

Andy Klise's Orient Last Layer Guide

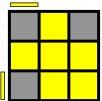
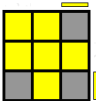
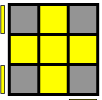
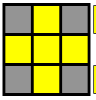
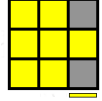
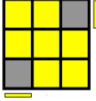
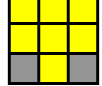

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Green = R U R' U' Family, **Blue** = R U R' U R U² R' Family, **Orange** = R F' R' F Family

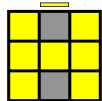
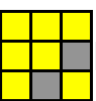
ĩ = inverse, m̃ = mirror, R = reverse rotation, ~ = minimal difference, ** = this algorithm may be faster

Try to recognize each pattern by viewing the fewest number of faces



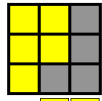
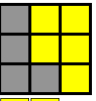
All Edges Oriented Correctly (second part of three look last layer)

 (R' U² R U R' U R) y (R U R' U R U ² R')	ĩ	(R' U' R U' R' U² R) y (R U ² R' U' R U' R')	
27 - Probability = 1/54		26 - Probability = 1/54	
 R U² R² U' R² U' R² U² R f (R U R' U') f' F (R U R' U') F'		(R U R' U)(R U' R' U)(R U² R') (R' U' R U')(R' U R U')(R' U ² R) y (R U ² R')(U' R U R')(U' R U' R')	
22 - Probability = 1/54		21 - Probability = 1/108	
 x (R' U')(L U)(R U' L' U) y ² (r U R' U')(L' U R U') x' y x' (R U R') D (R U' R') D' x		(R' F)(R B')(R' F')(R B) x' D (R U R') D' (R U' R') x	
24 - Probability = 1/54		25 - Probability = 1/54	
 R² D (R' U² R) D' (R' U² R') y ² R ² D' (R U ² R') D (R U ² R)		Solved 58 - Probability = 1/216	
23 - Probability = 1/54			


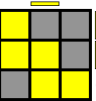
Corners Correct, Edges Flipped

 (R U R' U') M' (U R U' r') (R U R' U') r R' (U R U' r')	ĩ	(r U R' U') M (U R U' R') (r U R' U') r' R (U R U' R') (M U M') U ² (M U M') OR (r' R U M') U ² (r' R U M')	
57 - Probability = 1/108		28 - Probability = 1/54	

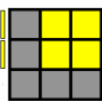

P-Shapes

 F (U R U' R') F' y ² f (R U R' U') f'	m̃	F' (U' L' U L) F y ² f' (L' U' L U) f R' U' (F R' F' R) U R	
44 - Probability = 1/54		43 - Probability = 1/54	
 (L U F')(U' L' U L) F L' F U R U' F' (r U R' U') r' y ² R U B' (U' R' U R) B R'	m̃	(R' U' F)(U R U' R') F' R y' (F R' F' R) U R (U R' U' R) U' R'	
32 - Probability = 1/54		31 - Probability = 1/54	

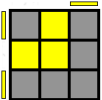
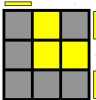
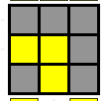
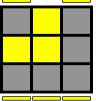
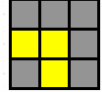

W-Shapes

 (R U R' U)(R U' R' U')(R' F R F')	~R	(R' U' R U')(R' U R U) x' (R U' R' U) x	
38 - Probability = 1/54		36 - Probability = 1/54	

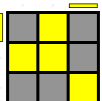
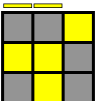
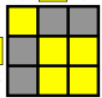

Squares

 (r U² R' U' R U' r')	R	(r' U² R U R' U r)	
6 - Probability = 1/54		5 - Probability = 1/54	

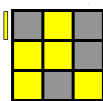
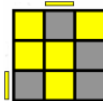


L Shapes

 F (R U R' U')(R U R' U') F'	m̃	F' (L' U' L U)(L' U' L U) F R' U' (R' F R F')(R' F R F') U R	
48 - Probability = 1/54		47 - Probability = 1/54	
 r' U² (R U R' U') R U R' U r y' r' U' R U (R' U R U') R' U ² r	R	r U² (R' U' R U) R' U' R U' r' y r U' R U (R U' R' U) R U ² r' **	
53 - Probability = 1/54		54 - Probability = 1/54	
 (R B')(R² F) R² (B R²)(F' R)	m̃	(R' F)(R² B') R² (F' R²)(B R')	
49 - Probability = 1/54		50 - Probability = 1/54	


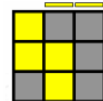
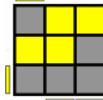
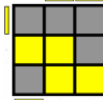

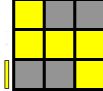
Fish Shapes

 (R' U' R) y' x' (R U' R' F)(R U R') x y (R U R' U') R' F R ² U R' U' F'		(R U R') y (R' F R U')(R' F' R) (R' U' R U) R B' R ² U' R U B	
9 - Probability = 1/54		10 - Probability = 1/54	
 (R U²)(R² F R F')(R U² R')		F (R U')(R' U' R U) R' F' (F R' F' R)(U R U' R')	
35 - Probability = 1/54		37 - Probability = 1/54	

Awkward Shapes

 F R' F R² U' (R' U' R U) R' F² F U (R U') x' (U R') D' (R U' R') x y ² (R ² U R') B' (R U' R ² U)(R B R')		M U (R U R' U')(R' F R F') M' y ² (R' F R F')(R U ² R') d' (L' U' L) y (R U R' U')(R U' R' F') U' (F R U R')	
30 - Probability = 1/54		29 - Probability = 1/54	
 F (U R U' R') F' (R' U² R U R' U R) F (U R U' R') F' U (R U R' U R U ² R')	ĩ	(R' U' R U' R' U² R) F (R U R' U') F' y (R' U ² R U R' U R ²) y (R U R' U') F'	
41 - Probability = 1/54		42 - Probability = 1/54	

Lightning Bolts

 (r U R' U R U² r')	R	(r' U' R U' R' U² r)	
7 - Probability = 1/54		8 - Probability = 1/54	
 r U R' U (R' F R F') R U² r' y' F' (L' U' L U) F U F (R U R' U') F' y ² (r' R ² U R' U)(R U ²)(R' U R' r)	~R ~m̃ R	r' U' R U' x' (R U' R' U) x R' U² r y' F (R U R' U') F' U F (R U R' U') F' y ² (r' R ² U' R U')(R' U ²)(R U' R r')	
11 - Probability = 1/54		12 - Probability = 1/54	
 (L F')(L' U' L U) F U' L' y ² R B' (R' U' R U) B U' R'	m̃	(R' F)(R U R' U') F' U R	
39 - Probability = 1/54		40 - Probability = 1/54	

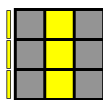
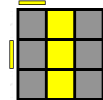
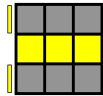
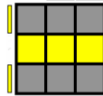
T-Shapes

 F (R U R' U') F'		(R U R' U')(R' F R F')	
45 - Probability = 1/54		33 - Probability = 1/54	

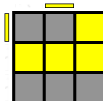
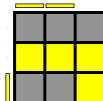
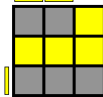
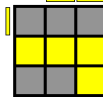
C-Shapes

 R' U' (R' F R F') U R (R U) x' (R U' R' U) x (U' R')		(R U R' U') B' (R' F R F') B (R U R' U') x D' (R' U R U') D x'	
46 - Probability = 1/54		34 - Probability = 1/54	

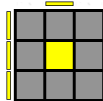
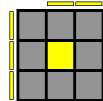
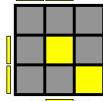
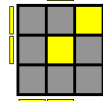
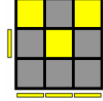
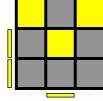
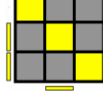
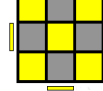
I Shapes

 R U² R² U' (R U' R' U²)(F R F') R' U ² R ² U (R' U R U ²) x' (U' R' U)		(R U R' U)(R U') y (R U' R' F') y'	
55 - Probability = 1/108		52 - Probability = 1/54	
 r' U' (r U' R' U)(R U' R' U) M U r r' U' (r U' R' U)(R U' R' U)(R r') U r *		f (R U R' U')(R U R' U') f' y ² F (R U R' R')(U R U' R') F'	
56 - Probability = 1/108		51 - Probability = 1/54	

Knight Move Shapes

 (r U r')(R U R' U')(r U' r') (L F L')(R U' U')(L F L') *	R m̃	(r' U' r)(R' U' R U)(r' U r) y ² (R' F' R)(L' U' L U)(R' F R) * (L' B' L)(R' U' R U)(L' B L)	
16 - Probability = 1/54		15 - Probability = 1/54	
 x' (R U' R')(F' R U R') x y (R' U R) y' y ² F U R U ² (R' U' R U) R' F'		(R' F R)(U R' F' R) y' (R U' R')	
13 - Probability = 1/54		14 - Probability = 1/54	

No Edges Flipped Correctly

 (R U²)(R² F R F') U² (R' F R F')		F (R U R' U') F' f (R U R' U') f'	
1 - Probability = 1/108		2 - Probability = 1/54	
 f (R U R' U') f' U' F (R U R' U') F y ² F (U R U' R') F' R y (R U R' U') F' y'	~	f (R U R' U') f' U F (R U R' U') F' f (R U R' U') f' U R y (R U R' U') F' y'	
3 - Probability = 1/54		4 - Probability = 1/54	
 (r U R' U R U² (r²) U' R U' R' U² r)		M U (R U R' U') r (R² F R F') (r' U ² R U R' U (r ²) U ² R' U' R' r)	
18 - Probability = 1/54		19 - Probability = 1/54	
 (R U R' U)(R' F R F') U² (R' F R F')		M U (R U R' U') M² (U R U' r') (r' R) U (R U R' U')(r ² R ²)(U R U' r') (M' U ² M') U ² (M' U M) U ² (M U ² M)	
17 - Probability = 1/54		20 - Probability = 1/216	

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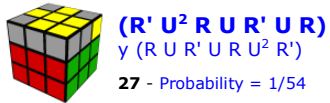
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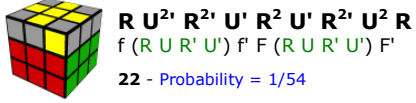
(R' U² R U R' U R)
y (R U R' U R U² R')

27 - Probability = 1/54

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(R' U' R U' R' U² R)
y (R U² R' U' R U' R')

26 - Probability = 1/54

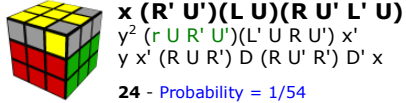


R U² R² U' R² U' R² U² R
f (R U R' U') f' F (R U R' U') F'

22 - Probability = 1/54

(R U R' U')(R U' R' U)(R U² R')
(R' U' R U')(R' U R U')(R' U² R)
y (R U² R')(U' R U R')(U' R U' R')

21 - Probability = 1/108

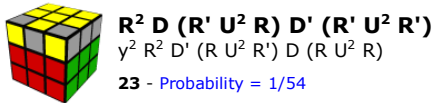


x (R' U')(L U)(R U' L' U)
y² (r U R' U')(L' U R U') x'
y x' (R U R') D (R U' R') D' x

24 - Probability = 1/54

(R' F)(R B')(R' F')(R B)
x' D (R U R') D' (R U' R') x

25 - Probability = 1/54



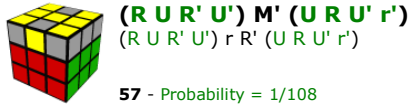
R² D (R' U² R) D' (R' U² R')
y² R² D' (R U² R') D (R U² R)

23 - Probability = 1/54

Solved

58 - Probability = 1/216

Corners Correct, Edges Flipped



(R U R' U') M' (U R U' r')
(R U R' U') r R' (U R U' r')

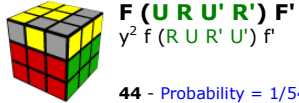
57 - Probability = 1/108

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(r U R' U') M (U R U' R')
(r U R' U') r' R (U R U' R')
(M U M') U² (M U M') OR (r' R U M') U² (r' R U M')

28 - Probability = 1/54

P-Shapes



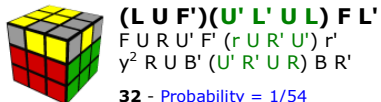
F (U R U' R') F'
y² f (R U R' U') f'

44 - Probability = 1/54

m̃
m̃

F' (U' L' U L) F
y² f' (L' U' L U) f
R' U' (F R' F' R) U R

43 - Probability = 1/54



(L U F')(U' L' U L) F L'
F U R U' F' (r U R' U') r'
y² R U B' (U' R' U R) B R'

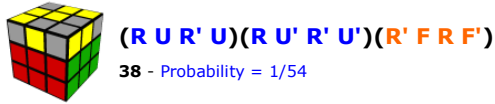
32 - Probability = 1/54

m̃

(R' U' F)(U R U' R') F' R
y' (F R' F' R) U R (U R' U' R) U' R'

31 - Probability = 1/54

W-Shapes



(R U R' U)(R U' R' U')(R' F R F')

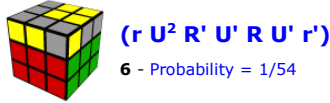
38 - Probability = 1/54

~R

(R' U' R U')(R' U R U) x' (R U' R' U) x

36 - Probability = 1/54

Squares



(r U² R' U' R U' r')

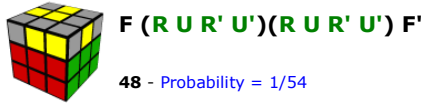
6 - Probability = 1/54

R

(r' U² R U R' U r)

5 - Probability = 1/54

L Shapes



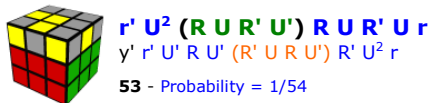
F (R U R' U')(R U R' U') F'

48 - Probability = 1/54

m̃

F' (L' U' L U)(L' U' L U) F
R' U' (R' F R F')(R' F R F') U R

47 - Probability = 1/54



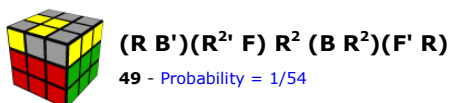
r' U² (R U R' U') R U R' U r
y' r' U' R U (R' U R U') R' U² r

53 - Probability = 1/54

R
R

r U² (R' U' R U) R' U' R U' r'
y r U R' U (R U' R' U) R U² r' **

54 - Probability = 1/54



(R B')(R² F) R² (B R²)(F' R)

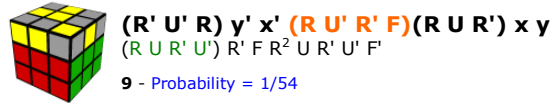
49 - Probability = 1/54

m̃

(R' F)(R² B') R² (F' R²)(B R')

50 - Probability = 1/54

Fish Shapes

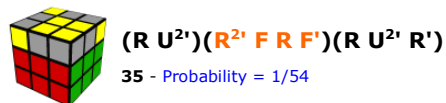


(R' U' R) y' x' (R U' R' F)(R U R') x y
(R U R' U') R' F R² U R' U' F'

9 - Probability = 1/54

(R U R') y (R' F R U')(R' F' R)
(R' U' R U) R B' R² U R U B

10 - Probability = 1/54



(R U²')(R² F R F')(R U² R')

35 - Probability = 1/54

F (R U')(R' U' R U) R' F'
(F R' F' R)(U R U' R')

37 - Probability = 1/54

Awkward Shapes



F R' F R² U' (R' U' R U) R' F²
F U (R U') x' (U R') D' (R U' R') x
y² (R² U R') B' (R U' R² U)(R B R')

30 - Probability = 1/54



F (U R U' R') F' (R' U² R U R' U R)
F (U R U' R') F' U (R U R' U R U² R')

41 - Probability = 1/54

Lightning Bolts



(r U R' U R U² r')

7 - Probability = 1/54

R

(r' U' R U' R' U² r)

8 - Probability = 1/54



r U R' U (R' F R F') R U² r'
y' F' (L' U' L U) F U F (R U R' U') F'
y² (r' R² U R' U)(R U²')(R' U R' r)

11 - Probability = 1/54

~R
~m̃
R

r' U' R U' x' (R U' R' U) x R' U² r
y' F (R U R' U') F' U F (R U R' U') F'
y² (r R² U' R U')(R U²')(R U' R r')

12 - Probability = 1/54



(L F')(L' U' L U) F U' L'
y² R B' (R' U' R U) B U' R'

39 - Probability = 1/54

m̃

(R' F)(R U R' U') F' U R

40 - Probability = 1/54

T-Shapes



F (R U R' U') F'

45 - Probability = 1/54

(R U R' U')(R' F R F')

33 - Probability = 1/54

C-Shapes



R' U' (R' F R F') U R
(R U) x' (R' U' R' U) x (U' R')

46 - Probability = 1/54

(R U R' U') B' (R' F R F') B
(R U R' U') x D' (R' U R U') D x'

34 - Probability = 1/54

I Shapes



R U² R² U' (R U' R' U²)(F R F')
R' U² R² U (R' U R U²) x' (U' R' U)

55 - Probability = 1/108

(R U R' U)(R U') y (R U' R' F') y'

52 - Probability = 1/54



r' U' (r U' R' U)(R U' R' U) M U r
r' U' (r' U' R' U)(R U' R' U)(R r') U r *

56 - Probability = 1/108

f (R U R' U')(R U R' U') f'
y² F (R U R' R')(U R U' R') F'

51 - Probability = 1/54

Knight Move Shapes



(r U r')(R U R' U')(r U' r')
(L F L')(R U R' U')(L F L') *

16 - Probability = 1/54

R
m̃

(r' U' r)(R' U' R U)(r' U r)
y² (R' F' R)(L' U' L U)(R' F R) *
(L' B' L)(R' U' R U)(L' B L)

15 - Probability = 1/54



x' (R U' R')(F' R U R') x y (R' U R) y'
y² F U R U² (R' U' R U) R' F'

13 - Probability = 1/54

(R' F R)(U R' F' R) y' (R U' R')

14 - Probability = 1/54

No Edges Flipped Correctly



(R U²')(R² F R F') U² (R' F R F')

1 - Probability = 1/108

F (R U R' U') F' f (R U R' U') f'

2 - Probability = 1/54



f (R U R' U') f' U' F (R U R' U') F
y² F (U R U' R') F' R y (R U R' U') F' y'

3 - Probability = 1/54

~

f (R U R' U') f' U F (R U R' U') F'
f (R U R' U') f' U R y (R U R' U') F' y'

4 - Probability = 1/54



(r U R' U R U² (r²) U' R U' R' U² r)

18 - Probability = 1/54

M U (R U R' U') r (R² F R F')
(r' U² R U R' U (r²) U² R' U' R U' r)

19 - Probability = 1/54



(R U R' U)(R' F R F') U² (R' F R F')

17 - Probability = 1/54

M U (R U R' U') M² (U R U' r')
(r' R) U (R U R' U')(r² R²')(U R U' r')
(M' U² M') U² (M' U M) U² (M U² M)

20 - Probability = 1/216