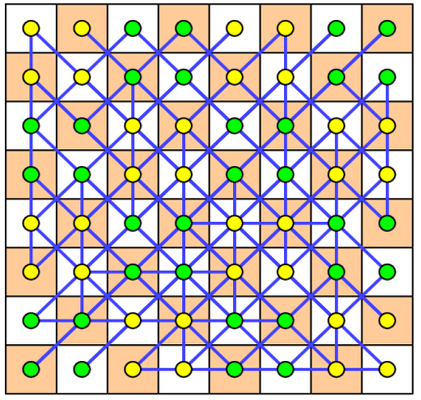
4 pairs of complementary rows

Index of complementary tour: o-07

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-5, 7, 15, 22, 27, 29, 31, 38, 47, 52, 60

Path length: $48 + 165\sqrt{2} = 281.3$



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33	21	40	20	59	15	62	10
22	34	19	39	16	60	9	61
27	47	30	42	1	53	8	52
48	28	41	29	54	2	51	7
58	14	63	11	36	24	37	17
13	57	12	64	23	35	18	38
4	56	5	49	26	46	31	43
55	3	50	6	45	25	44	32

Open Bimagic Queen's Tour o-21

The queen starts her tour from square e6.

Dudeney Group III (original symmetric)

S1 Diagonally magic? Yes: and 1 + 1 broken magic diagonals.

4 pairs of complementary columns

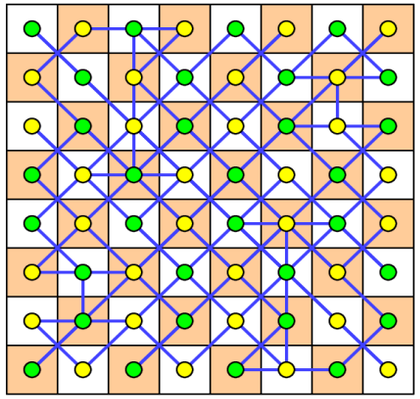
4 pairs of complementary rows

Index of complementary tour: o-21 (self-complementary)

Moves: orthogonal 8 + 4, diagonal 27 + 24

Transformable into o-41, 44, 45, 48, 51

Path length: 24 + 109√2 = 178.1



20	42	39	29	16	54	59	1
35	25	24	46	63	5	12	50
38	32	17	43	58	4	13	55
21	47	34	28	9	51	62	8
15	53	60	2	19	41	40	30
64	6	11	49	36	26	23	45
57	3	14	56	37	31	18	44
10	52	61	7	22	48	33	27

Open Bimagic Queen's Tour o-22

The queen starts her tour from a corner of the board. (Square h8)

S1 Diagonally magic? No.

4 pairs of complementary columns

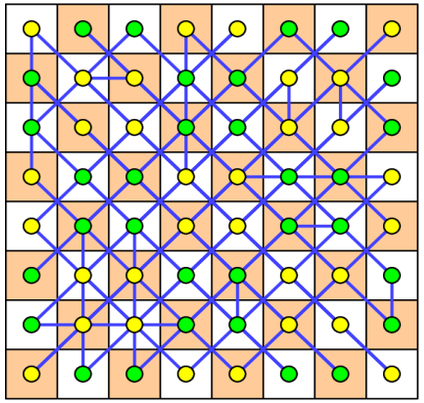
4 pairs of complementary rows

Index of complementary tour: o-60

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-5, 7, 15, 20, 27, 29, 31, 38, 47, 52, 60

Path length: 24 + 169√2 = 263.0



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Open Bimagic Queen's Tour o-23

56	46	55	45	11	17	12	18
47	53	48	54	20	10	19	9
27	52	41	2	21	62	39	16
49	26	3	44	63	24	13	38
42	1	28	51	40	15	22	61
4	43	50	25	14	37	64	23
5	31	6	32	58	36	57	35
30	8	29	7	33	59	34	60

The queen starts her tour from square b4.

S1 Diagonally magic? No.

4 pairs of complementary columns

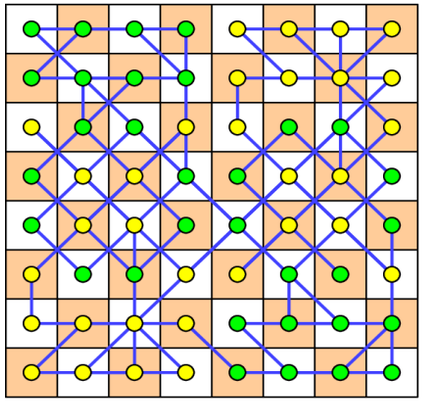
4 pairs of complementary rows

Index of complementary tour: o-16

Moves: orthogonal 16 + 8, diagonal 20 + 19

Transformable into o-16

Path length: $48 + 69\sqrt{2} = 145.6$



Open Bimagic Queen's Tour o-24

13	32	39	54	17	4	59	42
12	25	34	51	24	5	62	47
38	55	16	29	58	43	20	1
35	50	9	28	63	46	21	8
18	3	60	41	14	31	40	53
23	6	61	48	11	26	33	52
57	44	19	2	37	56	15	30
64	45	22	7	36	49	10	27

The queen starts her tour from an edge of the board. (Square h6)

S1 Diagonally magic? No.

4 pairs of complementary columns

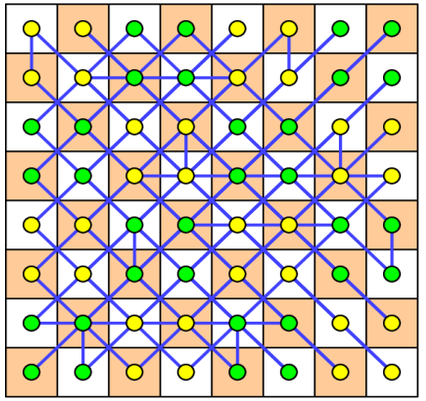
4 pairs of complementary rows

Index of complementary tour: o-36

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-2, 3, 14, 18, 26, 36, 37, 39, 57, 58, 62

Path length: $24 + 169\sqrt{2} = 263.0$



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18	57	56	31	14	37	44	3
64	23	26	49	36	11	6	45
53	30	19	60	41	2	15	40
27	52	61	22	7	48	33	10
13	38	43	4	17	58	55	32
35	12	5	46	63	24	25	50
42	1	16	39	54	29	20	59
8	47	34	9	28	51	62	21

Open Bimagic Queen's Tour o-25

The queen starts her tour from square b2.

S1 Diagonally magic? No.

4 pairs of complementary columns

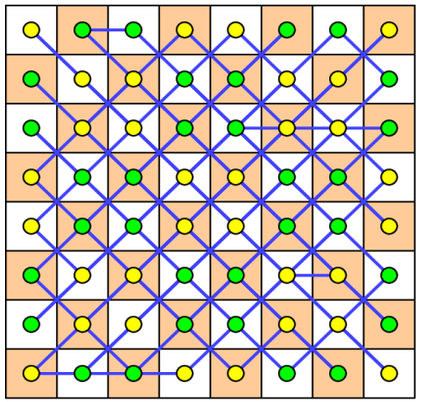
4 pairs of complementary rows

Index of complementary tour: o-56

Moves: orthogonal 4 + 0, diagonal 30 + 29

Transformable into o-56

Path length: 8 + 173√2 = 252.7



1	38	43	16	29	58	55	20
52	23	26	61	48	11	6	33
42	13	4	39	54	17	32	59
27	64	49	22	7	36	45	10
30	57	56	19	2	37	44	15
47	12	5	34	51	24	25	62
53	18	31	60	41	14	3	40
8	35	46	9	28	63	50	21

Open Bimagic Queen's Tour o-26

The queen starts her tour from a corner of the board. (Square a8)

S1 Diagonally magic? No.

4 pairs of complementary columns

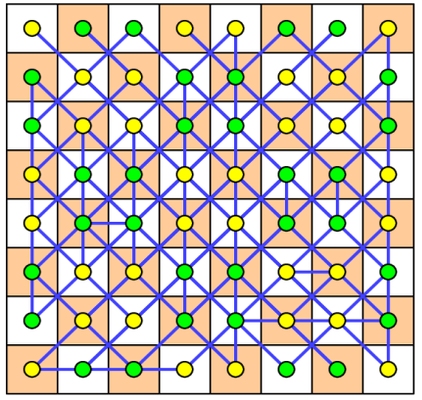
4 pairs of complementary rows

Index of complementary tour: o-58

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-2, 3, 14, 18, 24, 36, 37, 39, 57, 58, 62

Path length: 40 + 165√2 = 273.3



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3	18	56	37	31	14	44	57
6	23	49	36	26	11	45	64
53	40	2	19	41	60	30	15
52	33	7	22	48	61	27	10
32	13	43	58	4	17	55	38
25	12	46	63	5	24	50	35
42	59	29	16	54	39	1	20
47	62	28	9	51	34	8	21

Open Bimagic Queen's Tour o-27

The queen starts her tour from square g2.

S1 Diagonally magic? No.

4 pairs of complementary columns

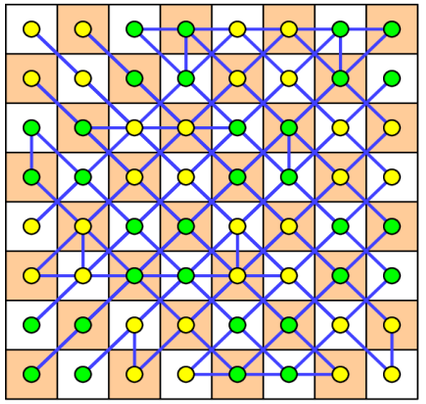
4 pairs of complementary rows

Index of complementary tour: o-38

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-5, 7, 15, 20, 22, 29, 31, 38, 47, 52, 60

Path length: $24 + 165\sqrt{2} = 257.3$



1	43	23	16	52	26	61	38
42	4	13	22	27	49	39	64
29	55	33	58	48	6	11	20
54	32	59	36	7	45	17	10
51	25	62	37	2	44	24	15
28	50	40	63	41	3	14	21
47	5	12	19	30	56	34	57
8	46	18	9	53	31	60	35

Open Bimagic Queen's Tour o-28

The queen starts her tour from a corner of the board. (Square a8)

S1 Diagonally magic? No.

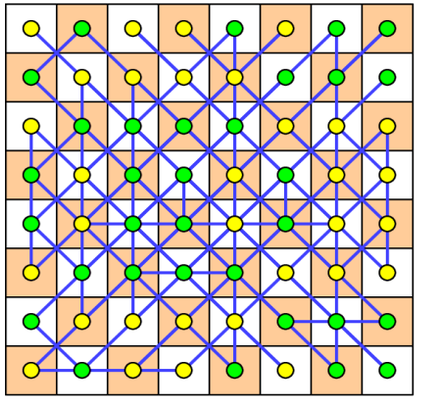
4 pairs of complementary rows

Index of complementary tour: o-33

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-1, 46

Path length: $44 + 149\sqrt{2} = 254.7$



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13	58	17	38	55	4	43	32
59	16	39	20	1	54	29	42
18	37	14	57	44	31	56	3
40	19	60	15	30	41	2	53
12	63	24	35	50	5	46	25
62	9	34	21	8	51	28	47
23	36	11	64	45	26	49	6
33	22	61	10	27	48	7	52

Open Bimagic Queen's Tour o-29

The queen starts her tour from square e7.

Dudeney Group III (original symmetric)

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

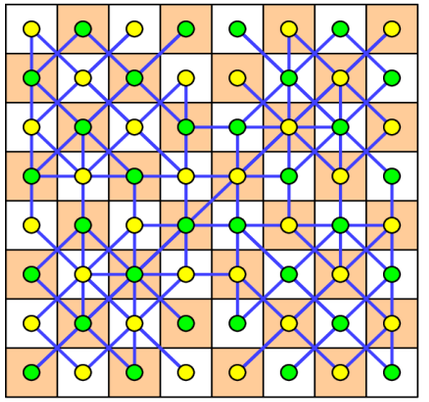
4 pairs of complementary rows

Index of complementary tour: o-29 (self-complementary)

Moves: orthogonal 8 + 4, diagonal 27 + 24

Transformable into o-5, 7, 15, 20, 22, 27, 31, 38, 47, 52, 60

Path length: $48 + 89\sqrt{2} = 173.9$



5	30	42	49	27	4	56	47
31	8	52	43	1	26	46	53
41	50	6	29	55	48	28	3
51	44	32	7	45	54	2	25
12	19	39	64	22	13	57	34
18	9	61	38	16	23	35	60
40	63	11	20	58	33	21	14
62	37	17	10	36	59	15	24

Open Bimagic Queen's Tour o-30

The queen starts her tour from square e7.

S1 Diagonally magic? No.

4 pairs of complementary columns

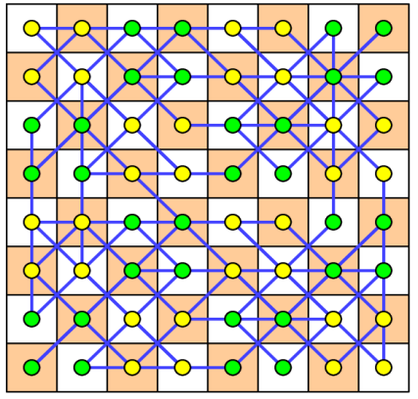
4 pairs of complementary rows

Index of complementary tour: o-42

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-4, 9, 10, 17, 19, 42, 49

Path length: $48 + 87\sqrt{2} = 171.0$



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50	8	45	27	55	1	44	30
5	51	26	48	4	54	31	41
46	28	49	7	43	29	56	2
25	47	6	52	32	42	3	53
12	62	23	33	13	59	18	40
63	9	36	22	58	16	37	19
24	34	11	61	17	39	14	60
35	21	64	10	38	20	57	15

Open Bimagic Queen's Tour o-31

The queen starts her tour from an edge of the board. (Square f8)

Dudeney Group III (original symmetric)

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

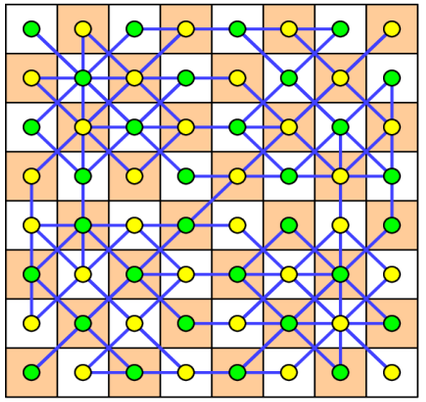
4 pairs of complementary rows

Index of complementary tour: o-31 (self-complementary)

Moves: orthogonal 8 + 4, diagonal 27 + 24

Transformable into o-5, 7, 15, 20, 22, 27, 29, 38, 47, 52, 60

Path length: $48 + 83\sqrt{2} = 165.4$



5	30	55	48	27	4	41	50
31	8	45	54	1	26	51	44
56	47	6	29	42	49	28	3
46	53	32	7	52	43	2	25
12	19	58	33	22	13	40	63
18	9	36	59	16	23	62	37
57	34	11	20	39	64	21	14
35	60	17	10	61	38	15	24

Open Bimagic Queen's Tour o-32

The queen starts her tour from square e7.

S1 Diagonally magic? No.

4 pairs of complementary columns

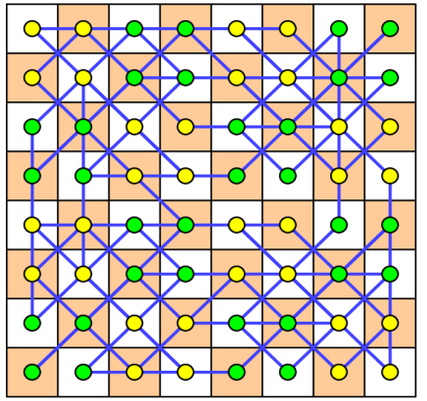
4 pairs of complementary rows

Index of complementary tour: o-12

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-12

Path length: $48 + 85\sqrt{2} = 168.2$



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27	1	45	55	50	44	8	30
4	26	54	48	41	51	31	5
39	16	59	20	21	62	9	34
13	38	17	58	63	24	35	12
49	43	7	29	28	2	46	56
42	52	32	6	3	25	53	47
22	61	10	33	40	15	60	19
64	23	36	11	14	37	18	57

Open Bimagic Queen's Tour o-33

The queen starts her tour from an edge of the board. (Square b8)

S1 Diagonally magic? No.

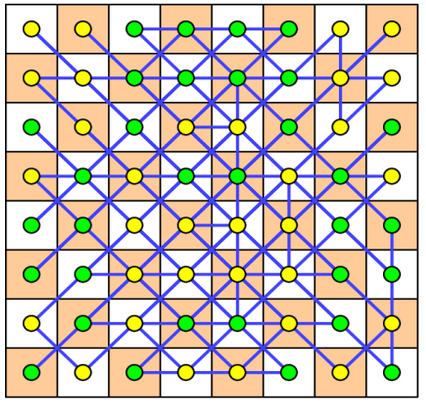
4 pairs of complementary columns

Index of complementary tour: o-28

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-6, 54

Path length: $44 + 149\sqrt{2} = 254.7$



27	1	52	42	47	53	8	30
4	26	43	49	56	46	31	5
58	16	38	20	21	35	9	63
13	59	17	39	34	24	62	12
48	54	7	29	28	2	51	41
55	45	32	6	3	25	44	50
22	36	10	64	57	15	37	19
33	23	61	11	14	60	18	40

Open Bimagic Queen's Tour o-34

The queen starts her tour from an edge of the board. (Square b8)

S1 Diagonally magic? Yes: and 1 + 1 broken magic diagonals.

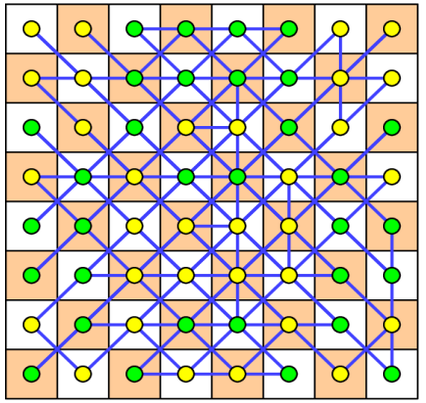
4 pairs of complementary columns

Index of complementary tour: o-43

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-8, 40, 55

Path length: $44 + 150\sqrt{2} = 256.1$



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Open Bimagic Queen's Tour o-35

20	38	43	29	16	58	55	1
35	21	28	46	63	9	8	50
42	32	17	39	54	4	13	59
25	47	34	24	5	51	62	12
15	57	56	2	19	37	44	30
64	10	7	49	36	22	27	45
53	3	14	60	41	31	18	40
6	52	61	11	26	48	33	23

The queen starts her tour from a corner of the board. (Square h8)

S1 Diagonally magic? No.

4 pairs of complementary columns

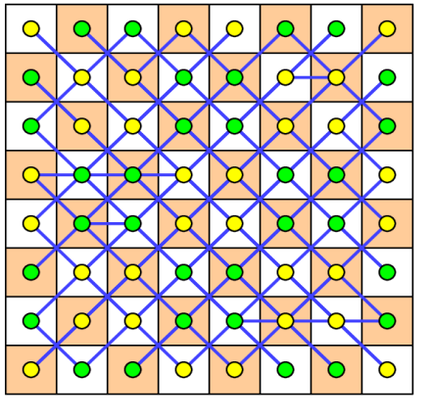
4 pairs of complementary rows

Index of complementary tour: o-59

Moves: orthogonal 4 + 0, diagonal 30 + 29

Transformable into o-59

Path length: 8 + 177√2 = 258.3



Open Bimagic Queen's Tour o-36

1	20	43	58	29	16	55	38
8	21	46	63	28	9	50	35
42	59	4	17	54	39	32	13
47	62	5	24	51	34	25	12
30	15	56	37	2	19	44	57
27	10	49	36	7	22	45	64
53	40	31	14	41	60	3	18
52	33	26	11	48	61	6	23

The queen starts her tour from a corner of the board. (Square a8)

S1 Diagonally magic? No.

4 pairs of complementary columns

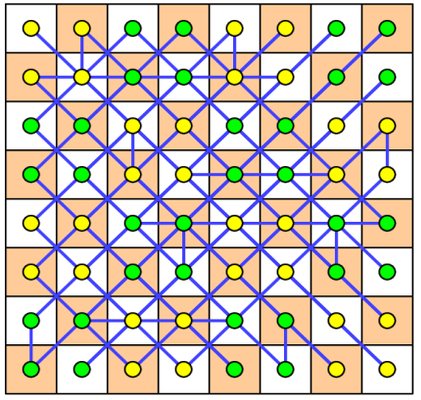
4 pairs of complementary rows

Index of complementary tour: o-24

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-2, 3, 14, 18, 24, 26, 37, 39, 57, 58, 62

Path length: 24 + 169√2 = 263.0



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30	53	1	42	52	27	47	8
56	31	43	4	26	49	5	46
2	41	29	54	48	7	51	28
44	3	55	32	6	45	25	50
15	40	20	59	33	10	62	21
37	14	58	17	11	36	24	63
19	60	16	39	61	22	34	9
57	18	38	13	23	64	12	35

Open Bimagic Queen's Tour o-37

The queen starts her tour from an edge of the board. (Square c8)

Dudeney Group III (original symmetric)

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

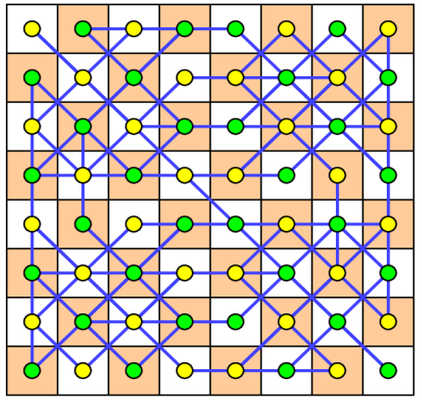
4 pairs of complementary rows

Index of complementary tour: o-37 (self-complementary)

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-2, 3, 14, 18, 24, 26, 36, 39, 57, 58, 62

Path length: $48 + 83\sqrt{2} = 165.4$



8	1	50	55	27	30	45	44
21	20	35	38	10	15	64	57
51	54	5	4	48	41	26	31
34	39	24	17	61	60	11	14
28	29	46	43	7	2	49	56
9	16	63	58	22	19	36	37
47	42	25	32	52	53	6	3
62	59	12	13	33	40	23	18

Open Bimagic Queen's Tour o-38

The queen starts her tour from an edge of the board. (Square b8)

S1 Diagonally magic? No.

4 pairs of complementary columns

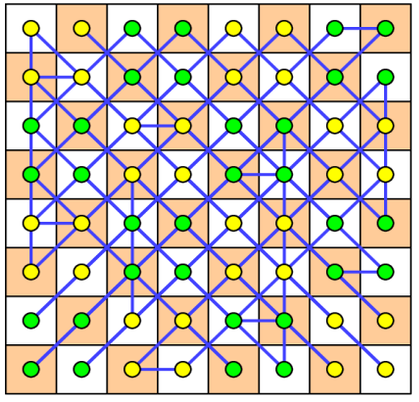
4 pairs of complementary rows

Index of complementary tour: o-27

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-5, 7, 15, 20, 22, 27, 29, 31, 47, 52, 60

Path length: $24 + 165\sqrt{2} = 257.3$



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33	11	61	23	52	26	48	6
10	36	22	64	27	49	7	45
62	24	34	12	47	5	51	25
21	63	9	35	8	46	28	50
15	37	19	57	30	56	2	44
40	14	60	18	53	31	41	3
20	58	16	38	1	43	29	55
59	17	39	13	42	4	54	32

Open Bimagic Queen's Tour o-39

The queen starts her tour from square e2.

Dudeney Group III (original symmetric)

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

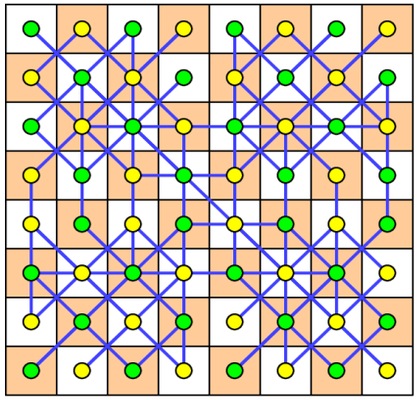
4 pairs of complementary rows

Index of complementary tour: o-39 (self-complementary)

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-2, 3, 14, 18, 24, 26, 36, 37, 57, 58, 62

Path length: $48 + 89\sqrt{2} = 173.9$



63	12	19	40	41	50	30	5
9	62	37	18	51	44	8	31
20	39	64	11	29	6	42	49
38	17	10	61	7	32	52	43
16	59	36	23	54	45	1	26
58	13	22	33	48	55	27	4
35	24	15	60	2	25	53	46
21	34	57	14	28	3	47	56

Open Bimagic Queen's Tour o-40

The queen starts her tour from square g4.

S1 Diagonally magic? No: but 1 broken magic diagonal.

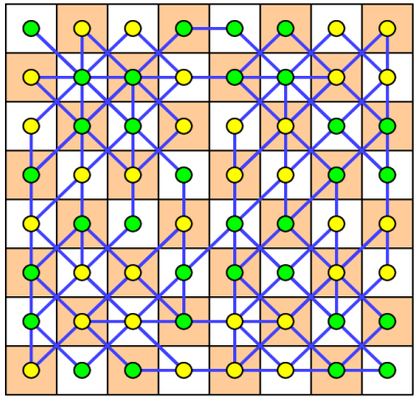
4 pairs of complementary rows

Index of complementary tour: o-50

Moves: orthogonal 8 + 4, diagonal 27 + 24

Transformable into o-8, 34, 55

Path length: $48 + 86\sqrt{2} = 169.6$



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9	62	18	37	51	8	44	31
61	10	38	17	7	52	32	43
19	40	12	63	41	30	50	5
39	20	64	11	29	42	6	49
16	59	23	36	54	1	45	26
60	15	35	24	2	53	25	46
22	33	13	58	48	27	55	4
34	21	57	14	28	47	3	56

Open Bimagic Queen's Tour o-41

The queen starts her tour from square f4.

Dudeney Group III (original symmetric)

S1 Diagonally magic? Yes: and 1 + 1 broken magic diagonals.

4 pairs of complementary columns

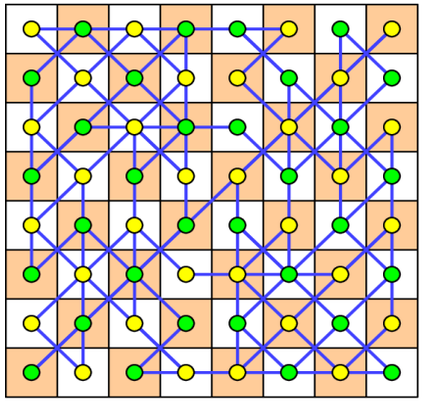
4 pairs of complementary rows

Index of complementary tour: o-41 (self-complementary)

Moves: orthogonal 8 + 4, diagonal 27 + 24

Transformable into o-21, 44, 45, 48, 51

Path length: 48 + 75√2 = 154.1



18	12	62	40	31	5	51	41
9	19	37	63	8	30	44	50
61	39	17	11	52	42	32	6
38	64	10	20	43	49	7	29
16	22	36	58	1	27	45	55
23	13	59	33	26	4	54	48
35	57	15	21	46	56	2	28
60	34	24	14	53	47	25	3

Open Bimagic Queen's Tour o-42

The queen starts her tour from square e4.

S1 Diagonally magic? No.

4 pairs of complementary columns

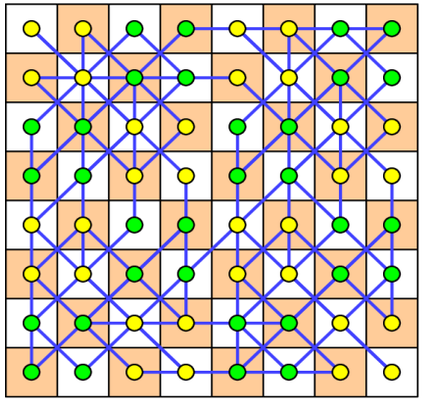
4 pairs of complementary rows

Index of complementary tour: o-30

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-4, 9, 10, 17, 19, 30, 49

Path length: 48 + 87√2 = 171.0



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25	46	15	24	53	2	60	35
47	28	21	14	3	56	34	57
5	50	40	63	41	30	19	12
51	8	62	37	31	44	9	18
54	1	59	36	26	45	16	23
4	55	33	58	48	27	22	13
42	29	20	11	6	49	39	64
32	43	10	17	52	7	61	38

Open Bimagic Queen's Tour o-43

The queen starts her tour from square b4.

S1 Diagonally magic? Yes: and 1 + 1 broken magic diagonals.

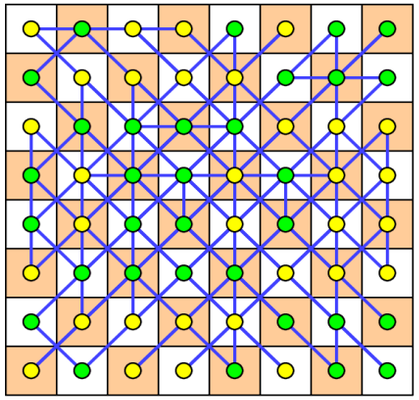
4 pairs of complementary rows

Index of complementary tour: o-34

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-13, 50, 53

Path length: $44 + 150\sqrt{2} = 256.1$



53	2	24	35	46	25	15	60
1	54	36	23	26	45	59	16
42	29	11	64	49	6	20	39
30	41	63	12	5	50	40	19
47	28	14	57	56	3	21	34
27	48	58	13	4	55	33	22
52	7	17	38	43	32	10	61
8	51	37	18	31	44	62	9

Open Bimagic Queen's Tour o-44

The queen starts her tour from an edge of the board. (Square a7)

Dudeney Group III (translated symmetric)

S1 Diagonally magic? Yes: and 1 + 1 broken magic diagonals.

4 pairs of complementary columns

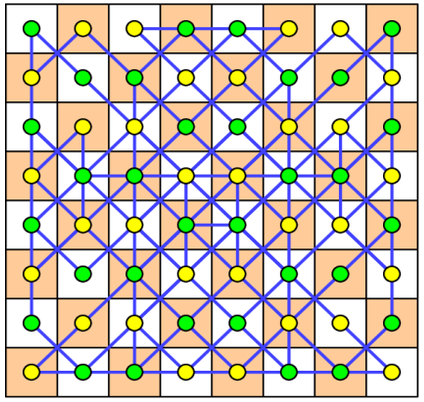
4 pairs of complementary rows

Index of complementary tour: o-45

Moves: orthogonal 8 + 4, diagonal 27 + 24

Transformable into o-21, 41, 45, 48, 51

Path length: $48 + 105\sqrt{2} = 196.5$



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56	4	43	31	46	26	49	5
3	55	32	44	25	45	6	50
21	33	10	62	15	59	20	40
34	22	61	9	60	16	39	19
47	27	52	8	53	1	42	30
28	48	7	51	2	54	29	41
14	58	17	37	24	36	11	63
57	13	38	18	35	23	64	12

Open Bimagic Queen's Tour o-45

The queen starts her tour from square f4.

Dudeney Group III (translated symmetric)

S1 Diagonally magic? Yes: and 1 + 1 broken magic diagonals.

4 pairs of complementary columns

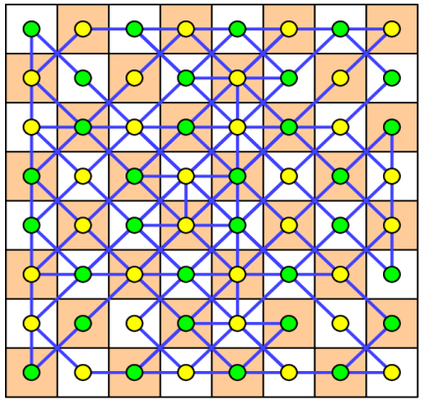
4 pairs of complementary rows

Index of complementary tour: o-44

Moves: orthogonal 8 + 4, diagonal 27 + 24

Transformable into o-21, 41, 44, 48, 51

Path length: 48 + 105√2 = 196.5



28	50	40	63	41	3	14	21
51	25	62	37	2	44	24	15
54	32	59	36	7	45	17	10
29	55	33	58	48	6	11	20
42	4	13	22	27	49	39	64
1	43	23	16	52	26	61	38
8	46	18	9	53	31	60	35
47	5	12	19	30	56	34	57

Open Bimagic Queen's Tour o-46

The queen starts her tour from an edge of the board. (Square a3)

S1 Diagonally magic? No.

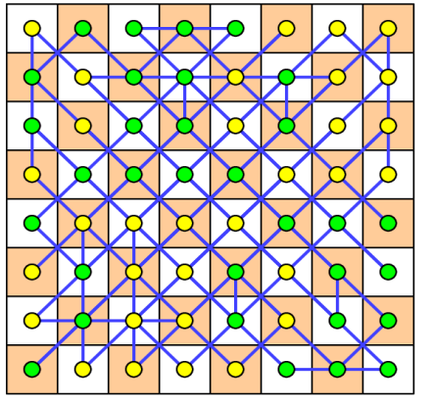
4 pairs of complementary rows

Index of complementary tour: o-06

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-1, 28

Path length: 28 + 149√2 = 238.7



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6	23	49	36	26	11	45	64
32	13	43	58	4	17	55	38
52	33	7	22	48	61	27	10
42	59	29	16	54	39	1	20
25	12	46	63	5	24	50	35
3	18	56	37	31	14	44	57
47	62	28	9	51	34	8	21
53	40	2	19	41	60	30	15

Open Bimagic Queen's Tour o-47

The queen starts her tour from square g5.

S1 Diagonally magic? No.

4 pairs of complementary columns

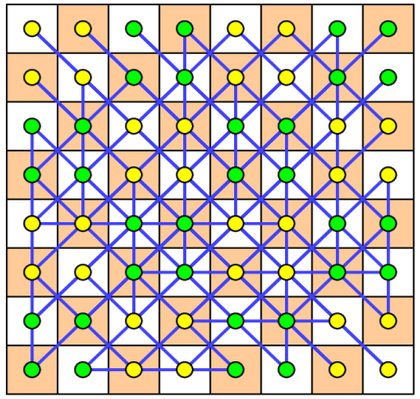
4 pairs of complementary rows

Index of complementary tour: o-52

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-5, 7, 15, 20, 22, 27, 29, 31, 38, 52, 60

Path length: 48 + 165√2 = 281.3



12	19	63	40	41	50	30	5
18	9	37	62	51	44	8	31
64	39	11	20	29	6	42	49
38	61	17	10	7	32	52	43
23	16	36	59	54	45	1	26
13	22	58	33	48	55	27	4
35	60	24	15	2	25	53	46
57	34	14	21	28	3	47	56

Open Bimagic Queen's Tour o-48

The queen starts her tour from square g4.

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

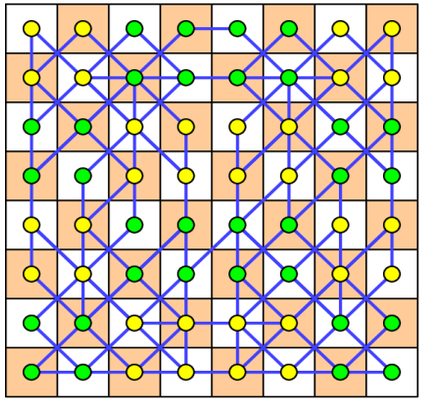
4 pairs of complementary rows

Index of complementary tour: o-51

Moves: orthogonal 8 + 4, diagonal 27 + 24

Transformable into o-21, 41, 44, 45, 51

Path length: 48 + 86√2 = 169.6



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44	8	19	63	50	30	9	37
7	43	64	20	29	49	38	10
54	26	13	33	48	4	23	59
25	53	34	14	3	47	60	24
51	31	12	40	41	5	18	62
32	52	39	11	6	42	61	17
45	1	22	58	55	27	16	36
2	46	57	21	28	56	35	15

Open Bimagic Queen's Tour o-49

The queen starts her tour from square b2.

Dudeney Group III (translated symmetric)

S1 Diagonally magic? No: but 2+2 broken magic diag.

4 pairs of complementary columns

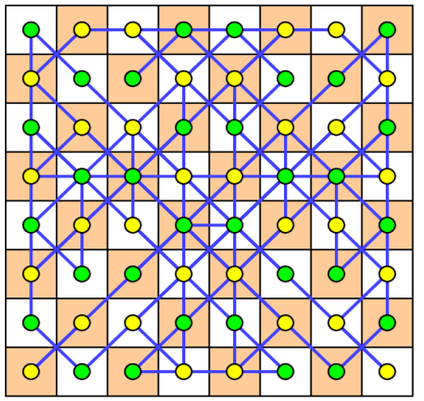
4 pairs of complementary rows

Index of complementary tour: o-09

Moves: orthogonal 8 + 4, diagonal 27 + 24

Transformable into o-4, 9, 10, 17, 19, 30, 42

Path length: 48 + 101√2 = 190.8



2	56	45	27	49	7	30	44
53	3	26	48	6	52	41	31
46	28	1	55	29	43	50	8
25	47	54	4	42	32	5	51
24	14	36	58	11	17	63	37
15	21	59	33	20	10	40	62
35	57	23	13	64	38	12	18
60	34	16	22	39	61	19	9

Open Bimagic Queen's Tour o-50

The queen starts her tour from square c6.

S1 Diagonally magic? No: but 1 broken magic diag.

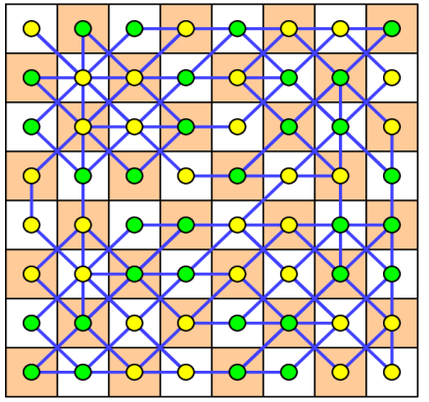
4 pairs of complementary columns

Index of complementary tour: o-40

Moves: orthogonal 8 + 4, diagonal 27 + 24

Transformable into o-13, 43, 53

Path length: 48 + 86√2 = 169.6



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53	47	1	27	42	52	30	8
46	56	26	4	49	43	5	31
2	28	54	48	29	7	41	51
25	3	45	55	6	32	50	44
24	14	36	58	11	17	63	37
15	21	59	33	20	10	40	62
35	57	23	13	64	38	12	18
60	34	16	22	39	61	19	9

Open Bimagic Queen's Tour o-51

The queen starts her tour from an edge of the board. (Square c8)

S1 Diagonally magic? Yes: semi-pandiagonal.

4 pairs of complementary columns

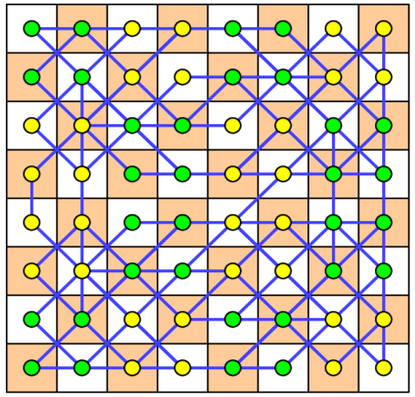
4 pairs of complementary rows

Index of complementary tour: o-48

Moves: orthogonal 8 + 4, diagonal 27 + 24

Transformable into o-21, 41, 44, 45, 48

Path length: 48 + 86√2 = 169.6



1	27	55	45	30	8	44	50
20	10	38	64	15	21	57	35
54	48	4	26	41	51	31	5
39	61	17	11	60	34	14	24
29	7	43	49	2	28	56	46
16	22	58	36	19	9	37	63
42	52	32	6	53	47	3	25
59	33	13	23	40	62	18	12

Open Bimagic Queen's Tour o-52

The queen starts her tour from a corner of the board. (Square a8)

S1 Diagonally magic? No.

4 pairs of complementary columns

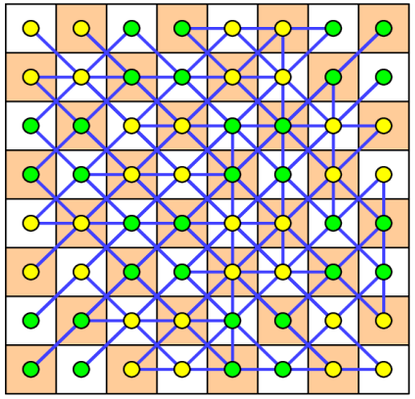
4 pairs of complementary rows

Index of complementary tour: o-47

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-5, 7, 15, 20, 22, 27, 29, 31, 38, 47, 60

Path length: 48 + 165√2 = 281.3



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18	12	57	35	38	64	13	23
9	19	34	60	61	39	22	16
44	30	56	2	7	49	27	45
31	41	3	53	52	6	48	26
37	63	14	24	17	11	58	36
62	40	21	15	10	20	33	59
8	50	28	46	43	29	55	1
51	5	47	25	32	42	4	54

Open Bimagic Queen's Tour o-53

The queen starts her tour from an edge of the board. (Square h2)

S1 Diagonally magic? No: but 2+2 broken magic diagonals.

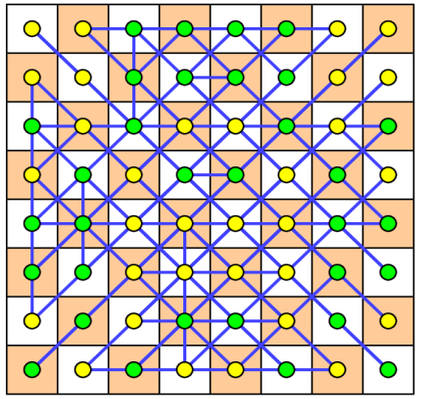
4 pairs of complementary columns

Index of complementary tour: o-55

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-13, 43, 50

Path length: $44 + 150\sqrt{2} = 256.1$



11	36	23	64	57	18	37	14
33	10	61	22	19	60	15	40
6	32	52	42	47	53	25	3
29	7	43	49	56	46	2	28
58	17	38	13	12	35	24	63
20	59	16	39	34	9	62	21
48	54	26	4	5	31	51	41
55	45	1	27	30	8	44	50

Open Bimagic Queen's Tour o-54

The queen starts her tour from an edge of the board. (Square c1)

S1 Diagonally magic? No.

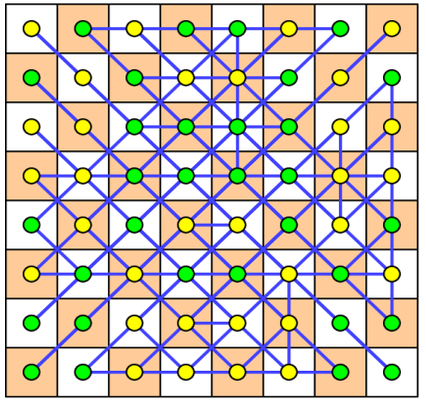
4 pairs of complementary columns

Index of complementary tour: o-01

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-6, 33

Path length: $44 + 149\sqrt{2} = 254.7$



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11	61	23	33	40	18	60	14
64	10	36	22	19	37	15	57
6	32	45	55	50	44	25	3
29	7	54	48	41	51	2	28
39	17	59	13	12	62	24	34
20	38	16	58	63	9	35	21
49	43	26	4	5	31	46	56
42	52	1	27	30	8	53	47

Open Bimagic Queen's Tour o-55

The queen starts her tour from an edge of the board. (Square c1)

S1 Diagonally magic? No: but 2 + 2 broken magic diagonals.

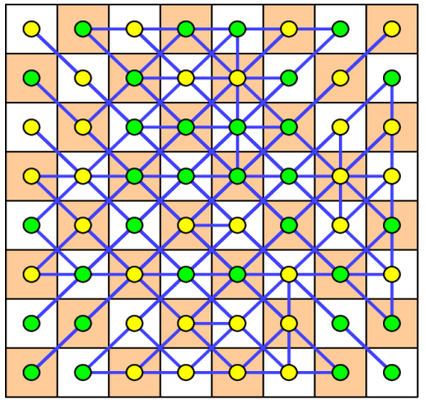
4 pairs of complementary columns

Index of complementary tour: o-53

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-8, 34, 40

Path length: $44 + 150\sqrt{2} = 256.1$



57	23	30	52	38	12	1	47
18	64	53	27	13	35	42	8
31	49	60	22	4	46	39	9
56	26	19	61	43	5	16	34
37	11	2	48	58	24	29	51
14	36	41	7	17	63	54	28
3	45	40	10	32	50	59	21
44	6	15	33	55	25	20	62

Open Bimagic Queen's Tour o-56

The queen starts her tour from an edge of the board. (Square g8)

S1 Diagonally magic? No.

4 pairs of complementary columns

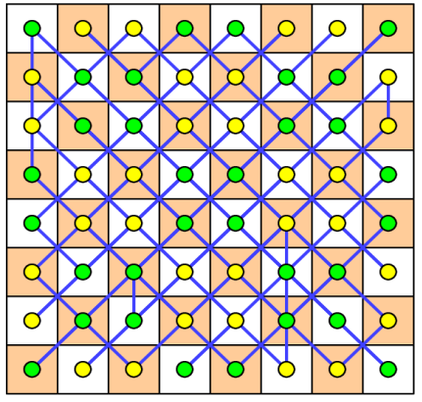
4 pairs of complementary rows

Index of complementary tour: o-25

Moves: orthogonal 4 + 0, diagonal 30 + 29

Transformable into o-25

Path length: $8 + 173\sqrt{2} = 252.7$



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53	27	30	52	42	8	1	47
18	64	57	23	13	35	38	12
31	49	56	26	4	46	43	5
60	22	19	61	39	9	16	34
41	7	2	48	54	28	29	51
14	36	37	11	17	63	58	24
3	45	44	6	32	50	55	25
40	10	15	33	59	21	20	62

Open Bimagic Queen's Tour o-57

The queen starts her tour from an edge of the board. (Square g8)

S1 Diagonally magic? No.

4 pairs of complementary columns

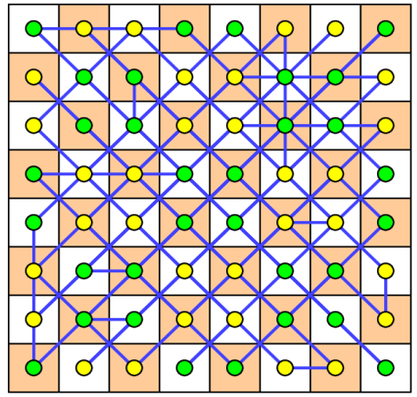
4 pairs of complementary rows

Index of complementary tour: o-18

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-2, 3, 14, 18, 24, 26, 36, 37, 39, 58, 62

Path length: 24 + 165√2 = 257.3



44	25	3	50	55	6	32	45
15	62	40	21	20	33	59	10
2	51	41	28	29	48	54	7
37	24	14	63	58	11	17	36
56	5	31	46	43	26	4	49
19	34	60	9	16	61	39	22
30	47	53	8	1	52	42	27
57	12	18	35	38	23	13	64

Open Bimagic Queen's Tour o-58

The queen starts her tour from square e2.

S1 Diagonally magic? No.

4 pairs of complementary columns

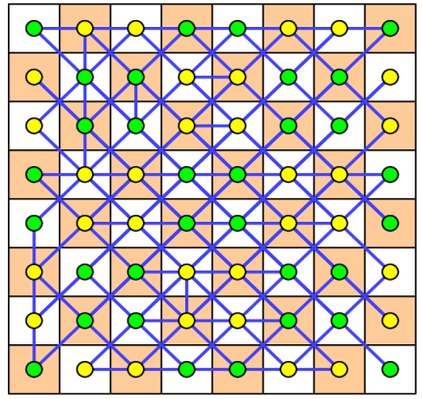
4 pairs of complementary rows

Index of complementary tour: o-26

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-2, 3, 14, 18, 24, 26, 36, 37, 39, 57, 62

Path length: 40 + 165√2 = 273.3



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59	12	1	50	40	23	30	45
13	62	55	8	18	33	44	27
4	51	58	9	31	48	37	22
54	5	16	63	41	26	19	36
39	24	29	46	60	11	2	49
17	34	43	28	14	61	56	7
32	47	38	21	3	52	57	10
42	25	20	35	53	6	15	64

Open Bimagic Queen's Tour o-59

The queen starts her tour from an edge of the board. (Square c8)

S1 Diagonally magic? No.

4 pairs of complementary columns

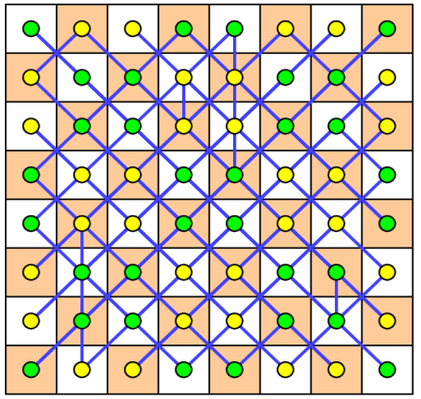
4 pairs of complementary rows

Index of complementary tour: o-35

Moves: orthogonal 4 + 0, diagonal 30 + 29

Transformable into o-35

Path length: 8 + 177√2 = 258.3



55	8	1	50	44	27	30	45
13	62	59	12	18	33	40	23
4	51	54	5	31	48	41	26
58	9	16	63	37	22	19	36
43	28	29	46	56	7	2	49
17	34	39	24	14	61	60	11
32	47	42	25	3	52	53	6
38	21	20	35	57	10	15	64

Open Bimagic Queen's Tour o-60

The queen starts her tour from an edge of the board. (Square c8)

S1 Diagonally magic? No.

4 pairs of complementary columns

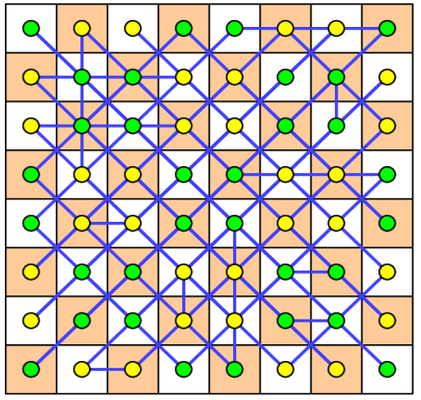
4 pairs of complementary rows

Index of complementary tour: o-22

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-5, 7, 15, 20, 22, 27, 29, 31, 38, 47, 52

Path length: 24 + 169√2 = 263.0



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24	35	15	60	46	25	53	2
36	23	59	16	26	45	1	54
10	61	17	38	52	7	43	32
62	9	37	18	8	51	31	44
47	28	56	3	21	34	14	57
27	48	4	55	33	22	58	13
49	6	42	29	11	64	20	39
5	50	30	41	63	12	40	19

Open Bimagic Queen's Tour o-61

The queen starts her tour from square g7.

Dudeney Group III (translated symmetric)

S1 Diagonally magic? No: but 2+2 broken magic diagonals.

4 pairs of complementary columns

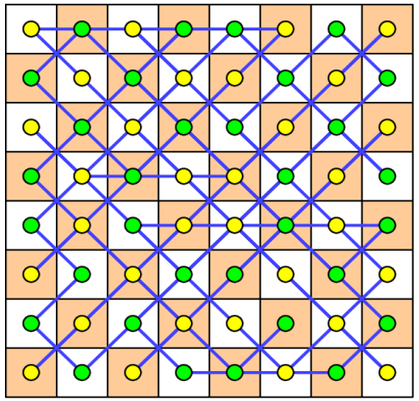
4 pairs of complementary rows

Index of complementary tour: o-11

Moves: orthogonal 4 + 0, diagonal 31 + 28

Transformable into o-11

Path length: 16 + 117√2 = 181.5



35	8	9	46	63	28	21	50
18	53	60	31	14	41	40	3
12	47	34	5	24	51	62	25
57	30	19	56	37	2	15	44
64	27	22	49	36	7	10	45
13	42	39	4	17	54	59	32
23	52	61	26	11	48	33	6
38	1	16	43	58	29	20	55

Open Bimagic Queen's Tour o-62

The queen starts her tour from an edge of the board. (Square b1)

S1 Diagonally magic? No.

4 pairs of complementary columns

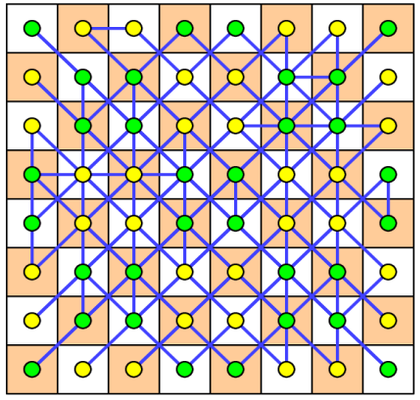
4 pairs of complementary rows

Index of complementary tour: o-02

Moves: orthogonal 8 + 4, diagonal 26 + 25

Transformable into o-2, 3, 14, 18, 24, 26, 36, 37, 39, 57, 58

Path length: 40 + 165√2 = 273.3



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Appendix Erratum

In the first edition of this paper there was a duplication of the left-hand illustration of the tour o-43 in tour o-44. We are grateful to Bogdan Golunski for pointing this out. On the 7th September 2020 the correct illustration for the tour o-44 was inserted. The properties and the line path illustration of the tour o-44 remain unchanged.

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