

Cycle Structures

Introduction

A cycle structure is basically a means of representing a series of disjoint N-cycles of cube pieces. Given a number of pieces that can move within their orbit, there are many possible cases of decomposing a permutation into disjoint cycles. This is better shown on an exemple. If we take 15 center pieces, a possible cycle structure would be:

$$1 \text{ 4-cycle} + 1 \text{ 6-cycle} + 2 \text{ 5-cycles}$$

a more straightforward structure would be:

$$3 \text{ 5-cycles}$$

Permutation Parity

N-cycles are particular permutations of cube pieces where N pieces are permuted in a *single* cycle. Among them are *even* parity permutations, for which an *odd* number of pieces are permuted and *odd* parity permutations where an *even* number of pieces are permuted. Disjoint cycles can be combined where the parity of the composed permutation is obtained simply by applying the following rules:

- even + even = even
- even + odd = odd
- odd + even = odd
- odd + odd = even
- even x even = even
- even x odd = even
- odd x even = even
- odd x odd = odd

Pieces can only move within their respective orbits on a cube, so that a given orbit contains:

- 8 corner pieces, of 3 stickers each, or
- 12 midge pieces, of 2 stickers each, or
- 24 edge pieces, of 2 stickers each, or
- 24 center pieces, of 1 sticker each, or
- 6 true center pieces, of 1 sticker each

Orientation Parity

Corners, midges and true centers do also present orientation parity. This means that *both* permutation *and* orientation parities must be even for their orbits to be of even parity:

- sum of corner twists = 0 (modulo 3)
- sum of midge flips = 0 (modulo 2)
- sum of true center orientations = 0° or 180° (modulo 360°)

Midges can be flipped whereas edges can only be swapped ie. there can't be any orientation parity with edges, only permutation parity.

Let's consider for example the case of a twisted corner 5-cycle, where 5 corner pieces are permuted and 1 out of the 5 permuted corner and 1 unpermuted corner are twisted. The permutation parity is even because there is an odd number of permuted pieces but the orientation parity may be odd or even, depending on the sum of the 6 twists. If the sum is equal to 0 (modulo 3), then both permutation *and* orientation parities are even and thus the orbit of corner pieces is also of even parity.

The same reasoning can also be applied to flipped midges N-cycles.

Permutation of True Centers

Due to mechanical restrictions, true centers do not behave exactly as other centers do. But the same permutation laws apply to them with the added feature of orientation parity. Main restrictions are listed below:

- 1- Only 4-spot and 6-spot true center permutations are legal
- 2- Opposed centers will always stay opposed through any legal move
- 3- For a solved cube, the sum of the orientations of all centers will always be equal either to 0° or 180° modulo 360°

Cycle structures of true center permutations, shown in the table below, are either of even or of odd parity. Odd parity permutations imply that other pieces are messed up, eg. edges, so they aren't really usable for displaying letters on cube centers only. In the 6-spot even parity case, there are two 3-cycles of true centers. Again this is not a suitable case because only opposed centers are to be swapped, ie only 2-cycles can be used. The only remaining case is thus the 4-spot two 2-cycles case. This means that only 0 or 2 letters using true centers can be displayed on the cube.

True Centers – Cycle Structures			
N-spot	Cycle Structure	Note	Permutation Parity
4-spot	2-cycle + 2-cycle	2-cycles: 2 <i>opposed</i> centers	even
4-spot	2-cycle + 2-cycle + 2-cycle	–	odd
6-spot	3-cycle + 3-cycle	3-cycles: 3 <i>adjacent</i> centers	even
6-spot	2-cycle + 2-cycle + 2-cycle	–	odd

Tables of Cycle Structures

Cycle structures are given in tables below. For centers/edges, it can be seen that there are exactly 792 even parity cases and 781 odd parity cases.

If we consider the even parity cycle structure at index 287, we can see that it is composed of:

3 4-cycles + 1 6-cycle + 2 3-cycles, which is obviously of even parity, because:

$$\text{odd} + \text{odd} + \text{even} = \text{even}.$$

Corners

Cycle Decomposition Table – Untwisted & Twisted Corner Cycles – Even Parity Permutations								
	Untwisted Corner Cycles				Twisted Corner Cycles			
ix	Cycles	Corners	Stickers	Order	Cycles	Corners	Stickers	Order
1	7c	7	21	7	7c + 1t	8	24	21
2	5c	5	15	5	5c + 1t	6	18	15
3	3c	3	9	3	3c + 1t	4	12	9
4	3c + 5c	8	24	15	–	–	–	–
5	2 3c	6	18	3	2 3c + 1t	7	21	9
6	2 4c	8	24	4	–	–	–	–
7	2c + 6c	8	24	6	–	–	–	–
8	2c + 4c	6	18	4	2c + 4c + 1t	7	21	18
9	2 2c	4	12	2	2 2c + 1t	5	15	6
10	2 2c + 3c	7	21	6	2 2c + 3c + 1t	8	24	18
11	4 2c	8	24	2	–	–	–	–

Cycle Decomposition Table – Even Parity Permutations – Up To 8 Permuted Corners

ix	Odd Parity Cycles				Even Parity Cycles		
	2c	4c	6c	8c	3c	5c	7c
1							1
2						1	
3					1		
4					1	1	
5					2		
6		2					
7	1		1				
8	1	1					
9	2						
10	2				1		
11	4						

Cycle Decomposition Table – Odd Parity Permutations – Up To 8 Permuted Corners							
	Odd Parity Cycles				Even Parity Cycles		
ix	2c	4c	6c	8c	3c	5c	7c
1				1			
2			1				
3		1					
4		1			1		
5	1					1	
6	1				1		
7	1				2		
8	2	1					
9	3						

Edges

Cycle Decomposition Table – Unflipped & Flipped Midge Cycles – Even Parity Permutations								
	Unflipped Midge Cycles				Flipped Midge Cycles			
ix	Cycles	Midges	Stickers	Order	Cycles	Midges	Stickers	Order
1	11c	11	22	11	11c + 1f	12	24	22
2	9c	9	18	9	9c + 1f	10	20	18
3	7c	7	14	7	7c + 1f	8	16	14
4	5c	5	10	5	5c + 1f	6	12	10
5	5c + 7c	12	24	35	–	–	–	–
6	2 5c	10	20	5	2 5c + 1f	11	22	10
7	3c	3	6	3	3c + 1f	4	8	6
8	3c + 9c	12	24	9	–	–	–	–
9	3c + 7c	10	20	21	3c + 7c + 1f	11	22	42
10	3c + 5c	8	16	15	3c + 5c + 1f	9	18	30
11	2 3c	6	12	3	2 3c + 1f	7	14	6
12	2 3c + 5c	11	22	15	2 3c + 5c + 1f	12	24	30
13	3 3c	9	18	3	3 3c + 1f	10	20	6
14	4 3c	12	24	3	–	–	–	–
15	2 6c	12	24	6	–	–	–	–
16	4c + 8c	12	24	8	–	–	–	–
17	4c + 6c	10	20	12	4c + 6c + 1f	11	22	24
18	2 4c	8	16	4	2 4c + 1f	9	18	8
19	2 4c + 3c	11	22	12	2 4c + 3c + 1f	12	24	24
20	2c + 10c	12	24	10	–	–	–	–
21	2c + 8c	10	20	8	2c + 8c + 1f	11	22	16
22	2c + 6c	8	16	6	2c + 6c + 1f	9	18	12
23	2c + 6c + 3c	11	22	6	2c + 6c + 3c + 1f	12	24	12
24	2c + 4c	6	12	4	2c + 4c + 1f	7	14	8
25	2c + 4c + 5c	11	22	20	2c + 4c + 5c + 1f	12	24	40
26	2c + 4c + 3c	9	18	12	2c + 4c + 3c + 1f	10	20	24
27	2c + 4c + 2 3c	12	24	12	–	–	–	–
28	2 2c	4	8	2	2 2c + 1f	5	10	4
29	2 2c + 7c	11	22	14	2 2c + 7c + 1f	12	24	28
30	2 2c + 5c	9	18	10	2 2c + 5c + 1f	10	20	20
31	2 2c + 3c	7	14	6	2 2c + 3c + 1f	8	16	12
32	2 2c + 3c + 5c	12	24	30	–	–	–	–
33	2 2c + 2 3c	10	20	6	2 2c + 2 3c + 1f	11	22	12
34	2 2c + 2 4c	12	24	4	–	–	–	–
35	3 2c + 6c	12	24	6	–	–	–	–
36	3 2c + 4c	10	20	4	3 2c + 4c + 1f	11	22	8
37	4 2c	8	16	2	4 2c + 1f	9	18	4
38	4 2c + 3c	11	22	6	4 2c + 3c + 1f	12	24	12
39	6 2c	12	24	2	–	–	–	–

Cycle Decomposition Table – Even Parity Permutations – Up To 12 Permuted Midges											
	Odd Parity Cycles						Even Parity Cycles				
ix	2c	4c	6c	8c	10c	12c	3c	5c	7c	9c	11c
1											1
2										1	
3									1		
4								1			
5							1	1	1		
6							2				
7							1				
8							1			1	
9							1		1		
10							1	1	1		
11							2				
12							2	1			
13							3				
14							4				
15			2								
16		1		1							
17		1	1								
18		2									
19		2					1				
20	1				1						
21	1			1							
22	1		1								
23	1		1				1				
24	1	1									
25	1	1						1			
26	1	1						1			
27	1	1					2				
28	2										
29	2								1		
30	2							1			
31	2							1			
32	2							1	1		
33	2							2			
34	2	2									
35	3		1								
36	3	1									
37	4										
38	4						1				
39	6										

Cycle Decomposition Table – Even Parity Permutations – Up To 12 Permuted Midges											
	Odd Parity Cycles						Even Parity Cycles				
ix	2c	4c	6c	8c	10c	12c	3c	5c	7c	9c	11c
1											1
2										1	
3									1		
4								1			
5							1	1	1		
6							2				
7							1				
8							1			1	
9							1		1		
10							1	1	1		
11							2				
12							2	1			
13							3				
14							4				
15			2								
16		1		1							
17		1	1								
18		2									
19		2					1				
20	1				1						
21	1			1							
22	1		1								
23	1		1				1				
24	1	1									
25	1	1						1			
26	1	1						1			
27	1	1					2				
28	2										
29	2								1		
30	2							1			
31	2							1			
32	2							1	1		
33	2							2			
34	2	2									
35	3		1								
36	3	1									
37	4										
38	4						1				
39	6										

Cycle Decomposition Table – Odd Parity Permutations – Up To 12 Permuted Midges

	Odd Parity Cycles						Even Parity Cycles				
ix	2c	4c	6c	8c	10c	12c	3c	5c	7c	9c	11c
1						1					
2					1						
3				1							
4				1			1				
5			1								
6			1					1			
7			1				1				
8			1				2				
9		1									
10		1							1		
11		1						1			
12		1					1				
13		1					1	1			
14		1					2				
15		3									
16	1									1	
17	1								1		
18	1							1			
19	1							2			
20	1						1				
21	1						1		1		
22	1						1	1			
23	1							2			
24	1							3			
25	1	1	1								
26	1	2									
27	2			1							
28	2			1							
29	2	1									
30	2	1					1				
31	3										
32	3							1			
33	3								1		
34	3							2			
35	4	1									
36	5										

Centers/Edges – Even Parity Permutations

	Cycle Decomposition Table – Even Parity Permutations – Up To 24 Permuted Centers/Edges																							
	Odd Parity Cycles												Even Parity Cycles											
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c	
1																								1
2																								1
3																								1
4																								1
5																								1
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46																								1
47																								1
48																								1
49																								1
50																								1
51																								1
52																								1
53																								1
54																								1
55																								2

Cycle Decomposition Table – Even Parity Permutations – Up To 24 Permuted Centers/Edges																								
	Odd Parity Cycles												Even Parity Cycles											
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c	
56													1		1									
57													1		1								1	
58													1		1								1	
59													1		1	1								
60													1		2									
61													1		3									
62													1	1										
63													1	1									1	
64													1	1								1		
65													1	1			1							
66													1	1			1							
67													1	1	1									
68													1	1	1	1								
69													1	1	2									
70													1	2										
71													1	2								1		
72													1	2			1							
73													1	2	1									
74													1	3										
75													1	4										
76													2											
77													2										1	
78													2										1	
79													2									1		
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81													2			1								
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83													2		1									
84													2		1			1						
85													2		1	1								
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92													2	2										
93													2	2	1									
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97													3										1	
98													3									1		
99													3			1								
100													3			1								
101													3			2								
102													3	1										
103													3	1			1							
104													3	1	1									
105													3	2										
106													3	3										
107													4											
108													4									1		
109													4				1							
110													4			1								

Cycle Decomposition Table – Even Parity Permutations – Up To 24 Permuted Centers/Edges																								
	Odd Parity Cycles												Even Parity Cycles											
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c	
111													4	1										
112													4	1	1									
113													4	2										
114													5											
115													5			1								
116													5		1									
117													5	1										
118													6											
119													6	1										
120													7											
121													8											
122													2											
123													1	1										
124													1	1										
125													2											
126													2											
127													1		1									
128													1											
129													1	1										
130													1	1										
131													1	1										
132													1	1										
133													1											
134													1	1										
135													2											
136													2											
137													2											
138													2											
139													2											
140													2											
141													1		1									
142													1											
143													1	1										
144													1	1										
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153													1	1										
154													2											
155													1	1										
156													1	1										
157													1	1										
158													1											
159													2											
160													1											
161													1											
162													1	1										
163													2											
164													3											
165													2											

Cycle Decomposition Table – Even Parity Permutations – Up To 24 Permuted Centers/Edges																							
	Odd Parity Cycles												Even Parity Cycles										
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c
166																					1		
167																					1		
168																					1		
169																					1		
170																				1	1		
171																				2			
172																1							
173																1			1				
174																1		1					
175																1	1						
176																2							
177																2	1						
178																3							
179																4							
180												4											
181		1														1							
182		1														1							
183		1														1							
184		1														1							
185		1														1							
186		1															1						
187		1															1						
188		1														2							
189		1																1					
190		1																1					
191		1																1					
192		1															1						
193		1															1	1					
194		1														2							
195		1																	1				
196		1																	1				
197		1																	1				
198		1																1					
199		1															2						
200		1															1						
201		1															1		1				
202		1															1	1					
203		1															2						
204		1															3						
205		1																	1				
206		1																	1				
207		1																	1				
208		1																1					
209		1																1					
210		1																1	1				
211		1																2					
212		1															1						
213		1															1		1				
214		1															1	1					
215		1															1	1					
216		1															2						
217		1															2	1					
218		1															3						
219		1															4						
220		1	1																				

Cycle Decomposition Table – Even Parity Permutations – Up To 24 Permuted Centers/Edges															Even Parity Cycles								
	Odd Parity Cycles												Even Parity Cycles										
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c
221		1	1																			1	
222		1	1																			1	
223		1	1																			1	
224		1	1																			1	
225		1	1																			2	
226		1	1																			1	
227		1	1																			1	
228		1	1																			1	
229		1	1																			2	
230		1	1																			1	
231		1	1																			1	
232		1	1																			1	
233		1	1																			1	
234		1	1																			1	
235		1	1																			1	
236		1	1																			2	
237		1	1																			2	
238		1	1																			1	
239		1	1																			3	
240		1	1																			3	
241		1	1																			4	
242		1	2	1																			
243		1	3																				
244		2																					
245		2																				1	
246		2																				1	
247		2																				1	
248		2																				1	
249		2																				1	
250		2																				1	
251		2																				2	
252		2																				1	
253		2																				1	
254		2																				1	
255		2																				1	
256		2																				2	
257		2																				3	
258		2																				1	
259		2																				1	
260		2																				1	
261		2																				1	
262		2																				1	
263		2																				1	
264		2																				1	
265		2																				2	
266		2																				2	
267		2																				1	
268		2																				2	
269		2																				1	
270		2																				2	
271		2																				3	
272		2																				3	
273		2																				1	
274		2																				4	
275		2																				5	

Cycle Decomposition Table – Even Parity Permutations – Up To 24 Permuted Centers/Edges																							
	Odd Parity Cycles												Even Parity Cycles										
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c
276				2																			
277			2	1					1														
278			2	1	1																		
279			2	2																			
280			2	2												1							
281			3						1														
282			3						1														
283			3					1															
284			3				1									1							
285			3	1																			
286			3	1													1						
287			3	1													1						
288			3	1													2						
289			4																				
290			4															1					
291			4															1					
292			4															1					
293			4														1	1					
294			4														2						
295			6																				
296	1														1								
297	1														1								
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314	1					1											2						
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325	1				1													1	1				
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327	1				1												1						
328	1				1												1			1			
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330	1				1												1	1					

Cycle Decomposition Table – Even Parity Permutations – Up To 24 Permuted Centers/Edges																								
	Odd Parity Cycles												Even Parity Cycles											
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c	
331	1						1						2											
332	1						1						2	1										
333	1						1						3											
334	1						1						4											
335	1					1																		
336	1					1													1					
337	1					1												1						
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339	1					1											1							
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344	1					1											2							
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350	1					1											1	2						
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354	1					1											3							
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356	1					1											4							
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379	1					1											2							
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385	1					1											3		1					

Cycle Decomposition Table – Even Parity Permutations – Up To 24 Permuted Centers/Edges																								
	Odd Parity Cycles										Even Parity Cycles													
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c	
386	1		1										3	1										
387	1		1										4											
388	1		1										5											
389	1		1	2																				
390	1		2		1																			
391	1		2	1																				
392	1		3																					
393	1		3										1											
394	1	1																						
395	1	1																				1		
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397	1	1																			1			
398	1	1																			1			
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400	1	1																			2			
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404	1	1																			2			
405	1	1																			1			
406	1	1																			1			
407	1	1																			1			
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409	1	1																			1			
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411	1	1																			2	1		
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431	1	1																			2	2		
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434	1	1																			3		1	
435	1	1																			3	1		
436	1	1																			4			
437	1	1																			4	1		
438	1	1																			5			
439	1	1																			6			
440	1	1		1	1																			

Cycle Decomposition Table – Even Parity Permutations – Up To 24 Permuted Centers/Edges																							
	Odd Parity Cycles												Even Parity Cycles										
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c
441	1	1			2																		
442	1	1	1						1														
443	1	1	1			1																	
444	1	1	1	1																			
445	1	1	1	1									1										
446	1	1	2																				
447	1	1	2										1										
448	1	1	2										1										
449	1	1	2										2										
450	1	2					1																
451	1	2				1																	
452	1	2				1																	
453	1	2				1							1										
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471	1	3												1	1								
472	1	3												2									
473	1	3												3									
474	1	4	1																				
475	1	5																					
476	2																						
477	2																			1			
478	2																			1			
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480	2																		1				
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487	2														1	1							
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492	2														1								
493	2														1			1					
494	2														1	1							
495	2														1	1							

	Odd Parity Cycles												Even Parity Cycles											
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c	
496	2												1	2										
497	2												2											
498	2												2		1									
499	2												2	1										
500	2												3											
501	2												4											
502	2												1											
503	2												1										1	
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510	2												1		2									
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514	2												1	1	1									
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516	2												1	2	1									
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518	2												2											
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522	2												2		1									
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524	2												2	1										
525	2												2	1									1	
526	2												2	1	1									
527	2												2	2										
528	2												3											
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531	2												3		1									
532	2												3	1										
533	2												3	2										
534	2												4											
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536	2												4	1										
537	2												5											
538	2												5	1										
539	2												6											
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541	2						1		1															
542	2						1	1																
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548	2	1							1					1										
549	2	1	1														1							
550	2	1	1														1							

Cycle Decomposition Table – Even Parity Permutations – Up To 24 Permuted Centers/Edges																								
	Odd Parity Cycles												Even Parity Cycles											
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c	
551	2		1	1									1											
552	2		1	1									2											
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599	2	3											1											
600	2	3	1																					
601	2	4																						
602	2	4																						
603	3												1											
604	3												1											
605	3												1											

Cycle Decomposition Table – Even Parity Permutations – Up To 24 Permuted Centers/Edges																							
	Odd Parity Cycles												Even Parity Cycles										
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c
606	3						1						1										
607	3							1															
608	3							1							1								
609	3							1						1									
610	3							1					2										
611	3							1															
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613	3							1							1								
614	3							1						1									
615	3							1						1	1								
616	3							1					2										
617	3							1															
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619	3							1							1								
620	3							1						1									
621	3							1						2									
622	3							1						1									
623	3							1						1	1								
624	3							1						1	1								
625	3							1						2									
626	3							1						3									
627	3							1															
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632	3							1							1	1							
633	3							1						2									
634	3							1						1									
635	3							1						1				1					
636	3							1						1	1								
637	3							1						1	1								
638	3							1						2									
639	3							1						2	1								
640	3							1						3									
641	3							1						4									
642	3							3															
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649	3	1													1								
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653	3	1													1								
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658	3	1													1	2							
659	3	1													2								
660	3	1													2		1						

Cycle Decomposition Table – Even Parity Permutations – Up To 24 Permuted Centers/Edges																								
	Odd Parity Cycles												Even Parity Cycles											
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c	
661	3	1											2	1										
662	3	1												3										
663	3	1												3	1									
664	3	1												4										
665	3	1	1	1																				
666	3	1	2																					
667	3	2							1															
668	3	2						1																
669	3	2	1																					
670	3	2	1											1										
671	3	3																						
672	3	3													1									
673	3	3													1									
674	3	3													2									
675	4																							
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680	4																						1	
681	4																						1	
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686	4																						1	
687	4																						2	
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689	4															1								
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696	4															1	2							
697	4																2							
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700	4																2	1						
701	4																2	2						
702	4																	3						
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705	4																	4						
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709	4																1							
710	4																2							
711	4																1							
712	4	1															1							
713	4	1															1							
714	4	1															1							
715	4	1															1							

Cycle Decomposition Table – Even Parity Permutations – Up To 24 Permuted Centers/Edges																								
	Odd Parity Cycles												Even Parity Cycles											
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c	
716	4	1	1																					
717	4	1	1																					
718	4	1	1																					
719	4	1	1																					
720	4	2																						
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724	4	2																						
725	4	2																						
726	4	4																						
727	5																							
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766	6																							
767	6																							
768	6		2																					
769	6	1	1	1																				
770	6	1	1	1																				

Cycle Decomposition Table – Even Parity Permutations – Up To 24 Permuted Centers/Edges															Even Parity Cycles									
	Odd Parity Cycles										Even Parity Cycles													
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c	
771	6	2																						
772	6	2																						
773	7								1															
774	7								1															
775	7						1																	
776	7						1																	
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778	7	1																						
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780	7	1																						
781	8																							
782	8																							
783	8																							
784	8																							
785	8																							
786	8																							
787	8	2																						
788	9								1															
789	9	1																						
790	10																							
791	10																							
792	12																							

Centers/Edges – Odd Parity Permutations

	Cycle Decomposition Table – Odd Parity Permutations – Up To 24 Permuted Centers/Edges												Even Parity Cycles											
	Odd Parity Cycles												Even Parity Cycles											
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c	
1												1												
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55												1												

Cycle Decomposition Table – Odd Parity Permutations – Up To 24 Permuted Centers/Edges																							
	Odd Parity Cycles												Even Parity Cycles										
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c
56							1						2										
57							1						2		1								
58							1						2	1									
59							1						3										
60							1						3	1									
61							1						4										
62							1																
63							1											1					
64							1											1					
65							1											1					
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89							1											3					
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110							1											1	1				

	Odd Parity Cycles												Even Parity Cycles											
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c	
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165	1																					1		

Cycle Decomposition Table – Odd Parity Permutations – Up To 24 Permuted Centers/Edges															Even Parity Cycles									
	Odd Parity Cycles												Even Parity Cycles											
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Cycle Decomposition Table – Odd Parity Permutations – Up To 24 Permuted Centers/Edges																							
	Odd Parity Cycles												Even Parity Cycles										
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272	3																	4					
273	3	2																					
274	4			1																			
275	4	1																					

Cycle Decomposition Table – Odd Parity Permutations – Up To 24 Permuted Centers/Edges																							
	Odd Parity Cycles												Even Parity Cycles										
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Cycle Decomposition Table – Odd Parity Permutations – Up To 24 Permuted Centers/Edges																								
	Odd Parity Cycles												Even Parity Cycles											
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c	
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Cycle Decomposition Table – Odd Parity Permutations – Up To 24 Permuted Centers/Edges																							
	Odd Parity Cycles												Even Parity Cycles										
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Cycle Decomposition Table – Odd Parity Permutations – Up To 24 Permuted Centers/Edges															Even Parity Cycles									
	Odd Parity Cycles												Even Parity Cycles											
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c	
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Cycle Decomposition Table – Odd Parity Permutations – Up To 24 Permuted Centers/Edges																							
	Odd Parity Cycles												Even Parity Cycles										
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Cycle Decomposition Table – Odd Parity Permutations – Up To 24 Permuted Centers/Edges																							
	Odd Parity Cycles												Even Parity Cycles										
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Cycle Decomposition Table – Odd Parity Permutations – Up To 24 Permuted Centers/Edges																								
	Odd Parity Cycles												Even Parity Cycles											
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624	3												2	2										
625	3												3											
626	3												3					1						
627	3												3		1									
628	3												3	1										
629	3												4											
630	3												4	1										
631	3												5											
632	3												6											
633	3						1	1																
634	3						2																	
635	3				1				1															
636	3				1				1															
637	3				1	1																		
638	3				1	1											1							
639	3				2																			
640	3				2													1						
641	3				2													1						
642	3				2												2							
643	3	1							1															
644	3	1							1															
645	3	1							1															
646	3	1							1								1							
647	3	1							1															
648	3	1							1									1						
649	3	1							1									1						
650	3	1							1								2							
651	3	1	1																					
652	3	1	1																1					
653	3	1	1																1					
654	3	1	1														1							
655	3	1	1														1	1						
656	3	1	1														2							
657	3	2																						
658	3	2																						
659	3	2																1						
660	3	2															1							

Cycle Decomposition Table – Odd Parity Permutations – Up To 24 Permuted Centers/Edges																							
	Odd Parity Cycles												Even Parity Cycles										
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c
661	3	2											2										
662	3	2											1										
663	3	2											1		1								
664	3	2											1	1									
665	3	2											2										
666	3	2											3										
667	3	3	1																				
668	3	4																					
669	4												1										
670	4												1										
671	4												1										
672	4												1										
673	4												1										
674	4												1										
675	4												1										
676	4												2										
677	4												1										
678	4												1										
679	4												1										
680	4												1										
681	4												1		1								
682	4												2										
683	4		1																				
684	4		1																				
685	4		1																				
686	4		1																				
687	4		1																				
688	4		1																				
689	4		1																				
690	4		1																				
691	4		1																				
692	4		1																				
693	4	1																					
694	4	1																					
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697	4	1																					
698	4	1																					
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702	4	1																					
703	4	1																					
704	4	1																					
705	4	1																					
706	4	1																					
707	4	1																					
708	4	1	2																				
709	4	2		1																			
710	4	2	1																				
711	4	3																					
712	4	3													1								
713	5																						
714	5																			1			
715	5																			1			

Cycle Decomposition Table – Odd Parity Permutations – Up To 24 Permuted Centers/Edges																								
	Odd Parity Cycles												Even Parity Cycles											
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c	
716	5																							1
717	5																							1
718	5																							2
719	5																							1
720	5																							1
721	5																							1
722	5																							2
723	5																							1
724	5																							1
725	5																							1
726	5																							1
727	5																							1
728	5																							2
729	5																							2
730	5																							1
731	5																							2
732	5																							3
733	5																							3
734	5																							4
735	5												1	1										
736	5												2											
737	5	1											1											
738	5	1											1											
739	5	1	1																					
740	5	1	1																					1
741	5	2																						
742	5	2																						1
743	5	2																						1
744	5	2																						2
745	6																							1
746	6																							1
747	6												1											
748	6												1											1
749	6												1											
750	6												1											1
751	6												1											1
752	6												1											2
753	6	1																						
754	6	1																						1
755	6	1																						1
756	6	1																						1
757	6	1																						1
758	6	1																						2
759	6	3																						
760	7																							
761	7																							1
762	7																							1
763	7																							1
764	7																							2
765	7																							1
766	7																							1
767	7																							1
768	7																							2
769	7																							3
770	7	1	1	1																				

Cycle Decomposition Table – Odd Parity Permutations – Up To 24 Permuted Centers/Edges															Even Parity Cycles											
	Odd Parity Cycles												Even Parity Cycles													
ix	2c	4c	6c	8c	10c	12c	14c	16c	18c	20c	22c	24c	3c	5c	7c	9c	11c	13c	15c	17c	19c	21c	23c			
771	7	2																								
772	8								1																	
773	8			1																						
774	8	1																								
775	8	1													1											
776	9																									
777	9																									
778	9															1										
779	9																2									
780	10	1																								
781	11																									