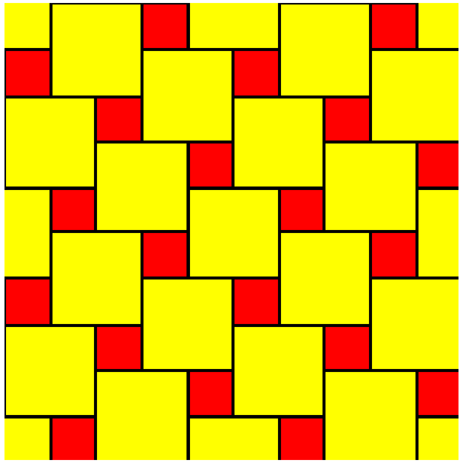
Pretty Patterns

on NxNxN Cubes

Algorithm Viewer

// Pythagorean Tiling



http://en.wikipedia.org/wiki/Pythagorean_tiling

// Pythagorean Tiling
// 6x6x6 Cube

// Corners:
// 2 3-cycles: (C0 C4 C6) (C1 C7 C3)
// (HUO) (AKR)

// 2 twisted in-place: C2, C5
// (BLS) (GXN)

// Corners (SCS: 26 f))
R B' R F' D F D' R' B D F' D' F R' U R2 U' F L2 F' U R2 U' F L2 F'

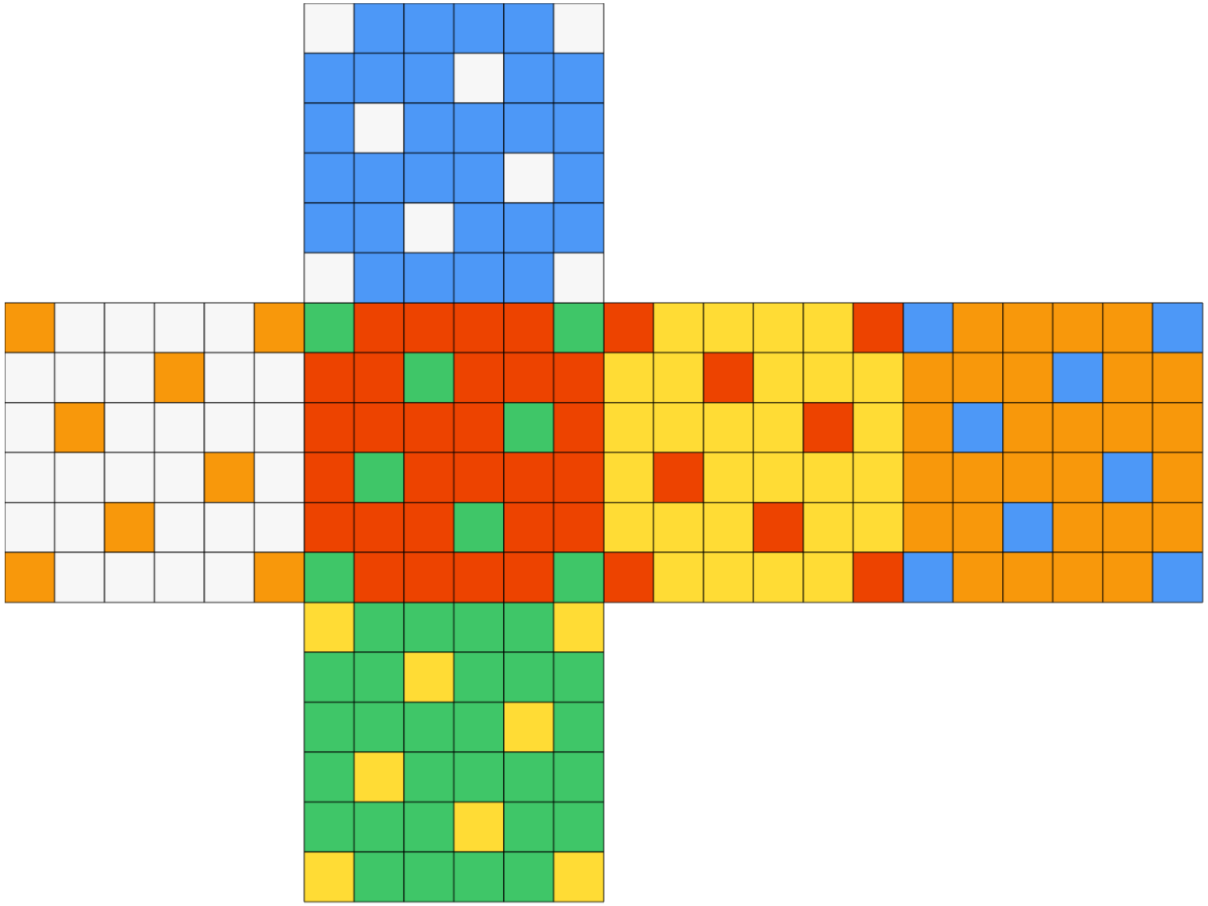
// Corners (CubeExplorer: 18 f*))
L' R D' B2 F2 U2 L2 R2 U' L R' D' L2 R2 D2 B2 F2 U'

// Corners (Symmetric Commutator --- Point Reflection)
// [L' R, D' B2 F2 U2 L2 R2 U']$_{s=24}$ --- [X Y, Z P Q A G H I]$_{s=24}$

// Corners (Optimized with S moves: 12 m)
SR D' SF2 U2 SR2 U' SR' D' SR2 D2 SF2 U'

// Centers (Commutators: 16 m)
[N2F, N3L]
[N3F, N2R']
[N3B', N2L]
[N2B', N3R']

// Algorithm (28 moves) (48 permuted stickers) (Permutation order: 3):
SR D' SF2 U2 SR2 U' SR' D' SR2 D2 SF2 U' NF N3L NF' N3L' N3F NR' N3F' NR N3B' NL N3B NL' NB' N3R' NB N3R



Pythagorean Tiling 6x6x6

	1	2	3	3	2	1	
1							1
2							2
3							3
3							3
2							2
1							1
	1	2	3	3	2	1	

Pythagorean Tiling 6x6x6

// Pythagorean Tiling
// 11x11x11 Cube

// Corners (Optimized: 12 m)
SR D' SF2 U2 SR2 U' SR' D' SR2 D2 SF2 U'

// Midges (4 3-Cycles: 44 m)
(F') [(B R B'), MR'] (F)
(B) [(F' L' F), MR'] (B')
(D2 F) [(B' L B), MR'] (F' D2)
(U2 B') [(F R' F'), MR'] (B U2)

// Midges (SCS: 18m)
MF' SL' D MR2 D' SL D MR2 D' SR U' MR2 U SR' U' MR2 U MF

// Centers 1
[N2F N5B', N3L N4R']

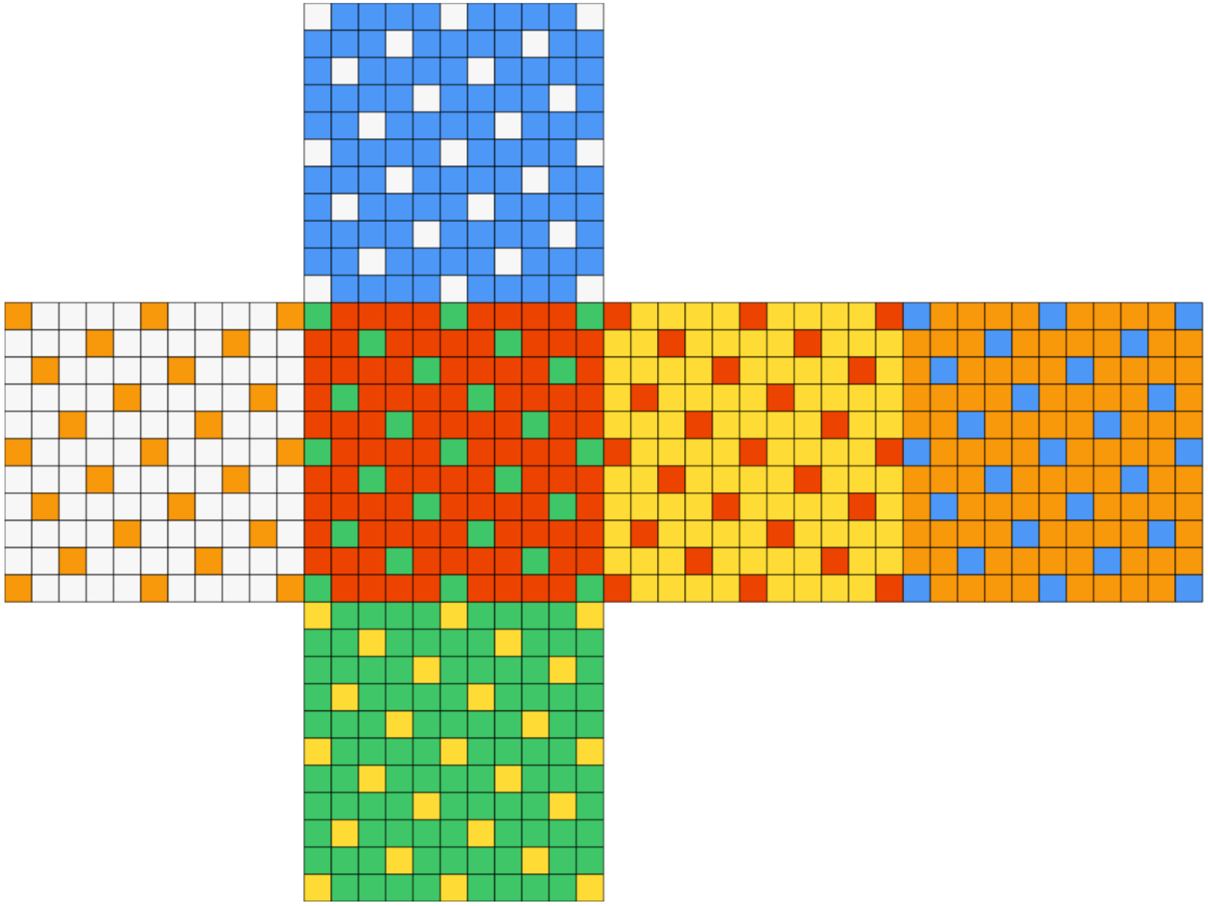
// Centers 2
[N3F N4B', N5L N2R']

// Centers 3
[N4F N3B', N2L N5R']

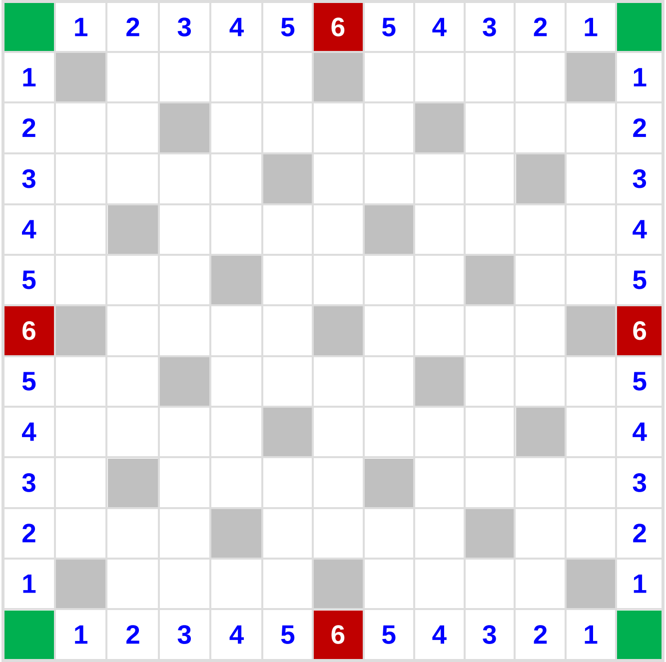
// Centers 4
[N5F N2B', N4L N3R']

// True Centers
[MR, MU]

// Algorithm (66 moves) (150 permuted stickers) (Permutation order: 3):
SR D' SF2 U2 SR2 U' SR' D' SR2 D2 SF2 U' MF' SL' D MR2 D' SL D MR2 D' SR U' MR2 U SR' U' MR2 U MF NF N5B' N3L N4R' N5B NF' N4R N3L' N3F N4B' N5L NR' N4B N3F' NR N5L' N4F N3B' NL N5R' N3B N4F' N5R NL' N5F NB' N4L N3R' NB N5F' N3R MR N4L' MU MR' MU'



Pythagorean Tiling 11x11x11



Pythagorean Tiling 11x11x11

// Pythagorean Tiling
// 16x16x16

// Corners (Optimized: 12 m)
SR D' SF2 U2 SR2 U' SR' D' SR2 D2 SF2 U'

// Midges (4 3-Cycles: 44 m)
(F') [(B R B'), N6L N6R'] (F)
(B) [(F' L' F), N6L N6R'] (B')
(D2 F) [(B' L B), N6L N6R'] (F' D2)
(U2 B') [(F R' F'), N6L N6R'] (B U2)

// Centers 1
[N2F N7F N5B', N3L N8L N4R']

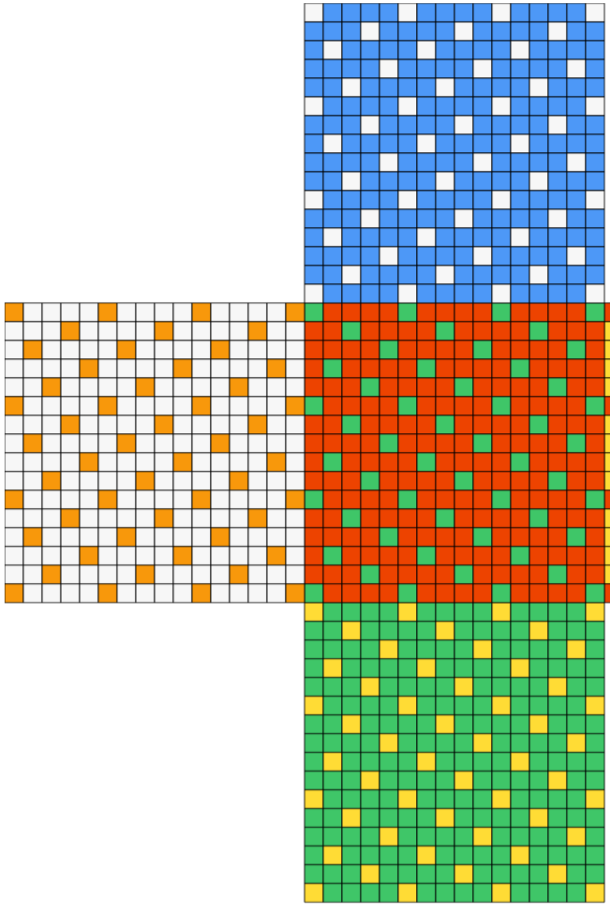
// Centers 2
[N3F N8F N4B', N5L N7R' N2R']

// Centers 3
[N4F N8B' N3B', N2L N7L N5R']

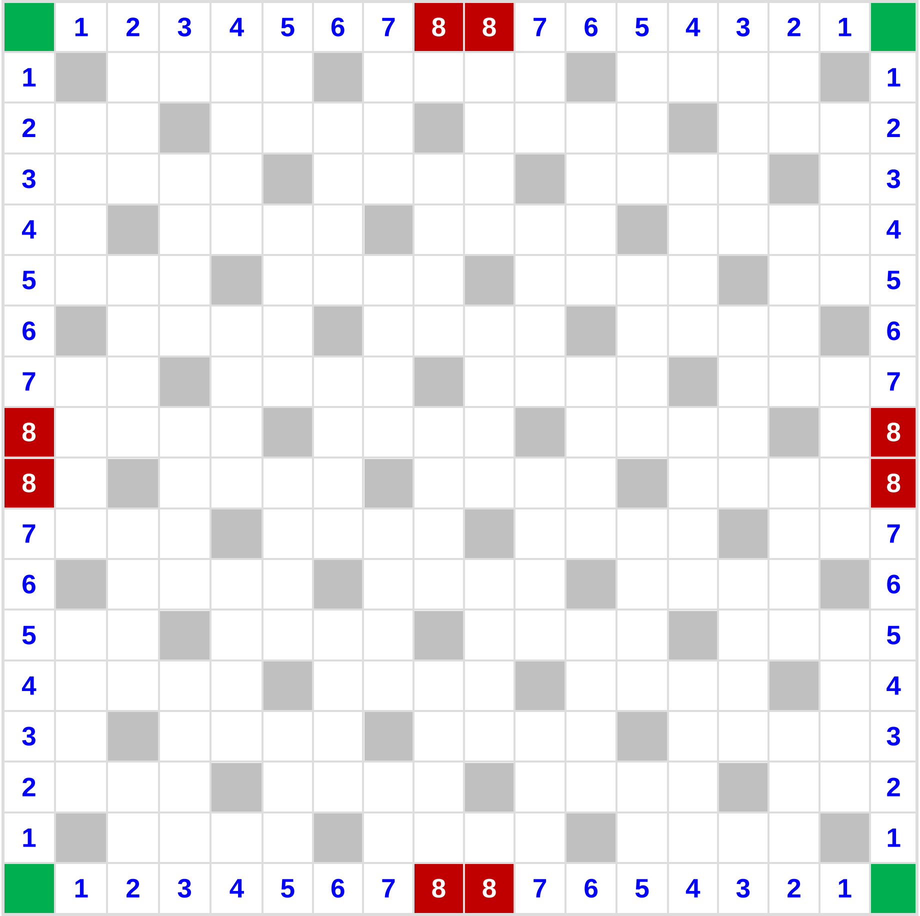
// Centers 4
[N5F N7B' N2B', N4L N8R' N3R']

// Centers 5
[N6F N6B', N6L N6R']

// Algorithm (114 moves) (312 permuted stickers) (Permutation order: 3):
SR D' SF2 U2 SR2 U' SR' D' SR2 D2 SF2 U' SF' R B' N6L N6R' B R' B' N6R N6L' B L' F N6L N6R' F' L F N6R N6L' B' D2 SF L B N6L N6R' B' L' B N6R N6L' F' SU2 SF R' F' N6L N6R' F R F' N6R N6L' B U2 NF N7F N5B' N3L N8L N4R' N5B N7F' NF' N4R N8L' N3L' N3F N8F N4B' N5L N7R' NR' N4B N8F' N3F' NR N7R N5L' N4F N8B' N3B' NL N7L N5R' N3B N8B N4F' N5R N7L' NL' N5F N7B' NB' N4L N8R' N3R' NB N7B N5F' N3R N8R N4L' N6F N6B' N6L N6R' N6B N6F' N6R N6L'

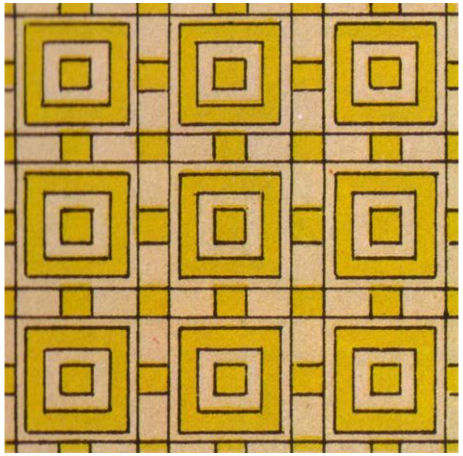


Pythagorean Tiling 16x16x16



Pythagorean Tiling 16x16x16

// Assyrian Ornamental Wall Painting



http://en.wikipedia.org/wiki/Wallpaper_group

// Assyrian Wall Painting
// 7x7x7 Cube

// Corners (Optimized: 12 m)
SR D' SF2 U2 SR2 U' SR' D' SR2 D2 SF2 U'

// Midges (4 3-Cycles: 44 m)
(F') [(B R B'), MR'] (F)
(B) [(F' L' F), MR'] (B')
(D2 F) [(B' L B), MR'] (F' D2)
(U2 B') [(F R' F'), MR'] (B U2)

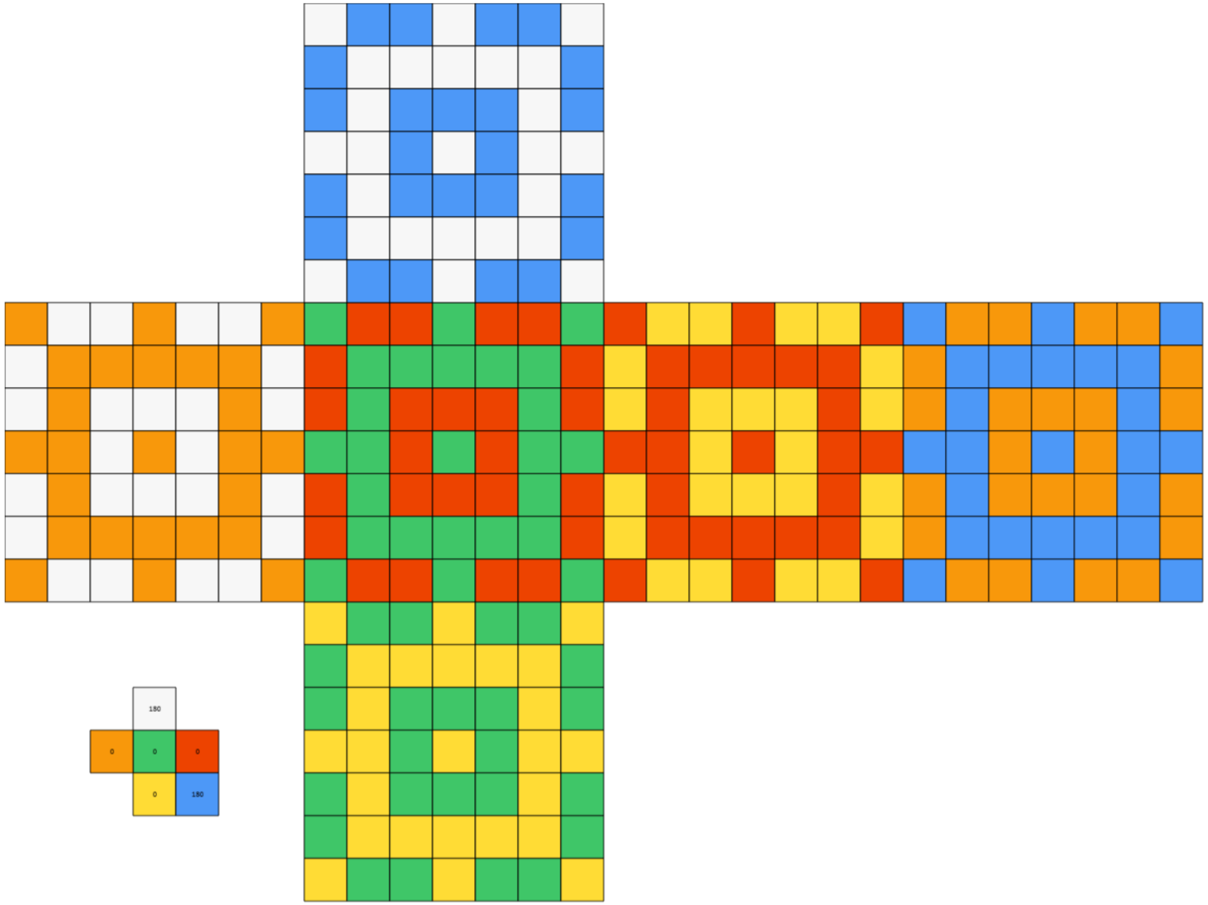
// Midges (SCS: 18m)
MF' SL' D MR2 D' SL D MR2 D' SR U' MR2 U SR' U' MR2 U MF

// Centers 1
[N2F N2B', N2L N3L N4L N3R' N2R']

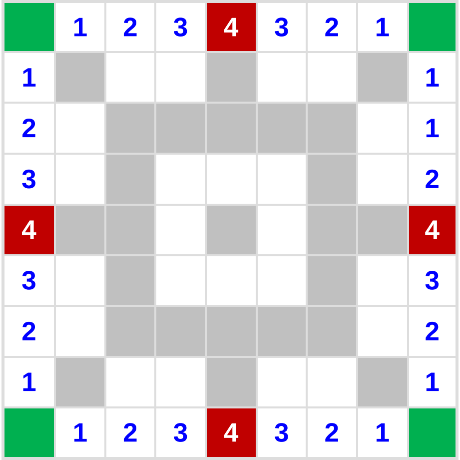
// Centers 2
[N3F N4F N3B', N2L N2R']

// True Centers
[MR, MU]

// Algorithm (54 moves) (150 permuted stickers) (Permutation order: 3):
SR D' SF2 U2 SR2 U' SR' D' SR2 D2 SF2 U' MF' SL' D MR2 D' SL D MR2 D' SR U' MR2 U SR' U' MR2 U MF NF NB' VL MR' VR' NB NF' VR MR VL' N3F MF N3B' NL NR' N3B MF' N3F' NR MR NL' MU MR' MU'



Assyrian Wall Painting 7x7x7



Assyrian Wall Painting 7x7x7

// Assyrian Ornamental Wall Painting
// 13x13x13 Cube

// Corners (Optimized: 12 m)
SR D' SF2 U2 SR2 U' SR' D' SR2 D2 SF2 U'

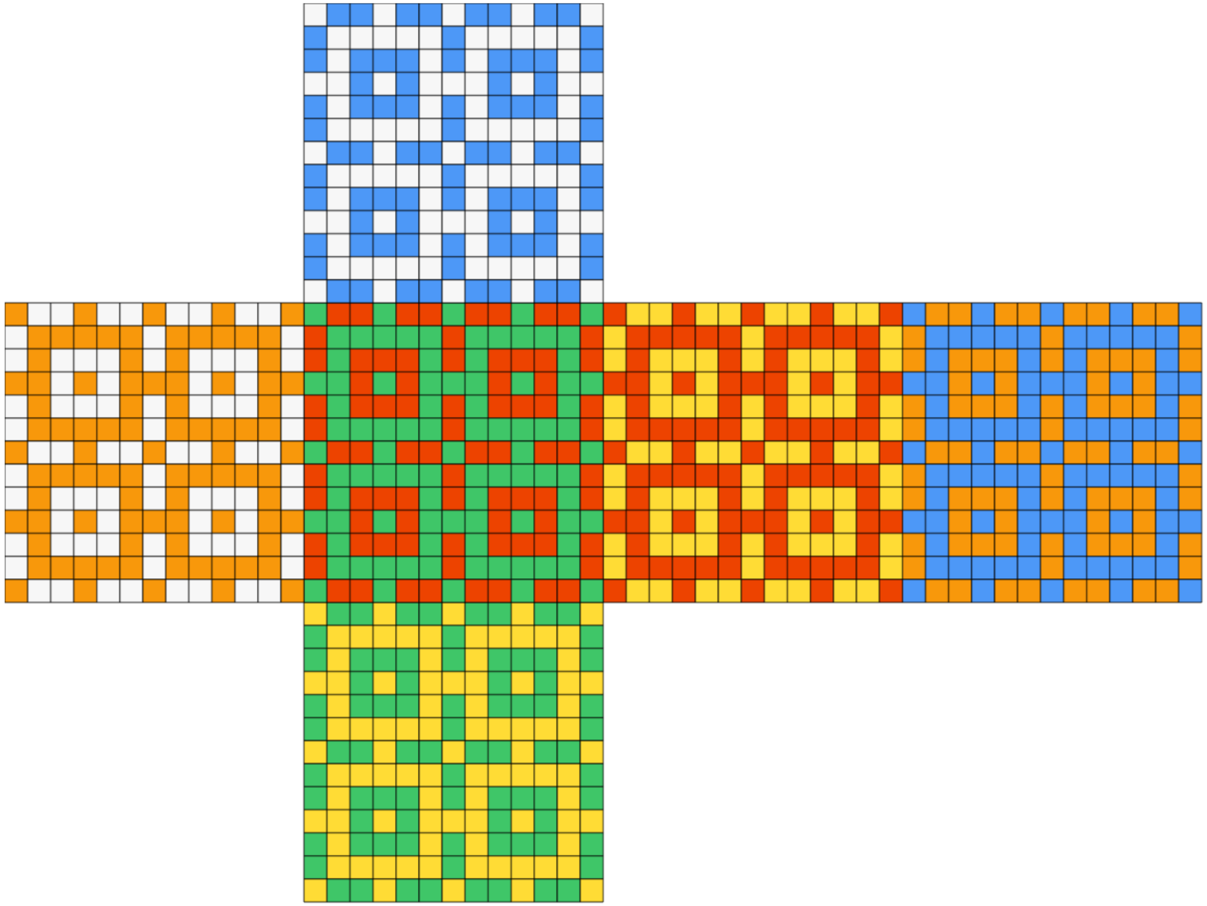
// Edges
(F') [(B R B'), N4R' MR' N4L] (F)
(B) [(F' L' F), N4R' MR' N4L] (B')
(D2 F) [(B' L B), N4R' MR' N4L] (F' D2)
(U2 B') [(F R' F'), N4R' MR' N4L] (B U2)

// Centers 1
[N2F N6F N6B' N2B', N2L N3L N4L N5L N6L N6R' N5R' N4R' N3R' N2R']

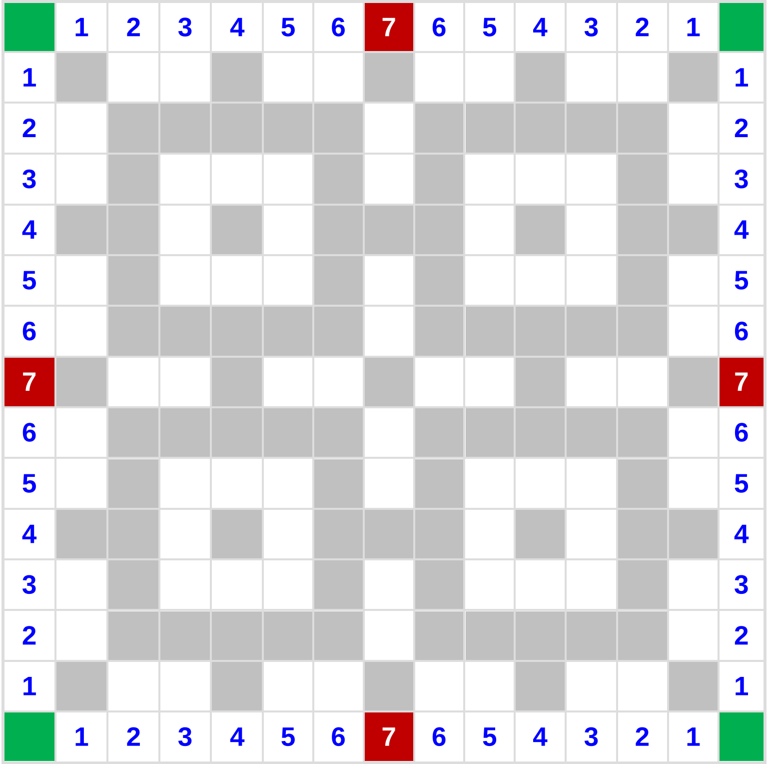
// Centers 2
[N3F N4F N5F N5B' N4B' N3B', N2L N6L N6R' N2R']

// Centers 3
[N4F N7F N4B', N4L N7L N4R']

// Algorithm (122 moves) (534 permuted stickers) (Permutation order: 3):
SR D' SF2 U2 SR2 U' SR' D' SR2 D2 SF2 U' SF' R B' N4R' MR' N4L B R' B' N4L' MR N4R B L' F N4R' MR' N4L F' L F N4L' MR N4R B' D2 SF L B N4R' MR' N4L B' L' B N4L' MR N4R F' SU2 SF R' F' N4R' MR' N4L F R F' N4L' MR N4R B U2 NF N6F N6B' NB' VL N4L N5L N6L N6R' N5R' N4R' VR' NB N6B N6F' NF' VR N4R N5R N6R N6L' N5L' N4L' VL' N3F N4F N5F N5B' N4B' N3B' NL N6L N6R' NR' N3B N4B N5B N5F' N4F' N3F' NR N6R N6L' NL' N4F MF N4B' N4L MR' N4R' N4B MF' N4F' N4R MR N4L'



Assyrian Wall Painting 13x13x13



Assyrian Wall Painting 13x13x13

// Assyrian Ornamental Wall Painting
// 19x19x19 Cube

// Corners (Optimized: 12 m)
SR D' SF2 U2 SR2 U' SR' D' SR2 D2 SF2 U'

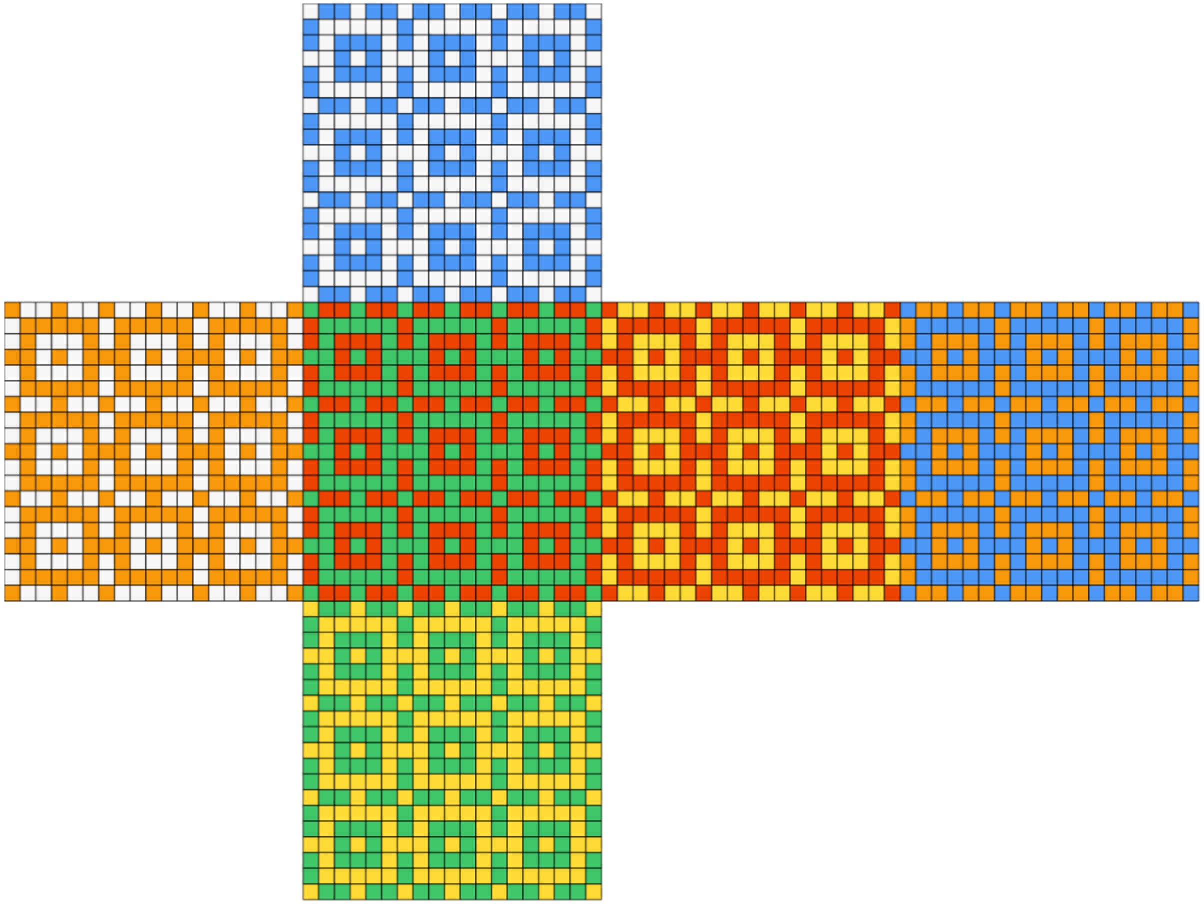
// Edges
(F') [(B R B'), N4R' N7R' MR' N7L N4L] (F)
(B) [(F' L' F), N4R' N7R' MR' N7L N4L] (B')
(D2 F) [(B' L B), N4R' N7R' MR' N7L N4L] (F' D2)
(U2 B') [(F R' F'), N4R' N7R' MR' N7L N4L] (B U2)

// Centers 1
[N2F N6F N8F N8B' N6B' N2B', N2L N3L N4L N5L N6L N8L N9L N10L N9R' N8R' N6R' N5R' N4R' N3R' N2R']

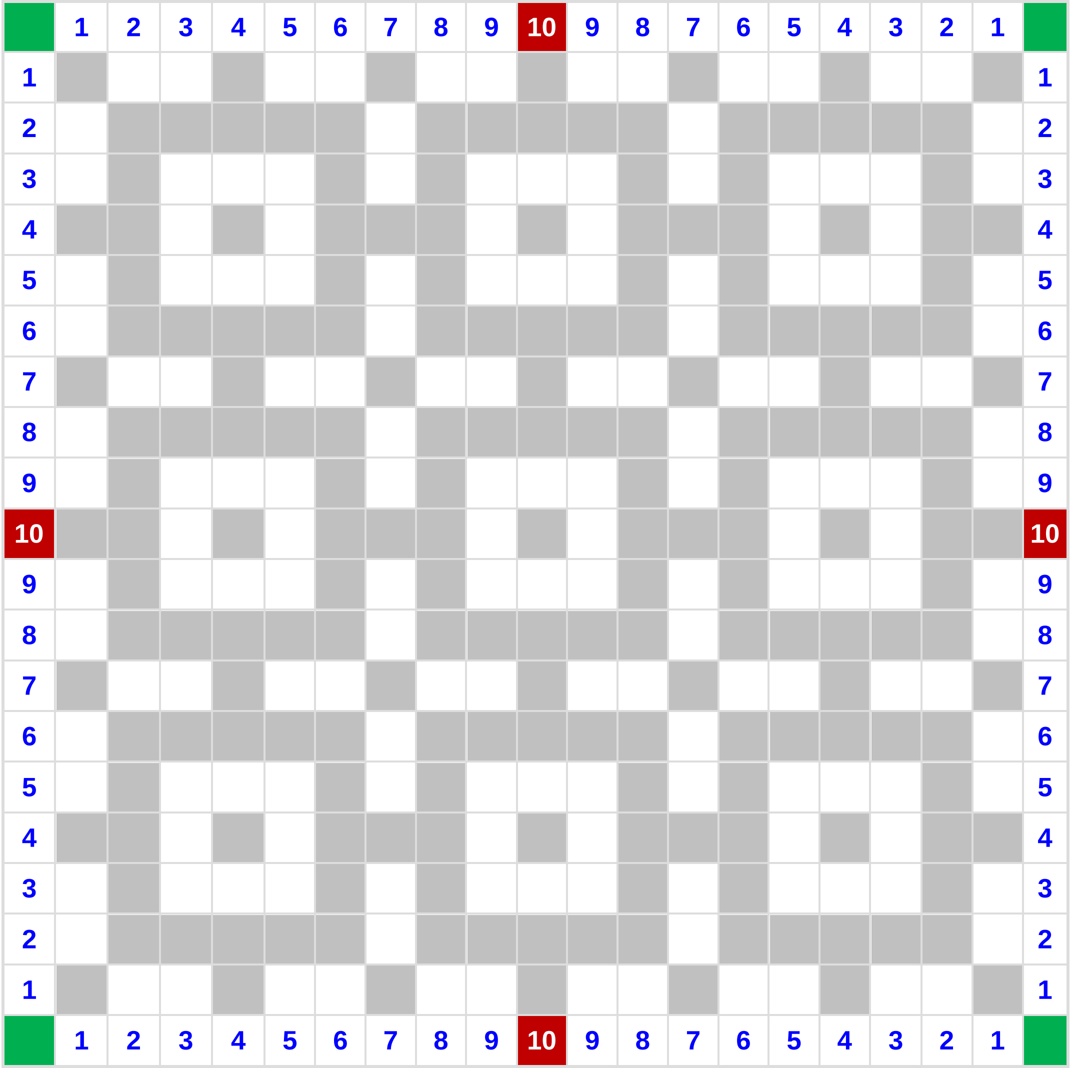
// Centers 2
[N3F N4F N5F N9F N10F N9B' N5B' N4B' N3B', N2L N6L N8L N8R' N6R' N2R']

// Centers 3
[N4F N7F N10F N7B' N4B', N4L N7L N10L N7R' N4R']

// Algorithm (171 moves) (1158 permuted stickers) (Permutation order: 3):
SR D' SF2 U2 SR2 U' SR' D' SR2 D2 SF2 U' SF' R B' N4R' N7R' MR' N7L N4L B R' B' N4L' N7L' MR N7R N4R B L' F N4R' N7R' MR' N7L N4L F' L F N4L' N7L' MR N7R N4R B' D2 SF L B N4R' N7R' MR' N7L N4L B' L' B N4L' N7L' MR N7R N4R F' SU2 SF R' F' N4R' N7R' MR' N7L N4L F R F' N4L' N7L' MR N7R N4R B U2 NF N6F N8F N8B' N6B' NB' VL N4L N5L N6L N8L N9L MR' N6R' N9R' N8R' N3R' N5R' N4R' NR' NB N6B N8B N8F' N6F' NF' VR N4R N5R N6R N8R N9R MR N8L' N6L' N9L' N4L' VL' N5L' N3F N4F N5F N9F MF N9B' N5B' N4B' N3B' NL N6L N8L N8R' N6R' NR' N3B N4B N5B N9B MF' N9F' N5F' N4F' N3F' NR N6R N8R N8L' N6L' NL' N4F N7F MF N7B' N4B' N4L N7L MR' N7R' N4R' N4B N7B MF' N7F' N4F' N4R MR N7R N4L' N7L'



Assyrian Wall Painting 19x19x19



Assyrian Wall Painting 19x19x19

2012
15x15x15 Cube

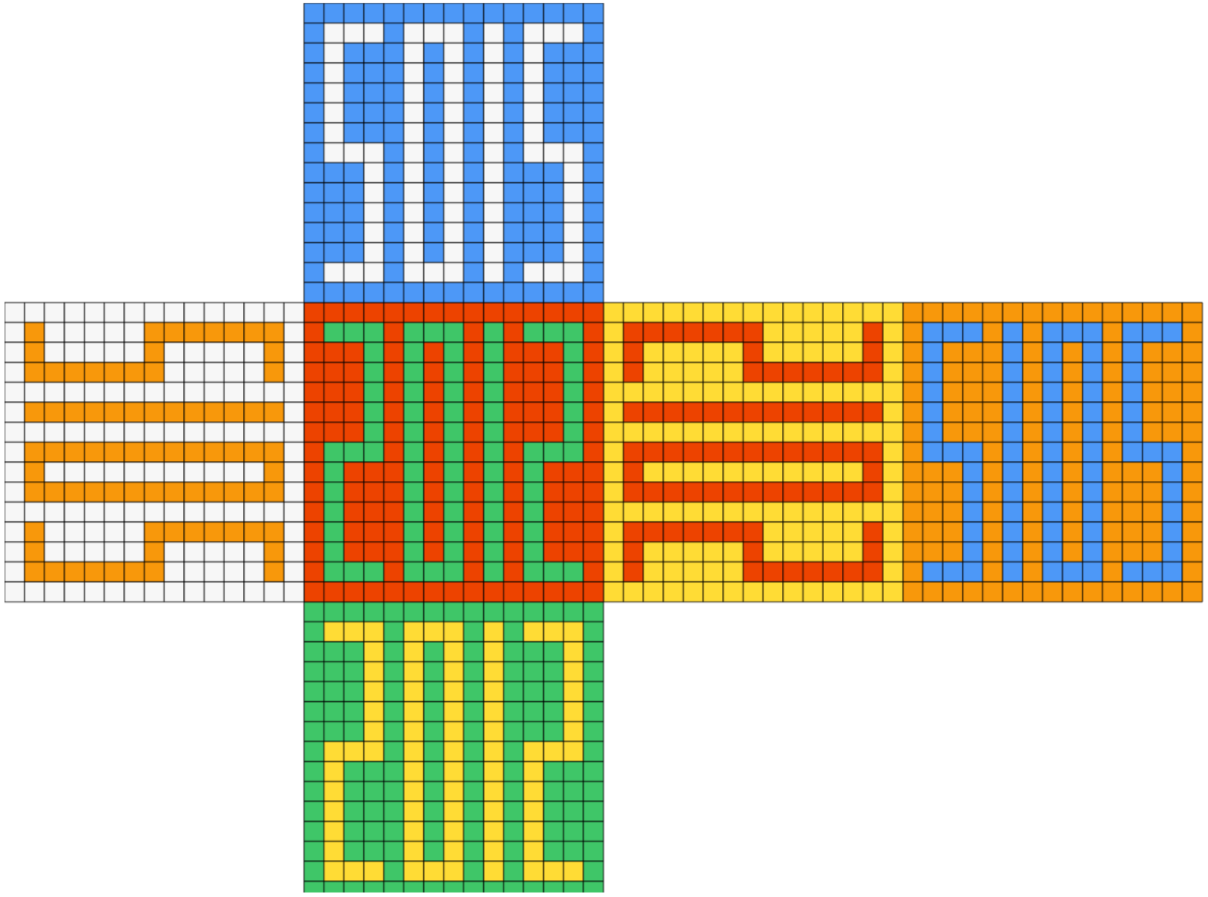
// Centers 1
[NF NB', NL N3L N4L N6L N7L ML N6R' N4R' N3R' NR']

// Centers 2
[N3F N4F N5F N6F N7F, N4L N6L ML N6R' NR']

// Centers 3
[MF, NL N3L N4L N6L ML N6R' N4R' N3R' NR']

// Centers 4
[N3B' N4B' N5B' N6B' N7B', NL N6L ML N6R' N4R']

Algorithm (77 moves) (474 permuted stickers) (Permutation order: 3):
NF NB' VL N4L N6L N7L MR' N6R' N4R' VR' NB NF' VR N4R N6R MR N6L' N4L' N7L' VL' N3F N4F N5F N6F N7F N4L N6L MR' N6R' NR' N7F' N6F' N5F' N4F' N3F' NR MR N6R N4L' N6L' MF VL N4L N6L MR' N3R' N6R' N4R' NR' MF' VR N4R N6R MR N4L' VL' N6L' N3B' N4B' N5B' N6B' N7B' NL N6L MR' N6R' N4R' N7B N6B N5B N4B N3B N4R MR N6R NL' N6L'



2012 15x15x15

HAPPY 2012!
21x21x21

// Centers 1
[N6F, NL N4L N6L N7L N8L N10L ML N10R' N8R' N7R' N6R' N4R' NR']

// Centers 2
[N7F, NL N4L N6L N8L N10L N10R' N8R' N6R' N4R' NR']

// Centers 3
[N8F, NL N3L N4L N6L N7L N8L N10L ML N10R' N8R' N7R' N6R' N4R' N3R' NR']

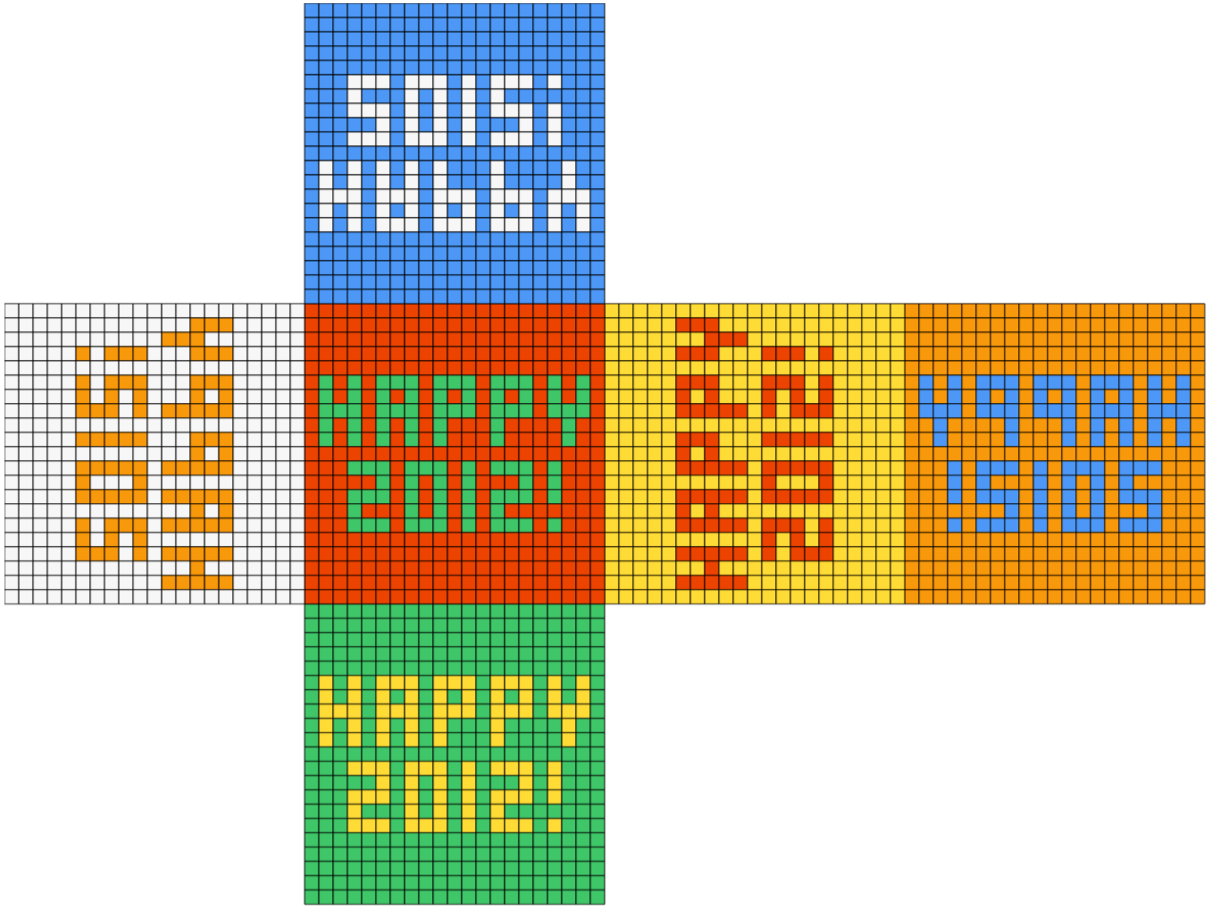
// Centers 4
[N9F N10F, NL N4L N6L N8L N10L N8R' N3R']

// Centers 5
[N10B' N6B', N4L N5L N6L N8L N9L N10L N10R' N8R' N7R' N6R' N4R']

// Centers 6
[N8B', N4L N5L N6L N8L N10L N10R' N8R' N7R' N6R' N4R']

// Centers 7
[N7B', N4L N8L N10L N10R' N8R']

Algorithm (171 moves) (570 permuted stickers) (Permutation order: 3):
N6F NL N4L N6L N7L N8L N10L MR' N7R' N10R' N8R' NR' N6R' N4R' N6F' NR N4R N6R N7R N8R N10R MR N8L' N7L' N10L' N4L' NL' N6L' N7F NL N4L N6L N8L N10L N10R' N8R' N6R' N4R' NR' N7F' NR N4R N6R N8R N10R N10L' N8L' N6L' N4L' NL' N8F VL N4L N6L N7L N8L N10L MR' N7R' N10R' N8R' N3R' N6R' N4R' NR' N8F' VR N4R N6R N7R N8R N10R MR N8L' N7L' N10L' N4L' VL' N6L' N9F N10F NL N4L N6L N8L N10L N8R' N3R' N10F' N9F' N3R N8R N10L' N8L' N6L' N4L' NL' N10B' N6B' N4L N5L N6L N8L N9L N10L N10R' N8R' N7R' N6R' N4R' N6B N10B N4R N6R N7R N8R N10R N10L' N9L' N8L' N6L' N5L' N4L' N9B' N6L N8L N10L N10R' N6R' N4R' N9B N4R N6R N10R N10L' N8L' N6L' N8B' N4L N5L N6L N8L N10L N10R' N8R' N7R' N6R' N4R' N8B N4R N6R N7R N8R N10R N10L' N8L' N6L' N5L' N4L' N7B' N4L N8L N10L N10R' N8R' N7B N8R N10R N10L' N8L' N4L'



HAPPY 2012! 15x15x15

Vasarely Composition
Vonal Stri

Vasarely Composition
22x22x22 Cube

// Square 1
[N2F N2B', N2L N3L N4L N5L N6L N7L N8L N9L N10L N11L N12L N13L N14L N15L N16L N17L N18L N19L N20L N21L]
[N3F N4F N5F N6F N7F N8F N9F N10F N11F N12F N13F N14F N15F N16F N17F N18F N19F N20F, N2L N2R']

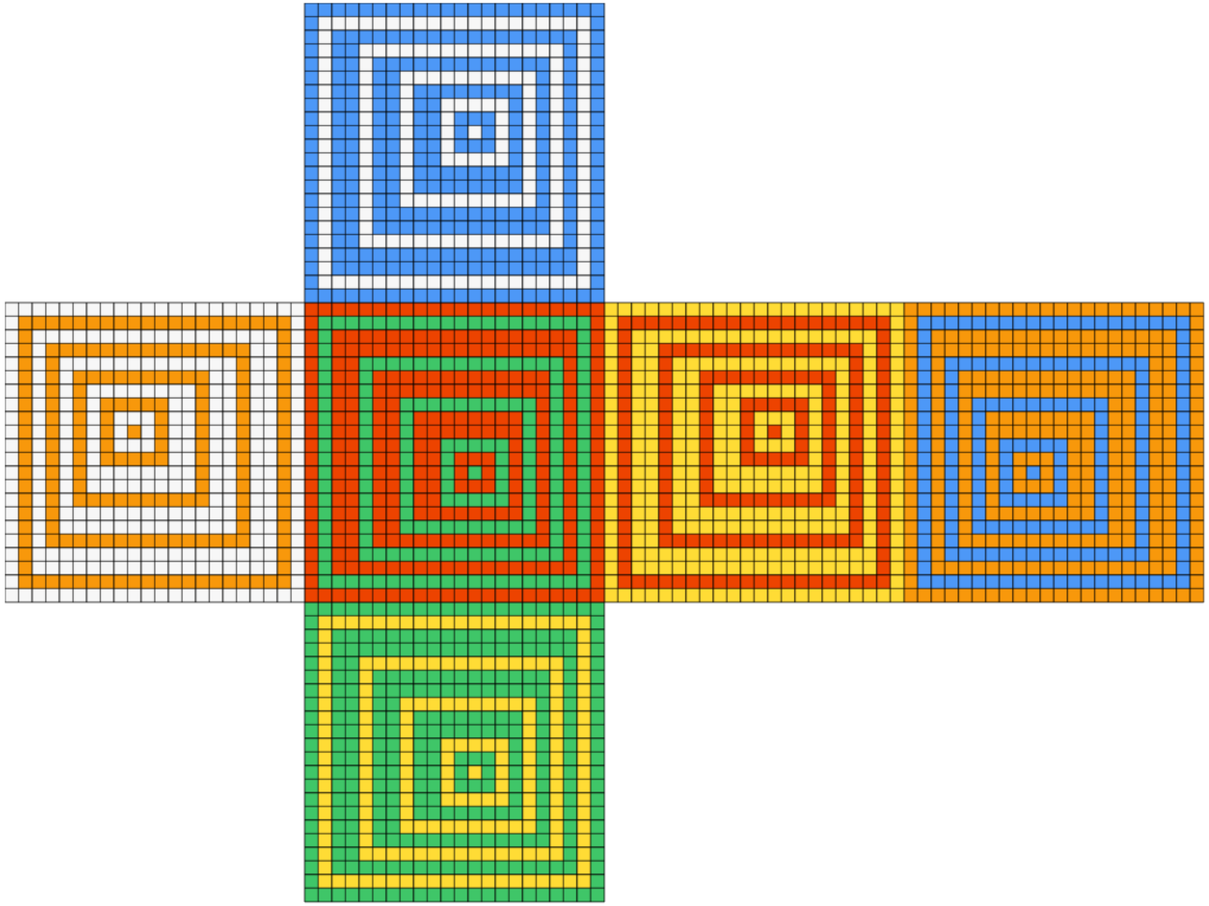
// Square 2
[N5F N4B', N5L N6L N7L N8L N9L N10L N11L N12L N13L N14L N15L N16L N17L N18L N19L]
[N6F N7F N8F N9F N10F N11F N12F N13F N14F N15F N16F N17F N18F, N5L N4R']

// Square 3
[N8F N6B', N8L N9L N10L N11L N12L N13L N14L N15L N16L N17L]
[N9F N10F N11F N12F N13F N14F N15F N16F, N8L N6R']

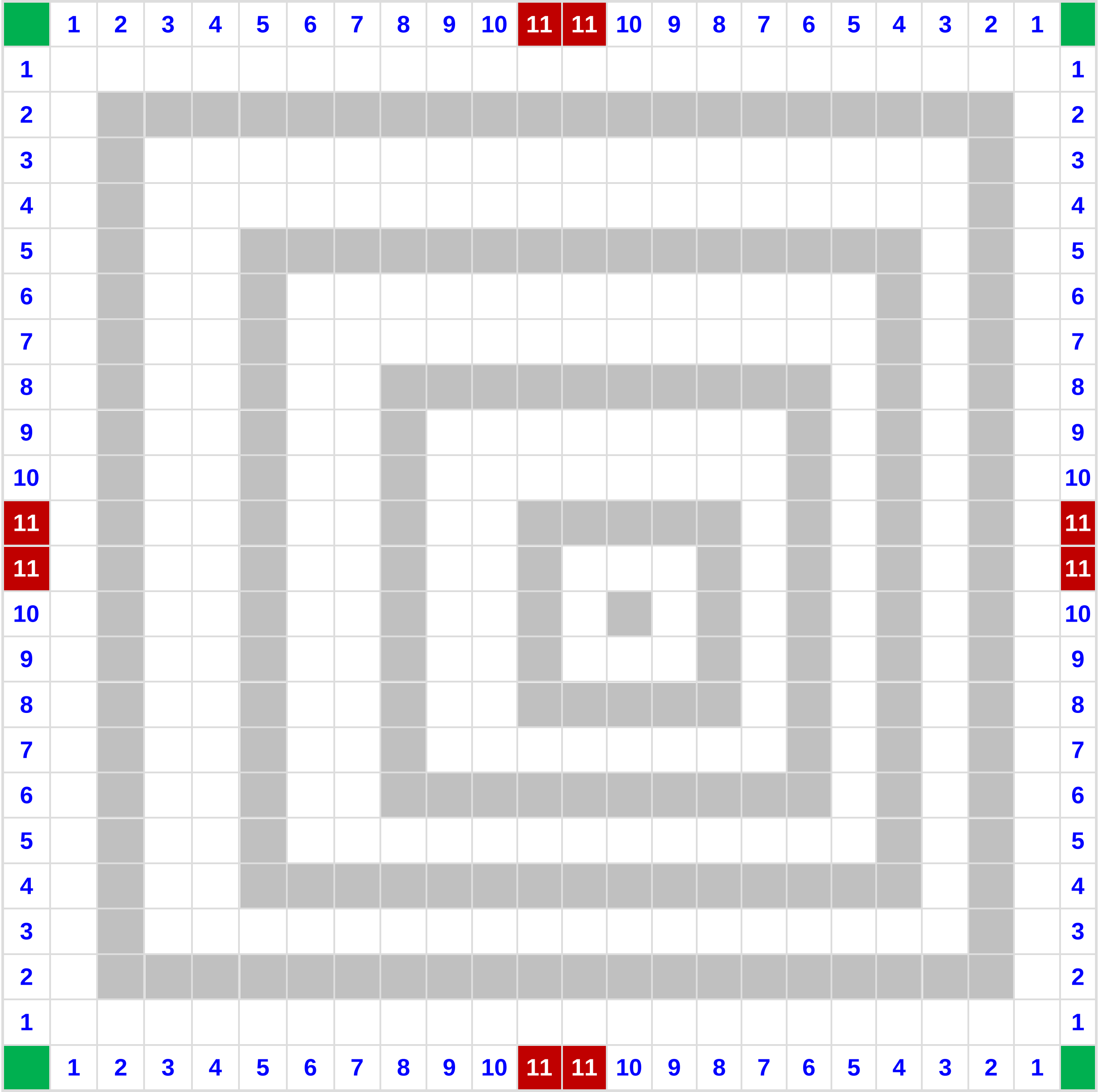
// Square 4
[N11F N8B', N11L N12L N13L N14L N15L]
[N12F N13F N14F, N11L N8R']

// Square 5
[N10B', N13L]

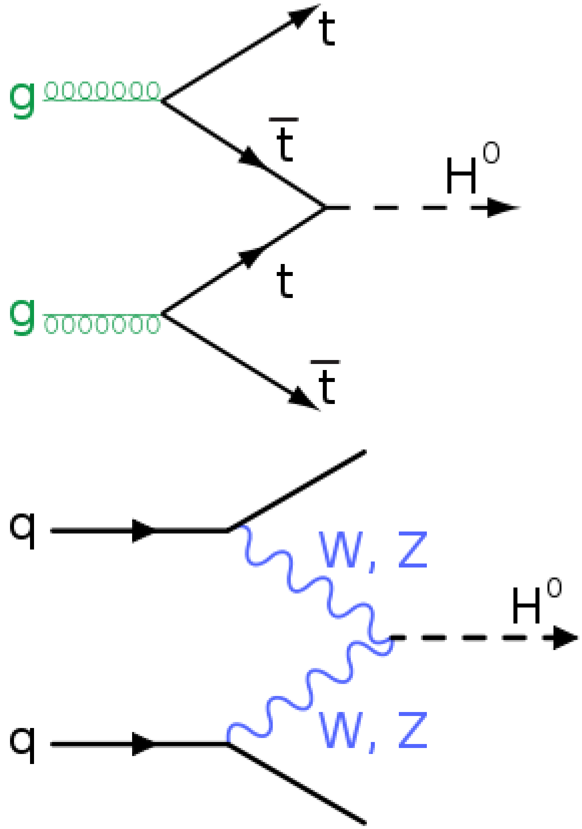
Algorithm (218 moves) (1110 permuted stickers) (Permutation order: 3):
NF NB' VL N4L N5L N6L N7L N8L N9L N10L N11L N12L N13L N14L N15L N16L N17L N18L N19L N20L N21L NB NF' N21L' N20L' N19L' N18L' N17L' N16L' N15L' N14L' N13L' N12L' N11L' N10L' N9L' N8L' N7L' N6L' N5L' N4L' VL' N3F N4F N5F N6F N7F N8F N9F N10F N11F N12F N13F N14F N15F N16F N17F N18F N19F N20F NL NR' N20F' N19F' N18F' N17F' N16F' N15F' N14F' N13F' N12F' N11F' N10F' N9F' N8F' N7F' N6F' N5F' N4F' N3F' NR NL' N5F N4B' N5L N6L N7L N8L N9L N10L N11L N12L N13L N14L N15L N16L N17L N18L N19L N4B N5F' N19L' N18L' N17L' N16L' N15L' N14L' N13L' N12L' N11L' N10L' N9L' N8L' N7L' N6L' N5L' N6F N7F N8F N9F N10F N11F N12F N13F N14F N15F N16F N17F N18F N5L N4R' N18F' N17F' N16F' N15F' N14F' N13F' N12F' N11F' N10F' N9F' N8F' N7F' N6F' N4R N5L' N8F N6B' N8L N9L N10L N11L N12L N13L N14L N15L N16L N17L N6B N8F' N17L' N16L' N15L' N14L' N13L' N12L' N11L' N10L' N9L' N8L' N9F N10F N11F N12F N13F N14F N15F N16F N8L N6R' N16F' N15F' N14F' N13F' N12F' N11F' N10F' N9F' N6R N8L' N11F N8B' N11L N12L N13L N14L N15L N8B N11F' N15L' N14L' N13L' N12L' N11L' N12F N13F N14F N11L N8R' N14F' N13F' N12F' N8R N11L' N10B' N13L N10B N13L'



Vasarely Composition 22x22x22



Vasarely Composition 22x22x22



http://en.wikipedia.org/wiki/Higgs_boson

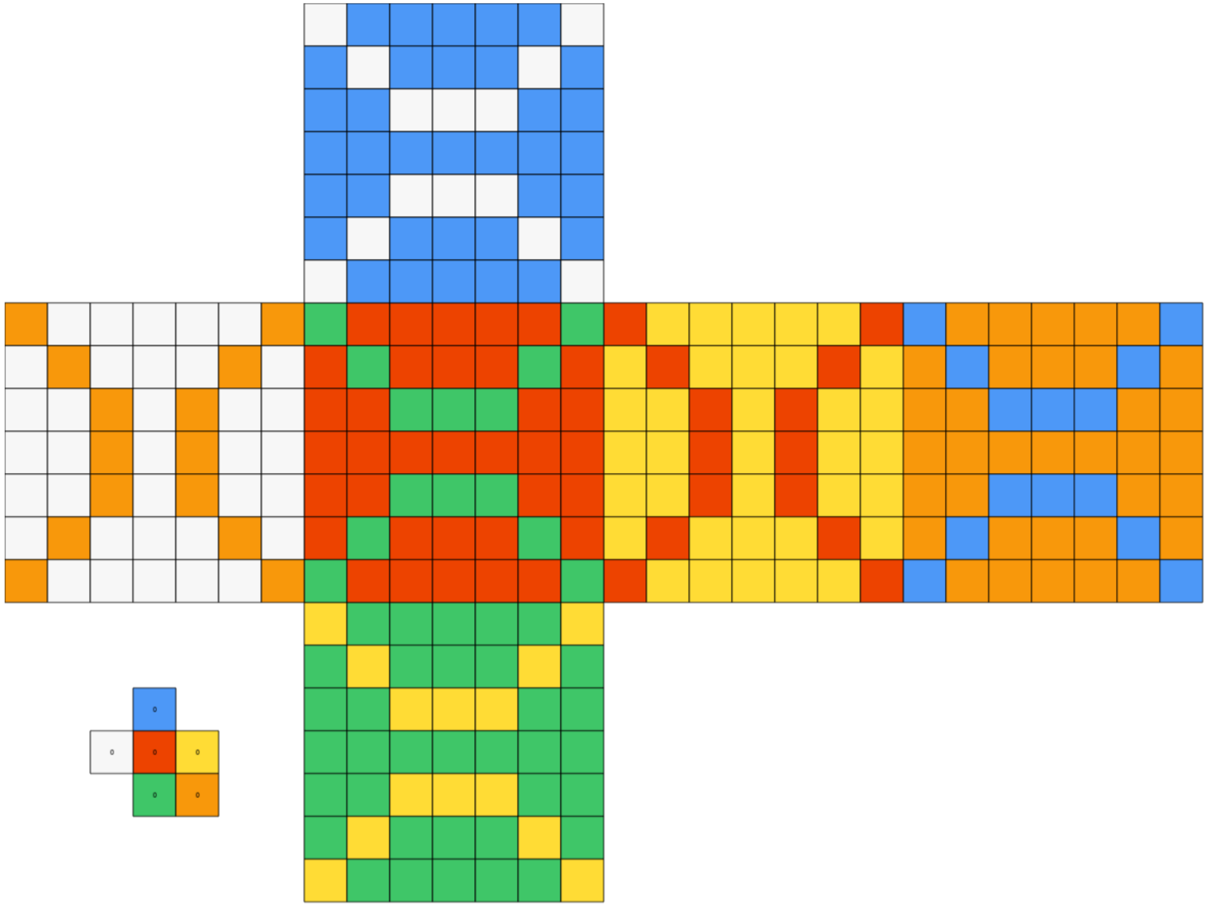
// Bosons
// 7x7x7 Cube

// Corners (Optimized: 12 m)
SR D' SF2 U2 SR2 U' SR' D' SR2 D2 SF2 U'

// Centers 1
[N2F N2B', N2L N2R']

// Centers 2
[N3F N3B', M3L]

// Algorithm (26 moves) (84 permuted stickers) (Permutation order: 3):
SR D' SF2 U2 SR2 U' SR' D' SR2 D2 SF2 U' NF NB' NL NR' NB NF' NR NL' N3F N3B' M3L N3B N3F' M3L'



Bosons 7x7x7

	1	2	3	4	3	2	1	
1								1
2								1
3								2
4								4
3								3
2								2
1								1
	1	2	3	4	3	2	1	

Bosons 7x7x7

// Bosons
// 13x13x13 Cube

// Corners (Optimized: 12 m)
SR D' SF2 U2 SR2 U' SR' D' SR2 D2 SF2 U'

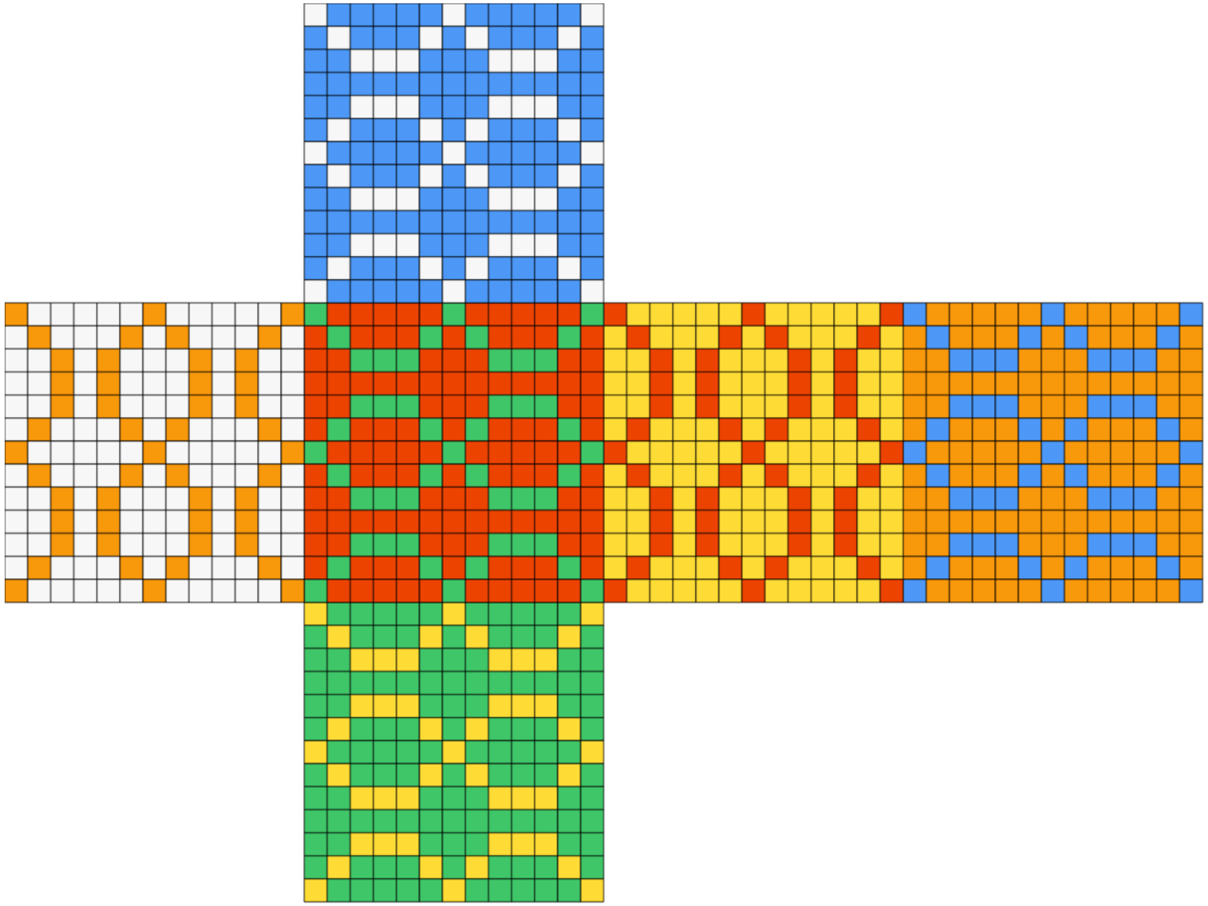
// Midges (SCS: 18m)
MF' SL' D MR2 D' SL D MR2 D' SR U' MR2 U SR' U' MR2 U MF

// Centers 1
[N2F N6F N6B' N2B', N2L N6L N6R' N2R']

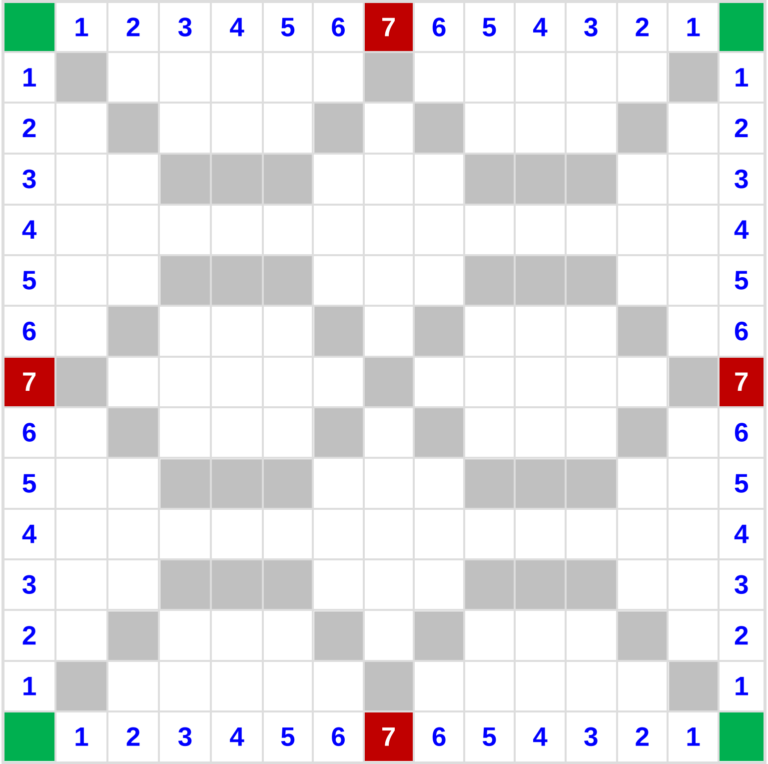
// Centers 2
[N3F N5F N5B' N3B', N3L N4L N5L N5R' N4R' N3R']

// True Centers
[MR, MU]

// Algorithm (70 moves) (294 permuted stickers) (Permutation order: 3):
SR D' SF2 U2 SR2 U' SR' D' SR2 D2 SF2 U' MF' SL' D MR2 D' SL D MR2 D' SR U' MR2 U SR' U' MR2 U MF NF N6F N6B' NB' NL N6L N6R' NR' NB N6B N6F' NF' NR N6R N6L' NL' N3F N5F N5B' N3B' N3L N4L N5L N5R' N4R' N3R' N3B N5B N5F' N3F' N3R N4R N5R N5L' N4L' N3L' MR MU MR' MU'



Bosons 13x13x13



Bosons 13x13x13

// Bosons
// 19x19x19 Cube

// Corners (Optimized: 12 m)
SR D' SF2 U2 SR2 U' SR' D' SR2 D2 SF2 U'

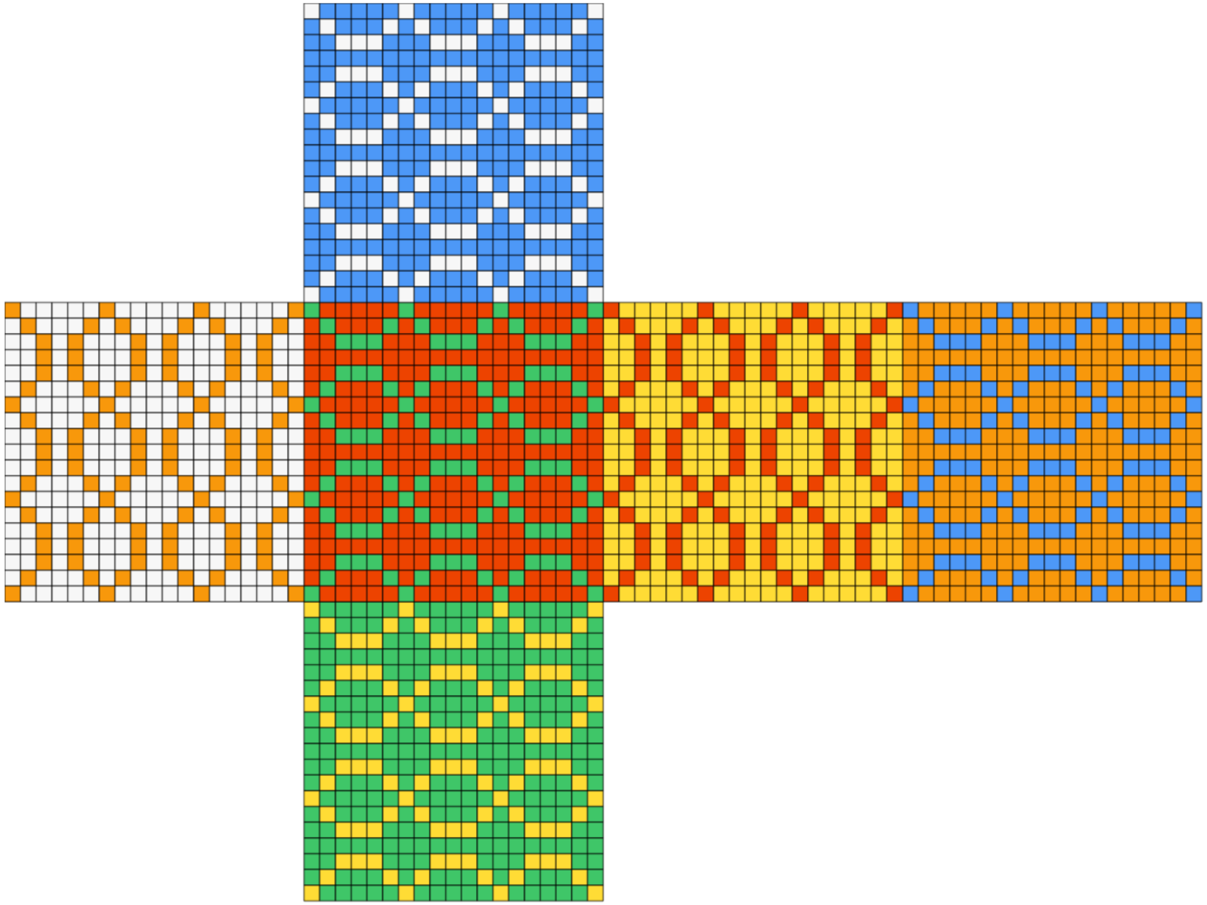
// Edges
(F') [(B R B'), N7R' N7L] (F)
(B) [(F' L' F), N7R' N7L] (B')
(D2 F) [(B' L B), N7R' N7L] (F' D2)
(U2 B') [(F R' F'), N7R' N7L] (B U2)

// Centers 1
[N2F N6F N8F N8B' N6B' N2B', N2L N6L N8L N8R' N6R' N2R']

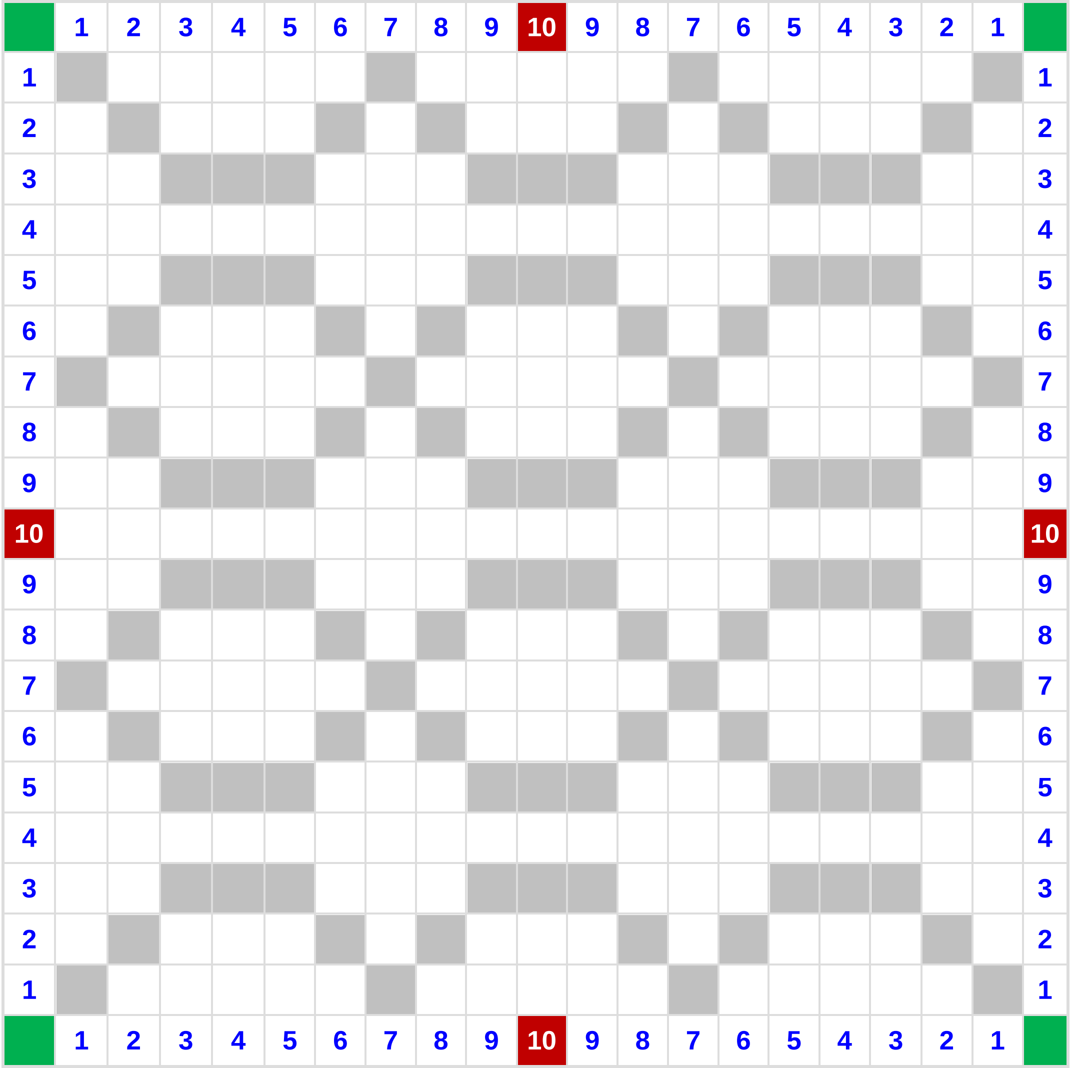
// Centers 2
[N3F N5F N9F N9B' N5B' N3B', N3L N4L N5L N9L N10L N9R' N5R' N4R' N3R']

// Centers 3
[N7F N7B', N7L N7R']

// Algorithm (120 moves) (636 permuted stickers) (Permutation order: 3):
SR D' SF2 U2 SR2 U' SR' D' SR2 D2 SF2 U' SF' R B' N7R' N7L B R' B' N7L' N7R B L' F N7R' N7L F' L F N7L' N7R B' D2 SF L B N7R' N7L B' L' B N7L' N7R F' SU2 SF R' F' N7R' N7L F R F' N7L' N7R B U2 NF N6F N8F N8B' N6B' NB' NL N6L N8L N8R' N6R' NR' NB N6B N8B N8F' N6F' NF' NR N6R N8R N8L' N6L' NL' N3F N5F N9F N9B' N5B' N3B' N3L N4L N5L N9L MR' N4R' N9R' N5R' N3R' N3B N5B N9B N9F' N5F' N3F' N3R N4R N5R N9R MR N5L' N4L' N9L' N3L' N7F N7B' N7L N7R' N7B N7F' N7R N7L'

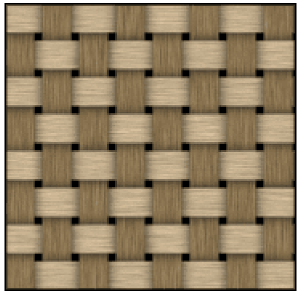


Bosons 19x19x19



Bosons 19x19x19

// Basketweave



http://en.wikipedia.org/wiki/Basketweave

// Basketweave
// 7x7x7 Cube

// Centers 1 (Color 1)
[N2F N4F N2B', N3D N3U']
[N3B', N3U']
[N3F, N3D]

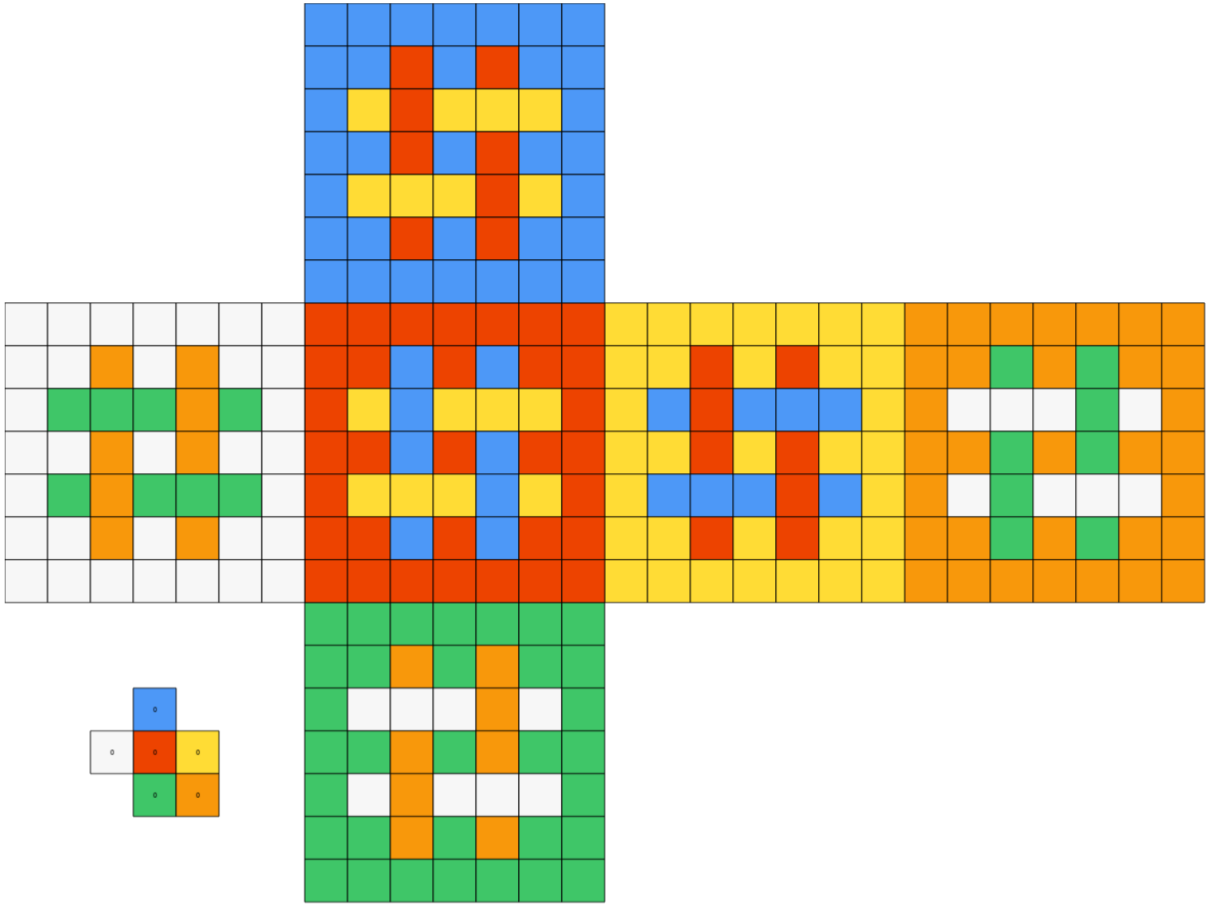
// Centers 1 (Color 1) 5x
[N2F N3F, N2D]
[N3F N4F, N4D]

// Centers 2 (Color 2)
[N2D N4D N2U', N3F N3B']
[N3U', N3F]
[N3D, N3B']

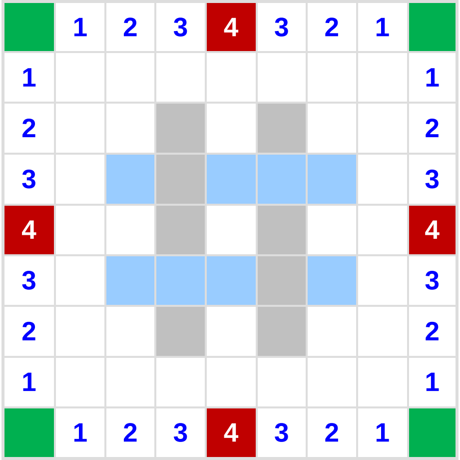
// Centers 2 (Color 2) 5x
[N3D N4D, N2F]
[N2D N3D, N4F]

// Optimized Algorithm
[N2F N4F N2B', N3D N3U']
[N3D, N3B'] [N3B', N3U'] [N3U', N3F] [N3F, N3D]
[N2D N4D N2U', N3F N3B']

Algorithm (28 moves) (96 permuted stickers) (Permutation order: 3):
NF MF NB' N3D N3U' NB MF' NF' N3U N3B' N3D' N3U' N3B N3F N3U N3D N3F' N3D' ND MU' NU' N3F N3B' NU MU ND' N3B N3F'



Basketweave 7x7x7



Basketweave 7x7x7

// Tangled Lines 5x5x5
// Centers 1 (Color 1)
[N2F N3F, N2D]
[N3F N4F, N4D]

// Centers 2 (Color 2)
[N3D N4D, N2F]
[N2D N3D, N4F]

// Optimize
[N3D N4D, N2F] [N2F N3F, N2D] [N2D N3D, N4F] [N4F N3F, N4D]
[VU', NF][VF, ND][VD, NB'][VB', NU']

4 Algorithm(s):
VU' NF VU N3F ND VF' N3D NB' VD' N3B' NU' VB NU (13 moves) (48 solved stickers) (Order: 3)
VB' NU' VB N3U' NF VU N3F ND VF' N3D NB' VD' NB (13 moves) (48 solved stickers) (Order: 3)
VD NB' VD' N3B' NU' VB N3U' NF VU N3F ND VF' ND' (13 moves) (48 solved stickers) (Order: 3)
VF ND VF' N3D NB' VD' N3B' NU' VB N3U' NF VU NF' (13 moves) (48 solved stickers) (Order: 3)

// 13 moves
VF VD NB' MU VF' ND' MF VU' NF MU VB NU NF'

// Edges 12(2c): (AF)(VQ) (HC)(XS) (EI)(JB)(LD)(PT)(WO)(KG)(RN)(MU)

// Edges 4(2c): (AF)(VQ)(HC)(XS): 11 m
NL SD L2 SD' NL2 NR2 SD L2 SD' NL NR2

NL [SD L2 SD', NL2 NR2] NL'

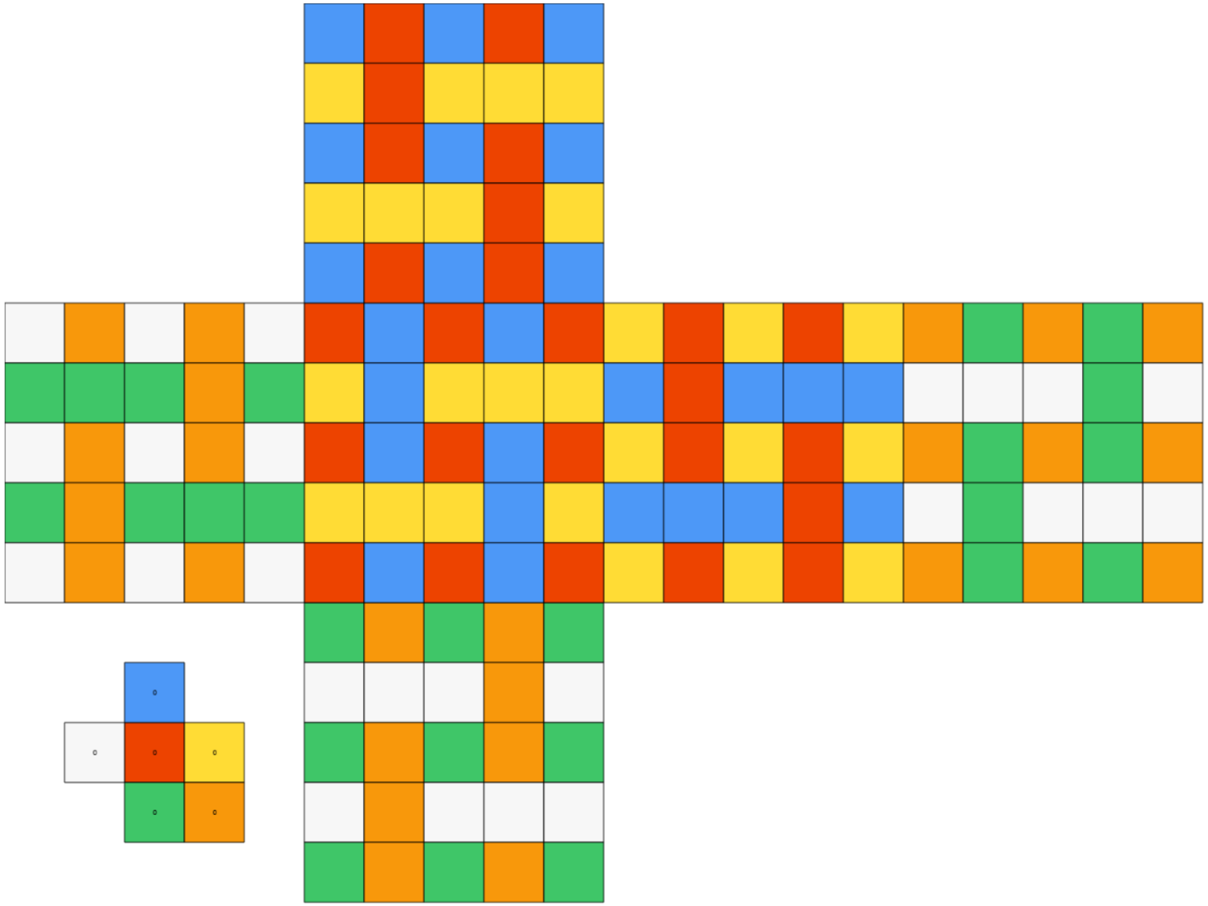
// Edges 8(2c): (EI)(JB)(LD)(PT)(WO)(KG)(RN)(MU): 24 m
NB L' SB NR2 SB' R L SB NR2 SB' R' NB' NU R' SU NL2 SU' L R SU NL2 SU' L' NU'

(NB L') [SB NR2 SB', L R] (L NB')
(NU R') [SU NL2 SU', R L] (R NU')

// Edges 12(2c):34 m
NF' R SF' NL2 SF L' NR' SU' R2 SU NR2 NL2 SU' R2 SU TR' NL2 SF' NL2 SF L NF ND' L SD' NR2 SD R' L' SD' NR2 SD R ND

// Optimize Algorithm
VF VD NB' MU VF' ND' MF VU' NF MU VB NU **NF'**
NF' R SF' NL2 SF L' NR' SU' R2 SU NR2 NL2 SU' R2 SU TR' NL2 SF' NL2 SF L NF ND' L SD' NR2 SD R' L' SD' NR2 SD R ND

// Algorithm (46 moves) (96 permuted stickers) (Permutation order: 6):
VF VD NB' MU VF' ND' MF VU' NF MU VB NU NF2 R SF' NL2 SF L' NR' SU' R2 SU NR2 NL2 SU' R2 SU TR' NL2 SF' NL2 SF L NF ND' L SD' NR2 SD R' L' SD' NR2 SD R ND



	1	2	3	2	1	
1						1
2						2
3						3
2						2
1						1
	1	2	3	2	1	

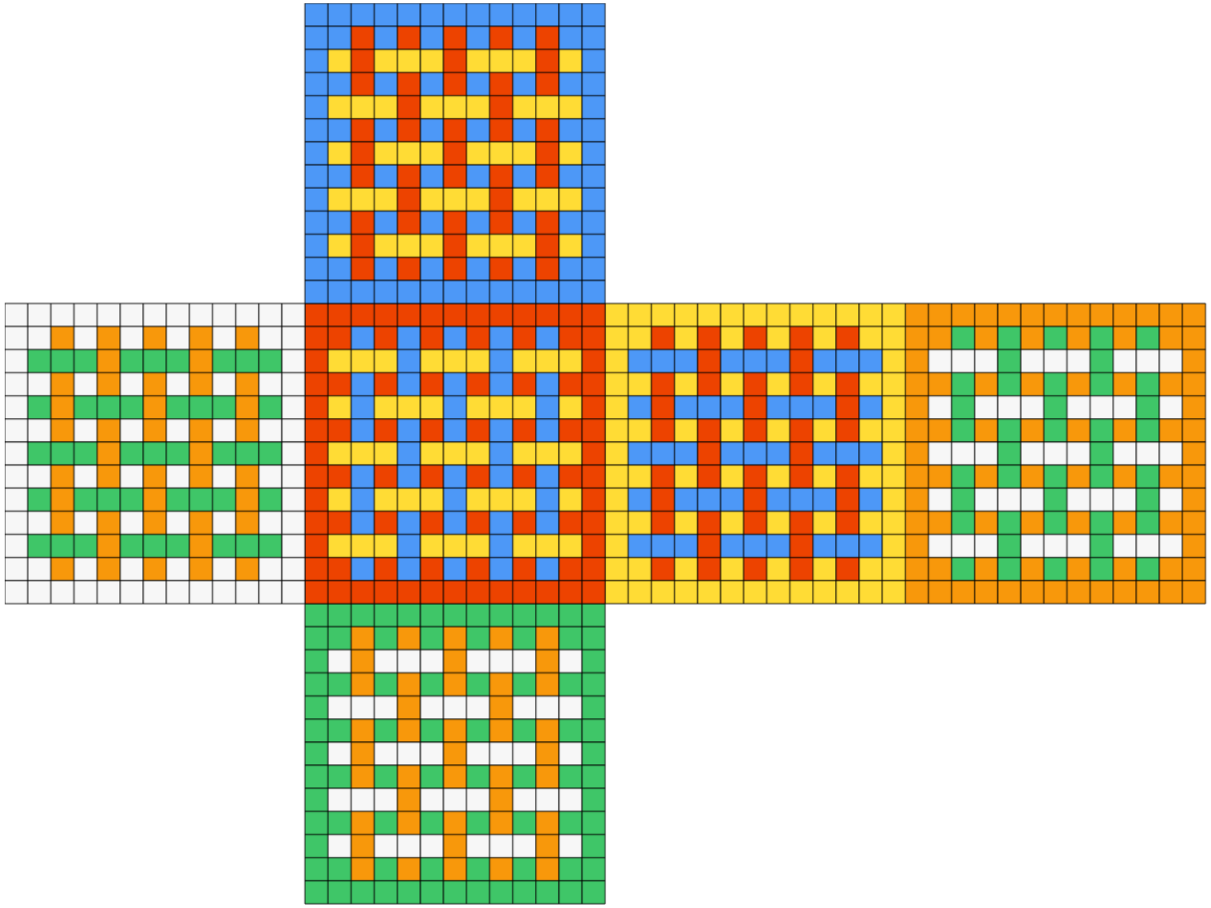
Tangled Lines 5x5x5

// Basketweave
// 13x13x13 Cube

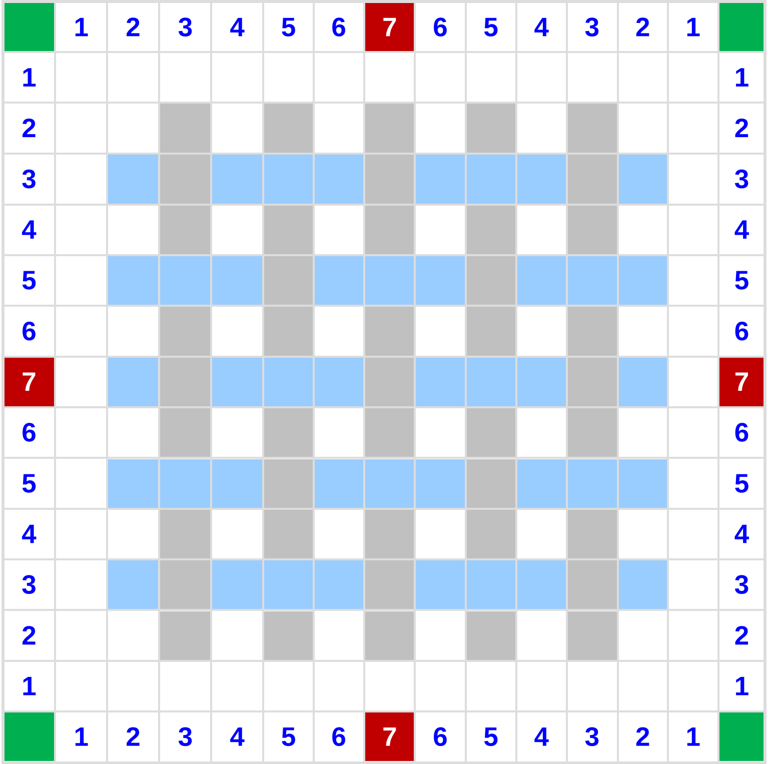
// Pattern 1 (Color 1)
[N2F N4F N6F N6B' N4B' N2B', N3D N5D N7D N5U' N3U']
[N3B' N7B' N3F, N3U' N7U' N3D]
[N5F N5B', N5D N5U']

// Pattern 2 (Color 2)
[N2D N4D N6D N6U' N4U' N2U', N3F N5F N7F N5B' N3B']
[N3D N7D N3U', N5F N5B']
[N5D N5U', N3F N7F N3B']

Algorithm (84 moves) (510 permuted stickers) (Permutation order: 3):
NF N4F N6F N6B' N4B' NB' N3D N5D MU' N5U' N3U' NB N4B N6B N6F' N4F' NF' N3U MU N5U N3D' N5D' N3B' MF N3F N3U' MU' N3D N3F' MF' N3B N3D' MU N3U N5F N5B' N5D N5U' N5B N5F' N5U N5D' ND N4D N6D N6U' N4U' NU' N3F N5F MF N5B' N3B' NU N4U N6U N6D' N4D' ND' N3B N5B MF' N5F' N3F' N3D MU' N3U' N5F N5B' N3U MU N3D' N5B N5F' N5D N5U' N3F MF N3B' N5U N5D' N3B MF' N3F'



Basketweave 13x13x13



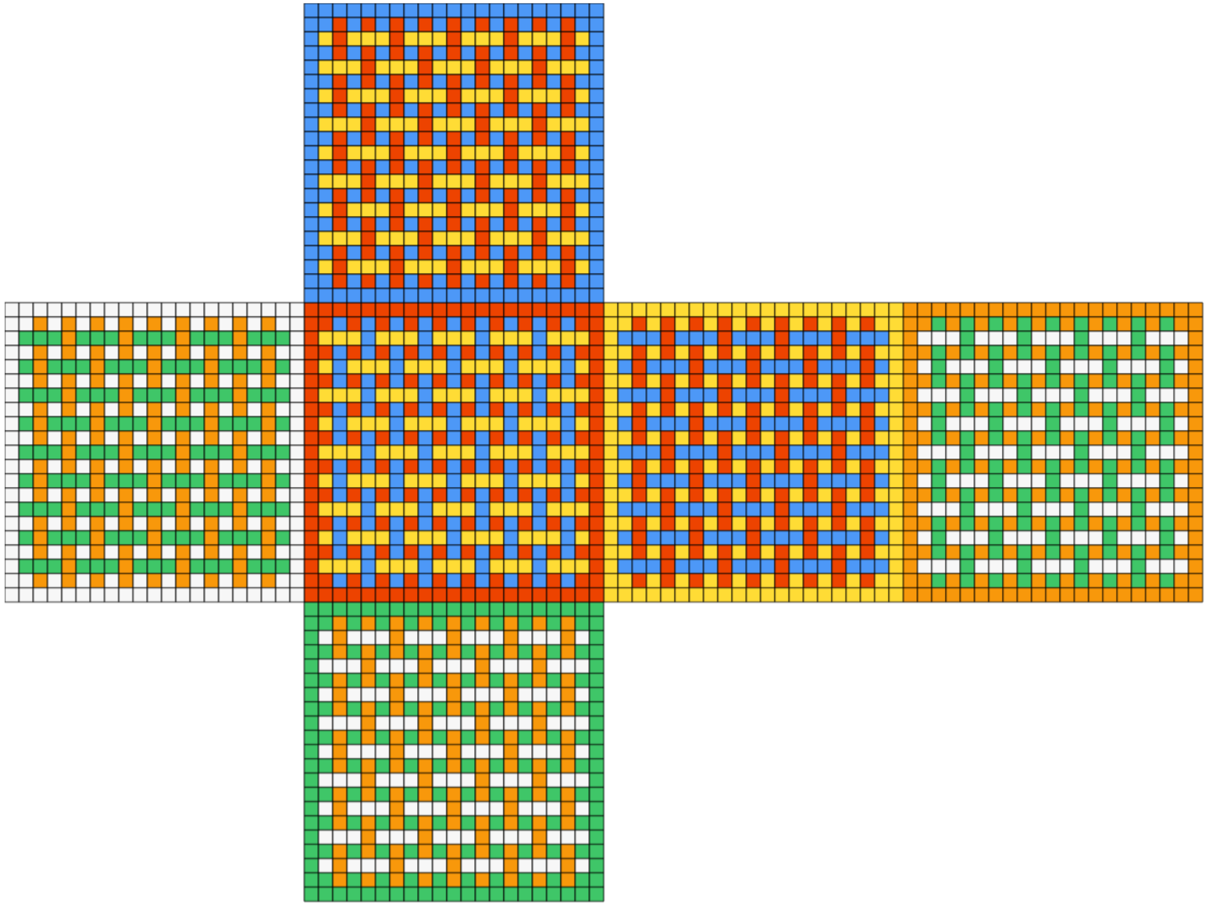
Basketweave 13x13x13

// Basketweave
// 21x21x21 Cube

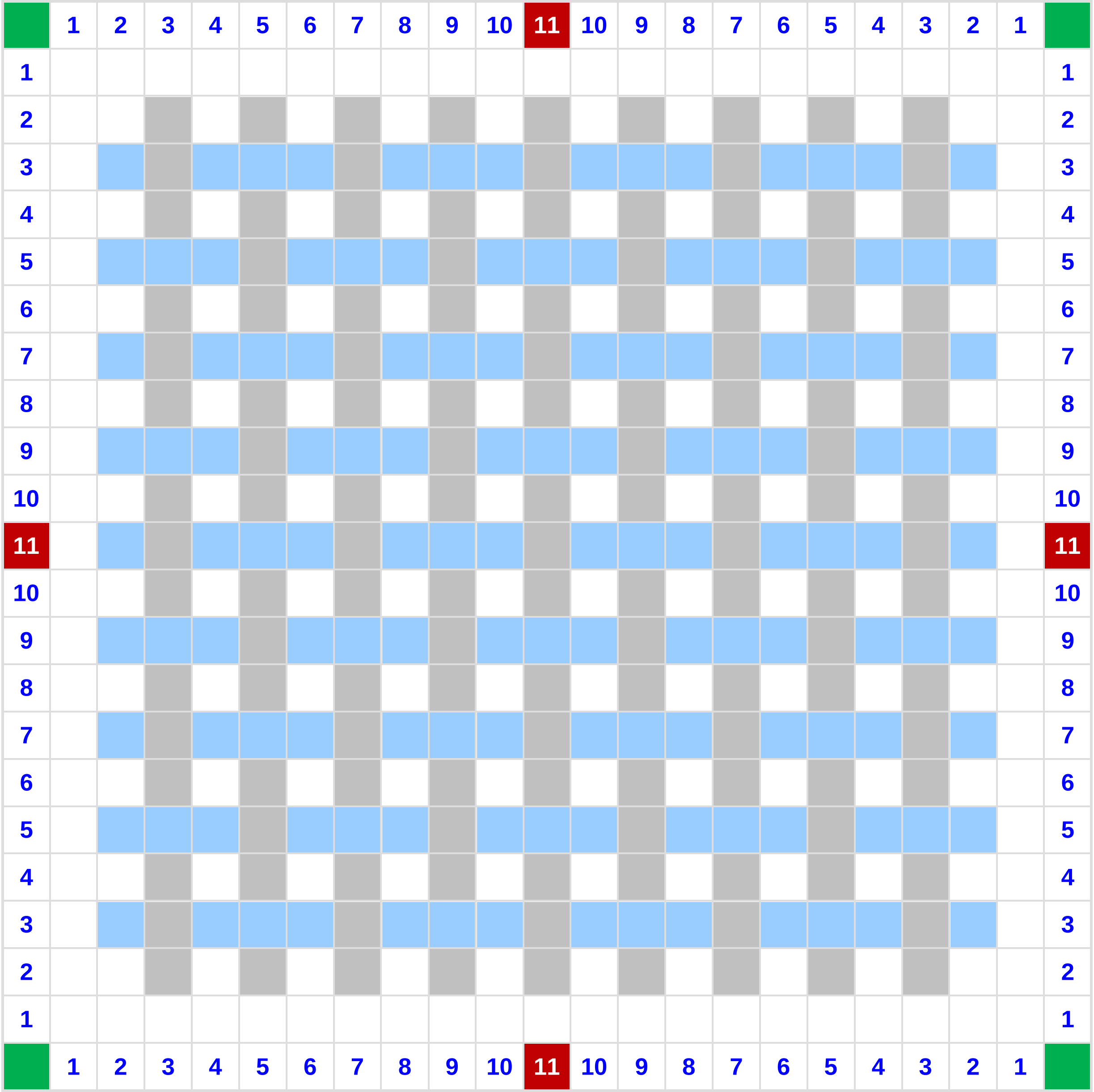
// Pattern 1 (Color 1)
[N2F N4F N6F N8F N10F N10B' N8B' N6B' N4B' N2B', N3D N5D N7D N9D N11D N9U' N7U' N5U' N3U']
[N3B' N7B' N11B' N7F N3F, N3U' N7U' N11U' N7D N3D]
[N5F N9F N9B' N5B', N5D N9D N9U' N5U']

// Pattern 2 (Color 2)
[N2D N4D N6D N8D N10D N10U' N8U' N6U' N4U' N2U', N3F N5F N7F N9F N11F N9B' N7B' N5B' N3B']
[N3D N7D N11D N7U' N3U', N5F N9F N9B' N5B']
[N5D N9D N9U' N5U', N3F N7F N11F N7B' N3B']

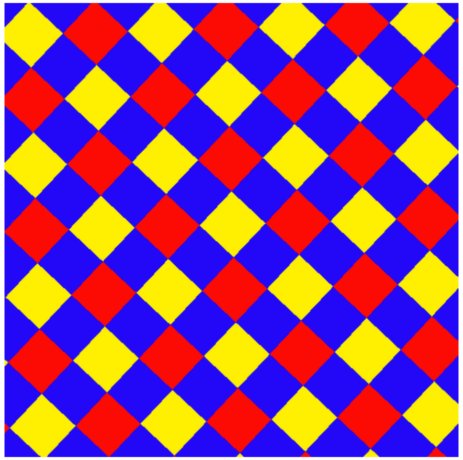
// Algorithm (148 moves) (1566 permuted stickers) (Permutation order: 3):
NF N4F N6F N8F N10F N10B' N8B' N6B' N4B' NB' N3D N5D N7D N9D MU' N5U' N9U' N7U' N3U' NB N4B N6B N8B N10B N10F' N8F' N6F' N4F' NF' N3U N5U N7U N9U MU N7D' N5D' N9D' N3D' N3B' N7B' MF N7F N3F N3U' N7U' MU' N7D N3D N3F' MF' N7F' N3B N7B N3D' N7D' MU N7U N3U N5F N9F N9B' N5B' N5D N9D N9U' N5U' N5B N9B N9F' N5F' N5U N9U N9D' N5D' ND N4D N6D N8D N10D N10U' N8U' N6U' N4U' NU' N3F N5F N7F N9F MF N9B' N7B' N5B' N3B' NU N4U N6U N8U N10U N10D' N8D' N6D' N4D' ND' N3B N5B N7B N9B MF' N9F' N7F' N5F' N3F' N3D N7D MU' N7U' N3U' N5F N9F N9B' N5B' N3U MU N7U N3D' N7D' N5B N9B N9F' N5F' N5D N9D N9U' N5U' N3F N7F MF N7B' N3B' N5U N9U N9D' N5D' N3B N7B MF' N7F' N3F'



Basketweave 21x21x21



Basketweave 21x21x21



http://en.wikipedia.org/wiki/Uniform_tiling

Chessboards (Three-Cycles)

6 Small Chessboards (single-color pattern)
[N2F N3B', N3D N2U'] [N3F N2B', N2D N3U']

14 m (Optimized):
VF VB' N3U' ND NB N3F' ND' N3D N3U NU' N3B NF' NU N3D'

6 Small Chessboards (2-color pattern)
[N2F N3B', N3D N2U'] [N2D N3U', N3F N2B']

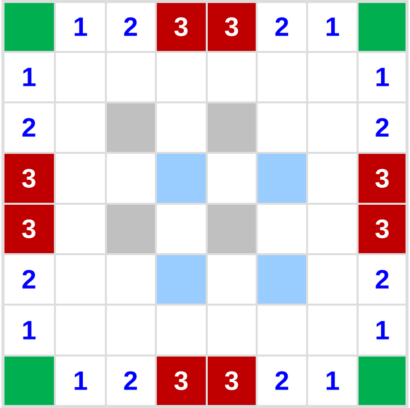
12 m (Optimized):
NF N3B' VD VU' N3F NB' ND' N3U VB VF' NU N3D'

3 Small Chessboards (single-color pattern)
[NF N3B', L N3D NU' L'] [N3F NB', L ND N3U' L']

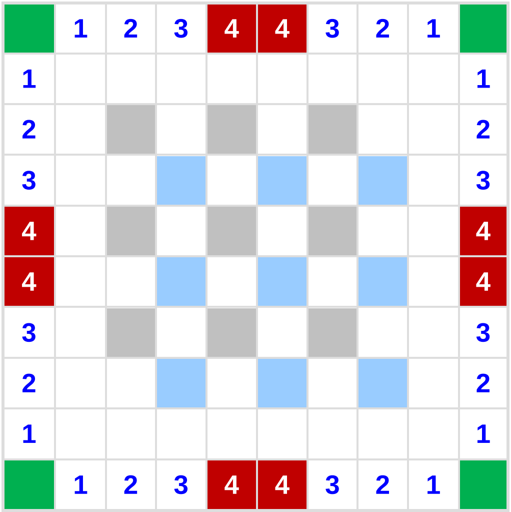
24 m (Unoptimized):
NF N3B' L N3D NU' L' N3B NF' L NU N3D' L' N3F NB' L ND N3U' L' NB N3F' L N3U ND' L'

3 Small Chessboards (2-color pattern)
[NF N3B', L N3D NU' L'] [L ND N3U' L', N3F NB']

22m (Optimized):
NF N3B' L N3D NU' L' N3B NF' L NU N3D' ND N3U' L' N3F NB' L N3U ND' L' NB N3F'



Pwain 6x6x6



Pwain 8x8x8

6 Small Chessboards (2-color pattern)
// Reference
[N2F N4F N3B', N2U' N4U' N3D]

// Translate
[N3F N4B' N2B', N3U' N4D N2D]

// Invert
[N3U' N4D N2D, N3F N4B' N2B']

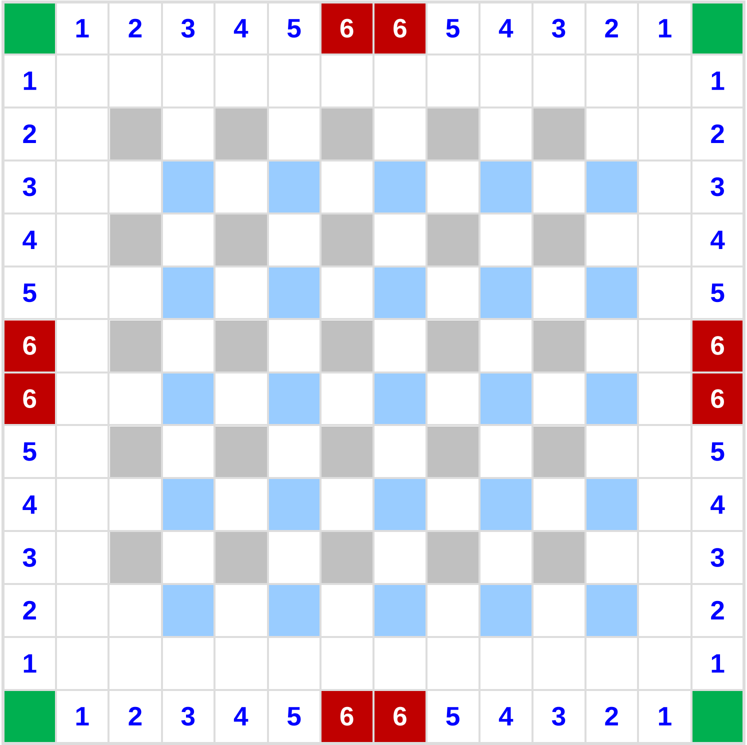
// Final
[N2F N4F N3B', N2U' N4U' N3D]
[N3U' N4D N2D, N3F N4B' N2B']

3 Small Chessboards (2-color pattern)
// Reference
[N2F N4F N3B', L N2U' N4U' N3D L']

// Translate
[N3F N4B' N2B', L N3U' N4D N2D L']

// Invert
[L N3U' N4D N2D L', N3F N4B' N2B']

// Final
[N2F N4F N3B', L N2U' N4U' N3D L']
[L N3U' N4D N2D L', N3F N4B' N2B']



Pwain 12x12x12

6 Small Chessboards (2-color pattern)

// Reference
[N2F N4F N6F N5B' N3B', N2U' N4U' N6U' N5D N3D]

// Translate
[N3F N5F N6B' N4B' N2B', N3U' N5U' N6D N4D N2D]

// Invert
[N3U' N5U' N6D N4D N2D, N3F N5F N6B' N4B' N2B']

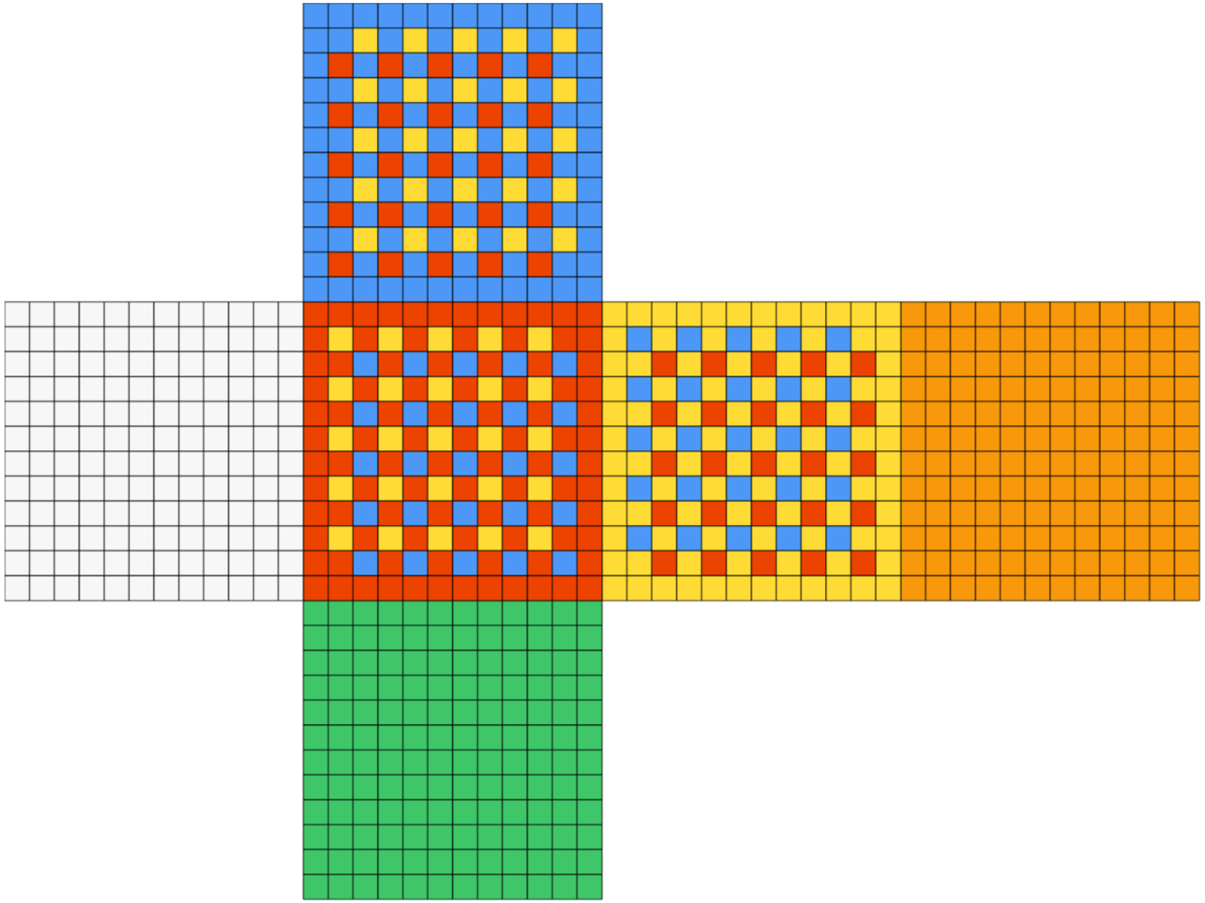
// Final
[N2F N4F N6F N5B' N3B', N2U' N4U' N6U' N5D N3D]
[N3U' N5U' N6D N4D N2D, N3F N5F N6B' N4B' N2B']

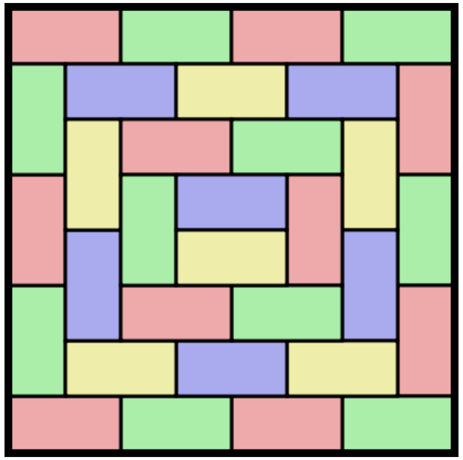
3 Small Chessboards (2-color pattern)
// Reference
[N2F N4F N6F N5B' N3B', L N2U' N4U' N6U' N5D N3D L']

// Translate
[N3F N5F N6B' N4B' N2B', L N3U' N5U' N6D N4D N2D L']

// Invert
[L N3U' N5U' N6D N4D N2D L', N3F N5F N6B' N4B' N2B']

// Final
[N2F N4F N6F N5B' N3B', L N2U' N4U' N6U' N5D N3D L']
[L N3U' N5U' N6D N4D N2D L', N3F N5F N6B' N4B' N2B']





http://en.wikipedia.org/wiki/File:Dominoes_tiling_8x8.svg

// Ring (colors 1 & 2)
// Reference
[N2F N2B', N2D N3D]
[N3F N3B', N2U']

// Transform
[N2F N2B', N2U' N3U']
[N3F N3B', N2D]

// Invert to change color 1 to color 2
[N2U' N3U', N2F N2B']
[N2D, N3F N3B']

// Final: compose Reference with (Transformed + Inverted)
[N2F N2B', N2D N3D]
[N3F N3B', N2U']
[N2U' N3U', N2F N2B']
[N2D, N3F N3B']

// Optimize
[V2U', N2F N2B'] [N2F N2B', V2D]
[N2D, M2F] [M2F, N2U']

// Algorithm (13 moves) (72 permuted stickers) (Permutation order: 3):
VU' NF NB' VU VD NB NF' N3D' M2F ND' NU' M2F' NU

// 2 (2c) (RF)(SE)
[N3R N3F' N3U, N3F2]

// 2 (2c) (OI)(PL)
[N3U N3F' N3L, N3F2]

// 2 (2c) (WA)(BV)
[N3U N3R' N3F, N3R2]

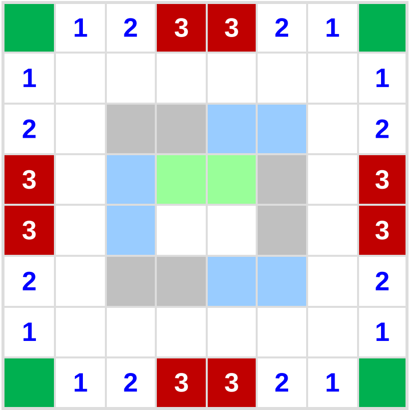
// SCS (21 moves)
// 3 2(2c): (RF)(SE) (OI)(PL) (WA)(VB)
N3R N3F' N3U N3F2 N3U' N3F N3R' N3F N3U N3F N3U' N3F N3R' N3F' N3D N3R N3D' N3R N3F' N3R' N3F

// AFL (21 moves)
// Transform algorithm to begin with N3U
N3U N3F N3U' N3F N3R' N3F' N3D N3R N3D' N3R N3F' N3R' N3F N3R N3F' N3U N3F2 N3U' N3F N3R' N3F

// Compose and combine
VU' NF NB' VU VD NB NF' N3D' M2F ND' NU' M2F' NU
N3U N3F N3U' N3F N3R' N3F' N3D N3R N3D' N3R N3F' N3R' N3F N3R N3F' N3U N3F2 N3U' N3F N3R' N3F

// Algorithm (33 moves) (84 solved stickers) (Order: 6)
VU' NF NB' VU VD NB NF' N3D' M2F ND' NU' M2F' VU N3F N3U' N3F N3R' N3F' N3D N3R N3D' N3R N3F' N3R' N3F N3R N3F' N3U N3F2 N3U' N3F N3R' N3F

// Optimized Algorithm (19 moves): see TP Forum
(VU' NF NB' VU VD NF' NB MD' M2F NU' ND' M2F') (U') (TD MB2 MR2 MB2 S2U MF2)



Domino Tiling 6x6x6

Four Fives

This is a test case for the N 2-cycles optimizer of SCS.
Four fives (or eight ones) are displayed on four faces. Algorithms are those of 2-cycles, *not* 3-cycles

// Orbit 06: Midges: (BU)(DW)(IN)(KP)
R' L' MU2 L R SD R L MU2 L' R' SD'

// Midges + Edges
R' L' **M3U2** L R SD R L **M3U2** L' R' SD'

// Orbit 03: Centers: (BU)(DW)(IN)(KP)
NU' ND R2 NF2 R2 ND' R2 NF2 NB2 R2 NU R2 NB2 R2

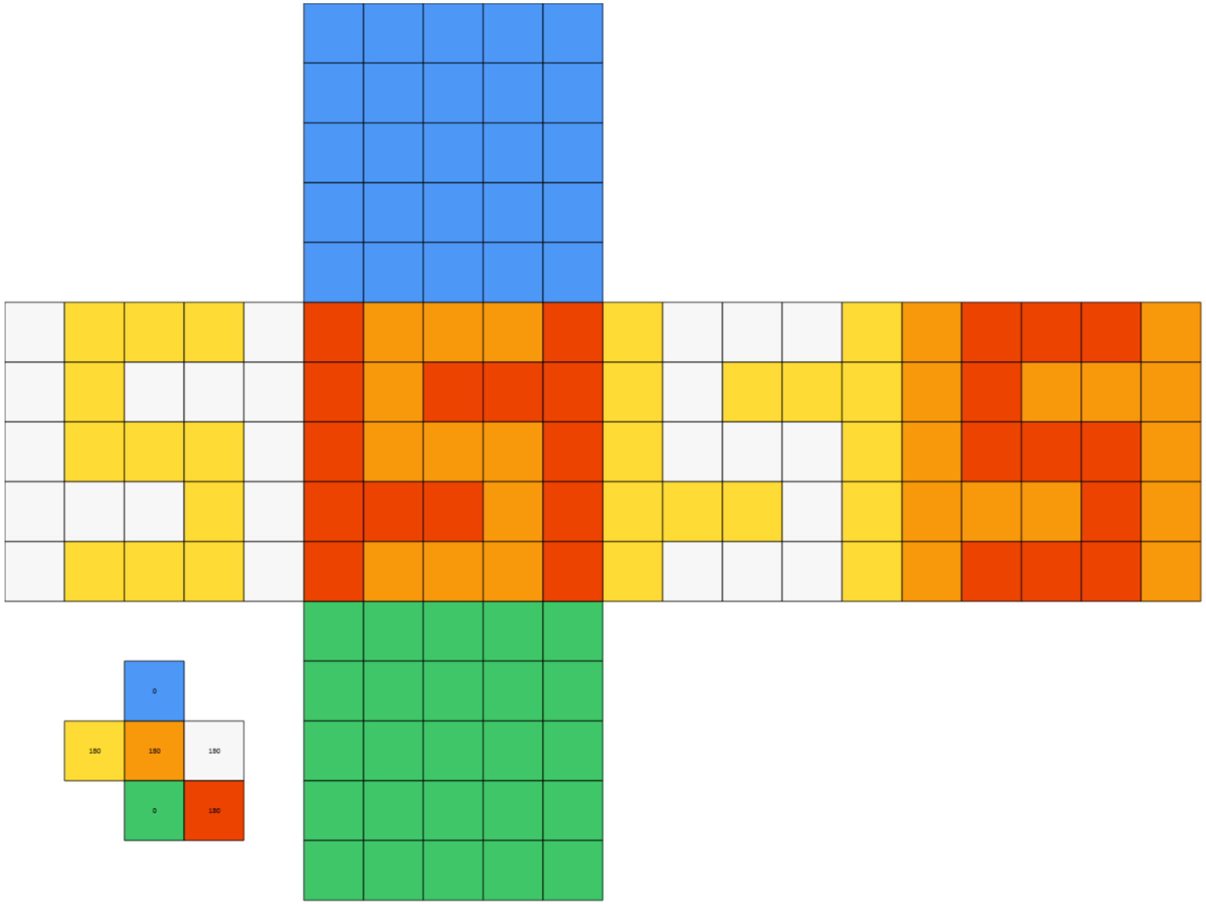
// Use AFL to transform this algorithm into one beginning in NU and ending in F2
NU F2 NR2 F2 NU' ND F2 NL2 F2 ND' F2 NL2 NR2 F2

// Orbit 05: Centers: (AX)(CV)(JO)(LM)
F2 NL2 R2 MU NR2 NL2 MU' TR2 F2

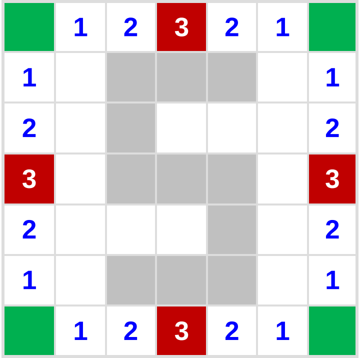
// True Centers
MD MR2 MD' MR2

// Complete Algorithm
R' L' M3U2 L R SD R L M3U2 L' R' SD'
NU F2 NR2 F2 NU' ND F2 NL2 F2 ND' F2 NL2 NR2 F2
F2 NL2 R2 MU NR2 NL2 MU' TR2 F2
MD MR2 MD' MR2

// Final Optimization with Algorithm Viewer
// Algorithm (34 moves) (68 permuted stickers) (Permutation order: 2):
R' L' M3U2 L R SD R L M3U2 L' R' SD' NU F2 NR2 F2 NU' ND F2 NL2 F2 ND' F2 TR2 MU NR2 NL2 MU' TR2 F2 MU' MR2 MU MR2



Four Fives 5x5x5



Four Fives 5x5x5

1.4

This is a test case for the N 2-cycles optimizer of SCS.
Four '1.4' are displayed on four faces of a 5x5x5 cube. Algorithms are those of 2-cycles, *not* 3-cycles

// Orbit 02: Corners: (AX)(CV)(BU)(DW)
SR' SD2 SR D2 SR' SD2 SR D2
[SR' SD2 SR, D2]

// Orbit 06: Midges: (AX)(CV)
SR' SD2 SR MU' SR' SD2 SR MU
[SR' SD2 SR, MU']

// Vertical Bars (Corners + Midges + Edges)
[SR' SD2 SR, D2 WU']

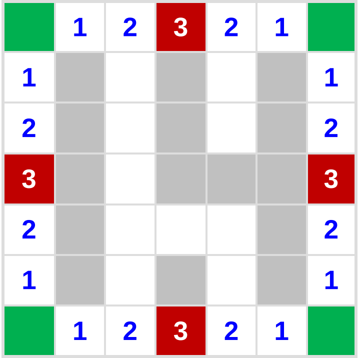
// Orbit 06: Midges: (DW)(IN) (BU)(KP)
[R' L' MU2 L R, SD]

// Orbit 05: Centers: (BU)(DW)(IN)(KP)
MR' R2 TF2 MU' NF2 MU F2 R2 NU' MR NU2 MR' NU' MR

// Orbit 0: True Centers
MD MR2 MD' MR2

// Complete Algorithm (Unoptimized)
[SR' SD2 SR, D2 WU']
[R' L' MU2 L R, SD]
MD MR2 MD' MR2
MR' R2 TF2 MU' NF2 MU F2 R2 NU' MR NU2 MR' NU' MR

// Algorithm (39 moves) (76 permuted stickers) (Permutation order: 2):
SR' SD2 SR D2 WU' SR' SD2 SR WU D2 R' L' MU2 L R SD R' L' MU2 L R SD' MU' MR2 MU MR R2 TF2 MU' NF2 MU F2 R2 NU' MR NU2 MR' NU' MR



1.4 5x5x5

14

This is a test case for the N 2-cycles optimizer of SCS.
Four '14' are displayed on four faces of a 5x5x5 cube. Algorithms are those of 2-cycles, *not* 3-cycles

// Orbit 02: Corners: (AX)(CV)(BU)(DW)
SR' SD2 SR D2 SR' SD2 SR D2
[SR' SD2 SR, D2]

// Orbit 06: Midges: (AX)(CV)
SR' SD2 SR MU' SR' SD2 SR MU
[SR' SD2 SR, MU']

// Vertical Bars (Corners + Midges + Edges)
[SR' SD2 SR, D2 WU']

// Orbit 06: Midges: (DW)(IN)
MR2 U MR' SU2 MR U2 MR' SU2 MR U MR2

// Orbit 05: Centers: (BU)(DW)(IN)(KP)
MR' R2 TF2 MU' NF2 MU F2 R2 NU' MR NU2 MR' NU' MR

// Orbit 0: True Centers
MD MR2 MD' MR2

// Complete Algorithm (Unoptimized)
[SR' SD2 SR, D2 WU']
MD MR2 MD' MR2
MR2 U MR' SU2 MR U2 MR' SU2 MR U MR2
MR' R2 TF2 MU' NF2 MU F2 R2 NU' MR NU2 MR' NU' MR

// Algorithm (36 moves) (68 permuted stickers) (Permutation order: 2):
SR' SD2 SR D2 WU' SR' SD2 SR WU MU' D2 MR2 MU U MR' SU2 MR U2 MR' SU2 MR U MR R2 TF2 MU' NF2 MU F2 R2 NU' MR NU2 MR' NU' MR

	1	2	3	2	1	
1						1
2						2
3						3
2						2
1						1
	1	2	3	2	1	

14 5x5x5

1.4 (IMPROVED: see TPF)
(25 m)
1. N2F2 N4F2 N2R2 N4R2 TD2 N2F2 N4F2 N2R2 N4R2 TD2 ("wide edges")
2. MR- N2D MR N2D2 MR- N2D MR (centers)
3. F2 L2 N2R2 MU- N2R2 MU L2 F2 (final centers)

// New arrangement
3. R2 B2 MU NB2 MU' TB2 R2 (7 m)
2. N3F2 ND N3F2 ND2 N3F2 ND **N3F2** (7 m)
1. **N2F2** N4F2 N2R2 N4R2 TD2 N2F2 N4F2 N2R2 N4R2 TD2 (10 m)

// Algorithm (23 moves) (64 permuted stickers) (Permutation order: 2):
R2 B2 MU NB2 MU' TB2 R2 MF2 ND MF2 ND2 MF2 ND VF2 N4F2 NR2 N4R2 TD2 NF2 N4F2 NR2 N4R2 TD2

14 (IMPROVED: see TPF)
(26 m)
1.WF2 TU WR2 TU2 WR2 TU WF2 ("wide edges")
2.N2R2 N4R2 TD N2F2 N4F2 TD2 N2F2 N4F2 TD N2R2 N4R2 (more "wide edges")
3.F2 L2 N2R2 MU- N2R2 MU L2 F2

// New arrangement
3.R2 B2 MU NB2 MU' TB2 **R2** (7 m)
2.**N2R2** N4R2 TD N2F2 N4F2 TD2 N2F2 N4F2 TD N2R2 **N4R2** (11 m)
1.**WR2** TU' WF2 TU2 WF2 TU' WR2 (7 m)

Algorithm (23 moves) (68 permuted stickers) (Permutation order: 2):
R2 B2 MU NB2 MU' TB2 TR2 N4R2 TD NF2 N4F2 TD2 NF2 N4F2 TD NR2 M2R2 TU' WF2 TU2 WF2 TU' WR2

23SE

// Edges (6 m)
D2 WR2 WF2 D2 WF2 **WR2**

// Centers 1
WR2 MU' WR2 MU

// Centers 2 --- Orbit 03: (AW)(CU)(JM)(KN)
B2 ND' NB' NR NB2 NR' NB ND TB2

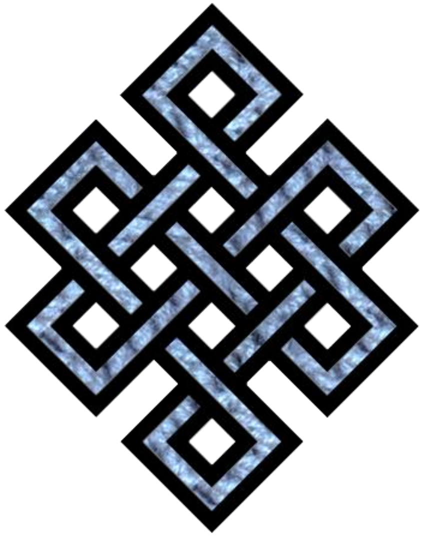
D2 WR2 WF2 D2 WF2 **WR2**
WR2 MU' WR2 MU
B2 ND' NB' NR NB2 NR' NB ND TB2

Algorithm (17 moves) (68 permuted stickers) (Permutation order: 2):
D2 WR2 WF2 D2 WF2 MU' WR2 MU B2 ND' NB' NR NB2 NR' NB ND TB2

23SE++
//
(T3U2 M2F2 M2R2 T3U2)
D2 WR2 WF2 D2 WF2 M2U' WR2 M2U B2 ND' NB' NR NB2 NR' NB ND **TB2**
(**N3B2** N3L2 N3R2)2

//
(T3U2 M2F2 M2R2 T3U2)
D2 WR2 WF2 D2 WF2 M2U' WR2 M2U B2 ND' NB' NR NB2 NR' NB ND T3B2
N3L2 N3R2 N3B2 N3L2 N3R2

// Algorithm (26 moves) (144 permuted stickers) (Permutation order: 2):
T3U2 M2F2 M2R2 T3U2 D2 WR2 WF2 D2 WF2 M2U' WR2 M2U B2 ND' NB' NR NB2 NR' NB ND T3B2 N3L2 N3R2 N3B2 N3L2 N3R2



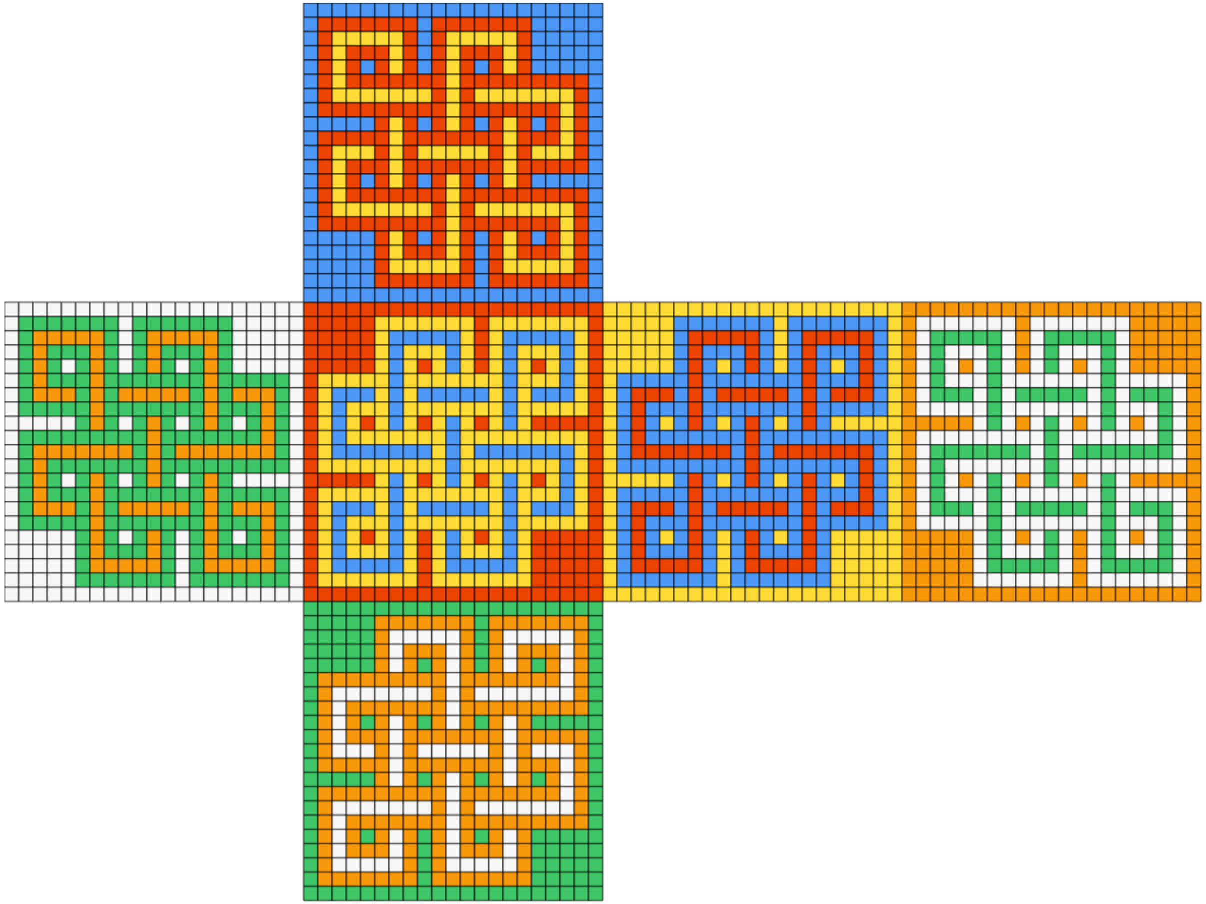
http://en.wikipedia.org/wiki/Endless_knot

// Endless Knot
// 21x21x21 Cube

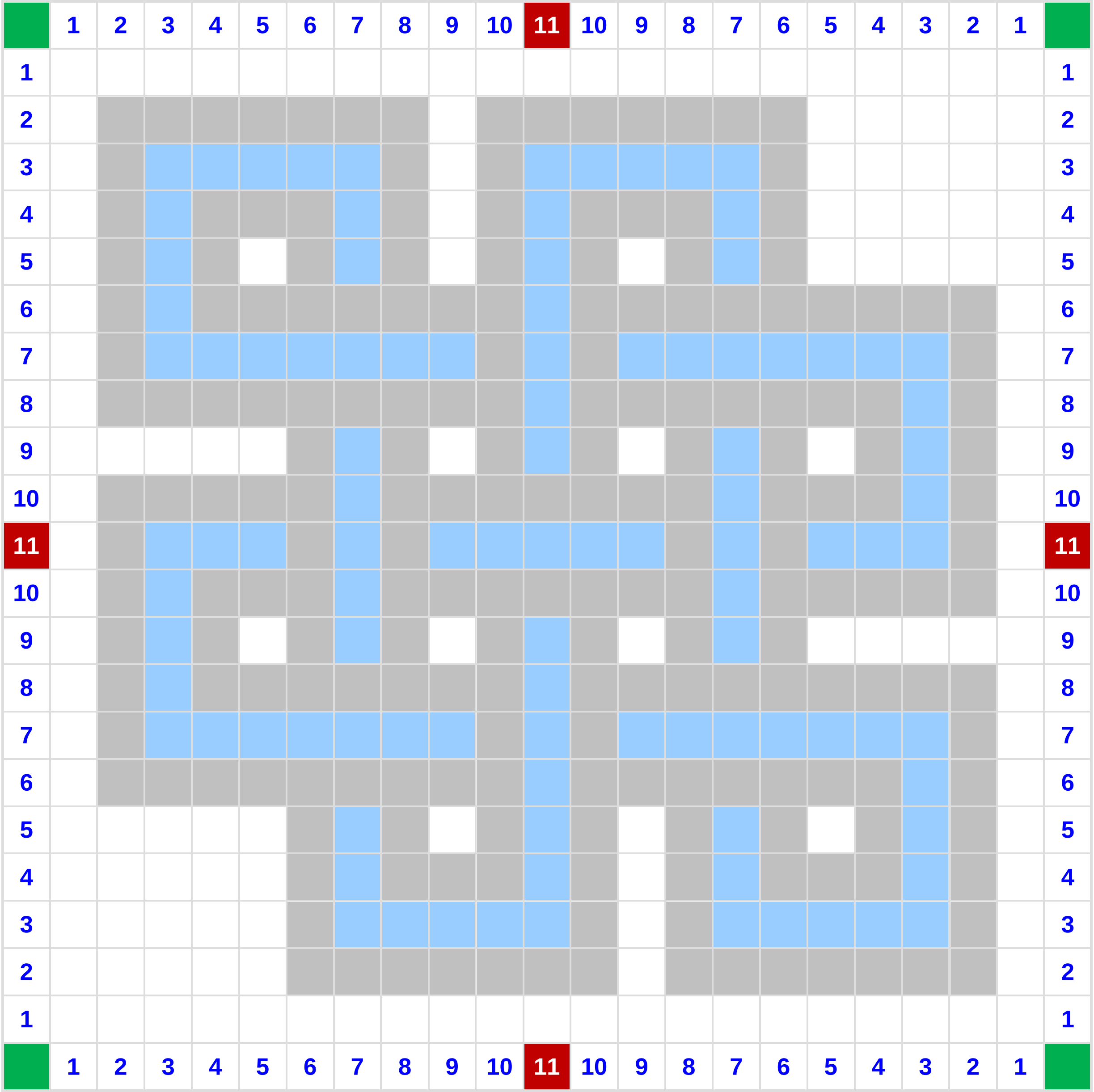
// Pattern 1 (Color 1)
[N2F, N2D N3D N4D N5D N6D N7D N8D N10D N11D N12D N13D N14D N15D N16D]
[N3F, N2D N8D N10D N16D]
[N4F, N2D N4D N5D N6D N8D N10D N12D N13D N14D N16D]
[N5F N13F, N2D N4D N6D N8D N10D N12D N14D N16D]
[N6F N14F, N2D N4D N5D N6D N7D N8D N9D N10D N12D N13D N14D N15D N16D N17D N18D N19D N20D]
[N7F N15F, N2D N10D N12D N20D]
[N8F N16F, N2D N3D N4D N5D N6D N7D N8D N9D N10D N12D N13D N14D N15D N16D N17D N18D N20D]
[N9F N17F, N6D N8D N10D N12D N14D N16D N18D N20D]
[N10F, N2D N3D N4D N5D N6D N8D N9D N10D N11D N12D N13D N14D N16D N17D N18D N20D]
[N11F, N2D N6D N8D N14D N16D N20D]
[N12F, N2D N4D N5D N6D N8D N9D N10D N11D N12D N13D N14D N16D N17D N18D N19D N20D]
[N18F, N6D N8D N9D N10D N12D N14D N16D N17D N18D N20D]
[N19F, N6D N12D N14D N20D]
[N20F, N6D N7D N8D N9D N10D N11D N12D N14D N15D N16D N17D N18D N19D N20D]

// Pattern 2 (Color 2)
[N3D, N3F N4F N5F N6F N7F N11F N12F N13F N14F N15F]
[N4D N5D N13D, N3F N7F N11F N15F]
[N6D N14D, N3F N7F N15F]
[N7D N15D, N3F N4F N5F N7F N9F N10F N11F N12F N13F N15F N17F N18F N19F]
[N8D, N7F N15F N19F]
[N9D, N7F N11F N15F N19F]
[N10D, N11F N19F]

[N11D, N3F N4F N5F N6F N7F N8F N9F N11F N13F N14F N15F N16F N17F N18F N19F]
[N12D, N3F N11F]
[N16D, N7F N15F N19F]
[N17D N18D, N7F N11F N15F N19F]
[N19D, N7F N8F N9F N10F N11F N15F N16F N17F N18F N19F]



Endless Knot 21x21x21



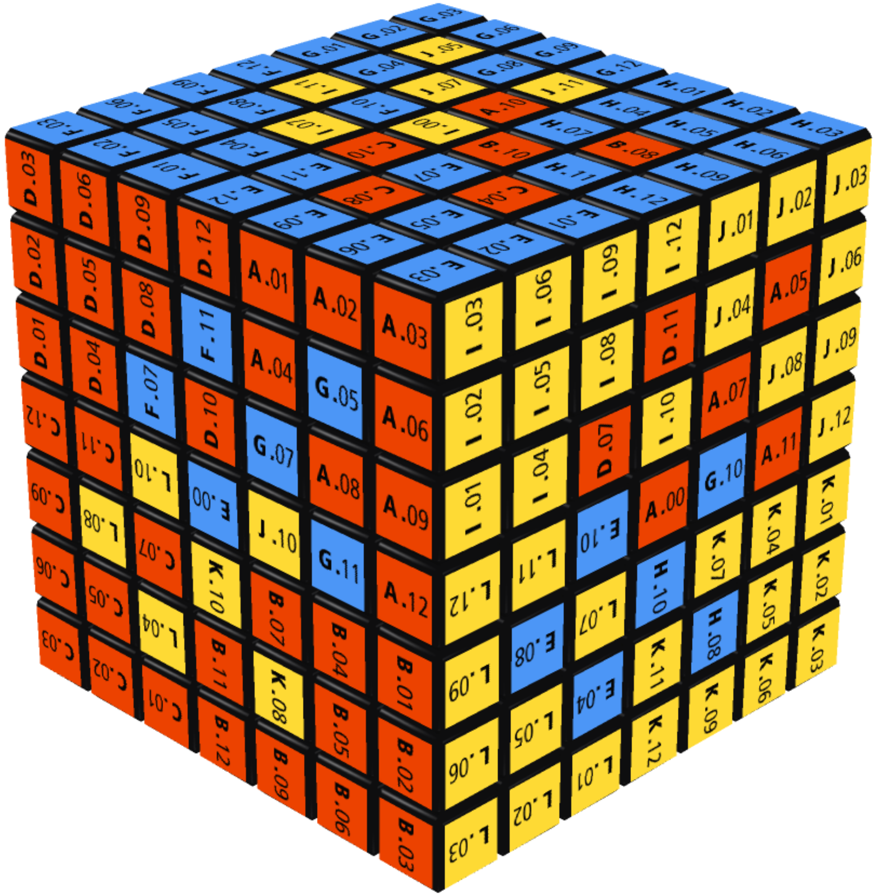
Endless Knot 21x21x21

// Pattern 1 (Color 1)
[N2F N4F, N3D]
[N3F N5F, N2D N4D]

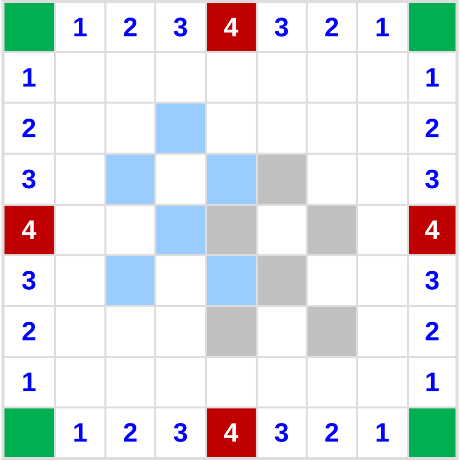
// Pattern 2 (Color 2)
[N5D, N3F N5F]
[N4D N6D, N4F N6F]

// Optimize
[N5D, **N3F N5F**] [**N3F N5F**, **N4D** N2D] [**N4D** N6D, **N4F** N6F] [**N4F** N2F, N3D]
(N5D N3F N5F N5D' **N5F' N3F') (N3F N5F** N4D N2D N5F' N3F' N2D' **N4D') (N4D** N6D N4F N6F N6D' N4D' N6F' **N4F'**) (**N4F** N2F N3D N2F' N4F' N3D')
N3U' N3F N3B' N3U MU' ND N3B N3F' ND' NU' MF NB' NU MU NB NF N3D NF' MF' N3D'

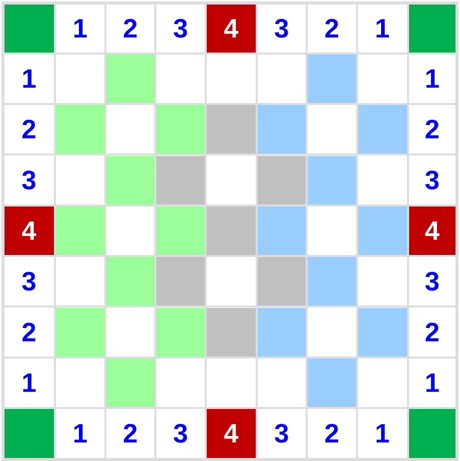
// Algorithm (20 moves) (72 permuted stickers) (Permutation order: 3):
N3U' N3F N3B' N3U MU' ND N3B N3F' ND' NU' MF NB' NU MU NB NF N3D NF' MF' N3D'



Personal Match Logo 7x7x7



Personal Match Logo 7x7x7

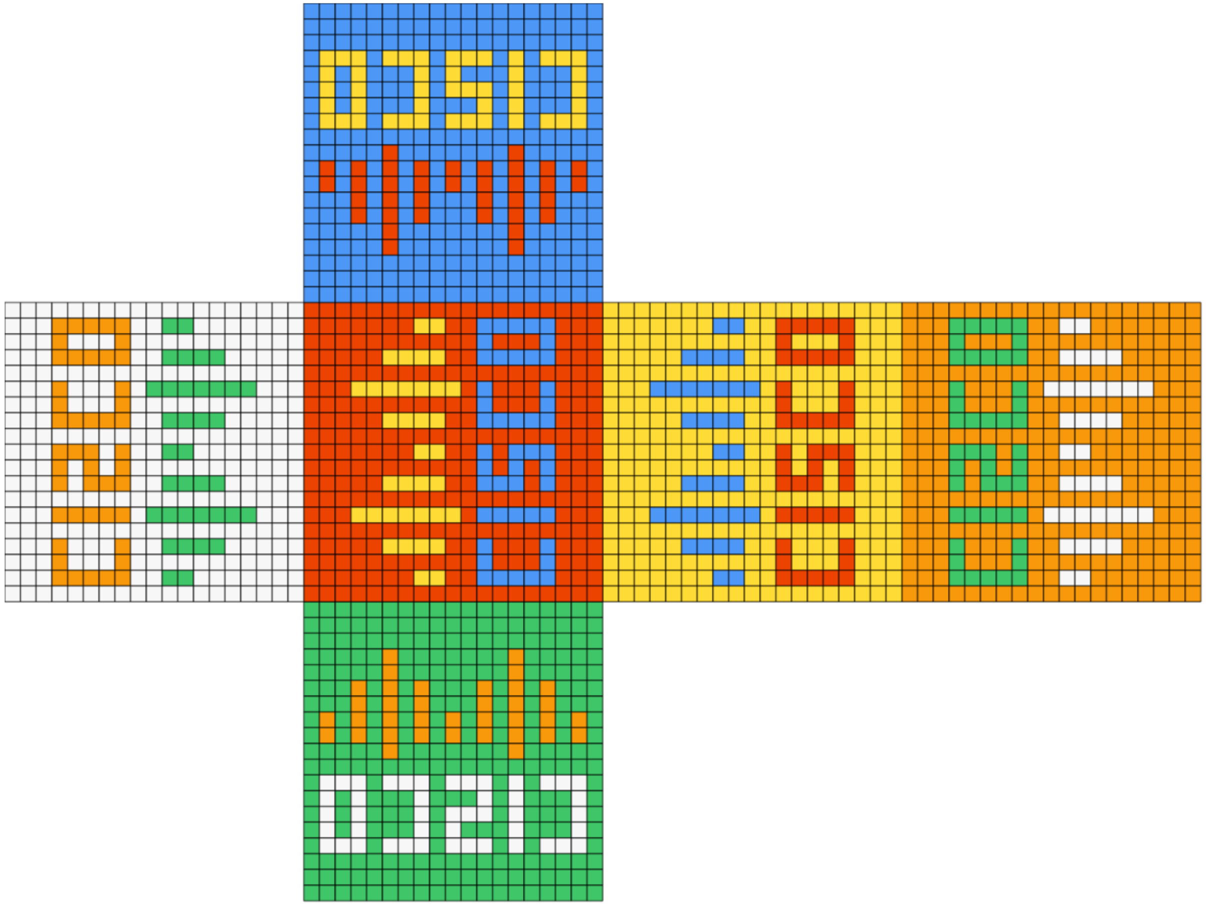


Personal Match Logo 2 7x7x7

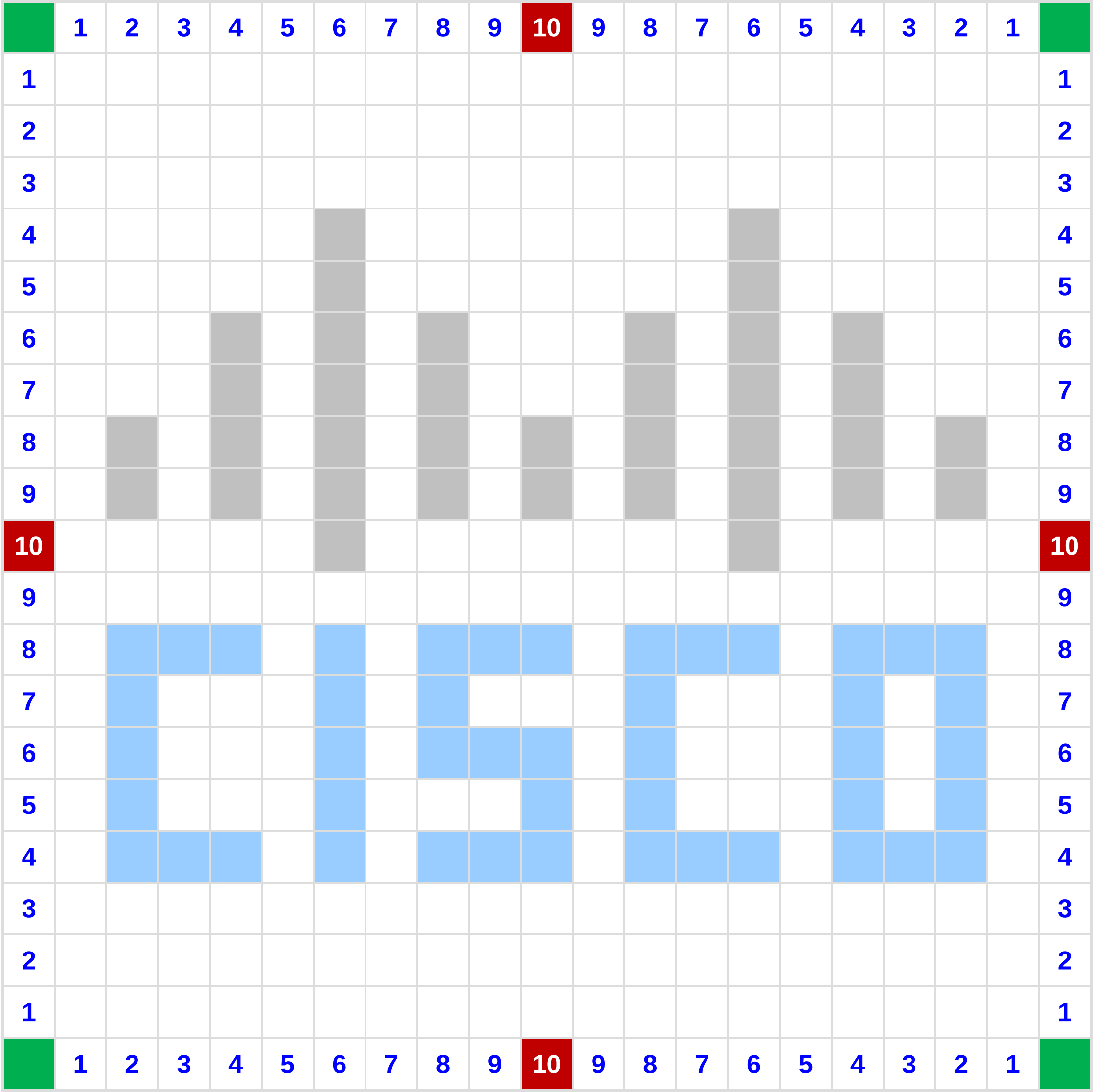
// Cisco 19x19x19

// Pattern 1 (Color 1)
[N4F N5F N6F N7F N8F N9F N10F, N6D N14D]
[N6F N7F N8F N9F, N4D N8D N12D N16D]
[N8F N9F, N2D N10D N18D]

// Pattern 2 (Color 2)
[N2D N6D N12D N16D N18D, N12F N13F N14F N15F N16F]
[N3D N4D N8D N9D N10D N13D N14D N17D, N12F N16F]
[N8D N9D N10D, N14F]
[N8D, N13F]
[N10D, N15F]



Cisco 19x19x19

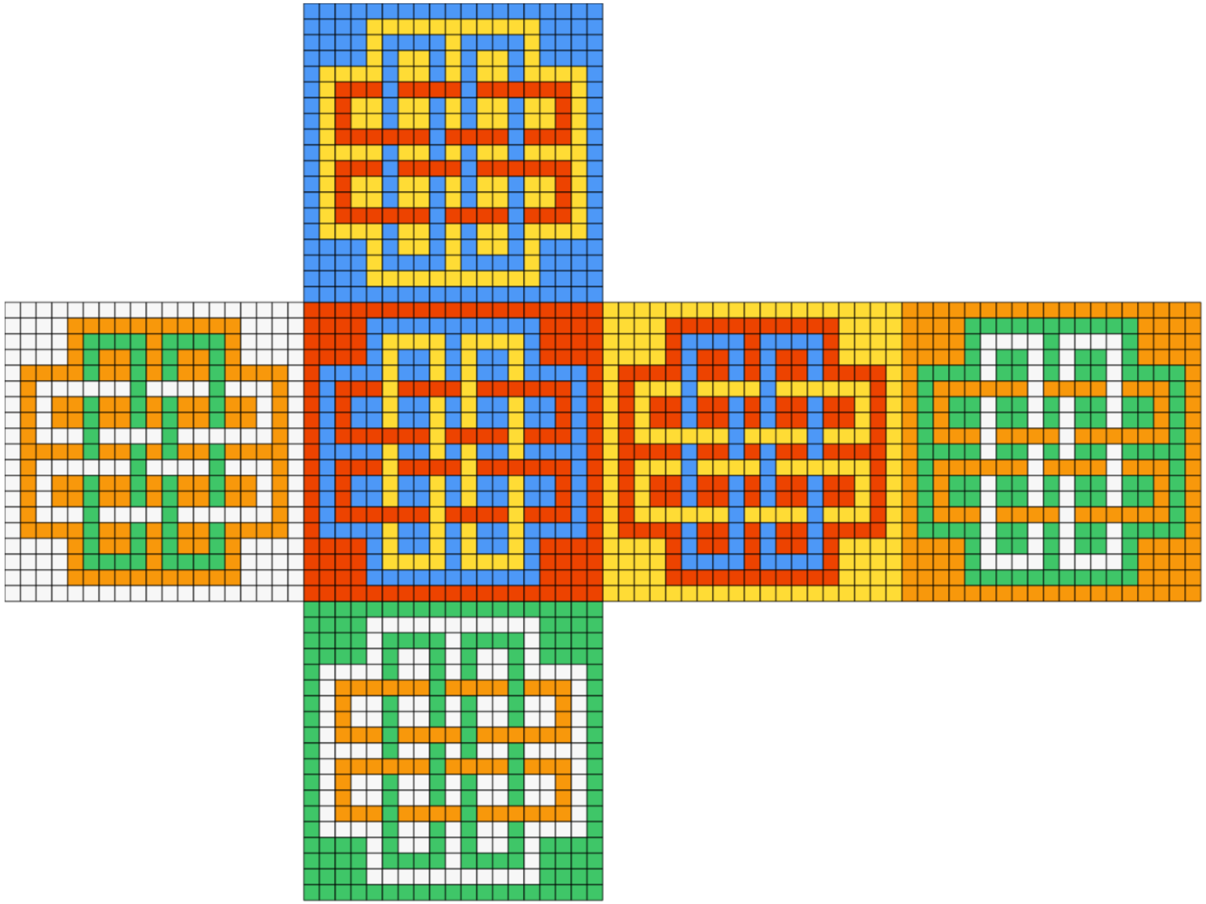


Cisco 19x19x19

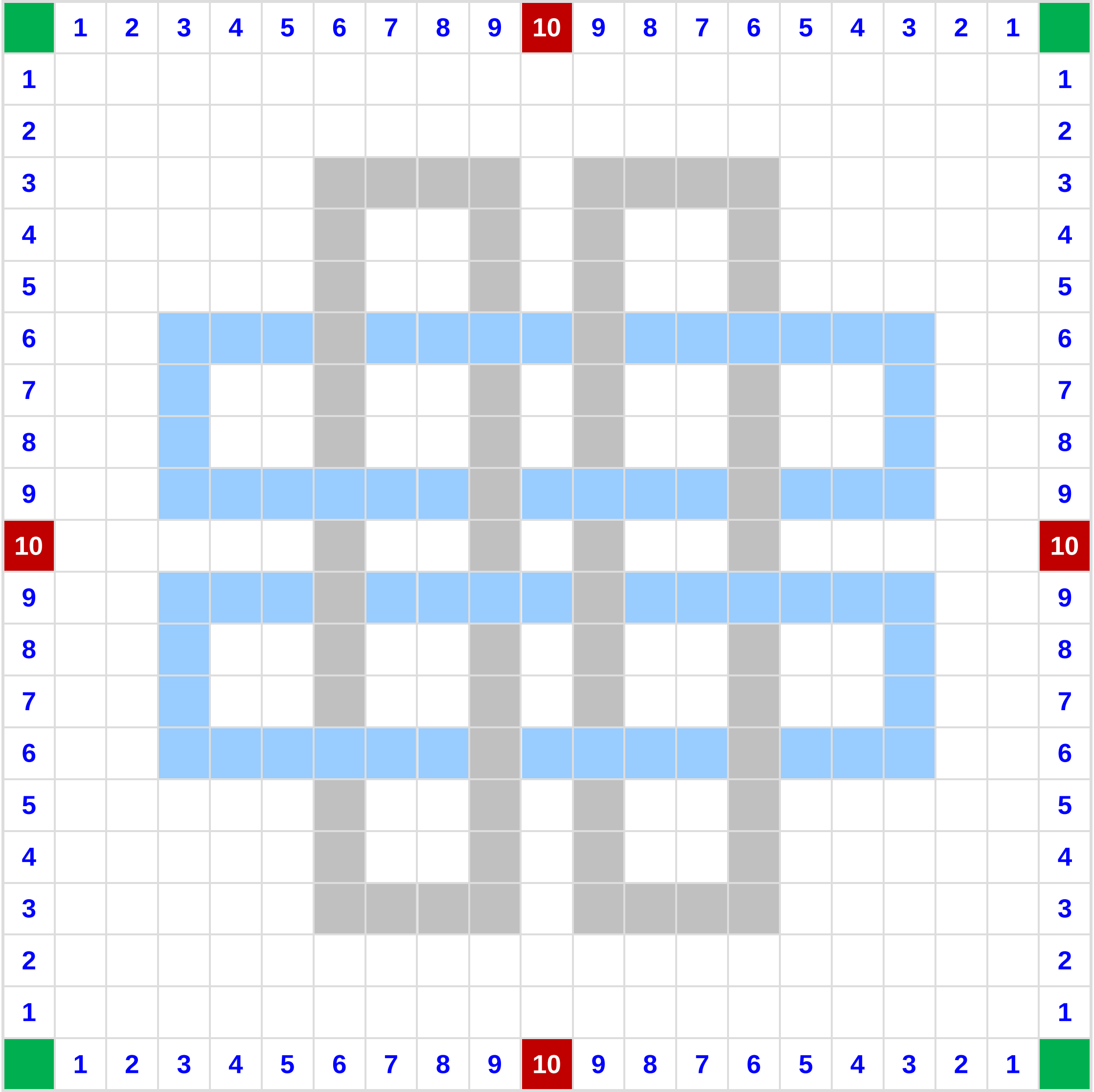
// Tangled Rings 19x19x19
// Pattern 1 (Color 1)
[N3F N4F N5F N7F N8F N10F N12F N13F N15F N16F N17F, N6D N9D N11D N14D]
[N3F N17F, N7D N8D N12D N13D]
[N9F N14F, N9D N14D]
[N6F N11F, N6D N11D]

// Pattern 2 (Color 2)
[N3D N4D N5D N7D N8D N10D N12D N13D N15D N16D N17D, N6F N9F N11F N14F]
[N3D N17D, N7F N8F N12F N13F]
[N9D N14D, N6F N11F]
[N6D N11D, N9F N14F]

// Pattern 3 (Color 3)
[N5D N6D N7D N8D N9D N10D N11D N12D N13D N14D N15D, N2F N3F N4F N16F N17F N18F]
[N2D N3D N4D N16D N17D N18D, N5F N6F N7F N8F N9F N10F N11F N12F N13F N14F N15F]
[N5D N6D N7D N8D N9D N10D N11D N12D N13D N14D N15D, N5F N6F N7F N8F N9F N10F N11F N12F N13F N14F N15F]



Tangled Rings 19x19x19



Tangled Rings 19x19x19

IN WORKS!
Superflip on a 7x7x7 Cube (Per --- TPF)

// 1.Reference Superflip (3x3x3 cube with twisted centers)
MF U B2 D2 MR' D' MR2 MF U R2 D MR2 U B2 U MF2 (16 s*)

// Extension to a 7x7x7 Cube
// Part A
M5F U B2 D2 M5R' D' M5R2 M5F U R2 D M5R2 U B2 U M5F2

// Part B
M3F TU TB2 TD2 M3R' TD' M3R2 M3F TU TR2 TD M3R2 TU TB2 TU M3F2

// Part C
MF T3U T3B2 T3D2 MR' T3D' MR2 MF T3U T3R2 T3D MR2 T3U T3B2 T3U MF2

// [A, B]
[M5F U B2 D2 M5R' D' M5R2 M5F U R2 D M5R2 U B2 U M5F2, M3F TU TB2 TD2 M3R' TD' M3R2 M3F TU TR2 TD M3R2 TU TB2 TU M3F2]

// [B, C]
[M3F TU TB2 TD2 M3R' TD' M3R2 M3F TU TR2 TD M3R2 TU TB2 TU M3F2, MF T3U T3B2 T3D2 MR' T3D' MR2 MF T3U T3R2 T3D MR2 T3U T3B2 T3U MF2]

// [C, A]
[MF T3U T3B2 T3D2 MR' T3D' MR2 MF T3U T3R2 T3D MR2 T3U T3B2 T3U MF2, M5F U B2 D2 M5R' D' M5R2 M5F U R2 D M5R2 U B2 U M5F2]

A, B and C do not commute because of twisted centers

// 2.Reference Superflip (3x3x3 cube with **no** twisted centers)
CR2 MF' MR2 MU' MF' R U B L U MR F' MR B MR F' L' U' R' U' (19 s*)

// Extension to a 7x7x7 Cube
// Part A
M5F' M5R2 M5U' M5F' R U B L U M5R F' M5R B M5R F' L' U' R' U'

// Part B
M3F' M3R2 M3U' M3F' TR TU TB TL TU M3R TF' M3R TB M3R TF' TL' TU' TR' TU'

// Part C
MF' MR2 MU' MF' T3R T3U T3B T3L T3U MR T3F' MR T3B MR T3F' T3L' T3U' T3R' T3U'

A, B and C do commute because centers are not twisted

Four Outlined Hearts (90° Version)

// Edges
R F (VD2 R2 VU' R2 VU F2 VD' F2 (R2 VD')2) F' R'
R' (U B' VD B U' B' VD' B) R
B' (U L' VU' L U' L' VU L) B
F D (VB' D' B' VR B D SR' D' B' VR' B D SR VB) D' F'

// Midge-Centers: 14 m
MF2 (ND' MR2 ND R' ND' R' NU MR2 NU' R ND R) MF2

// Edge-Centers
B ND' B N3L2 B' ND B N3L2 B N3B2 N3D' B' L' NU' NR2 L B N3D B' NR2 L' NU L N3B2 B2
B N3D' B NL2 B' N3D B NL2 B NB2 ND' B' L' N3U' N3R2 L B ND B' N3R2 L' N3U L NB2 B2

// Midges
B2 R2 B' MR B R2 B' MR' MF2 B' D F MF2 L U' R2 L U MF2 U' R2 L' U L' F' D' MF2 (27 m)

//
// Search for shorter algorithms
//
// Edges: partial solution: (AOXJ)(DNWI): 16 moves
(VL VR D') [R L, SF VR' SF'] (D VR' VL')

// Midges: (AOXJ)(BPUK): 18 moves
(F2 MR' F2 U') [SF MR SF', R L] (U F2 MR F2)

// Edges: (AOXJ): 11 moves
(F2 VU')5 F2

// Edges: (EFGH)(DNWI): 17 moves
(F' L B D2)(L SD2 SR VD SR' SD2 SR VD' R')(D2 B' L' F)

// Edges: complete solution: (AOXJ)(EFGH)(DNWI): 27 moves
(F2 VU')5 F L B D2 L SD2 SR VD SR' SD2 SR VD' R' D2 B' L' F

// Edge-Centers: paired 2(4c): 4(4c): 19 m
[NB' NL' NF' NR', N3D] [ND', N3B' N3L' N3F' N3R']
NB' NL' NF' NR' N3D NR NF NL NB VD' N3B' N3L' N3F' N3R' ND N3R N3F N3L N3B

// Alternate form
N3D [N3D', NF NL NB NR] [N3F N3L N3B N3R, ND] N3D'
NF NL NB NR N3D NR' NB' NL' NF' N3F N3L N3B N3R ND N3R' N3B' N3L' N3F' VD'

// Edges + Edge-Centers: 45 m
(F2 VU')5 F L B D2 L SD2 SR VD SR' SD2 SR VD' R' D2 B' L' TF NL NB NR N3D NR' NB' NL' NF' N3F N3L N3B N3R ND N3R' N3B' N3L' N3F' VD'

// Midges + Edges + Edge-Centers: 61 m
F2 MR' F2 U' SF MR SF' R L SF MR' SF' L' R' U F2 MR VU' (F2 VU')4 F L B D2 L SD2 SR VD SR' SD2 SR VD' R' D2 B' L' TF NL NB NR N3D NR' NB' NL' NF' N3F N3L N3B N3R ND N3R' N3B' N3L' N3F' VD'

// Midge-Centers: 13 m
(MF2 TU')(NU2 MF D2 MF ND2 NU2 MF' TD2 MF')(TU MF2)

// Midges + Edges + Edge-Centers + Midge-Centers: 74 m
F2 MR' F2 U' SF MR SF' R L SF MR' SF' L' R' U F2 MR VU' F2 VU' F2 VU' F2 VU' F2 VU' F L B D2 L SD2 SR VD SR' SD2 SR VD' R' D2 B' L' TF NL NB NR N3D NR' NB' NL' NF' N3F N3L N3B N3R ND N3R' N3B' N3L' N3F' VD' MF2 TU' NU2 MF D2 MF ND2 NU2 MF' TD2 MF' TU MF2

//
// Recap
//
// Midges:
(F2 MR' F2 U') [SF MR SF', R L] (U F2 MR F2)

// Edges 1
(F2 VU')5 F2

// Edges 2
(F' L B D2) (L SD2 SR VD SR' SD2 SR VD' R') (D2 B' L' F)

// Edge-Centers:
N3D [N3D', NF NL NB NR] [N3F N3L N3B N3R, ND] N3D'

// Midge-Centers:
(MF2 TU') (NU2 MF D2 MF ND2 NU2 MF' TD2 MF') (TU MF2)

// Complete algorithm: 74 m
F2 MR' F2 U' SF MR SF' R L SF MR' SF' L' R' U F2 MR VU' F2 VU' F2 VU' F2 VU' F2 VU' F L B D2 L SD2 SR VD SR' SD2 SR VD' R' D2 B' L' TF NL NB NR N3D NR' NB' NL' NF' N3F N3L N3B N3R ND N3R' N3B' N3L' N3F' VD' MF2 TU' NU2 MF D2 MF ND2 NU2 MF' TD2 MF' TU MF2

Four Dotted Diamonds (90° Version)

// Four Crosses
T3U2 MF2 T3U MF2 T3U2 MR2 T3D' MR2

// Remove Vertical Midge-Centers
MR2 VD2 MF2 VD' MR2 VD2 MF2 VD

// Remove Horizontal Midge-Centers
[VB' VL' VF' VR', MU']

// Add Edge-Centers
[N3B' N3L' N3F' N3R', ND' NU] [N3D N3U', NB' NL' NF' NR']

// Complete alg: (46 moves) (232 solved stickers) (Order: 4)
T3U2 MF2 T3U MF2 T3U2 MR2 T3D' VD2 MF2 VD' MR2 VD2 MF2 VD VB' VL' VF' VR' MU' VR VF VL VB MU N3B' N3L' N3F' N3R' ND' NU N3R N3F N3L N3B VU' VD NB' NL' NF' NR' N3U N3D' NR NF NL NB

Four Stealthy Patterns (90° Version)

// Four setup moves
(R L B2 U2) (WF N2U' N2F' N3U' N3F' N4U' N4F' N5U' N5F' N6U' N6F' WU) (U2 B2 L' R')

// Complete alg (20 moves) (90 solved stickers) (Order: 3)
R L B2 U2 WF N2U' N2F' N3U' N3F' N4U' N4F' N5U' N5F' N6U' N6F' WU U2 B2 L' R'

Four Cartwheels (90° Version)

// Four Crosses
T3U2 MF2 T3U MF2 T3U2 MR2 T3D' MR2

// Edge-Centers
[N3B' N3L' N3F' N3R', ND' NU] [N3D N3U', NB' NL' NF' NR']

// Complete alg (30 moves) (184 solved stickers) (Order: 4)
T3U2 MF2 T3U MF2 T3U2 MR2 T3D' MR2 N3B' N3L' N3F' N3R' ND' NU N3R N3F N3L N3B VU' VD NB' NL' NF' NR' N3U N3D' NR NF NL NB

Four Diamonds (90° Version)

// Four Crosses
MR2 T3U MR2 T3D2 MF2 T3D' MF2 T3D2

// Corner-Centers
[N3D, N3B' N3F' N3R N3L N3F' N3B']

// Edge-Centers
[N3B' N3L' N3F' N3R', ND' NU] [N3D N3U', NB' NL' NF' NR']

// Insertion of Corner-Centers into Edge-Centers
N3B' N3L' N3F' N3R' ND' NU N3R N3F N3L N3B VU' VD NB' NL' NF' VR' N3L' N3F N3B N3L' N3R' N3U N3R N3L N3B' N3F' N3L N3R N3D' NR NF NL NB

// Complete alg (41 moves) (168 solved stickers) (Order: 4)
MR2 T3U MR2 T3D2 MF2 T3D' MF2 T3D2 N3B' N3L' N3F' N3R' ND' NU N3R N3F N3L N3B VU' VD NB' NL' NF' VR' N3L' N3F N3B N3L' N3R' N3U N3R N3L N3B' N3F' N3L N3R N3D' NR NF NL NB

Sixteen Small Crosses (90° Version)

// Four Wide Crosses
TU2 M3F2 TU M3F2 TU2 M3R2 TD' M3R2

// Edge-Centers
[NB' NL' NF' NR', N3D N3U'] [ND' NU, N3B' N3L' N3F' N3R']

// Corners
R2 SF2 R2 D SF2 R2 SF2 R2 D' SF2

// Complete alg (40 moves) (136 solved stickers) (Order: 4)
TU2 M3F2 TU M3F2 TU2 M3R2 TD' M3R2 NB' NL' NF' NR' N3D N3U' NR NF NL NB VU VD' N3B' N3L' N3F' N3R' NU' ND N3R N3F N3L N3B R2 SF2 R2 D SF2 R2 SF2 R2 D' SF2

Four Jerusalem Crosses (90° Version)

// Four Wide Crosses
TU2 M3F2 TU M3F2 TU2 M3R2 TD' M3R2

// Corner-Centers
([N3D, N3B' N3F' N3R N3L N3F' N3B'])'

// Edge-Centers
([N3B' N3L' N3F' N3R', ND' NU] [N3D N3U', NB' NL' NF' NR'])'

// Insertion of Corner-Centers into Edge-Centers
(N3B' N3L' N3F' N3R' ND' NU N3R N3F N3L N3B VU' VD NB' NL' NF' VR' N3L' N3F N3B N3L' N3R' N3U N3R N3L N3B' N3F' N3L N3R N3D' NR NF NL NB)'

// After inversion
NB' NL' NF' NR' N3D N3R' N3L' N3F N3B N3L' N3R' N3U' N3R N3L N3B' N3F' N3L VR NF NL NB VD' VU N3B' N3L' N3F' N3R' NU' ND N3R N3F N3L N3B

// Complete alg (41 moves) (176 solved stickers) (Order: 4)
TU2 M3F2 TU M3F2 TU2 M3R2 TD' M3R2 NB' NL' NF' NR' N3D N3R' N3L' N3F N3B N3L' N3R' N3U' N3R N3L N3B' N3F' N3L VR NF NL NB VD' VU N3B' N3L' N3F' N3R' NU' ND N3R N3F N3L N3B

U2 ML2 MF' MU' MF U MF MU MF' U' ML2 MF' U' MB' U MF U' MB

Single Ring (120°)

// Edges
F' [R M2D2 R', U'] F

// Centers
[MF R2 MF' MB' R2 MB, M2D]

// Optimization: insertion of Edges X [Y Z Zo' Y', P] X' into Centers [MF R2 MF' MB' R2 MB, M2D]

// Complete alg (21 moves) (24 solved stickers) (Order: 3)
MF R2 MF' R B M2R B' R' B M2R' TB' R2 MB M2D MB' R2 MB MF R2 MF' M2D'

Nested Rings (120°)

// Centers 1
[MF R2 MF' MB' R2 MB, M2D]

// Edges 1
F [R, U' ML2 U] F'

// Edges 2
F [U' MR2 U, R] F'

// Edges 1 + 2
F [R, U' ML2 U] [U' MR2 U, R] F'
F (R U' ML2 U R' U' ML2 U) (U' MR2 U R U' MR2 U R') F'
F (R U' ML2 U R' U' ML2 MR2 U R U' MR2 U R') F'
F (R U' ML2 U R' U' M2R2 U R U' MR2 U R') F'

// Centers 2
F [MD R2 MD', MR'] F'

// Optimization: insertion of Centers 2 [X Y X', Z] into Edges 1 + 2 F (R U' ML2 U R' U' M2R2 U R U' MR2 U R') F'

// Goal
F (R U' ML2 U R' U' M2R2 U R U' MR2 U R') [MD R2 MD', MR'] F'

// Result
F MD R2 MD' MR' MD R2 MD' TR U' ML2 U R' U' WL2 U R U' MR2 U R' F'

// Complete alg (36 moves) (24 solved stickers) (Order: 12)
MF R2 MF' MB' R2 MB M2D MB' R2 MB MF R2 MF' M2D' F MD R2 MD' MR' MD R2 MD' TR U' ML2 U R' U' WL2 U R U' MR2 U R' F'

Rings (Order 4)

// Initial Algorithm (Order 2)
L2 (U2 F2)3 L2
[M2R2, M2D]
D2 MR2 F2 MR2 F2 MF2 ML2 MF2 M2R2 D2

// Part 1 (3x3x3 Cube)
L2 (U2 F2)3 L2 [MR2, MD]
L2 (U2 F2)3 L2 MR2 MD MR2 MD
L2 U2 F2 U2 F2 U2 F2 L2 M2 E M2 E

// Optimization with Cube Explorer
D2 F2 R' S2 R2 S2 R' F2 U2
D2 F2 R' MF2 R2 MF2 R' F2 U2

// Transform
U2 B2 L MB2 L2 MB2 L B2 D2

// Part 1 (4x4x4 Cube)
U2 B2 L M2B2 L2 M2B2 L B2 D2

// Part 2
D2 ML2 B2 MR2 TB2 ML2 MB2 D2

// Part 1 + Part 2
// Complete alg (15 moves) (84 solved stickers) (Order: 4)
U2 B2 L M2B2 L2 M2B2 L B2 ML2 B2 MR2 TB2 ML2 MB2 D2

Wide Loop (Order 4)

// Part 1 (3x3x3 Cube)
D2 F2 R' MF2 R2 MF2 R' F2 U2

// Invert
U2 F2 R MF2 R2 MF2 R F2 D2

// Part 1 (4x4x4 Cube)
U2 F2 R M2F2 R2 M2F2 R F2 D2

// Part 2
D2 ML2 B2 MR2 TB2 ML2 MB2 D2

// Part 1 + Part 2
// Complete alg (15 moves) (84 solved stickers) (Order: 4)
U2 F2 R M2F2 R2 M2F2 R F2 ML2 B2 MR2 TB2 ML2 MB2 D2

Superflip

// Basic Form :
// (QP)(NF)(SK)(HI)
NF' L2 U2 NF NB U2 L2 U2 L2 NF' NB' L2 U2 NF
NF' [L2 U2, NF NB] [NF NB, U2 L2] NF

// (UT)(WG)(RB)(ED)
NR' F2 U2 NR NL U2 F2 U2 F2 NR' NL' F2 U2 NR
NR' [F2 U2, NR NL] [NR NL, U2 F2] NR

// (XM)(VJ)(OC)(LA)
ND' F2 R2 ND NU R2 F2 R2 F2 ND' NU' F2 R2 ND
ND' [F2 R2, ND NU] [ND NU, R2 F2] ND

// Extension of Basic Form
ND' NR' NF' [L2 U2 F2, NF NB NR NL NU ND][NF NB NR NL NU ND, F2 U2 L2] NF NR ND

Algorithm (30 moves) (48 permuted stickers) (Permutation order: 2):
ND' NR' NF' L2 U2 F2 NF NB NR NL NU ND F2 U2 L2 F2 U2 L2 ND' NU' NL' NR' NB' NF' L2 U2 F2 NF NR ND

Patched Rings
R L B2 (U' D' MF2 SD' MB2 ML2 MB2 D2) B2 R' L'
ML' [B MD2 B', TU'] ML
MR [F' MU2 F, TD] MR'

// Optimized
R L B2 (U' D' MF2 SD' MB2 ML2 MB2 D2) B2 L' R'
TR [U, TF' MD2 TF] TR'
TR [F' MU2 F, TD] TR'

R L B2 U' D' MF2 SD' MB2 ML2 MB2 D2 B2 L' R' TR U TF' MD2 TF U' TF' MD2 TF TR' TR F' MU2 F TD F' MU2 F TD' TR'

Algorithm (30 moves) (30 permuted stickers) (Permutation order: 30):
R L B2 U' D' MF2 SD' MB2 ML2 MB2 D2 B2 L' MR U TF' MD2 TF U' TF' MD2 MF MU2 F TD F' MU2 F TD' TR'

Small Flip

// (AL)(XM)
[R' F D' R F', NU2 ND2] (14 m)

NU SL U2 SL' NU ND SL U2 SL' NU2 ND' (11 m) (SCS)
NU SL U2 SL' ND NU SL U2 SL' ND' NU2
NU (SL U2 SL' ND NU SL U2 SL' ND' NU') NU'
NU (SL U2 SL' NU ND SL U2 SL' ND' NU') NU'

// Setup of [SL U2 SL', NU ND]
NU [SL U2 SL', NU ND] NU'

Algorithm (11 moves) (8 permuted stickers) (Permutation order: 2):
NU SL U2 SL' NU ND SL U2 SL' ND' NU2

// (AL)(JV)
[R' F D' R F', NU ND'] (14 m)

// Setup of [SL U2 SL', NU ND]
F2 ND [SL U2 SL', NU ND] ND' F2

Algorithm (13 moves) (8 permuted stickers) (Permutation order: 2):
F2 ND SL U2 SL' NU ND SL U2 SL' ND2 NU' F2

Four Deep Flips

// + Centers (AL)(BI)(NU)(MX)
NU SL U2 SL' NU ND SL U2 SL' ND' NU2
B2 (L2 NU' NR2 NU TR2 L2 NU NR2 NU' TR2) B2

Algorithm (23 moves) (16 permuted stickers) (Permutation order: 2):
NU SL U2 SL' NU ND SL U2 SL' ND' NU2 B2 L2 NU' NR2 NU TR2 L2 NU NR2 NU' TR2 B2

// + Centers (AL)(BI)(JV)(KW)
F2 ND SL U2 SL' NU ND SL U2 SL' ND2 NU' F2
NF2 (L2 NU NR2 NU' TR2 L2 NU' NR2 NU TR2) NF2

Algorithm (24 moves) (16 permuted stickers) (Permutation order: 2):
F2 ND SL U2 SL' NU ND SL U2 SL' ND2 NU' TF2 L2 NU NR2 NU' TR2 L2 NU' NR2 NU TR2 NF2

Four Deep Flips on a same face
// Per (16 m)
[TU2, TR' ND' TR2 ND2 TR2 ND TR]

4 Deep Flips

(NF TU2 NB') (NF' TU2 NF TU2) (NF' TU2 NB) (NF TU2 NF' TU2)

// Semi-commutator
]NF TU2 NB', NF' TU2 NF TU2[(14 m)

// Semi-commutator as a product of 3 commutators
]XY, ZP[= [X, Y] [YX, ZP] [Z, P] = X·Y·X'·Y'·YX·ZP·X'Y'·P'Z'·Z·P·Z'·P' = XY·ZP·X'Y'·Z'P'

// Algorithm (14 moves) (16 permuted stickers) (Permutation order: 2):
NF TU2 NB' NF' TU2 NF TU2 NF' TU2 NB NF TU2 NF' TU2

4 Edge Flips
// Per -- 4 Edge Flips (16 m)
[NR' D2 NL2 D2 NR, F R' F']

// SCS (DE)(HI) (**15 m**)
R F NU ND' F' R U' F R' NU' ND R F' U R2
R F NU ND' F' R U' F R' ND NU' R F' U R' F F' R'
R F [NU ND', F' R U' F R'] F' R'

// Slice 8 Small Edge Flips
// Per (14 m)
[NR D2 NL' NR' D2 NR, SU2]

// SCS (14 m)
NR' F2 U2 NR NL U2 F2 U2 F2 NL' NR' F2 U2 NR
(NR' F2 U2) [NR NL, U2 F2 U2 F2] (U2 F2 NR)

// 4 Midge Flips
// Per -- 4 Midge Flips on a same slice (16 m)
[R' F D' SR U F' L, MU2]

// SCS
// 4 Midge Flips on a same face R (16 m)
[R, U D MF2 MR' U' D' MF2]

12 Midge Flips
// Per (26 m)
[MU2 MR2 MF2, B L B2 D F D R D2 B U]

8 Tetrad Rings

// Apply to cube sizes greater than 3 (4, 5, 6, 7,...)
// Tetrad: see Jaap Puzzle Page on symmetry (http://www.jaapsch.net/puzzles/symmetr1.htm)

// Part 1
// Written as (Alg 1) (Alg 2), where Alg 1 transforms to Alg 2 by 180° symmetry about the FD – UB axis
// Two tetrads: one is twisted clockwise and the other counterclockwise
(B2 D2 B' R2 U D L2 B') (U2 F2 U' L2 B F R2 U') (16f*)

// Part 2
(TU TR2 TF' TB' TL2 TU TF2 TU2) (TB TL2 TD' TU' TR2 TB TD2 TB2)

// Algorithm (31 moves) (120 permuted stickers) (Permutation order: 36):
B2 D2 B' R2 U D L2 B' U2 F2 U' L2 B F R2 NU TR2 TF' TB' TL2 TU TF2 TU2 TB TL2 TD' TU' TR2 TB TD2 TB2

2 Edge-Ring Flips – Opposed – Same Face
R U' MF U R' F U' R MF' R' U F'
TF TU' TR M3F TR' TU TF' TR TU' M3F' TU TR'

Algorithm (23 moves) (20 permuted stickers) (Permutation order: 2):
R U' MF U R' F U' R MF' R' U NF TU' TR M3F TR' TU TF' TR TU' M3F' TU TR'

2 Edge-Ring Flips – Opposed – Same Slice
[MR2, F D' L F' D]
[TF TD' TL TF' TD, M3R2]

Algorithm (23 moves) (20 permuted stickers) (Permutation order: 2):
MR2 F D' L F' D MR2 D' F L' D NF TD' TL TF' TD M3R2 TD' TF TL' TD TF' M3R2

// 4 Edge-Ring Flips - Same Face
[U D MF2 MR' U' D' MF2, R]
[TR, TU TD M3F2 M3R' TU' TD' M3F2]

Algorithm (31 moves) (40 permuted stickers) (Permutation order: 2):
U D MF2 MR' U' D' MF2 R MF2 D U MR MF2 D' U' NR TU TD M3F2 M3R' TU' TD' M3F2 TR' M3F2 TD TU M3R M3F2 TD' TU'

// 4 Edge-Ring Flips – Same Slice
[MU2, R' F D' SR U F' L]
[TR' TF TD' TR TL' TU TF' TL, M3U2]

Algorithm (33 moves) (40 permuted stickers) (Permutation order: 2):
MU2 R' F D' SR U F' L MU2 L' F U' SR' D F' NR' TF TD' TR TL' TU TF' TL M3U2 TL' TF TU' TL TR' TD TF' TR M3U2

// 8 Edge-Ring Flips – 2 Opposed Faces
ML U MF2 U2 MF2 U MR [R2 MF R2 MF2, SR' SF SR]
M3L TU M3F2 TU2 M3F2 TU M3R [TR' TL TF TB' TR TL', TR2 M3F TR2 M3F2]

ML U MF2 U2 MF2 U MR [R2 MF R2 MF2, SR' SF SR]
[TR' TL TF TB' TR TL', TR2 M3F TR2 M3F2] M3L TU M3F2 TU2 M3F2 TU M3R

Algorithm (47 moves) (96 permuted stickers) (Permutation order: 4):
MR' U MF2 U2 MF2 U MR R2 MF R2 MF2 SR' SF SR MF2 R2 MF' R2 SR' SF' SR TR' TL TF TB' TR' TL' M3F TR2 M3F2 TL TR' TB TF' TL' TR M3F2 TR2 M3F' TR2 M3L TU M3F2 TU2 M3F2 TU M3R

// Per (shorter)
[R2 MF R2 MF2, SR' SF SR] ML U MF2 U2 MF2 U MR
TR TL TU' TD' TF TB TR' TL' TU TD TF' TB'

12 Edge-Ring Flips
[MU2 MR2 MF2, B L B2 D F D R D2 B U]
[TB TL TB2 TD TF TD TR TD2 TB TU, M3U2 M3R2 M3F2]

Algorithm (51 moves) (144 permuted stickers) (Permutation order: 12):
MU2 MR2 MF2 B L B2 D F D R D2 B U MF2 MR2 MU2 U' B' D2 R' D' F' D' B2 L' NB TL TB2 TD TF TD TR TD2 TB TU M3U2 M3R2 M3F2 TU' TB' TD2 TR' TD' TF' TD' TB2 TL' TB' M3F2 M3R2 M3U2

//Opposed Edges 2(3c) (Per: 18 m)
(NR2 NF2 NU2 R) (U F' NU2 ND2 F U' F' ND2 NU2 F) (R' NU2 NF2 NR2)
(NR2 NF2 NU2 R) [U, F' NU2 ND2 F] (R' NU2 NF2 NR2)

// Basic 3-cycle: Niklas commutator
[U, F' ND2 F]

// Add slice move NU2
[U, F' ND2 NU2 F]

// Use S moves instead of slice moves, to lower move count
[SD', F' ND2 F]

// Add 3 setup moves (14 m)
(SR D2 L2) [SD', F' ND2 F] (L2 D2 SR')

Algorithm (14 moves) (12 permuted stickers) (Permutation order: 3):
SR D2 L2 SD' F' ND2 F SD F' ND2 F L2 D2 SR'
SRD2L2SD-F-ND2FSDF-ND2FL2D2SR-

// Edge Belt (Halfway) (Per: 18 m)
(NR2 NF2 NU2 F') (R U2 R' NU ND' R U2 R' NU' ND) (F NU2 NF2 NR2)
(NR2 NF2 NU2 F') [R U2 R', NU ND'] (F NU2 NF2 NR2)

// Same process as above
(SL U2 L2) [F' ND2 F, SD] (L2 U2 SL')

Algorithm (14 moves) (12 permuted stickers) (Permutation order: 3):
SL U2 L2 F' ND2 F SD F' ND2 F SD' L2 U2 SL'
SLU2L2F-ND2FSDF-ND2FSD-L2U2SL-

2 Alternating Edge Belts (Per : 30 m)
(NR2 NF2 NU2) (F' R U2 R' NU ND' R U2 R' NU' ND F R F' U2 F NU' ND F' U2 F NU ND' R') (NU2 NF2 NR2)

// (OSW)(CGK) (12 m)
(R NU) [NU' ND', L' U' L] (NU' R')

// (BFJ)(NRV) (12 m)
(R' NF') [NB, L F L'] (NF R)

Algorithm (23 moves) (24 permuted stickers) (Permutation order: 3):
R ND' L' U' L ND NU L' U L NU' R2 NB L F L' NB' NF' L F' L' NF R
RND-L-U-LNDNUL-ULNU-R2NBLFL-NB-NF-LF-L-NFR

8 Opposed Rings (Faces R + L)
// 4 Midge Flips (Face R)
[U D MF2 MR' U' D' MF2, R] (16 m)

// 4 Midge Flips (Face L)
[U D MF2 MR U' D' MF2, L'] (16 m)

// Insert + Cancel + Combine
[U D MF2 U' D' MF2, SR]

// 8 Opposed Rings (Faces R + L)
[U D MF2 D' U' MF2, SR]
[TR TL', TU TD M3F2 TD' TU' M3F2]

Algorithm (30 moves) (80 permuted stickers) (Permutation order: 2):
U D MF2 D' U' MF2 SR MF2 U D MF2 D' U' SR' TR TL' TU TD M3F2 TD' TU' M3F2 TL TR' M3F2 TU TD M3F2 TD' TU'
UDMF2D-U-MF2SRMF2UDMF2D-U-SR-TRTL-TUTDM3F2TD-TU-M3F2TLTR-M3F2TUTDM3F2TD-TU-

8 Opposed Rings (Faces R + L) -- Per
M3R' M3B2 M3L' M3U2 [MU2, SF SU SF']

Algorithm (12 moves) (96 permuted stickers) (Permutation order: 2):
M3R' M3B2 M3L' M3U2 MU2 SF SU SF' MU2 SF SU' SF'

// Super Deep Midge Flips
// Super Midge Flips (16 s*) – 3x3x3 Cube
MR2 U' R2 D' MF MR2 U MR U2 F2 D' MF MR2 U' R2 U'

// Super Deep Midge Flips (16 btm) – 5x5x5 Cube
MR2 TU' TR2 TD' MF MR2 TU MR TU2 TF2 TD' MF MR2 TU' TR2 TU'
MR2TU-TR2TD-MFMR2TUMRTU2TF2TD-MFMR2TU-TR2TU-

// Super Deep Midge Flips (16 btm) – 7x7x7 Cube
MR2 T3U' T3R2 T3D' MF MR2 T3U MR T3U2 T3F2 T3D' MF MR2 T3U' T3R2 T3U'
MR2T3U-T3R2T3D-MFMR2T3UMRT3U2T3F2T3D-MFMR2T3U-T3R2T3U-

12 Flipped Vees
// Hint: 12 Block Flips first, Super Deep Midge Flips last

// 12 Block Flips (16 btm)
M3R2 TU' TR2 TD' M3F M3R2 TU M3R TU2 TF2 TD' M3F M3R2 TU' TR2 TU'

// 12 Flipped Vees
M3R2 TU' TR2 TD' M3F M3R2 TU M3R TU2 TF2 TD' M3F M3R2 TU' TR2 TU'
T3U T3R2 T3U MR2 MF' T3D T3F2 T3U2 MR' T3U' MR2 MF' T3D T3R2 T3U MR2

Algorithm (31 moves) (140 permuted stickers) (Permutation order: 36):
M3R2 TU' TR2 TD' M3F M3R2 TU M3R TU2 TF2 TD' M3F M3R2 TU' TR2 N3U T3R2 T3U MR2 MF' T3D T3F2 T3U2 MR' T3U' MR2 MF' T3D T3R2 T3U MR2
M3R2TU-TR2TD-M3FM3R2TUM3RTU2TF2TD-M3FM3R2TU-TR2N3UT3R2T3UMR2MF-T3DT3F2T3U2MR-T3U-MR2MF-T3DT3R2T3UMR2

12 Opposed Rings
// Pons Asinorum
M3F2 M3R2 M3U2

// 12 Opposed Midges
[MU2, SF SU SF']
[SF MU SF', SU2]
MU2 SF SU SF' MU2 SF SU' MU SF' SU2 SF MU' SF' SU2

Algorithm (17 moves) (168 permuted stickers) (Permutation order: 2):
M3F2 M3R2 M3U2 MU2 SF SU SF' MU2 SF SU' MU SF' SU2 SF MU' SF' SU2
M3F2M3R2M3U2MU2SFSUSF-MU2SFSU-MUSF-SU2SFMU-SF-SU2

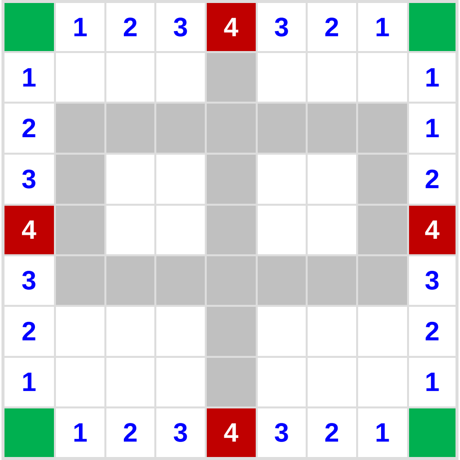
12 Opposed Vees
M3F2 M3R2 M3U2 MF2 MR2 MU2
M3F2M3R2M3U2MF2MR2MU2

6 Rings (Order 3)
[M3U, M3R] [MR, MU]

Algorithm (8 moves) (48 permuted stickers) (Permutation order: 3):
M3U M3R M3U' M3R' MR MU MR' MU'

6 Dotted Rings (Order 3)
[WR, WU] [M3U, M3R] [MR, MU]

Algorithm (12 moves) (102 permuted stickers) (Permutation order: 3):
WR WU WR' WU' M3U M3R M3U' M3R' MR MU MR' MU'



zhōng 7x7x7

// Midges (BW)(DU)(CV)(AX)
SU SR SU MR2 SU' SR' SU' MR2
 [SU SR SU, MR2]

// Midges (BU)(DW)(CV)(AX)
SL' MF2 SL F B SL MF2 SL' F' B'
[SL' MF2 SL, F B]

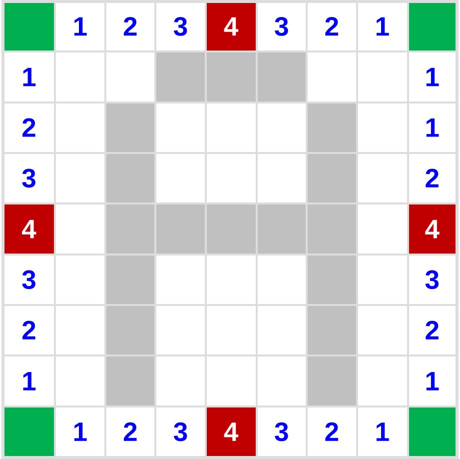
// Midges (BU)(DW)
SB2 MR B2 MR' SB2 MR B2 MR'
[SB2, MR B2 MR']

// Edges

// Centers 1
[NF N3B', WR']

// Centers 2
[N3F MF NB', ML]

M3U2 N3R2 N3F2 M3U2 M2B2 N3R2 M3F2 N3U2 MR2 MF2 N3U2 M2F2 MR2 N3F2



Triple A 7x7x7

// Centers 1
[NF NB', WR']

// Centers 2
[M3F, NL NR']

// True Centers
[MR, MU]

Double Python

R U' WR2 B' WR F2 B WR F2 U R'
SD2 TD MB2 TD' TR2 MD' TR2 MU TF2 MU' TB2 MU TF2 MU' TB2 SD2
U WR2 U2 MR2 TU2 MR2 MU2 ML2 D WR WF' WR' WF D' U'
MF' D2 MF WD MF' D2 MF WD'
MB D2 MB' WD MB D2 MB' WD'
MU' MR' MU L' MU' MR MU
R F MD TF' R' MU R TF MD' F' R' MU' L

// Parity
(U2 R2) (MD2 B2 MU' B2 MU R2 MD' R2 B2 MD' B2 MD') (R2 U2)

// Edges 2(3c): (BGJ)(IOQ)
U [U R U', MR] U' + U [U R U', ML] U' = U [U R U', MR ML] U'

// Edges 2(3c): (CEU)(NSV)
U [F L2 F', ML] U' + U [F L2 F', MR] U' = U [F L2 F', MR ML] U'

// Edges 4(3c): (BGJ)(IOQ)(CEU)(NSV)
U [U R U', MR ML] U' + U [F L2 F', MR ML] U' = U [U R U' F L2 F', MR ML] U'

// Center-Edge Pairs
// (3c) (CEU)
U [ML', U L U'] U'
TU [ML', TU L TU'] TU'

// (3c) (BGJ)
U [U R U', MR] U'
TU [TU R TU', MR] TU'

TU [ML', TU L TU'] TU' TU [TU R TU', MR] TU'
TU (ML' TU L TU' ML TU L' TU') (TU R TU' MR TU R' TU' MR') TU'
TU (ML' TU L TU' ML TU L' R TU' MR TU R' TU' MR') TU'
TU (ML' TU L TU' ML TU SL' TU' MR TU R' TU' MR') TU'

// (3c) (IOQ)
U [U R U', ML] U'
D [MF', D F D'] D'
TD [MF', TD F TD'] TD'

// (3c) (NSV)
U [F L2 F', MR] U'
D [D B D', MB] D'
TD [TD B TD', MB] TD'

TD [MF', TD F TD'] TD' TD [TD B TD', MB] TD'
TD [MF', TD F TD'] [TD B TD', MB] TD'
TD (MF' TD F TD' MF TD F' TD' TD B TD' MB TD B' TD' MB') TD'
TD (MF' TD F TD' MF TD SF' TD' MB TD B' TD' MB') TD'

// Total edges + a few centers
TU (ML' TU L TU' ML TU SL' TU' MR TU R' TU' MR') TU' TD (MF' TD F TD' MF TD SF' TD' MB TD B' TD' MB') TD'

Double Python (Edges Only)
// Edges (2c)
(U2 R2) (MD2 B2 MU' B2 MU R2 MD' R2 B2 MD' B2 MD') (R2 U2)

// Edges 2(3c) (BGJ)(IOQ)
U [U R U', MR ML] U'

// Edges 2(3c): (CEU)(NSV)
U [F L2 F', MR ML] U'

// Edges 4(3c): (BGJ)(IOQ)(CEU)(NSV)
U [U R U' F L2 F', MR ML] U'

// Complete alg (30 moves) (28 solved stickers) (Order: 6)
U2 R2 MD2 B2 MU' B2 MU R2 MD' R2 B2 MD' B2 MD' R' U' F L2 F' MR ML F L2 F' U R' U' ML' MR' U'

// Inverted alg
U MR ML U R U' F L2 F' ML' MR' F L2 F' U R MD B2 MD B2 R2 MD R2 MU' B2 MU B2 MD2 R2 U2

Double Python (Centers only)
R U' WR2 B' WR F2 B WR F2 U R' SD2 TD MB2 TD' TR2 MD' TR2 MU TF2 MU' TB2 MU TF2 MU' TB2 SD2 U WR2 U2 MR2 TU2 MR2 MU2 ML2 D WR WF' WR' WF D' U' MF' D2 MF WD MF' D2 MF WD' MB D2 MB' WD MB D2 MB' WD' MU' MR' MU L' MU' MR MU R F MD TF' R' MU R TF MD' F' R' MU' L U MR ML U R U' F L2 F' ML' MR' F L2 F' U R MD B2 MD B2 R2 MD R2 MU' B2 MU B2 MD2 R2 U2

// Centers solved by SCS
MF2 L' MD' ML' MD L2 MD ML MD' L' MF2 MR' MF' L MF MR2 ML' MF' L' MF WR' U MF' U' MB' U MF U' MB MU' MD' MB R' MB' MD MR' MB MD' R MD MB' MR MU MR' D MR MU2 MR' D' MR MU' F MD F' MU' TF MD' F MD MF' MD' F2

// Centers to be solved: inverted alg
F2 MD MF MD' F' MD TF' MU F MD' F' MU MR' D MR MU2 MR' D' MR MU' MR' MB MD' R' MD MB' MR MD' MB R MB' MD MU MB' U MF' U' MB U MF U' WR MF' L MF ML MR2 MF' L' MF MR MF2 L MD ML' MD' L2 MD' ML MD L MF2

// Centers 1
U MB MR' MU MR2 MU' MR MB' MR2 U'

// Centers 2
R2 MU' TR2 MU' TR2 MB2 TR2 MU TR2 MB2 MU R2

// Centers 3
WR2 WU' WR2 WU

// (u,f) – (10 m)
MR' WD R2 WU MR ML WU' R2 WD' ML'

// (u,d,l) – (12 m)
L2 U2 MB2 WL2 MB WL2 MB U2 R2 MF SL2 MB'

// Centers 4: (u,f,d,l) = (u,f) (u,d,l) – (22 m)
MR' WD R2 WU MR ML WU' R2 WD' ML' L2 U2 MB2 WL2 MB WL2 MB U2 R2 MF SL2 MB'

Algorithm (74 moves) (48 permuted stickers) (Permutation order: 18):
MB SL2 MF' R2 U2 MB' WR2 MB' WR2 MB2 U2 L2 ML WU' R2 WU ML' MR' WU' R2 WU MR WU' WR2 WU WR2 R2 MU' MB2 TR2 MU' TR2 MB2 TR2 MU TR2 MU R2 U2 R2 MD2 B2 MU' B2 MU R2 MD' R2 B2 MD' B2 MD' R' U' F L2 F' MR ML F L2 F' U R' U' WR MB MR' MU MR2 MU' MR MB' U'

MBSL2MF-R2U2MB-WR2MB-WR2MB2U2L2MLWU-R2WUML-MR-WU-R2WUMRWU-WR2WUWR2R2MU-MB2TR2MU-TR2MB2TR2MUTR2MUR2U2R2MD2B2MU-B2MUR2MD-R2B2MD-B2MD-R-U-FL2F-MRMLFL2F-UR-U-WRMBMR-MUMR2MU-MRMB-U-

// Centers to be solved: new inverted alg
MB SL2 MF' R2 U2 MB' WR2 MB' WR2 MB2 U2 L2 ML WU' R2 WU ML' MR' WU' R2 WU MR WU' WR2 WU WR2 R2 MU' MB2 TR2 MU' TR2 MB2 TR2 MU TR2 MU R2 U MR2 MB MR' MU MR2 MU' MR MB' U'

MBSL2MF-R2U2MB-WR2MB-WR2MB2U2L2MLWU-R2WUML-MR-WU-R2WUMRWU-WR2WUWR2R2MU-MB2TR2MU-TR2MB2TR2MUTR2MUR2UMR2MBMR-MUMR2MU-MRMB-U-

// New (5c)
// (5c) (f,l,r,d,u) (16 m)
]WR WD, MR' D2 ML MR D2 ML'[
WR WD MR' D2 ML MR D2 ML' WR' WD' MR D2 ML' MR' D2 ML

// (5c) (u,r,b,l,f) (16 m)
[WD2, WL MF' WL' U2 MF U2 MF'[
WD2 WL MF' WL' U2 MF U2 MF' WD2 WL' MF WL U2 MF' U2 MF

// (u,b,f)(r,l)
ML WD R2 WD' MR' ML' WD R2 WD' MR WD WR2 WD' WR2

5 Large Rings (2c)(3c) – Order 6 – 6x6x6 Cube

// 5 Large Rings (2c)(3c) -- Scaling to 6x6x6 cube
// (u,b,f)(r,l) – 4x4x4 cube
ML WD R2 WD' MR' ML' WD R2 WD' MR WD WR2 WD' WR2

// Scaling to 6x6x6 cube
VL WD R2 WD' VR' VL' WD R2 WD' VR WD WR2 WD' WR2
M2R2 M2D M2R2 M2D' MR' M2D R2 M2D' ML MR M2D R2 M2D' ML'

// Algorithm (27 moves) (60 permuted stickers) (Permutation order: 6):
M2R2 M2D M2R2 M2D' MR' M2D R2 M2D' ML MR M2D R2 M2D' NL WD R2 WD' VR' VL' WD R2 WD' VR WD WR2 WD' WR2

5 Large Rings (5c) – Order 5 – 6x6x6 Cube

// 5 Large Rings (5c) -- Scaling to 6x6x6 cube
// (u,r,b,l,f) – 4x4x4 cube
]WD2 WL, MF' WL' U2 MF U2 MF'[
WD2 WL MF' WL' U2 MF U2 MF' WD2 WL' MF WL U2 MF' U2 MF

// Scaling to 6x6x6 cube
WD2 WL VF' WL' U2 VF U2 VF' WD2 WL' VF WL U2 VF' U2 VF
MF' U2 MF U2 M2R MF' M2R' M2U2 MF U2 MF' U2 M2R' MF M2R M2U2

// Algorithm (31 moves) (60 permuted stickers) (Permutation order: 5):
WD2 WL VF' WL' U2 VF U2 VF' WD2 WL' VF WL U2 VF' U2 NF U2 MF U2 M2R MF' M2R' M2U2 MF U2 MF' U2 M2R' MF M2R M2U2
WD2WLVF-WL-U2VFU2VF-WD2WL-VFWLU2VF-U2NFU2MFU2M2RMF-M2R-M2U2MFU2MF-U2M2R-MFM2RM2U2

Slotted Dots/Rings – Odd-Order Cubes
// New (5c)
// 4x4x4 Cube – (5c) (f,l,r,d,u) (15 m)
]WR WD, MR' D2 ML MR D2 ML'[
WR WD MR' D2 ML MR D2 MR' WD' MR D2 ML' MR' D2 ML

// Scale to 5x5x5 Cube
5 Slotted Dots – Order 5 – 5x5x5 Cube
NL' NR ND NU' NR' D2 NL NR D2 NR' NU ND' NR D2 NL' NR' D2 NL

Algorithm (18 moves) (20 permuted stickers) (Permutation order: 5):
NL' NR ND NU' NR' D2 NL NR D2 NR' NU ND' NR D2 NL' NR' D2 NL
NL-NRNDNU-NR-D2NLNRD2NR-NUND-NRD2NL-NR-D2NL

// Scale to 7x7x7 Cube
5 Slotted Dots – Order 5 – 7x7x7 Cube
VL' VR VD VU' VR' D2 VL VR D2 VR' VU VD' VR D2 VL' VR' D2 VL

Algorithm (18 moves) (80 permuted stickers) (Permutation order: 5):
VL' VR VD VU' VR' D2 VL VR D2 VR' VU VD' VR D2 VL' VR' D2 VL
VL-VRVDVU-VR-D2VLVRD2VR-VUVD-VRD2VL-VR-D2VL

5 Slotted Rings – Order 5 – 7x7x7 Cube
// Apply substractive patterning
VL' VR VD VU' VR' D2 VL VR D2 VR' VU VD' VR D2 VL' VR' D2 VL
N3L' D2 N3R N3L D2 N3R' N3D N3U' N3R D2 N3R' N3L' D2 N3R N3U N3D' N3R' N3L
VL' VR VD VU' VR' D2 VL VR D2 VR' VU VD' VR D2 VL' VR' D2 NL D2 N3R N3L D2 N3R' N3D N3U' N3R D2 N3R' N3L' D2 N3R N3U N3D' N3R' N3L

Algorithm (35 moves) (60 permuted stickers) (Permutation order: 5):
VL' VR VD VU' VR' D2 VL VR D2 VR' VU VD' VR D2 VL' VR' D2 NL D2 N3R N3L D2 N3R' N3D N3U' N3R D2 N3R' N3L' D2 N3R N3U N3D' N3R' N3L
VL-VRVDVU-VR-D2VLVRD2VR-VUVD-VRD2VL-VR-D2NLD2N3RN3LD2N3R-N3DN3U-N3RD2N3R-N3L-D2N3RN3UN3D-N3R-N3L

2 Large Rings – Order 2 – 5x5x5 Cube
// (f,u) – 4x → 5x
NR' WU' R2 WU NL NR WU' R2 WU NL'

// (DG)(BE) – Midge-Centers 2(2c)
(F MR B) [MU2, NR2] (B' MR' F')

Algorithm (20 moves) (16 permuted stickers) (Permutation order: 2):
NR' WU' R2 WU NL NR WU' R2 WU NL' F MR B MU2 NR2 MU2 NR2 B' MR' F'
NR-WU-R2WUNLNRWU-R2WUNL-FMRBMU2NR2MU2NR2B-MR-F-

2 Large Rings – Order 2 – 6x6x6 Cube
// (f,u) – 4x → 5x
NR' WU' R2 WU NL NR WU' R2 WU NL'

// (DG)(BE) – Midge-Centers 2(2c)
(F M2R B) [M2U2, NR2] (B' M2R' F')

Algorithm (20 moves) (24 permuted stickers) (Permutation order: 2):
NR' WU' R2 WU NL NR WU' R2 WU NL' F M2R B M2U2 NR2 M2U2 NR2 B' M2R' F'
NR-WU-R2WUNLNRWU-R2WUNL-FM2RBM2U2NR2M2U2NR2B-M2R-F-

2 Large Rings – Order 2 – 7x7x7 Cube
// (f,u) – 4x → 7x
NR' WU' R2 WU NL NR WU' R2 WU NL'

// Scale Midge-Centers
(F M3R B) [M3U2, NR2] (B' M3R' F')

Algorithm (20 moves) (32 permuted stickers) (Permutation order: 2):
NR' WU' R2 WU NL NR WU' R2 WU NL' F M3R B M3U2 NR2 M3U2 NR2 B' M3R' F'
NR-WU-R2WUNLNRWU-R2WUNL-FM3RBM3U2NR2M3U2NR2B-M3R-F-

// Optimize: insert a template like (MF D) [NF2, MR2] (D' MF') into NR' WU' R2 WU NL NR WU' R2 WU NL'
NR' WU'   MF D (NF2 MR2)2 D' MF'   R2 WU NR NL WU' R2 WU NL'

Algorithm (18 moves) (16 permuted stickers) (Permutation order: 2):
NR' WU' MF D NF2 MR2 NF2 MR2 D' MF' R2 WU NR NL WU' R2 WU NL'

5 Rings – 5x5x5 Cube
// Per – (39 m)
// (r,f,u,b,d)
WU2 NR' WU2 NR NL WU2 NL WU2 NL2 MF WU' MF' SU MF WU MF' SU' (NU2 MR2)2 NU' WF' U2 WF NU ND WF' U2 WF ND' MR WF' MR' F MR WF MR' F'

//
// Corner-Centers (alternate solution)
// (u,r,b,l,f) – Scalable – (16 m) – 4x4x4 Cube
]WD2 WL, MF' WL' U2 MF U2 MF'[
WD2 WL MF' WL' U2 MF U2 MF' WD2 WL' MF WL U2 MF' U2 MF

// (u,r,b,l,f) – Scalable – (16 m) – 5x5x5 Cube
]WD2 WL, NF' WL' U2 NF U2 NF'[
WD2 WL NF' WL' U2 NF U2 NF' WD2 WL' NF WL U2 NF' U2 NF
WD2WLNF-WL-U2NFU2NF-WD2WL-NFWLU2NF-U2NF

// (r,f,u,b,d) – Symmetry #40 – (16 m)
]WL2 WB', ND WB R2 ND' R2 ND[
WR2 WF ND WF' R2 ND' R2 ND WR2 WF' ND' WF R2 ND R2 ND'

Small Flowers – 5x5x5 Cube

2 Small Flowers – (f,b)
// 2 Rings (f,b)
NR2 WU2 VR2 NU2 MR2 VD2

// 2 Rings (f,b) + shift → 2 Small Flowers (f,b)
MR2 VD2 NR2 WU2 VR2 NU2

// (f,b) – (6 m)
Algorithm (6 moves) (16 permuted stickers) (Permutation order: 2):
MR2 VD2 NR2 WU2 VR2 NU2
MR2VD2NR2WU2VR2NU2

2 Small Flowers – (r,u)
// (r,u) – (14 m)
WU' B' MR WU R' WU' MR' WU R MF WU' B WU MF'
WU-B-MRWUR-WU-MR-WURMFWU-BWUMF-

4 Small Flowers – (f,b)(r,l)
// (f,b)(r,l) – (8 m)
[MR2, MU] [WR2, WU']
Algorithm (8 moves) (32 permuted stickers) (Permutation order: 2):
MR2 MU MR2 MU' WR2 WU' WR2 WU
MR2MUMR2MU-WR2WU-WR2WU

// (f,b)(r,l) – (8 m)
[WU, MR2] (SR2 MU)2
Algorithm (8 moves) (16 permuted stickers) (Permutation order: 2):
WU MR2 WU' MR2 SR2 MU SR2 MU
WUMR2WU-MR2SR2MUSR2MU

4 Small Flowers – (f,r)(b,l)
// (f,r)(b,l) – (10 m)
]MR2 WU, WR MF' WR']
Algorithm (10 moves) (16 permuted stickers) (Permutation order: 2):
MR2 WU WR MF' WR' MR2 WU' WR MF WR'
MR2WUWRMF-WR-MR2WU-WRMFWR-

4 Small Flowers – (f,d,b,u)
// (f,d,b,u) – (12 m)
[MR, MU2] [WR, WU MF' WU'[
Algorithm (12 moves) (16 permuted stickers) (Permutation order: 4):
MR MU2 MR' MU2 WR WU MF' WU' WR' WU' MF WU
MRMU2MR-MU2WRWUMF-WU-WR-WU-MFWU

5 Small Flowers – (f,d,b,r,u)
// (f,d,b,r,u) = (f,d,b,u) (r,u)
Algorithm (24 moves) (20 permuted stickers) (Permutation order: 10):
MR MU2 MR' MU2 WR WU MF' WU' WR' WU' MF B' MR WU R' WU' MR' WU R MF WU' B WU MF'
MRMU2MR-MU2WRWUMF-WU-WR-WU-MFB-MRWUR-WU-MR-WURMFWU-BWUMF-

6 Small Flowers – (f,u,r)(b,d,l)
// (f,u,r)(b,d,l) – (10 m)
[MR MU, WR' MF2 WU']
Algorithm (10 moves) (24 permuted stickers) (Permutation order: 3):
MR MU WR' MF2 WU' MU' MR' WU MF2 WR
MRMUWR-MF2WU-MU-MR-WUMF2WR

6 Small Flowers – (f,r,u,b,l,d)
// (f,r,u,b,l,d) = (f,r,u)(b,l,d) (b,f)
// (f,r,u)(b,l,d)
WR' MF2 WU' MR MU WU MF2 WR MU' MR'

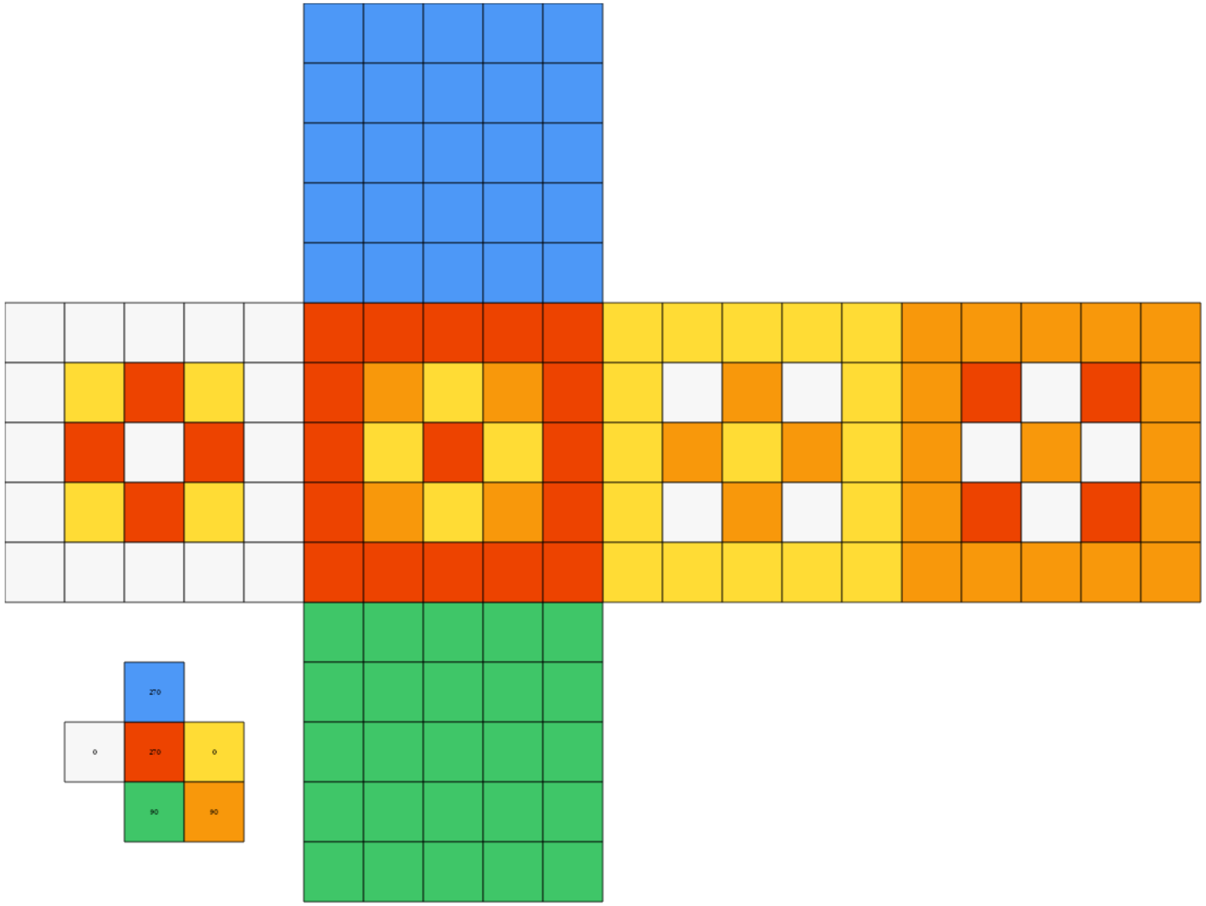
// (b,f)
MR2 VD2 NR2 WU2 VR2 NU2

// (f,r,u,b,l,d)
Algorithm (15 moves) (32 permuted stickers) (Permutation order: 6):
WR' MF2 WU' MR MU WU MF2 WR MU' MR VD2 NR2 WU2 VR2 NU2
WR-MF2WU-MRMUWUMF2WRMU-MRVD2NR2WU2VR2NU2

Rings + Small Flowers
// 2 Rings + 2 Small Flowers
// (u,d) | (f,b)
[NR2, MR MU2 WF2[
Algorithm (8 moves) (24 permuted stickers) (Permutation order: 2):
NR2 MR MU2 WF2 NR2 MR' MU2 WF2
NR2MRMU2WF2NR2MR-MU2WF2

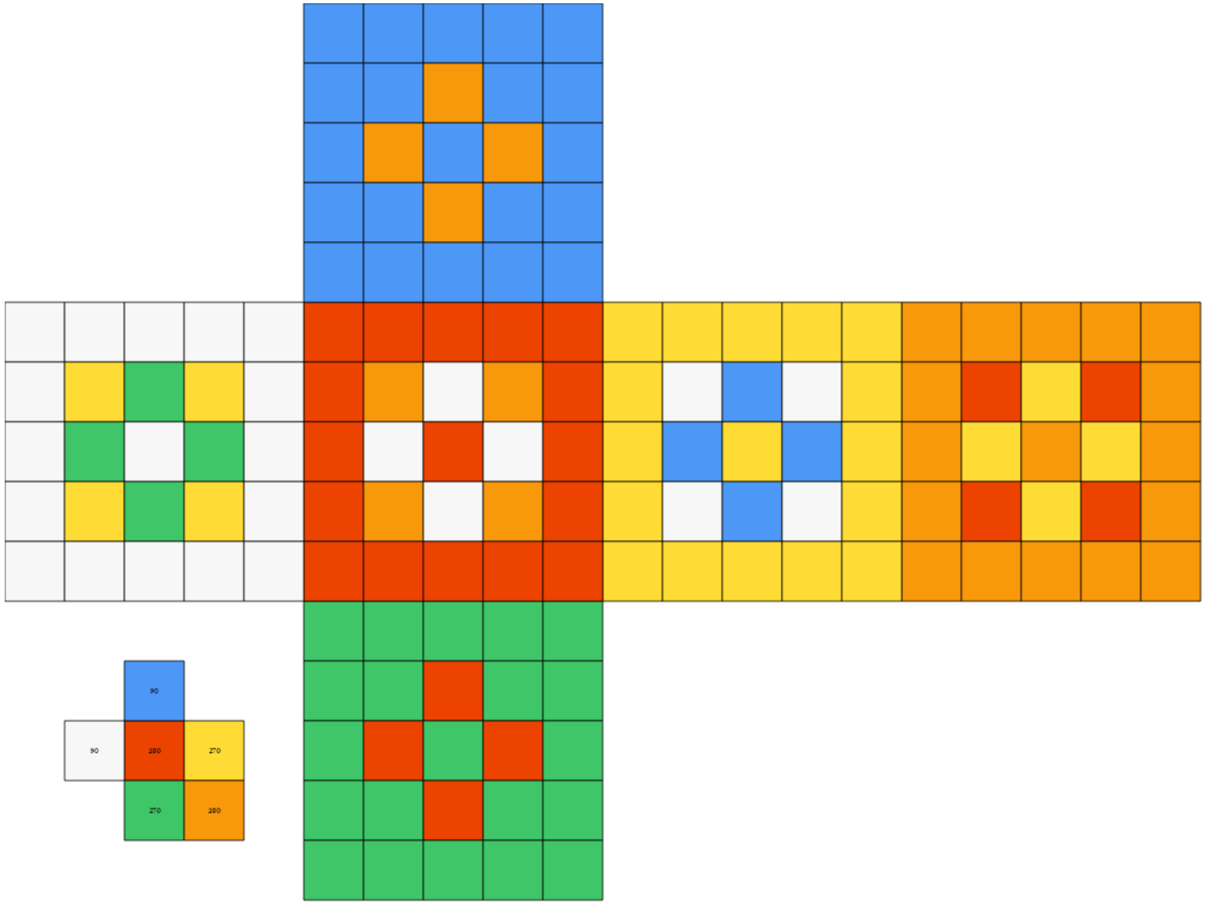
// 4 Rings + 2 Small Flowers
// (f,b)(u,d) | (r,l)
[MR, MU2] [MU2, WF WU WR[
Algorithm (10 moves) (48 permuted stickers) (Permutation order: 4):
MR MU2 MR' WF WU WR MU2 WF' WU' WR'
MRMU2MR-WFWUWRMU2WF-WU-WR-

// Mixed Rings and Small Flowers 1
// (f,b)(l,r) | (f,l,b,r)
Algorithm (10 moves) (48 permuted stickers) (Permutation order: 8):
WR WU WR WF MU WU' WR' WF' WR' MU'
WRWUWRWFMUWU-WR-WF-WR-MU-



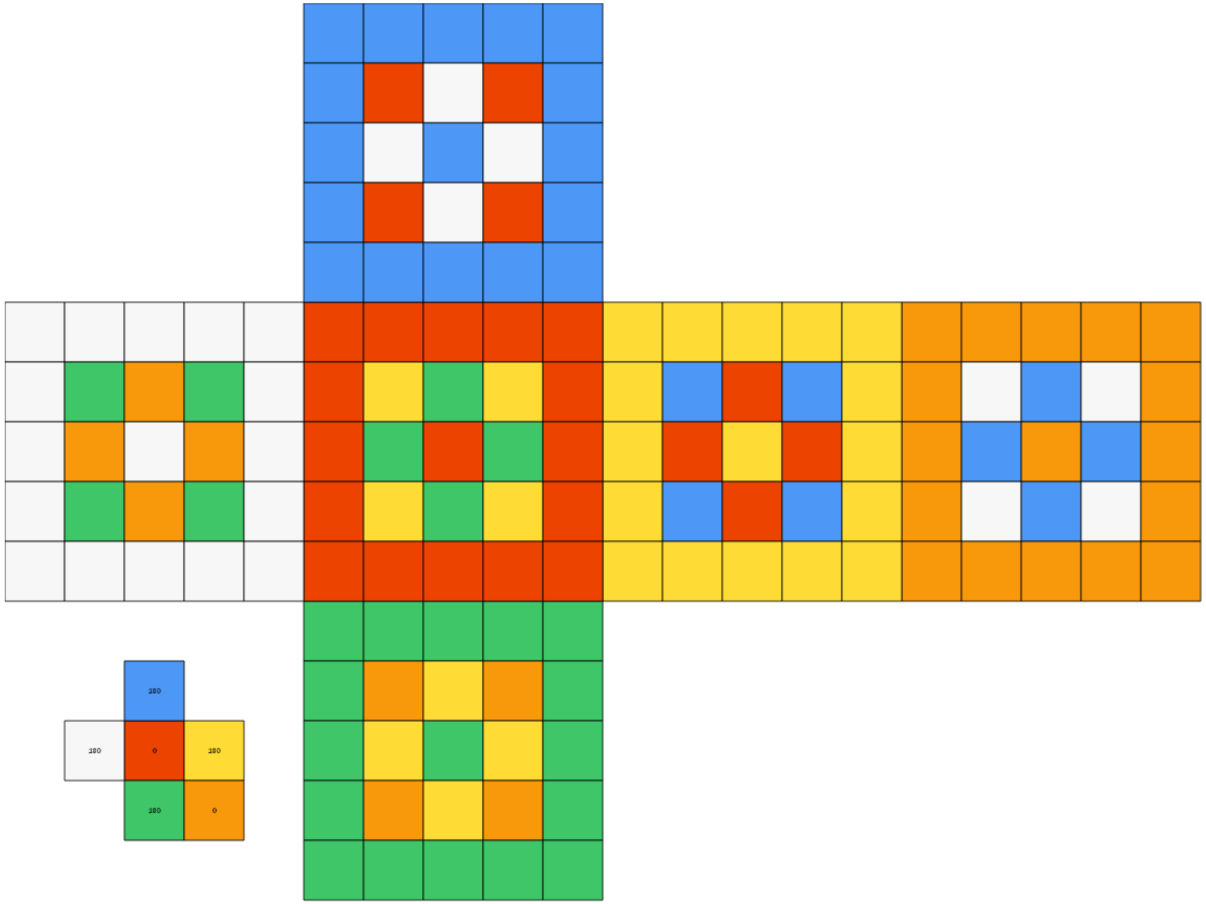
Mixed Rings and Small Flowers 1

// Mixed Rings and Small Flowers 2
// (f,b)(r,l) | (f,d,l)(b,u,r)
]WR WF, WU MF' MR]
Algorithm (10 moves) (48 permuted stickers) (Permutation order: 12):
WR WF WU MF' MR WR' WF' MR' MF WU'
WRWFWUMF-MRWR-WF-MR-MFWU-



Mixed Rings and Small Flowers 2

// Mixed Rings and Small Flowers 3
// (r,f,u)(d,l,b) | (d,f,r)(l,u,b)
Algorithm (12 moves) (48 permuted stickers) (Permutation order: 3):
MR WU MR' MU WR' MU MR WU' MR' MU WR MU
MRWUMR-MUWR-MUMRWU-MR-MUWRMU



Mixed Rings and Small Flowers 3

4 Pac-Man Monsters with small eyes

//1- Replace 16-mover (TR2 S2F2 TL2 D TR2 S2F2 TL2 U R2 SF2 L2 ND R2 SF2 L2 NU) with a 14-mover:
TU R2 SF2 L2 ND R2 SF2 NL2 S2F2 TR2 D TL2 S2F2 TR2

//2- Insert (V3F2 VR2 M2U2 VR2 VF2 M2U2 NR2 MF2 NR2) at *

TU * R2 SF2 L2 ND R2 SF2 NL2 S2F2 TR2 D TL2 S2F2 **TR2**
T3R2 NF2 MF2 NB2 T3R2 D T3L2 NF2 MF2 NB2 T3L2 D'

TU V3F2 VR2 M2U2 VR2 VF2 M2U2 NR2 MF2 TR2 SF2 L2 ND R2 SF2 NL2 S2F2 TR2 D TL2 S2F2 N3R2 NF2 MF2 NB2 T3R2 D T3L2 NF2 MF2 NB2 T3L2 D'

//3- Add (N3F N3L N3B N3R MD N3R' N3B' N3L' N3F' MD')

Algorithm (43 moves) (126 permuted stickers) (Permutation order: 12):
TU V3F2 VR2 M2U2 VR2 VF2 M2U2 NR2 MF2 TR2 SF2 L2 ND R2 SF2 NL2 S2F2 TR2 D TL2 S2F2 N3R2 NF2 MF2 NB2 T3R2 D T3L2 NF2 MF2 NB2 T3L2 D' N3F N3L N3B N3R MU' N3R' N3B' N3L' N3F' MU
TUV3F2VR2M2U2VR2VF2M2U2NR2MF2TR2SF2L2NDR2SF2NL2S2F2TR2DTL2S2F2N3R2NF2MF2NB2T3R2DT3L2NF2MF2NB2T3L2D-N3FN3LN3BN3RMU-N3R-N3B-N3L-N3F-MU

// 3 Rings (f,l,r) (18 m)
NU2 L2 F2 NU SF2 ND' B2 L2 NU2
WF [MR' F MR', WF2] WF'

Algorithm (18 moves) (24 permuted stickers) (Permutation order: 3):
NU2 L2 F2 NU SF2 ND' B2 L2 NU2 WF MR' F MR' WF2 MR F' MR WF
NU2L2F2NUSF2ND-B2L2NU2WFMR-FMR-WF2MRF-MRWF

4 Rings (f,l)(r,b) (15 m)
// 8 Midge-Centers (ND)(PB)(WI)(UK)
MF2 MR2 NU MF2 NU2 MR2 NU

// 16 Corner-Centers + 8 Midge-Centers (f,l)(r,b)
NU' WR2 NU2 WF2 NU' WR2 WF2

// 8 Midge-Centers (f,l)(r,b)
MF WR MF' SR' MF WR' MF' SR

// 4 Rings (f,l)(r,b) (15 m)
NU' WR2 NU2 WF2 NU' WR2 WF2 MF WR MF' SR' MF WR' MF' SR
Algorithm (15 moves) (32 permuted stickers) (Permutation order: 4):
NU' WR2 NU2 WF2 NU' WR2 WF2 MF WR MF' SR' MF WR' MF' SR
NU-WR2NU2WF2NU-WR2WF2MFWRMF-SR-MFWR-MF-SR

// 4 Rings (f,b,l,r) (22 m)
// 2 Rings (f,b)
VR2 WU2 NR2 VD2 MR2 NU2

// 3 Rings (f,l,r)
NU2 L2 F2 NU SF2 ND' B2 L2 NU2 WF MR' F MR' WF2 MR F' MR WF

// 4 Rings (f,b,l,r) = (f,b)(f,l,r)
Algorithm (22 moves) (32 permuted stickers) (Permutation order: 4):
VR2 WU2 NR2 VD2 MR2 L2 F2 NU SF2 ND' B2 L2 NU2 WF MR' F MR' WF2 MR F' MR WF
VR2WU2NR2VD2MR2L2F2NUSF2ND-B2L2NU2WFMR-FMR-WF2MRF-MRWF

// 6 Rings (u,r,f,d,l,b) (13 m)
// 6 Rings (u,r,f)(d,l,b)
WR WF' WR' MR MF MR' MF' WF

// 2 Rings (d,u)
WF2 VR2 NF2 MR2 VB2 NR2

// 6 Rings (u,r,f,d,l,b) = (u,r,f)(d,l,b) (d,u) = (u,r,f) (d,l,b,u) = (u,r,f) (u,d,l,b) = (u,r,f,d,l,b)
Algorithm (13 moves) (48 permuted stickers) (Permutation order: 6):
WR WF' WR' MR MF MR' MF' WF' VR2 NF2 MR2 VB2 NR2
WRWF-WR-MRMFMR-MF-WF-VR2NF2MR2VB2NR2

// 6 Rings (u,d)(r,l)(f,b) (11 m)
// 12 Centers
MR2 NF2 ND2 MR2 MF2 ND2 VF2

// 12 Bars
VF2 WU2 NB2 NR2 WU2 WF2 NR2

Algorithm (11 moves) (48 permuted stickers) (Permutation order: 2):
MR2 NF2 ND2 MR2 MF2 VU2 NB2 NR2 WU2 WF2 NR2
MR2NF2ND2MR2MF2VU2NB2NR2WU2WF2NR2

4 Rings (f,d,b,u) (19 m)
// 8 Bars
]NR WU2 NR2, WF2]

// 8 Centers
NU' MR2 NU MR' NU MR NU' MR NU' MR NU

Algorithm (19 moves) (32 permuted stickers) (Permutation order: 4):
NR WU2 NR2 WF2 NR' WU2 NR2 WF2 NU' MR2 NU MR' NU MR NU' MR NU' MR NU
NRWU2NR2WF2NR-WU2NR2WF2NU-MR2NUMR-NUMRNU-MRNU-MRNU

2 Rings (f,r) (18 m)
// 4 Centers
[MU, WR' D WR]

// 4 Bars
NU WR' D2 WR NU' ND' WR' D2 WR ND

Algorithm (18 moves) (16 permuted stickers) (Permutation order: 4):
MU WR' D WR MU' WR' D' WR NU WR' D2 WR ND' NU' WR' D2 WR ND

5 Rings (l,b,u,f,d) (31 m)
// (l,b,u,f,d) = (l,b,u,r,f,d)(f,r)
WR WF' WR' MR MF MR' MF' WF'
VR2 NF2 MR2 VB2 NR2

MU WR' D WR MU' WR' D' WR
ND' WR' D2 WR NU ND WR' D2 WR NU'

Algorithm (31 moves) (44 permuted stickers) (Permutation order: 20):
WR WF' WR' MR MF MR' MF' WF' VR2 NF2 MR2 VB2 NR2 MU WR' D WR MU' WR' D' WR ND' WR' D2 WR NU ND WR' D2 WR NU'
WRWF-WR-MRMFMR-MF-WF-VR2NF2MR2VB2NR2MUWR-DWRMU-WR-D-WRND-WR-D2WRNUNDWR-D2WRNU-

5 Rings (f,b)(u,r,l) (23 m)
// (f,b)
VR2 ND2 MR2 VU2 NR2 WU2

// (u,r,l)
WU ML' U ML' WU2 ML U' ML WU
NF2 R2 U2 NF SU2 NB' D2 R2 NF2

// (f,b)(u,r,l)
VR2 ND2 MR2 VU2 NR2 WU2
WU ML' U ML' WU2 ML U' ML WU
NF2 R2 U2 NF SU2 NB' D2 R2 NF2

Algorithm (23 moves) (40 permuted stickers) (Permutation order: 6):
VR2 ND2 MR2 VU2 NR2 WU' MR U MR WU2 MR' U' MR' WU NF2 R2 U2 NF SU2 NB' D2 R2 NF2

6 Rings (u,d)(r,l)(f,b) --- 5x5x5 Cube
Algorithm (10 moves) (48 permuted stickers) (Permutation order: 2):
WF VR2 NU2 MF MR2 MF' VD2 NR2 WF' WU2

6 Rings (u,d)(r,l)(f,b) --- 6x6x6 Cube
Algorithm (10 moves) (72 permuted stickers) (Permutation order: 2):
WF V3R2 NU2 M2F M2R2 M2F' V3D2 NR2 WF' WU2

6 Rings (u,d)(r,l)(f,b) --- 7x7x7 Cube
Algorithm (10 moves) (96 permuted stickers) (Permutation order: 2):
WF V4R2 NU2 M3F M3R2 M3F' V4D2 NR2 WF' WU2

Dot-Plus-Zero (11 m)
]MU' ND2 WF2, MR2] [MR', MU2]

Algorithm (11 moves) (28 permuted stickers) (Permutation order: 2):
MU' ND2 WF2 MR2 MU ND2 WF2 MR MU2 MR MU2
MU-ND2WF2MR2MUND2WF2MRMU2MRMU2

3 Rings (u,r,f) (Per: 21 m)
// (u,r,f)
WU [WU, MF U MF'] WU'
[WU, NL F2 NR' NL' F2 NR]

// (u,r,f)
Algorithm (21 moves) (24 permuted stickers) (Permutation order: 3):
WU2 MF U MF' WU' MF U' MF' NL F2 NR' NL' F2 NR WU' NR' F2 NL NR F2 NL'

5 Rings (u,r,b,l,f) (Per: 23 m)
// (f,r,u)(l,d,b)
WR' WU WR WU'
MU MR' MU' MR

// (l,b,f)
NU2 B2 L2 NU SL2 ND' R2 B2 NU2
WR' MF' L MF' WR2 MF L' MF WR'

// (f,r,u,l,d) = (f,r,u)(f,l,d) = (f,r,u)(l,d,f) = (f,r,u)(l,d,b,b,f) = (f,r,u)(l,d,b)(l,b,f)
WR' WU WR WU'
MU MR' MU' MR
NU2 B2 L2 NU SL2 ND' R2 B2 NU2
WR' MF' L MF' WR2 MF L' MF WR'

// True Centers
WR' WU WR WU'
NU2 B2 L2 NU SL2 ND' R2 B2 NU2
WR' MF' L MF' WR2 MF L' MF WR'

// Insert MU' MF' MU MF at position *
WR' * MF' L MF' WR2 MF L' MF WR'

// Shift
WU WR WU'
NU2 B2 L2 NU SL2 ND' R2 B2 NU2
WR' MU' MF' MU L MF' WR2 MF L' MF WR2

// (d,r,f,l,b)
Algorithm (23 moves) (40 permuted stickers) (Permutation order: 5):
WU WR WU' NU2 B2 L2 NU SL2 ND' R2 B2 NU2 WR' MU' MF' MU L MF' WR2 MF L' MF WR2

2 Rings (f,r) (Per: 18 m) (Alternate alg)
// (f,r)
[MU, WR' D WR]
ND' WR' D2 WR NU ND WR' D2 WR NU'

Algorithm (18 moves) (16 permuted stickers) (Permutation order: 4):
MU WR' D WR MU' WR' D' WR ND' WR' D2 WR NU ND WR' D2 WR NU'
MUWR-DWRMU-WR-D-WRND-WR-D2WRNUNDWR-D2WRNU-

5 Rings (f,b)(u,r,l) (25 m)
// (f,b)(r,l)
WF2 WU WF2 WU'
MU MF2 MU' MF2

// (r,u)
[MF', WR' F WR]
NF' WR' F2 WR NB NF WR' F2 WR NB'

// (f,b)(u,r,l) = (f,b)(r,l,u) = (f,b)(r,l)(r,u)
WF2 WU WF2 WU'
MU MF2 MU' MF2
[MF', WR' F WR]
NF' WR' F2 WR NB NF WR' F2 WR NB'

// (f,b)(u,r,l)
Algorithm (25 moves) (40 permuted stickers) (Permutation order: 6):
WF2 WU WF2 WU' MU MF2 MU' MF WR' F WR MF WR' F' WR NF' WR' F2 WR NB NF WR' F2 WR NB'
WF2WUWF2WU-MUMF2MU-MFWR-FWRMFWR-F-WRNF-WR-F2WRNBNFWR-F2WRNB-

5 Rings (l,r,b,f,u) (28 m)
// (l,r)(b,f)
MR2 MU' MR2 MU
WF2 WU WF2 WU'

// (b,u,l)
WU [WU, MF' U MF] WU'
[WU, NR B2 NL' NR' B2 NL]

// (l,r,b,f,u) = (l,r)(l,b,f,u) = (l,r)(b,f,u,l) = (l,r)(b,f)(b,u,l)
MR2 MU' MR2 MU
WF2 WU WF2 WU'
WU [WU, MF' U MF] WU'
[WU, NR B2 NL' NR' B2 NL]

// (l,r,b,f,u)

Algorithm (28 moves) (40 permuted stickers) (Permutation order: 5):
MR2 MU' MR2 MU WF2 WU WF2 WU MF' U MF WU' MF' U' MF NR B2 NL' NR' B2 NL WU' NL' B2 NR NL B2 NR'
MR2MU-MR2MUWF2WUWF2WUMF-UMFWU-MF-U-MFNRB2NL-NR-B2NLWU-NL-B2NRNLB2NR-

5 Rings (u,r)(d,b,l) (25 m)
// (u,f)
[MR', WU' R WU]
NR' WU' R2 WU NL NR WU' R2 WU NL'

// (u,f,r)(d,b,l)
[ML', MF']
[WF', WR]

// (u,r)(d,b,l) = (u,f,f,r)(d,b,l) = (u,f)(u,f,r)(d,b,l)
[MR', WU' R WU]
NR' WU' R2 WU NL NR WU' R2 WU NL'
[ML', MF']
[WF', WR]

// (u,r)(d,b,l)
Algorithm (25 moves) (48 permuted stickers) (Permutation order: 12):
MR' WU' R WU MR WU' R' WU NR' WU' R2 WU NL NR WU' R2 WU VL' MF' MR' MF WF' WR WF WR'
MR-WU-RWUMRWU-R-WUNR-WU-R2WUNLNRWU-R2WUVL-MF-MR-MFWF-WRWFWR-

6 Small Dual Diagonals (f,l,b,u,r,d)
[WF2, ML' MR' MU'[+ shift:
MR MU WF2 ML' MR' MU' WF2 ML
Algorithm (8 moves) (24 permuted stickers) (Permutation order: 6):
MR MU WF2 ML' MR' MU' WF2 ML
MRMUWF2ML-MR-MU-WF2ML

4 Rings (u,d)(r,f)
// (u,d)(r,l)
MR2 MF MR2 MF'
WF' WR2 WF WR2

// (r,l,f)
NU2 L2 F2 NU SF2 ND' B2 L2 NU2
WF MR' F MR' WF2 MR F' MR WF

// (u,d)(r,f) = (u,d)(r,l,l,f) = (u,d)(r,l)(r,l,f)

NU2 L2 F2 NU SF2 ND' B2 L2 NU2
WF MR' F MR' WF2 MR F' MR MR2 MF MR2 MF' WF
WF' WR2 WF WR2

(u,d)(r,f)
Algorithm (23 moves) (34 permuted stickers) (Permutation order: 4):
NU2 L2 F2 NU SF2 ND' B2 L2 NU2 WF MR' F MR' WF2 MR F' MR' MF MR2 MF' WR2 WF WR2
NU2L2F2NUSF2ND-B2L2NU2WFMR-FMR-WF2MRF-MR-MFMR2MF-WR2WFWR2

6 Rings (f,d)(l,b)(u,r)
// (f,d,l,b,u,r)
WR WF' WR' MR MF MR' MF' WF'
VR2 NF2 MR2 VB2 NR2

// (l,f,u)
WD2 MF' U' MF WD' MF' U MF
NR' F2 NL NR F2 NL' WD' NR' F2 NL NR F2 NL'

// (f,d)(l,b)(u,r) = (f,d,l,b,u,r) (l,f,u)
WR WF' WR' MR MF MR' MF' WF'
VR2 NF2 MR2 VB2 NR2
WD2 MF' U' MF WD' MF' U MF
NR' F2 NL NR F2 NL' WD' NR' F2 NL NR F2 NL'

Algorithm (34 moves) (48 permuted stickers) (Permutation order: 8):
WR WF' WR' MR MF MR' MF' WF' VR2 NF2 MR2 VB2 NR2 WU2 MF' U' MF WU MF' U MF NR' F2 NL NR F2 NL' WU NR' F2 NL NR F2 NL'
WRWF-WR-MRMFMR-MF-WF-VR2NF2MR2VB2NR2WU2MF-U-MFWUMF-UMFNR-F2NLNRF2NL-WUNR-F2NLNRF2NL-

New / Improved

4 Rings (f,r)(b,u)
// Insertion of (NR' WF NL R2 D2 NL' WF' NR NL WF NR' D2 R2 NR WF' NL') at *:
WR U WR' * MU WR U' WR' WF MU' B' MU WF' MU' B

// (f,r)(b,u)
Algorithm (30 moves) (32 permuted stickers) (Permutation order: 4):
WR U WR' NR' WF NL R2 D2 NL' WF' NR NL WF NR' D2 R2 NR WF' NL' MU WR U' WR' WF MU' B' MU WF' MU' B
WRUWR-NR-WFNLR2D2NL-WF-NRNLWFNR-D2R2NRWF-NL-MUWRU-WR-WFMU-B-MUWF-MU-B

4 Rings (u,d)(f,r)
// (u,d)(f,r)
Algorithm (22 moves) (32 permuted stickers) (Permutation order: 4):
MU WR' D WR MU' WR' D' WR ND' WR' TD2 VL2 MU2 NR2 VD2 WR' NU ND WR' D2 WR NU'
MUWR-DWRMU-WR-D-WRND-WR-TD2VL2MU2NR2VD2WR-NUNDWR-D2WRNU-

4 Rings (f,l,b,r)
// (f,l,b,r)
Algorithm (18 moves) (32 permuted stickers) (Permutation order: 4):
NR' MU2 NR MU NR MU' NR' WR2 ND2 WF2 ND' WR2 ND2 WF2 VD NR' MU' NR
NR-MU2NRMUNRMU-NR-WR2ND2WF2ND-WR2ND2WF2VDNR-MU-NR

4 Rings (f,b,u,r)
// (f,b,u,r)
Algorithm (25 moves) (32 permuted stickers) (Permutation order: 4):
NR2 VD2 MR2 NU2 VR2 MF U MF' WU' MF U' MF' NL F2 NR' NL' F2 NR WU' NL F2 NR' NL' F2 NR
NR2VD2MR2NU2VR2MFUMF-WU-MFU-MF-NLF2NR-NL-F2NRWU-NLF2NR-NL-F2NR

5 Rings (u,d)(l,r,f)
// (u,d)(l,r,f)
Algorithm (22 moves) (40 permuted stickers) (Permutation order: 6):
NU2 L2 F2 NU SF2 ND' B2 L2 NU2 WF MR' F MR' ND2 VB2 MU2 NF2 VD2 MR F' MR WF
NU2L2F2NUSF2ND-B2L2NU2WFMR-FMR-ND2VB2MU2NF2VD2MRF-MRWF

5 Rings (u,f)(d,l,b)
// (u,f)(d,l,b)
Algorithm (24 moves) (48 permuted stickers) (Permutation order: 12):
WF WU' WF' MF MU MF' WU WR' D WR MU' WR' D' WR ND' WR' D2 WR NU ND WR' D2 WR NU'
WFWU-WF-MFMUMF-WUWR-DWRMU-WR-D-WRND-WR-D2WRNUNDWR-D2WRNU-

5 Rings (u,d,r,l,f)
// (u,d,r,l,f)
Algorithm (25 moves) (40 permuted stickers) (Permutation order: 5):
MU2 WF WU2 WF' MF MU2 U MF' WU' MF U' MF' NL F2 NR' NL' F2 NR WU' NL F2 NR' NL' F2 NR
MU2WFWU2WF-MFMU2UMF-WU-MFU-MF-NLF2NR-NL-F2NRWU-NLF2NR-NL-F2NR

5 Rings (u,f,d,b,l)
// (u,f,d,b,l)
Algorithm (22 moves) (48 permuted stickers) (Permutation order: 20):
NU2 L2 F2 NU SF2 ND' B2 L2 NU2 WF MR' F MR' WF2 MR F' WR MF MR NF NB' WR'
NU2L2F2NUSF2ND-B2L2NU2WFMR-FMR-WF2MRF-WRMFMRNFNB-WR-

6 Rings (u,d)(f,r,b,l)
// (u,d)(f,r,b,l)
Algorithm (19 moves) (48 permuted stickers) (Permutation order: 8):
ND' WR2 NU ND WR2 NU' MF WR MF' SR' MF WR MR2 WF' WR2 WF MF' MR2 SR
ND-WR2NUNDWR2NU-MFWRMF-SR-MFWRMR2WF-WR2WFMF-MR2SR

6 Rings (u,d)(f,b,l,r)
// (u,d)(f,b,l,r)
Algorithm (25 moves) (48 permuted stickers) (Permutation order: 4):
VL2 MU2 NR2 VU2 T4L2 F2 NU SF2 ND' B2 L2 NU2 WF MR' F MR' NU2 VF2 MU2 NB2 VU2 MR F' MR WF
VL2MU2NR2VU2T4L2F2NUSF2ND-B2L2NU2WFMR-FMR-NU2VF2MU2NB2VU2MRF-MRWF

6 Rings (d,f)(u,l,b,r)
// (d,f)(u,l,b,r)
Algorithm (27 moves) (48 permuted stickers) (Permutation order: 16):
WU2 WR WF' WR' MR MF MR' WF U MF' WU' MF U' MF' NL F2 NR' NL' F2 NR WU' NL F2 NR' NL' F2 NR
WU2WRWF-WR-MRMFMR-WFUMF-WU-MFU-MF-NLF2NR-NL-F2NRWU-NLF2NR-NL-F2NR

6 Rings (d,f)(u,b,r,l)
// (d,f)(u,b,r,l)
Algorithm (23 moves) (48 permuted stickers) (Permutation order: 16):
NU2 L2 F2 NU SF2 ND' B2 L2 NU2 WF MR' F MR' WF2 MR F' MR2 WR' MF MR' NF NB' WR
NU2L2F2NUSF2ND-B2L2NU2WFMR-FMR-WF2MRF-MR2WR-MFMR-NFNB-WR

6 Rings (b,f,l,d,r,u)
// (b,f,l,d,r,u)
Algorithm (24 moves) (48 permuted stickers) (Permutation order: 12):
WR WU' WR' MR MU MR' WU WR' D WR MU' WR' D' WR ND' WR' D2 WR NU ND WR' D2 WR NU'
WRWU-WR-MRMUMR-WUWR-DWRMU-WR-D-WRND-WR-D2WRNUNDWR-D2WRNU-

6 Rings (f,l)(r,d)(b,u)
// (f,l)(r,d)(b,u)
Algorithm (31 moves) (48 permuted stickers) (Permutation order: 8):
WF' VL B2 NL' NR' B2 NL WU' NR B2 NL' NR' B2 NL WU2 MF' U MF WU' MF' U' WF MR MF MR' WR' VB2 NR2 MF2 VL2 NB2
WF-VLB2NL-NR-B2NLWU-NRB2NL-NR-B2NLWU2MF-UMFWU-MF-U-WFMRMFMR-WR-VB2NR2MF2VL2NB2

4x4x4 Waves
Edges
Basic Edge 4(3c)
[U' ML2 U D ML2 D', SL]

Edges 8(3c)
WF [U' ML2 U D ML2 D', SL] [SL, U' MR2 U D MR2 D'] WF'
WF U' ML2 U D ML2 D' SL D ML2 D' U' ML2 MR2 U D MR2 D' SL' D MR2 D' U' MR2 U WF'

Centers
(WF WR') (ML MD MR' MD') (MU' ML' MU MR) (WR WF')

Algorithm (35 moves) (60 permuted stickers) (Permutation order: 3):
WF U' ML2 U D ML2 D' SL D ML2 D' U' WR2 U D MR2 D' SL' D MR2 D' U' MR2 U WR' ML MD MR' MD' MU' ML' MU MR WR WF'
WFU-ML2UDML2D-SLDML2D-U-WR2UDMR2D-SL-DMR2D-U-MR2UWR-MLMDMR-MD-MU-ML-MUMRWRWF-

Improvement by double insertion (down to 31 moves):
Basic Edge 4(3c)
MR2 U' SR U WR2 U' SR' U ML2

Conjugate
D (MR2 U' SR U WR2 U' SR' U ML2) D'

Insertion 1: insert 4(3c) into 4(3c) to get 8(3c)
Edge 8(3c)
D MR2 U' SR D' MR2 U SL' U' WR2 U SL U' ML2 D U WR2 U' SR' U ML2 D'

Centers
WR' ML MD MR' MD' MU' ML' MU MR WR

Insertion 2: insert centers at *
D MR2 U' SR D' MR2 U SL' * U' WR2 U SL U' ML2 D U WR2 U' SR' U ML2 D'
D MR2 U' SR D' MR2 U SL' **MD' ML' MD MR ML MU MR' TU'** WR2 U SL U' ML2 D U WR2 U' SR' U ML2 D'

Conjugate
Algorithm (31 moves) (60 permuted stickers) (Permutation order: 3):
WF D MR2 U' SR D' MR2 U SL' MD' ML' MD MR ML MU MR' TU' WR2 U SL U' ML2 D U WR2 U' SR' U ML2 D' WF'
WFDMR2U-SRD-MR2USL-MD-ML-MDMRMLMUMR-TU-WR2USLU-ML2DUWR2U-SR-UML2D-WF-

Double Lines

(d, u)
// (4 moves) (12 solved stickers) (Order: 2) Main cycle: (d, u) Paired cycle: (d, u)
SR2 NF2 SR2 NB2

(f, r)*
// (10 moves) (12 solved stickers) (Order: 2) Main cycle: (f, r) Paired cycle: (f, r)
ND' WR' D2 WR NU ND WR' D2 WR NU'
ND' WR' D2 WR VU VD WR' D2 WR NU'
VD' WR' D2 WR NU ND WR' D2 WR VU'
VD' WR' D2 WR VU VD WR' D2 WR VU'

(b,f,r)
// (9 moves) (18 solved stickers) (Order: 3) Main cycle: (b, f, r) Paired cycle: (b, f, r)
NU2 B2 R2 NU SR2 ND' L2 B2 NU2 (9 moves) (18 solved stickers) (Order: 3) Main cycle: (b, f, r) Paired cycle: (b, f, r)

(b, d) (u, f)*
// (6 moves) (24 solved stickers) (Order: 2) Main cycle: (b, d) (u, f) Paired cycle: (b, d) (u, f)
NR WU2 NR' NL' WU2 NL

(l, r) (b, f)* --- Serial
// (6 moves) (24 solved stickers) (Order: 2) Main cycle: (l, r) (b, f) Paired cycle: (l, r) (b, f)
NU' ND WR2 ND' NU WR2

(l, r) (b, f)* --- Parallel
// (6 moves) (24 solved stickers) (Order: 2) Main cycle: (l, r) (b, f) Paired cycle: (l, r) (b, f)
NR2 WU NR2 NL2 WU' NL2

(l, r) (b, f)* --- Orhogonal
// (8 moves) (24 solved stickers) (Order: 2) Main cycle: (l, r) (b, f) Paired cycle: (l, r) (b, f)
NR' NL WF NL2 NR2 WF' MR WR'

(d, f, u, b)* --- Serial
// (8 moves) (24 solved stickers) (Order: 4) Main cycle: (d, f, u, b) Paired cycle: (d, f, u, b)
NR WU WF2 WU NR' WU' WF2 WU'

(u, r, d, l)* --- Orthogonal
// (8 moves) (24 solved stickers) (Order: 4) Main cycle: (u, r, d, l) Paired cycle: (u, r, d, l)
WU' NR WU WF2 WU NR' WU' WF2

(l, u, b) (d, f, r)
// (6 moves) (36 solved stickers) (Order: 3) Main cycle: (l, u, b) (d, f, r) Paired cycle: (l, u, b) (d, f, r)
NL' NR WU NR' NL WU'

(d, u) (l, r) (b, f)*
// (7 moves) (36 solved stickers) (Order: 2) Main cycle: (d, u) (l, r) (b, f) Paired cycle: (d, u) (l, r) (b, f)
VU2 WR2 NU2 WF WR2 MU2 WF'
WU2 MR2 WF VR2 WU2 NR2 WF'
VR2 WU2 NR2 WF MR2 WU2 WF'
VL2 WF2 NR2 NU2 WR2 WF2 NU2

(b, d) (l, r) (u, f)*
// (8 moves) (36 solved stickers) (Order: 2) Main cycle: (b, d) (l, r) (u, f) Paired cycle: (b, d) (l, r) (u, f)
NR WU2 NL' NR' NF2 WU2 NF2 NL

(b, f) (d, l, u, r)*
// (10 moves) (36 solved stickers) (Order: 4) Main cycle: (b, f) (d, l, u, r) Paired cycle: (b, f) (d, l, u, r)
NR WU2 NL' NR' WU2 NR WU NL NR' WU'

(b, f) (d, r, u, l)
// (10 moves) (36 solved stickers) (Order: 4) Main cycle: (b, f) (d, r, u, l) Paired cycle: (b, f) (d, r, u, l)
WU' NR' NF2 WU WF2 WU NF2 NR WU' WF2

(b, f) (d, r, u, l)
// (10 moves) (36 solved stickers) (Order: 4) Main cycle: (b, f) (d, r, u, l) Paired cycle: (b, f) (d, r, u, l)
NR2 WU2 NR2 NF WU2 NB2 WR2 NF' WR2 NB2

(d, u) (l, f, r, b)
// (10 moves) (36 solved stickers) (Order: 4) Main cycle: (d, u) (l, f, r, b) Paired cycle: (d, u) (l, f, r, b)
WR2 NU WR NU ND WR2 ND' NU' WR' NU'

(l, r) (d, f, u, b)
// (10 moves) (36 solved stickers) (Order: 4) Main cycle: (l, r) (d, f, u, b) Paired cycle: (l, r) (d, f, u, b)
NR NU2 WF WU2 WF NU2 NR' WF' WU2 WF'

(u, f, l, d, b, r)*
// (8 moves) (36 solved stickers) (Order: 6) Main cycle: (u, f, l, d, b, r) Paired cycle: (u, f, l, d, b, r)
NL' NR' NF2 WU' NF2 NL NR WU

3 Double Lines (u,r,f)
// 3 Double Lines (u,r,f) --- 14 moves
WU (NL F2 NL' NR' F2 NR) WU' (NR' F2 NR NL F2 NL')
[WU, NL F2 NL' NR' F2 NR]
// Basic Template 1
[X, Y Z Y' P Z' P']

WU (NL F2 NR' NL' F2 NR) WU' (NR' F2 NL NR F2 NL')
[WU, NL F2 NR' NL' F2 NR]
// Basic Template 2
[X, Y Z P Y' Z' P']

WU (NL F2 NL' NR' F2 NR) WU' (NL F2 NL' NR' F2 NR)
// Basic Template 3
X Y Z Y' P Z' P' X' Y Z Y' P Z' P'

WU (NL F2 NR' NL' F2 NR) WU' (NL F2 NR' NL' F2 NR)
// Basic Template 4
X Y Z P Y' Z' P' X' Y Z P Y' Z' P'

3 Double Lines (r,f,l)
// 3 Double Lines (r,f,l) --- 9 moves
NU2 L2 F2 NU SF2 ND' B2 L2 NU2

// 4 Double Lines (r,f)(u,b)
// 4 Double Lines (r,f)(u,b) --- 16 moves
NR' WF NL R2 D2 NL' WF' NR NL WF NR' D2 R2 NR WF' NL'

// Shift
R2 D2 NL' WF' NR NL WF NR' D2 R2 NR WF' NL' NR' WF NL
[R2 D2, NL' WF' NR NL WF NR']

// Basic Templates
[X Y, Z P Zo' Z' P' Zo]
[X Y, Z P Q Z' P' Q']

// 4 Double Lines (f,u)(r,d)
// 4 Double Lines (f,u)(r,d) --- 16 moves
NL' WF NL R2 D2 NL' WF' NL NR WF NR' D2 R2 NR WF' NR'

// Shift
R2 D2 NL' WF' NL NR WF NR' D2 R2 NR WF' NR' NL' WF NL
[R2 D2, NL' WF' NL NR WF NR']

// Basic Templates
[X Y, Z P Z' Zo' P' Zo]
[X Y, Z P Z' Q P' Q']

// Apply Symmetry #14 to (f,u)(r,d)
// 4 Double Lines (r,f)(u,b) --- 16 moves --- Alternate Pattern
ND' WR ND U2 B2 ND' WR' ND NU WR NU' B2 U2 NU WR' NU'

NEW
6 Rings (l,r,f) (d,u,b)*
(l,r,f)
NU2 L2 F2 NU SF2 ND' B2 L2 NU2
WF MR' F MR' WF2 MR F' MR WF

(d,u,b)
NR2 D2 B2 NR SB2 NL' F2 D2 NR2
WF' MU' B MU' WF2 MU B' MU WF'

(l,r,f) (d,u,b) --- Double Lines (18 m)
NU2 L2 F2 NU SF2 ND' B2 L2 NU2 NR2 D2 B2 NR SB2 NL' F2 D2 NR2

(l,r,f) (d,u,b) --- Midge-Centers (15 m)
WF' MU' B MU' MR' B MR' WF2 MR B' MR MU B' MU WF'

(l,r,f) (d,u,b) --- 6 Rings (33 m)
NU2 L2 F2 NU SF2 ND' B2 L2 NU2 NR2 D2 B2 NR SB2 NL' F2 D2 NR2
WF' MU' B MU' MR' B MR' WF2 MR B' MR MU B' MU WF'
NU2L2F2NUSF2ND-B2L2NU2NR2D2B2NRSB2NL-F2D2NR2WF-MU-BMU-MR-BMR-WF2MRB-MRMUB-MUWF-

6 Rings (f,b,d,u,l,r)*
(f,b)(d,u)(l,r)
WF' NR2 VU2 MF MR2 MF' ND2 VR2 WF WU2

(l,f,d)
WU2 MF D MF' WU MF D' MF'
NR F2 NL' NR' F2 NL WU NR F2 NL' NR' F2 NL

(f,b,d,u,l,r) = (f,b)(f,d,u,l,r) = (f,b)(d,u,l,r,f) = (f,b)(d,u)(d,l,r,f) = (f,b)(d,u)(l,r,f,d) = (f,b)(d,u)(l,r)(l,f,d)
WF' NR2 VU2 MF MR2 MF' ND2 VR2 WF WU2
WU2 MF D MF' WU MF D' MF'
NR F2 NL' NR' F2 NL WU NR F2 NL' NR' F2 NL

Algorithm (29 moves) (48 permuted stickers) (Permutation order: 6):
WF' NR2 VU2 MF MR2 MF' ND2 VR2 WF MF D MF' WU MF D' MF' NR F2 NL' NR' F2 NL WU NR F2 NL' NR' F2 NL
WF-NR2VU2MFMR2MF-ND2VR2WFMFDMF-WUMFD-MF-NRF2NL-NR-F2NLWUNRF2NL-NR-F2NL

6 Rings (u,f,r)(d,l,b) --- Per (24 m)
(NF' U2 NF2 R2 NB' MF) (WU' WF' WU WF) (MF' NB R2 NF2 U2 NF)
(WU MR U MR' WU' MR U' MR') (MR' MU MR MU')

NF' U2 NF2 R2 VB' WU' WF' WU NF R2 NF2 U2 NF

WU MR U MR' WU' MR U' MR2 MU MR MU'

4 Rings (u,r)(f,d) --- Per (29 m)
WU' WR2 (NB' R2 NB NF R2 NF') WR2 WU (NB' R2 NB NF R2 NF')
F' MU L MR' WU MR SU MR' WU' MR SU' L' MU' F

Alternate solution (29 m)*
[WU' WR2, NF R2 NF' NB' R2 NB]
MR MF' ND NU' MF2 U MF ND' NU MF' U' MF' MR'

Algorithm (29 moves) (32 permuted stickers) (Permutation order: 4):
WU' WR2 NF R2 NF' NB' R2 NB WR2 WU NB' R2 NB NF R2 NF' MR MF' ND NU' MF2 U MF ND' NU MF' U' MF' MR'
WU-WR2NFR2NF-NB-R2NBWR2WUNB-R2NBNFR2NF-MRMF-NDNU-MF2UMFND-NUMF-U-MF-MR-

4 Rings (b,d)(u,r,l)*
(b,d)
MR' WU R WU' MR WU R' WU'
NR' WU R2 WU' NL NR WU R2 WU' NL'

(u,r,l)
WU MR U MR WU2 MR' U' MR' WU
NF2 R2 U2 NF SU2 NB' D2 R2 NF2

(b,d)(u,r,l)
MR' WU R WU' MR WU R' WU'
WU MR U MR WU2 MR' U' MR' WU
NR' WU R2 WU' NL NR WU R2 WU' NL'
NF2 R2 U2 NF SU2 NB' D2 R2 NF2

(b,d)(u,r,l)
Algorithm (34 moves) (40 permuted stickers) (Permutation order: 12):
MR' WU R WU' MR WU R' MR U MR WU2 MR' U' MR' WU NR' WU R2 WU' NL NR WU R2 WU' NL' NF2 R2 U2 NF SU2 NB' D2 R2 NF2
MR-WURWU-MRWUR-MRUMRWU2MR-U-MR-WUNR-WUR2WU-NLNRWUR2WU-NL-NF2R2U2NFSU2NB-D2R2NF2

4 Rings (u,f,d,r)*
(d,u)
NF2 MR2 VB2 NR2 WF2 VR2

(d,f)(u,r)
WD WR2 NB' R2 NF NB R2 NF' WR2 WD'
NB' R2 NF NB R2 TF' MD' MR' L WD' MR SD' MR' WD MR SD L' MD F

(u,f,d,r) = (u,f,d)(u,r) = (d,u,f)(u,r) = (d,u)(d,f)(u,r)
NF2 MR2 VB2 NR2 WF2 VR2
WU' WR2 NB' R2 NF NB R2 NF' WR2 WU

NB' R2 NF NB R2 TF' MU MR' L WU MR SD' MR' WU' MR SD L' MU' F

Algorithm (33 moves) (32 permuted stickers) (Permutation order: 4):
WU' NL2 WF2 NR2 VF2 MR2 NB R2 NF NB R2 NF' WR2 WU NB' R2 NF NB R2 TF' MU MR' L WU MR SD' MR' WU' MR SD L' MU' F
WU-NL2WF2NR2VF2MR2NBR2NFNBR2NF-WR2WUNB-R2NFNBR2TF-MUMR-LWUMRSD-MR-WU-MRSDL-MU-F

5 Rings (r,b,l,d,u)*
(r,b,l)
ND2 L2 B2 ND SB2 NU' F2 L2 ND2
WF' MR' B MR' WF2 MR B' MR WF'

(r,d,u)
NF2 D2 R2 NF SR2 NB' L2 D2 NF2
WR MU' R MU' WR2 MU R' MU WR

(r,b,l,d,u) = (r,b,l)(r,d,u)
ND2 L2 B2 ND SB2 NU' F2 L2 ND2
WF' MR' B MR' WF2 MR B' MR WF'
NF2 D2 R2 NF SR2 NB' L2 D2 NF2
WR MU' R MU' WR2 MU R' MU WR

Algorithm (36 moves) (40 permuted stickers) (Permutation order: 5):
ND2 L2 B2 ND SB2 NU' F2 L2 ND2 WF' MR' B MR' WF2 MR B' MR WF' NF2 D2 R2 NF SR2 NB' L2 D2 NF2 WR MU' R MU' WR2 MU R' MU WR
ND2L2B2NDSB2NU-F2L2ND2WF-MR-BMR-WF2MRB-MRWF-NF2D2R2NFSR2NB-L2D2NF2WRMU-RMU-WR2MUR-MUWR

6 Rings (u,r,f,d,b,l)*
(u,r,f)(d,b,l)
MU MR' MU' MR2 U MR' WU MR U' MR' WU'
NF' U2 NF2 R2 NF' WU' WF WU VB R2 NF2 U2 NF

(d,u)
NF2 MR2 VB2 NR2 WF2 VR2

(u,r,f,d,b,l) = (u,r,f)(u,d,b,l) = (u,r,f)(d,b,l,u) = (u,r,f)(d,b,l)(d,u)
MU MR' MU' MR2 U MR' WU MR U' MR' WU'
NF' U2 NF2 R2 NF' WU' WF WU VB R2 NF2 U2 NF
NF2 MR2 VB2 NR2 WF2 VR2

Algorithm (29 moves) (48 permuted stickers) (Permutation order: 6):
MU MR' MU' MR2 U MR' WU MR U' MR' WU' NF' U2 NF2 R2 NF' WU' WF WU VB R2 NF2 U2 NF' MR2 VB2 NR2 WF2 VR2
MUMR-MU-MR2UMR-WUMRU-MR-WU-NF-U2NF2R2NF-WU-WFWUVBR2NF2U2NF-MR2VB2NR2WF2VR2

6 Rings (f,b,l,d,u,r)*
(f,b)(r,l)(d,u)

WF WD2 WF' VL2 NU2 MF MR2 MF' VD2 NL2

(d,r)(l,f)
WR' WD2 NB' D2 NF NB D2 NF' WD2 WR NB' D2 NF NB D2 TF' MR MD' U WR MD SL' MD' WR' MD SL U' MR' F

(f,b,l,d,u,r) = (f,b)(r,l)(d,u)(d,r)(l,f)
WF WD2 WF' VL2 NU2 MF MR2 MF' VD2 NL2
WR' WD2 NB' D2 NF NB D2 NF' WD2 WR NB' D2 NF NB D2 TF' MR MD' U WR MD SL' MD' WR' MD SL U' MR' F

Algorithm (39 moves) (48 permuted stickers) (Permutation order: 12):
WF WU2 WF' VL2 NU2 MF MR2 MF' VD2 NL2 WR' WU2 NB' D2 NF NB D2 NF' WU2 WR NB' D2 NF NB D2 TF' MR MU U WR MU' SL' MU WR' MU' SL U' MR' F
WFWU2WF-VL2NU2MFMR2MF-VD2NL2WR-WU2NB-D2NFNBD2NF-WU2WRNB-D2NFNBD2TF-MRMUUWRMU-SL-MUWR-MU-SLU-MR-F

RINGS
IMPROVED
(r,f)(d,l,b)
(23 moves) (48 solved stickers) (Order: 6)
WR WF' WR' VF WR' F2 WR NF' NB' WR' F2 WR NF WR' F WR MF' WR' F' WR MR MF MR'
WRWF-WR-VFWR-F2WRNF-NB-WR-F2WRNFWR-FWRMF-WR-F-WRMRMFMR-

(r,l)(b,f,u,d)
(24 moves) (48 solved stickers) (Order: 4)
WU' WR2 WU WF' MU F MU WF2 MU' F' MU' WF' NR2 U2 B2 NL SF2 NR' F2 U2 NL2 MU' MR2 MU
WU-WR2WUWF-MUFMUWF2MU-F-MU-WF-NR2U2B2NLSF2NR-F2U2NL2MU-MR2MU

(r,f,u,l,b,d)
(12 moves) (48 solved stickers) (Order: 6)
WR WF' WR VF2 NL2 MF2 VR2 NF' NB' MR MF MR'
WRWF-WRVF2NL2MF2VR2NF-NB-MRMFMR-

(r,f,u,d,l,b)
(23 moves) (48 solved stickers) (Order: 6)
WR WF' WR' VF WU F2 WU' NF' NB' WU F2 WU' NF WU F WU' MF' WU F' WU' MR MF MR'
WRWF-WR-VFWUF2WU-NF-NB-WUF2WU-NFWUFWU-MF-WUF-WU-MRMFMR-

(r,d,u,b,f,l)
(28 moves) (48 solved stickers) (Order: 6)
VB' R2 NB NF R2 NB' WU' NF' R2 NB NF R2 NB' MR D MR' WU' MR D' MR' WF' VL2 NU2 MF MR2 MF' VD2 NL2
VB-R2NBNFR2NB-WU-NF-R2NBNFR2NB-MRDMR-WU-MRD-MR-WF-VL2NU2MFMR2MF-VD2NL2

4 Woven Rings (4x4x4 Cube)

WF' WR WF WR'
F2 D2 R2 WU WF' MR2 WF WU' TR2 D2 F2
TF L2 U' R SU ML2 SU' R' SU ML2 D SL2 D' L SD MR2 SU L' SU' MR2 U R2 TF'

Algorithm (38 moves) (48 permuted stickers) (Permutation order: 9):
WF' WR WF WR' F2 D2 R2 WU WF' MR2 WF WU' TR2 D2 F2 TF L2 U' R SU ML2 SU' R' SU ML2 D SL2 D' L SD MR2 SU L' SU' MR2 U R2 TF'
WF-WRWFWR-F2D2R2WUWF-MR2WFWU-TR2D2F2TFL2U-RSUML2SU-R-SUML2DSL2D-LSDMR2SUL-SU-MR2UR2TF-

Double Hexagon 3 (4x4x4 Cube) --- Per
U D R2 B
WU2 R' WU2 R
B' R2 D' U'
U2 B2
B2
R2 MU2 F2 MU2 TF2 MU2 TF2 R2 F2 R2 F2
B2
MF MD U MF' MD MF U' MF' MR' MD' MR MD'
B2 U2
TU
MR' B2 MR (TR' F2 TR MB TR' F2 TR MB') TF MR' B2 MR TF'
TU'

Algorithm (53 moves) (35 solved stickers) (Permutation order: 6)
U D R2 B WU2 R' WU2 R B' R2 SU R2 MU2 F2 MU2 TF2 MU2 TF2 R2 F2 R2 SF2 MF MD U MF' MD MF U' MF' MR' MD' MR MD' B2 U2 TU MR' B2 R' F2 TR MB TR' F2 TR MB' TF MR' B2 MR TF' TU'
UDR2BWU2R-WU2RB-R2SUR2MU2F2MU2TF2MU2TF2R2F2R2SF2MFMDUMF-MDMFU-MF-MR-MD-MRMD-B2U2TUMR-B2R-F2TRMBTR-F2TRMB-TFMR-B2MRTF-TU-

Fat Hexagon (4x4x4 Cube) --- Per
R2
F2 MR2 U2 MR2 TU2 MR2 TU2 F2 U2 F2 U2
D2
MU ML R MU' ML MU R' MU' MF' ML' MF ML'
D2
R2

Algorithm (26 moves) (33 permuted stickers) (Permutation order: 10):
R2 F2 MR2 U2 MR2 TU2 MR2 TU2 F2 U2 F2 SU2 MU ML R MU' ML MU R' MU' MF' ML' MF ML' D2 R2

Single Hexagon (4x4x4 Cube) --- Per
R'

MU F2 MU' MB' MU F2 MU' MB
B F MR U' MR' U B' L' U' MR U MR' L F'
R

Algorithm (23 moves) (15 permuted stickers) (Permutation order: 3):
R' MU F2 MU' MB' MU F2 MU' TB F MR U' MR' U B' L' U' MR U MR' L F' R
R-MUF2MU-MB-MUF2MU-TBFMRU-MR-UB-L-U-MRUMR-LF-R

Double Hexagon 2 (4x4x4 Cube) --- Per
R2
F2 MR2 U2 MR2 TU2 MR2 TU2 F2 U2 F2 U2
D2
MU ML R MU' ML MU R' MU' MF' ML' MF ML'
D2
R2
R'
MU F2 MU' MB' MU F2 MU' MB
B F MR U' MR' U B' L' U' MR U MR' L F'
R

Algorithm (48 moves) (33 permuted stickers) (Permutation order: 18):
R2 F2 MR2 U2 MR2 TU2 MR2 TU2 F2 U2 F2 SU2 MU ML R MU' ML MU R' MU' MF' ML' MF ML' D2 R MU F2 MU' MB' MU F2 MU' TB F MR U' MR' U B' L' U' MR U MR' L F' R
R2F2MR2U2MR2TU2MR2TU2F2U2F2SU2MUMLRMU-MLMUR-MU-MF-ML-MFML-D2RMUF2MU-MB-MUF2MU-TBFMRU-MR-UB-L-U-MRUMR-LF-R

Fat Hexagon (Order 3) (4x4x4 Cube) --- Per
U
B2 WR2 L WF WR2 D WF D' L' B2
U'
U
F2 L2 D MR MB MR' MB' D' L2 F2
U'

Algorithm (21 moves) (42 permuted stickers) (Permutation order: 90):
U B2 WR2 L WF WR2 D WF D' L' SF2 L2 D MR MB MR' MB' D' L2 F2 U'

Fat Hexagon (Order 6) (4x4x4 Cube) --- Per
F L2 WU2 D' WR WU2 B WR B' D L2 F MR2 U2 MR2 TU2 MR2 MU2 F2
MR2 MD' MR U2 MR' MD MR U2 MR MD' L2 MD' MR' MD L2 MD' MR MU ML' MU' L' MU ML MU' L MD2

1-Corner-Centers
MR2 MD' MR U2 MR' MD MR U2 MR MD' L2 MD' MR' MD L2 MD' MR MU ML' MU' L' MU ML MU' L MD2

SCS

Nearest position algorithm at distance 1 (14 moves):
U2 R2 MU' MR MU TR' MF2 R' MB' R MF2 R' MB U2

AFL
Corner-Centers (16 moves) (7 solved stickers) (Order: 7)
F2 U2 R2 MU' MR MU TR' MF2 R' MB' R MF2 R' MB U2 F2 (16 moves) (7 solved stickers) (Order: 7)

F2 U2 R2 NU' NR NU TR' NF2 R' NB' R NF2 R' NB U2 F2

Composition of 3-cycles:
F2 U2 R2
[MU', MR]
R' [MF2, R' MB' R] R
R2 U2 F2

New Algorithm
F L2 WU2 D' WR WU2 B WR B' D L2 F MR2 U2 MR2 TU2 MR2 MU2 F2
F2 U2 R2 MU' MR MU TR' MF2 R' MB' R MF2 R' MB U2 F2

Algorithm (32 moves) (38 permuted stickers) (Permutation order: 12):
F L2 WU2 D' WR WU2 B WR B' D L2 F MR2 U2 MR2 TU2 MR2 TU2 R2 MU' MR MU TR' MF2 R' MB' R MF2 R' MB U2 F2
FL2WU2D-WRWU2BWRB-DL2FMR2U2MR2TU2MR2TU2R2MU-MRMUTR-MF2R-MB-RMF2R-MBU2F2

2-Edges
F L2 WU2 D' WR WU2 B WR B' D L2 F MR2 U2 MR2 TU2 MR2 MU2 F2

Orbit 04: 2(6c): (NCRKVG)(OBSJWF)
F L2 WU2 D' WR WU2 B WR B' D L2 F'
F2 MR2 U2 MR2 TU2 MR2 MU2 F2

Orbit 04: 4(3c): (WFO)(RKV)(NCG)(JBS)
F L2 D' (D WU2 D' WR WU2 B WR B') D L2 F'

F L2 D' (WU2 WR WU2 B WR B') D L2 F' (alternate form)
F L2 D' (WR B WU2 WR WU2 B') D L2 F' (alternate form)

F' D2 L (B' WR2 WU WR2 B WU) L' D2 F
B' R2 U (WR F' WU2 WR WU2 F) U' R2 B
B U2 R' (F WU F' WR2 WU WR2) R U2 B'
B' R2 U (WU2 WR WU2 F' WR F) U' R2 B
B U2 R' (F WR2 WU WR2 F' WU) R U2 B'

Orbit 04: 2(2c): (RG)(WB)
F2 (MR2 U2 MR2 TU2 MR2 MU2) F2

Serpentine (Order 4) (4x4x4 Cube)
WU' WR' MF WU WR2 WU MF' WR'
MR2 MU2 MR2 WF2 MU' WF2 MU'

(15 m)
WU' WR' MF WU WR2 WU MF' WR' MR2 MU2 MR2 WF2 MU' WF2 MU'
WU-WR-MFWUWR2WUMF-WR-MR2MU2MR2WF2MU-WF2MU-

Bridge (Order 4) (4x4x4 Cube)
WU' WR' MF WU WR2 WU MF' WR'
SR2 MR2 MU2 MR2 WF2 MU' WF2 MU' SR2

(17 m)
WU' WR' MF WU WR2 WU MF' WR' SR2 MR2 MU2 MR2 WF2 MU' WF2 MU' SR2
WU-WR-MFWUWR2WUMF-WR-SR2MR2MU2MR2WF2MU-WF2MU-SR2

Edges (Order 6) (4x4x4 Cube)
[WR, U R B]

Serpentine (8 m) --- Per
MR2 MU2 MR2 MD MR2 WU2 MR2 MU

Bridge (13 m) --- Per
MF2 MD2 MF2 MD2 WF2 MU WU2 MR2 WU2 MR2 MU' WF2 WU

Improved by insertion of (MF2 MD2 MF2 MD2) into (WF2 MU WU2 MR2 WU2 MR2 MU' WF2 WU):
(11 m)
MB2 MU2 MF2 MD2 MU MR2 WU2 MR2 MU' WF2 WU
MB2MU2MF2MD2MUMR2WU2MR2MU-WF2WU

Fat Anaconda (Order 6) (26 m)
6 wide edges
F L2 WU2 D' WR WU2 B WR B' D L2 F MR2 U2 MR2 TU2 MR2 MU2 F2

6 big dots
MF2 WF WR2 MF2 WU' WR2 WF' WU

F L2 WU2 D' WR WU2 B WR B' D L2 F MR2 U2 MR2 TU2 MR2 MU2 TF2 WF WR2 MF2 WU' WR2 WF' WU
FL2WU2D-WRWU2BWRB-DL2FMR2U2MR2TU2MR2MU2TF2WFWR2MF2WU-WR2WF-WU

Double Hexagon (Order 3) (6x6x6 Cube) --- Per
R L B2 U VL' U2 VL U NF VD NF' VD' VF ND VF' ND' U' VL' U2 VL U' B2 L' R' (centers)
R N3U' F' U2 F N3U N3D F' U2 F N3D' R' (edges)
R' N3B' U F2 U' N3B N3F U F2 U' N3F' R (final edges)

Algorithm (45 moves) (42 permuted stickers) (Permutation order: 3):
R L B2 U VL' U2 VL U NF VD NF' VD' VF ND VF' ND' U' VL' U2 VL U' B2 L' N3U' F' U2 F N3U N3D F' U2 F N3D' R2 N3B' U F2 U' N3B N3F U F2 U' N3F' R

Centers
(R L B2) (U VL' U2 VL U) (NF VD NF' VD' VF ND VF' ND') (U' VL' U2 VL U') (B2 L' R')

Centers – 1 (4 setup moves)
(X Y Z P) (NF VD NF' VD' VF ND VF' ND') (P' Z' Y' X')

(VF' U2 VF U2) (NF VD NF' VD' VF ND VF' ND') (U2 VF' U2 VF) (16 moves) (18 solved stickers) (Order: 3)
(VB' R2 VB U2) (NF VD NF' VD' VF ND VF' ND') (U2 VB' R2 VB) (16 moves) (18 solved stickers) (Order: 3)

Centers – 2 (+3 setup moves)
12 algorithm(s):
[0] R L B2 VF' U2 VF U2 NF VD NF' VD' VF ND VF' ND' U2 VF' U2 VF B2 L' R' (22 moves) (18 solved stickers) (Order: 3)
[1] R B2 L VF' U2 VF U2 NF VD NF' VD' VF ND VF' ND' U2 VF' U2 VF L' B2 R' (22 moves) (18 solved stickers) (Order: 3)
[2] L R B2 VF' U2 VF U2 NF VD NF' VD' VF ND VF' ND' U2 VF' U2 VF B2 R' L' (22 moves) (18 solved stickers) (Order: 3)
[3] L B2 R VF' U2 VF U2 NF VD NF' VD' VF ND VF' ND' U2 VF' U2 VF R' B2 L' (22 moves) (18 solved stickers) (Order: 3)
[4] B2 R L VF' U2 VF U2 NF VD NF' VD' VF ND VF' ND' U2 VF' U2 VF L' R' B2 (22 moves) (18 solved stickers) (Order: 3)
[5] B2 L R VF' U2 VF U2 NF VD NF' VD' VF ND VF' ND' U2 VF' U2 VF R' L' B2 (22 moves) (18 solved stickers) (Order: 3)
[6] R L B2 VB' R2 VB U2 NF VD NF' VD' VF ND VF' ND' U2 VB' R2 VB B2 L' R' (22 moves) (18 solved stickers) (Order: 3)
[7] R B2 L VB' R2 VB U2 NF VD NF' VD' VF ND VF' ND' U2 VB' R2 VB L' B2 R' (22 moves) (18 solved stickers) (Order: 3)
[8] L R B2 VB' R2 VB U2 NF VD NF' VD' VF ND VF' ND' U2 VB' R2 VB B2 R' L' (22 moves) (18 solved stickers) (Order: 3)
[9] L B2 R VB' R2 VB U2 NF VD NF' VD' VF ND VF' ND' U2 VB' R2 VB R' B2 L' (22 moves) (18 solved stickers) (Order: 3)
[10] B2 R L VB' R2 VB U2 NF VD NF' VD' VF ND VF' ND' U2 VB' R2 VB L' R' B2 (22 moves) (18 solved stickers) (Order: 3)
[11] B2 L R VB' R2 VB U2 NF VD NF' VD' VF ND VF' ND' U2 VB' R2 VB R' L' B2 (22 moves) (18 solved stickers) (Order: 3)

Improved centers
(R L B2) (VB' R2 VB U2) (NF VD NF' VD' VF ND VF' ND') (U2 VB' R2 VB) (B2 L' R')

R L B2 VB' R2 VB U2 NF VD NF' VD' VF ND VF' ND' U2 VB' R2 VB B2 L' R'
R N3U' F' U2 F N3U N3D F' U2 F N3D' R'
R' N3B' U F2 U' N3B N3F U F2 U' N3F' R

Algorithm (43 moves) (42 permuted stickers) (Permutation order: 3):
R L B2 VB' R2 VB U2 NF VD NF' VD' VF ND VF' ND' U2 VB' R2 VB B2 L' N3U' F' U2 F N3U N3D F' U2 F N3D' R2 N3B' U F2 U' N3B N3F U F2 U' N3F' R
RLB2VB-R2VBU2NFVDNF-VD-VFNDVF-ND-U2VB-R2VBB2L-N3U-F-U2FN3UN3DF-U2FN3D-R2N3B-UF2U-N3BN3FUF2U-N3F-R

Zeros (6x6x6 Cube)
(f,b)
NR2 M2U2 NR2 WU2 N3R2 ND2 NU2 N3R2 (8 m)
NR2M2U2NR2WU2N3R2ND2NU2N3R2

(f,b)(r,l)
WR2 M2U WR2 M2U' M2R2 WU' M2R2 WU (8 m)
WR2M2UWR2M2U-M2R2WU-M2R2WU

Wide Double Hexagons (6x6x6 Cube)
SR D2 VU F2 VU2 R2 N3U N4B' NU N4B N3U' N3B' N3U N3B N4U' NB' N4U NB VU' R2 VU2 F2 VU' D2 L ND F' U2 F ND' NU' F' U2 F NU R2 NF U F2 U' NF' NB' U F2 U' NB R

Centers:
(R L' D2 VU F2 VU2 R2 VU) [NU' , N3F] [N3U' , N3B'] [N3D , NB'] (VU' R2 VU2 F2 VU' D2 L R')

Replace [NU' , N3F] with VU' [N3F, NU] VU, to give:

(R L' D2 VU F2 VU2 R2 VU) (VU' N3F NU N3F' N3B' N3U N3B N3D NB' N3D' NB) (VU' R2 VU2 F2 VU' D2 L R')

Edges
R ND F' U2 F ND' NU' F' U2 F NU R'
R' NF U F2 U' NF' NB' U F2 U' NB R

Algorithm (45 moves) (42 permuted stickers) (Permutation order: 3):
SR D2 VU F2 VU2 R2 N3F NU N3F' N3B' N3U N3B N3D NB' N3D' NB VU' R2 VU2 F2 VU' D2 L ND F' U2 F ND' NU' F' U2 F NU R2 NF U F2 U' NF' NB' U F2 U' NB R
SRD2VUF2VU2R2N3FNUN3F-N3B-N3UN3BN3DNB-N3D-NBVU-R2VU2F2VU-D2LNDF-U2FND-NU-F-U2FNUR2NFUF2U-NF-NB-UF2U-NBR

Double Hexagon (Order 3) (6x6x6 Cube) --- New
SR D2 VU F2 VU2 R2 NB' VU NB NU' VB' NU VB VU' R2 VU2 F2 VU' D2 L N3D F' U2 F N3D' N3U' F' U2 F N3U R2 N3F U F2 U' N3F' N3B' U F2 U' N3B R

SR D2 VU F2 VU2 R2 NB' VU NB NU' VB' NU VB VU' R2 VU2 F2 VU' D2 SR'
R N3D F' U2 F N3D' N3U' F' U2 F N3U R'
R' N3F U F2 U' N3F' N3B' U F2 U' N3B R

Centers
SR (D2 VU F2 VU2 R2 VU) [VU', NB'] [NU', VB'] (VU' R2 VU2 F2 VU' D2) SR'

Replace setup (D2 VU F2 VU2 R2 VU) with (VD R2 T3D2 F2)

Hint:
-use a single quarter-turn slice move VD, half-turn moves R2, F2 and combine D2 with VD2 into T3D2
-isolate T3D2 from VD with R2 and F2
-try all combinations (hopefully, not too many)
SR (VD R2 T3D2 F2) (VU' NB' VU NB) (NU' VB' NU VB) (F2 T3D2 R2 VD') SR'

Algorithm (40 moves) (42 permuted stickers) (Permutation order: 3):
SR VD R2 T3D2 F2 VU' NB' VU NB NU' VB' NU VB F2 T3D2 R2 VD' L N3D F' U2 F N3D' N3U' F' U2 F N3U R2 N3F U F2 U' N3F' N3B' U F2 U' N3B R
SRVDR2T3D2F2VU-NB-VUNBNU-VB-NUVBF2T3D2R2VD-LN3DF-U2FN3D-N3U-F-U2FN3UR2N3FUF2U-N3F-N3B-UF2U-N3BR

Big Dots (4x4x4 Cube)
(l,r,d,u)
(10 m)
T3R2 D2 MB' SU2 MF U2 R2 MF WR2 MF'
T3R2D2MB-SU2MFU2R2MFWR2MF-

Double Fat Triangle (6x6x6) --- Per
R F' VU2 F U F' WU2 F U' F' VD2 F NB U2 NB' V3U' NB U2 NB' V3U N3B U2 N3B' N3U' N3B U2 N3B' N3U R2 V3F ND' F2 ND V3F' ND' F2 ND R

R (F' VU2 F U F' WU2 F U' F' VD2 F) R'
R (NB U2 NB' V3U' NB U2 NB' V3U) R'
R (N3B U2 N3B' N3U' N3B U2 N3B' N3U) R'
R' (V3F ND' F2 ND V3F' ND' F2 ND) R

Replace Part 3: R (N3B U2 N3B' N3U' N3B U2 N3B' N3U) R' with:
R' (N3F N3D' F2 N3D N3F' N3D' F2 N3D) R

Apply setup N3D' to Part 4:
R' N3D' (V3F ND' F2 ND V3F' ND' F2 ND) N3D R

Combine all 4 parts:
R F' VU2 F U F' WU2 F U' F' VD2 F R'
R (NB U2 NB' V3U' NB U2 NB' V3U) R'
R' (N3F N3D' F2 N3D N3F' N3D' F2 N3D) R
R' N3D' (V3F ND' F2 ND V3F' ND' F2 ND) N3D R

Algorithm (37 moves) (42 permuted stickers) (Permutation order: 3):
R F' VU2 F U F' WU2 F U' F' VD2 F NB U2 NB' V3U' NB U2 NB' V3U R2 N3F N3D' F2 N3D N3F' N3D' F2 V3F ND' F2 ND V3F' ND' F2 VD R
RF-VU2FUF-WU2FU-F-VD2FNBU2NB-V3U-NBU2NB-V3UR2N3FN3D-F2N3DN3F-N3D-F2V3FND-F2NDV3F-ND-F2VDR

Four Zeros
(f,b)(r,l)
Algorithm (10 moves) (32 permuted stickers) (Permutation order: 2):
NR2 NF2 NU2 M2F2 V3U2 V3F2 V3R2 V3U2 M2R2 NU2
NR2NF2NU2M2F2V3U2V3F2V3R2V3U2M2R2NU2

Four Chained Zeros
NR2 NF2 NU2 M2F2 V3U2 V3F2 V3R2 V3U2 M2R2 NU2

N3U2 SF2 SL2 N3D2 SF2 SL2

Algorithm (15 moves) (48 permuted stickers) (Permutation order: 2):
NR2 NF2 NU2 M2F2 V3U2 V3F2 V3R2 V3U2 M2R2 VU2 SF2 SL2 N3D2 SF2 SL2
NR2NF2NU2M2F2V3U2V3F2V3R2V3U2M2R2VU2SF2SL2N3D2SF2SL2

Per (5 moves)
M2U2 M2R2 WU M2R2 WU'

Two Chained Half-Zeros
B2 TR2 M2U NR2 WU' N3B2 ND' NU N3B2 R2 B2
N3D B F N3R N3L SF R2 SF' N3R' N3L' SF R2 F2 N3D'
Algorithm (25 moves) (24 permuted stickers) (Permutation order: 2):
B2 TR2 M2U NR2 WU' N3B2 ND' NU N3B2 R2 B2 N3D B F N3R N3L SF R2 SF' N3R' N3L' SF R2 F2 N3D'
B2TR2M2UNR2WU-N3B2ND-NUN3B2R2B2N3DBFN3RN3LSFR2SF-N3R-N3L-SFR2F2N3D-

Per (14 moves)
TL2 B2 N3U2 TF2 N3U2 T3F2 N3U2 NU ND' N3F2 ND NU' B2 TL2

From:
(TL2 B2) (N3U2 TF2 N3U2 T3F2 N3U2 N3F2) (B2 TL2)

Two Wide Edges (Order 2) (6 moves)
(VU2 F2 VU2 T3F2 VU2 VF2)
VU2F2VU2T3F2VU2VF2

Two Opposed Bricks (1x2x4) (9 moves)
(TL2 F2) (VU2 F2 VU2 T3F2 VU2 VF2) (F2 TL2)
TL2 F2 VU2 F2 VU2 T3F2 VU2 T3F2 TL2
TL2F2VU2F2VU2T3F2VU2T3F2TL2

Per (8 moves)
TL2 VU2 F2 VU2 T3F2 VU2 VF2 TL2

Quadruple Triangle
SF VL' U2 T3L2 F2 NU VL' NU' NL VU NL' VU' VL F2 T3L2 U2 VL SF' R F' N3U2 F U F' M2U2 F U' F' N4U2 F SR' D' N3B2 D B D' M2B2 D B' D' N4B2 D L'
(SF VL' U2 T3L2 F2 NU VL' NU' NL VU NL' VU' VL F2 T3L2 U2 VL SF')
(R F' N3U2 F U F' M2U2 F U' F' N4U2 F SR' D' N3B2 D B D' M2B2 D B' D' N4B2 D L')

Centers
(U2 VD VL2 F' L') (VU NL' VU' NL NU VL' NU' VL) (L F VL2 VD' U2)

Edges
(U' D' F2 L) (N3F2 SR B' SR' M2F2 SR B SR' N3B2) (L' F2 D U)

Algorithm (32 moves) (42 permuted stickers) (Permutation order: 3):
U2 VD VL2 F' L' VU NL' VU' NL NU VL' NU' T3L F VL2 VD' SU F2 L N3F2 SR B' SR' M2F2 SR B SR' N3B2 L' F2 D U
U2VDVL2F-L-VUNL-VU-NLNUVL-NU-T3LFVL2VD-SUF2LN3F2SRB-SR-M2F2SRBSR-N3B2L-F2DU

Double Hexagon (6x6x6)
SR VD R2 T3D2 F2 NB' VU' NB VU VB' NU' VB NU F2 T3D2 R2 VD' SR2 CR WF U2 CU F2 L N3F2 SR B' SR' M2F2 SR B SR' N3B2 L' F2 U2 CD WF' WR'

(SR VD R2 T3D2 F2) (NB' VU' NB VU VB' NU' VB NU) (F2 T3D2 R2 VD' SR') (SR' CR WF U2 CU F2 L N3F2 SR B' SR' M2F2 SR B SR' N3B2 L' F2 U2 CD WF' WR')

Centers
(SR VD R2 T3D2 F2) (NB' VU' NB VU VB' NU' VB NU) (F2 T3D2 R2 VD' SR')

Edges
(WR WF CU U2 F2 L) (N3F2 SR B' SR' M2F2 SR B SR' N3B2) (L' F2 U2 CD WF' WR')

Transform the inner alg and force the inverse setup to terminate with an L move:
(L' R' U2 F') (N3D2 SB' U SB M2U2 SB' U' SB N3U2) (F U2 R L)

Algorithm (33 moves) (42 permuted stickers) (Permutation order: 3):
L' R' U2 F' N3D2 SB' U SB M2U2 SB' U' SB N3U2 F U2 R2 VD R2 T3D2 F2 NB' VU' NB VU VB' NU' VB NU F2 T3D2 R2 VD' SR'
L-R-U2F-N3D2SB-USBM2U2SB-U-SBN3U2FU2R2VDR2T3D2F2NB-VU-NBVUVB-NU-VBNUF2T3D2R2VD-SR-

6 Xs – Per (18 moves)
SR F' M2U2 F SU F' M2U2 F SU' B M2U2 B' SU B M2U2 B' SU' SR'

3x3x3 Cube
SR F' MU2 F SU F' MU2 F SU' B MU2 B' SU B MU2 B' SU' SR'

SCS (16 moves):
MF SL (U' MR2 U D MR2 D') SL' (D MR2 D' U' MR2 U) MF'

Shift + setup:
Based on pure alg: (R MU2 R' L' MU2 L)
MF' [R MU2 R' L' MU2 L, SU] MF

Scale up to 6x6x6:
M2F' [R M2U2 R' L' M2U2 L, SU] M2F

Algorithm (16 moves) (48 permuted stickers) (Permutation order: 3):
M2F' R M2U2 R' L' M2U2 L SU L' M2U2 L R M2U2 R' SU' M2F
M2F-RM2U2R-L-M2U2LSUL-M2U2LRM2U2R-SU-M2F

Pattern 1 (22 moves)
NF2 N3B2 NR2 N3L2 NU2 N3D2 SR F' WU2 F SU F' WU2 F SU' SR' N3D2 NU2 N3L2 NR2 N3B2 NF2
(NF2 N3B2 NR2 N3L2 NU2 N3D2 SR) (F' WU2 F SU F' WU2 F SU') (SR' N3D2 NU2 N3L2 NR2 N3B2 NF2)
(NF2 N3B2 NR2 N3L2 NU2 N3D2 SR) [F' WU2 F, SU] (SR' N3D2 NU2 N3L2 NR2 N3B2 NF2)

Pattern 2 (16 moves)
N3F2 N3R2 N3U2 R F' M2U2 F U F' M2U2 F U' R' N3U2 N3R2 N3F2
(N3F2 N3R2 N3U2 R) (F' M2U2 F U F' M2U2 F U') (R' N3U2 N3R2 N3F2)
(N3F2 N3R2 N3U2 R) [F' M2U2 F, U] (R' N3U2 N3R2 N3F2)

Pattern 2 (14 moves):
Two Edge triangles (4x4x4) (14 moves)
(SF' U2 F2) [SU', L' N3U2 L] (F2 U2 SF)
SF-U2F2SU-L-N3U2LSUL-N3U2LF2U2SF

Four Edge Triangles (16 moves)
(SF' U2 F2) [SU', L' ND2 N3U2 L] (F2 U2 SF)
SF-U2F2SU-L-ND2N3U2LSUL-N3U2ND2LF2U2SF

Two Edge Propellers (14 moves)
(SF' U2 F2) [SU', L' WU2 L] (F2 U2 SF)
SF-U2F2SU-L-WU2LSUL-WU2LF2U2SF

Pattern 3 (16 moves)
N3B2 N3L2 N3D2 R F' M2U2 F U F' M2U2 F U' R' N3D2 N3L2 N3B2
(N3B2 N3L2 N3D2 R) (F' M2U2 F U F' M2U2 F U') (R' N3D2 N3L2 N3B2)
(N3B2 N3L2 N3D2 R) [F' M2U2 F, U] (R' N3D2 N3L2 N3B2)

Pattern 3 (14 moves):
Two Edge triangles (3x3x3)
(SF L2 B2) [U' N3R2 U, SR] (B2 L2 SF')
SFL2B2U-N3R2USRU-N3R2USR-B2L2SF-

Four Edge Triangles
(SF L2 B2) [U' NL2 N3R2 U, SR] (B2 L2 SF')

Two Edge Propellers
(SF L2 B2) [U' WR2 U, SR] (B2 L2 SF')

8 Triangles (22 moves)
M2F' [R M2U2 R' L' M2U2 L, SU] M2F

NF' NB [R NU2 ND2 R' L' ND2 NU2 L, SU] NB' NF
NF-NBRNU2ND2R-L-ND2NU2LSUL-NU2ND2LRND2NU2R-SU-NB-NF

Quadruple Triangle and Double Hexagon (version2) (48 btm)
SR F' N3U2 F SU F' M2U2 F SU' F' N3D2 F B N3U2 B' SU B M2U2 B' SU' B N3D2 B' VD' F2 T3D2 R2 NF VD' NF' ND VF ND' VF' NB' VU' NB VU VB' NU' VB NU VD R2 T3D2 F2 VD SR'

Edges
SR (F' N3U2 F SU F' M2U2 F SU' F' N3D2 F B N3U2 B' SU B M2U2 B' SU' B N3D2 B') SR'

Centers
(SR VD' F2 T3D2 R2 VD') (VD NF VD' NF') (ND VF ND' VF') (NB' VU' NB VU) (VB' NU' VB NU) (VD R2 T3D2 F2 VD SR')

Rework setup
(SR SU2) (VD NF VD' NF') (ND VF ND' VF') (NB' VU' NB VU) (VB' NU' VB NU) (SU2 SR')

Algorithm (42 moves) (84 permuted stickers) (Permutation order: 3):
SR F' N3U2 F SU F' M2U2 F SU' F' N3D2 F B N3U2 B' SU B M2U2 B' SU' B N3D2 B' SU2 VD NF VD' NF' ND VF ND' VF' NB' VU' NB VU VB' NU' VB NU SU2 SR'
SRF-N3U2FSUF-M2U2FSU-F-N3D2FBN3U2B-SUBM2U2B-SU-BN3D2B-SU2VDNFVD-NF-NDVFND-VF-NB-VU-NBVUVB-NU-VBNUSU2SR-

4 Fat Triangles (55 btm)
R L B2 U2 NB' VU' NB VU N3B' NU' N3B NU VD NB' VD' NB M2D N3B' M2D' N3B VU' N3F VU N3F' NU' NF NU NF' U2 B2 L' F' TD2 F U F' T4D2 F U' F' M2U2 F SL D' M2F2 D B D' T4F2 D B' D' TF2 D L'

Centers
(R L B2 U2) (NB' VU' NB VU) (N3B' NU' N3B NU) (VD NB' VD' NB) (M2D N3B' M2D' N3B) (VU' N3F VU N3F') (NU' NF NU NF') (U2 B2 L' R')

Edges + Corners
R F' TD2 F U F' T4D2 F U' F' M2U2 F SL D' M2F2 D B D' T4F2 D B' D' TF2 D L'

4 Fat Triangles and 2 Fat Hexagons (57 btm)
SR VD' F2 T3D2 R2 N3D' V3F ND' V3F' V3D NF V3D' NF' N3D N3F N3D' N3F' NB' V3U' NB V3U V3B' NU' V3B NU N3B' N3U' N3B N3U VD R2 T3D2 F2 VD F' VU2 F SU F' WU2 F SU' F' VD2 F B VU2 B' SU B WU2 B' SU' B VD2 B' SR'

Centers
(SR VD' F2 T3D2 R2 VD') (ND V3F ND' V3F') (V3D NF V3D' NF') (N3D N3F N3D' N3F') (NB' V3U' NB V3U) (V3B' NU' V3B NU) (N3B' N3U' N3B N3U) (VD R2 T3D2 F2 VD SR')

Rework setup
(SR SU2) (ND V3F ND' V3F') (V3D NF V3D' NF') (N3D N3F N3D' N3F') (NB' V3U' NB V3U) (V3B' NU' V3B NU) (N3B' N3U' N3B N3U) (SU2 SR')

Edges
SR (F' VU2 F SU F' WU2 F SU' F' VD2 F B VU2 B' SU B WU2 B' SU' B VD2 B') SR'

Algorithm (50 moves) (168 permuted stickers) (Permutation order: 3):
SR SU2 ND V3F ND' V3F' V3D NF V3D' NF' N3D N3F N3D' N3F' NB' V3U' NB V3U V3B' NU' V3B NU N3B' N3U' N3B N3U SU2 F' VU2 F SU F' WU2 F SU' F' VD2 F B VU2 B' SU B WU2 B' SU' B VD2 B' SR'

SRSU2NDV3FND-V3F-V3DNFV3D-NF-N3DN3FN3D-N3F-NB-V3U-NBV3UV3B-NU-V3BNUN3B-N3U-N3BN3USU2F-VU2FSUF-WU2FSU-F-VD2FBVU2B-SUBWU2B-SU-BVD2B-SR-

Y-Spectre (6x6x6) (29 btm)
SF (VL NU VL' NU' NL VU NL' VU') (M2L N3U M2L' N3U' N3L M2U N3L' M2U') (VR' N3D' VR N3D N3R' VD' N3R N3D NR' ND NR) SF'

16 moves
VL NU VL' NU' NL VU NL' VU'
NL VU NL' VU' VL NU VL' NU'

M2R' N3U M2R N3U' N3L M2U N3L' M2U'
N3L M2U N3L' M2U' M2R' N3U M2R N3U'

Insertion 1: 14 moves
M2R' N3U M2R N3U' N3L M2U NL NU NL' VU' NL VU VL' V3U'

11 moves
(VR' N3D' VR N3D) (N3R' VD' N3R VD) (VD' N3D NR' ND NR)
(VR' N3D' VR N3D) (N3R' VD' N3R VD) (ND' NR' ND NR)

VR' N3D' VR N3D N3R' VD' N3R VD
N3R' VD' N3R VD VR' N3D' VR N3D

Insertion 2: 10 moves
N3R' VD' N3R N3D NR' ND N3R' N3D' VR N3D

Insertion 3: 23 moves
(M2R' N3U M2R N3U' N3L M2U NL NU NL' VU') (N3D) (N3R' VD' N3R N3D NR' ND N3R' N3D' VR N3D) (N3D') (NL VU VL' V3U')
M2R' N3U M2R N3U' N3L M2U NL NU NL' V3U' N3R' VD' N3R N3D NR' ND N3R' N3D' VR NL VU VL' V3U'

Setup: 25 moves
Algorithm (25 moves) (60 permuted stickers) (Permutation order: 3):
SF M2R' N3U M2R N3U' N3L M2U NL NU NL' V3U' N3R' VD' N3R N3D NR' ND N3R' N3D' VR NL VU VL' V3U' SF'
SFM2R-N3UM2RN3U-N3LM2UNLNUNL-V3U-N3R-VD-N3RN3DNR-NDN3R-N3D-VRNLVUVL-V3U-SF-

Triangle Spectre (6x6x6) (31 btm)
SU SL (VL NU VL' NU' NL VU NL' VU') (M2L N3U M2L' N3U' N3L M2U N3L' M2U') (VR' N3D' VR N3D N3R' VD' N3R N3D NR' ND NR) SL' SU'

16 moves
VL NU VL' NU' NL VU NL' VU'
NL VU NL' VU' VL NU VL' NU'

M2R' N3U M2R N3U' N3L M2U N3L' M2U'
N3L M2U N3L' M2U' M2R' N3U M2R N3U'

Insertion 1: 14 moves
M2R' N3U M2R N3U' N3L M2U NL NU NL' VU' NL VU VL' V3U'
N3L M2U NL NU NL' VU' NL VU VL' V3U' M2R' N3U M2R N3U'
V3L VU VL' NU' VL NU NL' NU' M2R N3U' N3L M2U N3L' M2U'
N3L M2U N3L' M2U' V3L VU VL' NU' VL NU NL' NU' M2R N3U'
VL NU VL' NU' NL NU N3L M2U N3L' M2U' M2R' N3U V3L' VU'
NL NU N3L M2U N3L' M2U' M2R' N3U V3L' VU' VL NU VL' NU'
VL V3U N3L' M2U' M2R' N3U M2R N3U' NL' NU' NL VU NL' VU'
NL VU NL' VU' VL V3U N3L' M2U' M2R' N3U M2R N3U' NL' NU'
VL NU NL' M2U N3L' M2U' M2R' N3U M2R VU' NL VU NL' VU'
VL NU VL' NU' VL M2U N3L' M2U' M2R' N3U M2R NU NL' VU'
VL M2U N3L' M2U' M2R' N3U M2R NU NL' VU' VL NU VL' NU'
NL VU NL' VU' VL NU NL' M2U N3L' M2U' M2R' N3U M2R VU'

11 moves
(VR' N3D' VR N3D) (N3R' VD' N3R VD) (VD' N3D NR' ND NR)
(VR' N3D' VR N3D) (N3R' VD' N3R VD) (ND' NR' ND NR)

VR' N3D' VR N3D N3R' VD' N3R VD
N3R' VD' N3R VD VR' N3D' VR N3D

Insertion 2: 10 moves
N3R' VD' N3R N3D NR' ND N3R' N3D' VR N3D

Insertion 3: 23 moves
M2R' N3U M2R N3U' N3L M2U NL NU NL' V3U' N3R' VD' N3R N3D NR' ND N3R' N3D' VR NL VU VL' V3U'

Setup:
SR' SU M2R' N3U M2R N3U' N3L M2U NL NU NL' V3U' N3R' VD' N3R N3D NR' ND N3R' N3D' VR NL VU VL' V3U' SU' SR

Algorithm (26 moves) (60 permuted stickers) (Permutation order: 3):
SR' SU M2R' N3U M2R N3U' N3L M2U NL NU NL' V3U' N3R' VD' N3R N3D NR' ND N3R' N3D' VR NL VU VL' ND' SF CU'
SR-SUM2R-N3UM2RN3U-N3LM2UNLNUNL-V3U-N3R-VD-N3RN3DNR-NDN3R-N3D-VRNLVUVL-ND-SFCU-

6 Large Arrows
Centers
R' L' MF MD MF' MB' MU' MB NF ND NF' NB' NU' NB WU L R

Corners
(R' D2 R B' U2 B) (R' D2 R B' U2 B)

Edges
(SF' U2 F2) [L' WU2 L, SU'] (F2 U2 SF)

Algorithm (41 moves) (78 permuted stickers) (Permutation order: 3):
R' L' MF MD MF' MB' MU' MB NF ND NF' NB' NU' NB WU L D2 R B' U2 B R' D2 R B' U2 B SF' U2 F2 L' WU2 L SU' L' WU2 L SU F2 U2 SF

R-L-MFMDMF-MB-MU-MBNFNDNF-NB-NU-NBWULD2RB-U2BR-D2RB-U2BSF-U2F2L-WU2LSU-L-WU2LSUF2U2SF

Y Spectre (6x6x6) (23 btm) (Per)
SF (NU NL NU' M2L N3U V3L' N3U' N3L V3U N3L' V3U') (N3R' VD' N3R N3D NR' ND N3R' N3D' VR N3D) SF'

Part 1: 11 moves (Per)
(NU NL NU' M2L N3U V3L' N3U' N3L V3U N3L' V3U')
(NU NL NU' NL' NL M2L N3U V3L' N3U' N3L V3U N3L' V3U')
(NU NL NU' NL') (V3L N3U V3L' N3U') (N3L V3U N3L' V3U')

Insertion 1:
(V3L N3U V3L' N3U')
(N3L V3U N3L' V3U')
N3L V3U N3L' N3U' V3L N3U V3L' V3U'

Insertion 2:
(NU NL NU' NL')

Part 1: 10 moves (New)
N3L V3U N3L' N3U' V3L N3U M2R NU' NL' M2U'

Insertion 3:
(N3R' VD' N3R N3D NR' ND N3R' N3D' VR N3D)

(N3R' VD' N3R N3D NR') (N3L V3U N3L' N3U' V3L N3U M2R NU' NL' M2U') (ND N3R' N3D' VR N3D)

Algorithm (21 moves) (60 permuted stickers) (Permutation order: 3):
SF N3R' VD' N3R N3D NR' N3L V3U N3L' N3U' V3L N3U M2R NU' NL' V3D N3R' N3D' VR N3D SF'
SFN3R-VD-N3RN3DNR-N3LV3UN3L-N3U-V3LN3UM2RNU-NL-V3DN3R-N3D-VRN3DSF-

Triangle Spectre (6x6x6) (23 btm) (Per)
SF (NR' NU NR M2U N3R' V3U' N3R N3U V3R' N3U' V3R) (N3D' VL N3D N3L' ND' NL' N3D' N3L VD N3L') SF'

Part 1: 11 moves (Per)
(NR' NU NR M2U N3R' V3U' N3R N3U V3R' N3U' V3R)
(NR' NU NR NU') (NU M2U N3R' V3U' N3R N3U V3R' N3U' V3R)
(NR' NU NR NU') (V3U N3R' V3U' N3R) (N3U V3R' N3U' V3R)

Insertion 1:
(V3U N3R' V3U' N3R)
(N3U V3R' N3U' V3R)
(N3U V3R' N3U' V3R) (V3U N3R' V3U' N3R)

V3U V3R' N3U' V3R N3U N3R' V3U' N3R
N3U V3R' N3U' N3R V3U N3R' V3U' V3R

V3U N3R' V3U' N3R N3U V3R' N3U' V3R
N3U V3R' N3U' V3R V3U N3R' V3U' N3R

(N3U V3R' N3U' N3R V3U N3R' V3U' V3R)

Insertion 2:
(NR' NU NR NU')

Part 1: 10 moves (New)
N3U V3R' N3U' N3R V3U N3R' M2U' NR NU' M2R

Insertion 3:
(N3D' VL N3D N3L' ND' NL' N3D' N3L VD N3L')
(N3D' VL N3D N3L' ND') (N3U V3R' N3U' N3R V3U N3R' M2U' NR NU' M2R) (NL' N3D' N3L VD N3L')
SF (N3D' VL N3D N3L' ND') (N3U V3R' N3U' N3R V3U N3R' M2U' NR NU' M2R) (NL' N3D' N3L VD N3L') SF'

Algorithm (21 moves) (60 permuted stickers) (Permutation order: 3):
SF N3D' VL N3D N3L' ND' N3U V3R' N3U' N3R V3U N3R' M2U' NR NU' V3L' N3D' N3L VD N3L' SF'
SFN3D-VLN3DN3L-ND-N3UV3R-N3U-N3RV3UN3R-M2U-NRNU-V3L-N3D-N3LVDN3L-SF-

6 Small Arrows
F (D2 B R B' L' F D' L2 F2 R F' R' F2 L') F'
SF' NU NR' NU' ND' NL ND NL' NR SF

Algorithm (26 moves) (94 permuted stickers) (Permutation order: 24):
F D2 B R B' L' F D' L2 F2 R F' R' F2 L' F' SF' NU NR' NU' ND' NL ND NL' NR SF
FD2BRB-L-FD-L2F2RF-R-F2L-F-SF-NUNR-NU-ND-NLNDNL-NRSF

2 Triangles (4-4-4)
(SF' U2 F2) (L' N3U2 L SU' L' N3U2 L SU) (F2 U2 SF)
(B' F' L2 U D) (N3F NU' N3F' NF N3U' NF' VU) (D' U' L2 F B)
Algorithm (29 moves) (24 permuted stickers) (Permutation order: 3):
SF' U2 F2 L' N3U2 L SU' L' N3U2 L SU F2 U2 B2 L2 U D N3F NU' N3F' NF N3U' NF' VU U' D' L2 F B
SF-U2F2L-N3U2LSU-L-N3U2LSUF2U2B2L2UDN3FNU-N3F-NFN3U-NF-VUU-D-L2FB

6 Triangle Boomerangs
(WR WF' WR' WF)
F D2 R2 B (V3R' V3D' V3R V3D) B' R2 D2 F'

Algorithm (15 moves) (96 permuted stickers) (Permutation order: 36):
WR WF' WR' T5F D2 R2 B V3R' V3D' V3R V3D B' R2 D2 F'
WRWF-WR-T5FD2R2BV3R-V3D-V3RV3DB-R2D2F-

6 Y Boomerangs
(WR WF' WR' WF)
F B D2 R2 (V3L V3U V3L' V3U') R2 D2 B' F'

Algorithm (15 moves) (96 permuted stickers) (Permutation order: 36):
WR WF' WR' T5F B D2 R2 V3L V3U V3L' V3U' R2 D2 B' F'
WRWF-WR-T5FBD2R2V3LV3UV3L-V3U-R2D2B-F-

6 Offset Rings
Centers
(WR WF' WR' WF)
F D' R' B (V3R' V3D' V3R V3D) B' R D F'
WR WF' WR' T5F D' R' B V3R' V3D' V3R V3D B' R D F'

Edges
F (D2 B R B' L' F D' L2 F2 R F' R' F2 L') F'

Algorithm (28 moves) (141 permuted stickers) (Permutation order: 420):
WR WF' WR' T5F D' R' B V3R' V3D' V3R V3D B' R D' B R B' L' F D' L2 F2 R F' R' F2 L' F'
WRWF-WR-T5FD-R-BV3R-V3D-V3RV3DB-RD-BRB-L-FD-L2F2RF-R-F2L-F-

2 Y Loops (6x6x6)
Centers
(WR WF' WR' WF)
F B D2 R2 (V3L V3U V3L' V3U') R2 D2 B' F'

Edges
SF R2 F2 SR D NR2 D' SR' D NR2 D' F2 R2 SF'

Algorithm (27 moves) (108 permuted stickers) (Permutation order: 36):
WR WF' WR' T5F B D2 R2 V3L V3U V3L' V3U' R2 D2 B2 R2 F2 SR D NR2 D' SR' D NR2 D' F2 R2 SF'
WRWF-WR-T5FBD2R2V3LV3UV3L-V3U-R2D2B2R2F2SRDNR2D-SR-DNR2D-F2R2SF-

2 Y Loops (4x4x4)
Centers
(WR WF' WR' WF)
F B D2 R2 (ML MU ML' MU') R2 D2 B' F'

Edges
SF R2 F2 SR D MR2 D' SR' D MR2 D' F2 R2 SF'

Algorithm (27 moves) (36 permuted stickers) (Permutation order: 9):
WR WF' WR' T3F B D2 R2 ML MU ML' MU' R2 D2 B2 R2 F2 SR D MR2 D' SR' D MR2 D' F2 R2 SF'
WRWF-WR-T3FBD2R2MLMUML-MU-R2D2B2R2F2SRDMR2D-SR-DMR2D-F2R2SF-

2 Loops (Variation 1)
Edges
(SU' L2 D2 SR' F NL2 F' SR F NL2 F' D2 L2 SU)

Centers
(U D R B2 L) (WR' WU WR WU') (M3U M3R' M3U' M3R) (L' B2 R' D' U')

Algorithm (28 moves) (54 permuted stickers) (Permutation order: 3):
SU' L2 D2 SR' F NL2 F' SR F NL2 F' D2 L2 U2 R B2 T5L WU WR ND M3R' M3U' M3R L' B2 R' D' U'
SU-L2D2SR-FNL2F-SRFNL2F-D2L2U2RB2T5LWUWRNDM3R-M3U-M3RL-B2R-D-U-

2 Loops (Variation 2)
Edges
(SU F2 U2 L NF2 L' SF L NF2 L' SF' U2 F2 SU')

Centers
(U' D' F2 L' R') (WR' WU WR ND M3R' M3U' M3R) (R L F2 D U)

Algorithm (28 moves) (54 permuted stickers) (Permutation order: 3):
SU F2 U2 L NF2 L' SF L NF2 L' SF' U2 F2 U2 F2 L' T5R' WU WR ND M3R' M3U' M3R R L F2 D U
SUF2U2LNF2L-SFLNF2L-SF-U2F2U2F2L-T5R-WUWRNDM3R-M3U-M3RRLF2DU

American Flag (100x100x100 Cube)
American Flag
Close to 'G-spec' flag
A = 52 px
B = 98 px
C = 28 px
D = 44 px

// Cube rotation
CR' CF'

// Centers 1
[N26-27F N32-33F N38-39F N44-45F N50-51F, N3-4L N11-12L N19-20L N27-28L N35-36L N43-44L]

// Centers 2
[N29-30F N35-36F N41-42F N47-48F, N7-8L N15-16L N23-24L N31-32L N39-40L]

// Centers 3
[N29-32F N37-40F N45-48F, N46-99L]

// Centers 4
[N48-45B' N40-37B' N32-29B', WR']

// Centers 5
[N46-99L, N49-52B' N57-60B' N65-68B' N73-76B']

// Centers 6
[WR', N25-28B' N33-36B' N41-44B']

// Center Padding (Top)
[N2-24F, WR']

// Center Padding (Bottom)
[N2-24B', WR']

// Complete Algorithm (Un-optimized)
CR' CF'
[N26-27F N32-33F N38-39F N44-45F N50-51F, N3-4L N11-12L N19-20L N27-28L N35-36L N43-44L]
[N29-30F N35-36F N41-42F N47-48F, N7-8L N15-16L N23-24L N31-32L N39-40L]
[N29-32F N37-40F N45-48F, N46-99L]
[N48-45B' N40-37B' N32-29B', WR']
[N46-99L, N49-52B' N57-60B' N65-68B' N73-76B']
[WR', N25-28B' N33-36B' N41-44B']
[N2-24F, WR']
[N2-24B', WR']

Algorithm (82 moves) (55920 permuted stickers) (Permutation order: 60):
CR' CF' N26-27F N32-33F N38-39F N44-45F N50-51F N3-4L N11-12L N19-20L N27-28L N35-36L N43-44L N50-51F' N44-45F' N38-39F' N32-33F' N26-27F' N43-44L' N35-36L' N27-28L' N19-20L' N11-12L' N3-4L' N29-30F N35-36F N41-42F N47-48F N7-8L N15-16L N23-24L N31-32L N39-40L N47-48F' N41-42F' N35-36F' N29-30F' N39-40L' N31-32L' N23-24L' N15-16L' N7-8L' N29-32F N37-40F N45-48F N46-99L N45-48F' N37-40F' N29-32F' N46-99L' N48-45B' N40-37B' N32-29B' WR' N32-29B N40-37B N48-45B WR N46-99L N49-52B' N57-60B' N65-68B' N73-76B' N46-99L' N73-76B N65-68B N57-60B N49-52B WR' N25-28B' N33-36B' N41-44B' WR N41-44B N33-36B N25-28B N2-24F WR' N2-24F' WR N2-24B' WR' N2-24B WR