

# The RUBIKPATTERNS package

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[www.ctan.org/pkg/rubik](http://www.ctan.org/pkg/rubik)

## Abstract

The RUBIKPATTERNS package is a small data-base of well-known named Rubik patterns and associated rotation sequences, for use in conjunction with the other Rubik ‘bundle’ packages.

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## 1 Introduction

The RUBIKPATTERNS package is a small a data-base of well-known Rubik rotation sequences for use in conjunction with the Rubik bundle packages. These rotation sequences, which are well-known and widely available, were sourced from the Rubik-related websites of Reid M and Kociemba H (see References for URLs).

## 2 Requirements

The RUBIKPATTERNS package requires (a) the TikZ package, since it makes use of the TikZ picture environment, (b) the RUBIKCUBE package, and (c) the RUBIKROTATION package, since it uses the Perl program `rubikrotation.pl`. The TikZ package must be loaded *before* the RUBIKCUBE package. The RUBIKROTATION package requires Perl to be installed.

## 3 Installation

The Rubik bundle consists of the four packages RUBIKCUBE, RUBIKROTATION, RUBIKPATTERNS and RUBIKTWOUCUBE.

Here we describe only the installation of the RUBIKPATTERNS package, which consists of the following files:

```

rubikpatterns.ins
rubikpatterns.dtx
rubikpatterns.pdf      --this document
rubikpatternsLIST.tex
rubikpatternsLIST.pdf  --a graphic list of all patterns in this package
rubikpatterns-doc-figA.pdf

```

The package documentation is the file `rubikpatterns.pdf`. The style option `rubikpatterns.sty` is generated by running (pdf)L<sup>A</sup>T<sub>E</sub>X on the file `rubikpatterns.ins` as follows:

```
pdflatex rubikpatterns.ins
```

The documentation file (`rubikpatterns.pdf`) is then generated using the following sequence of steps<sup>1</sup>:

```

pdflatex rubikpatterns.dtx
pdflatex rubikpatterns.dtx
makeindex -s gind.ist rubikpatterns
makeindex -s gglo.ist -o rubikpatterns.gls rubikpatterns.glo
pdflatex rubikpatterns.dtx
pdflatex rubikpatterns.dtx

```

---

<sup>1</sup>Since the documentation includes a complicated indexing system as well a PDF index and hyperref links (the package `hypdoc` is used), then a lot of pdf<sub>l</sub>at<sub>e</sub>x runs are required. Prior to the first run it is a good idea to delete any relevant `.toc`, `.aux`, `.out` files.

### 3.1 Placing the files

Place the files either in a working directory, or where your system will find them, e.g., in your `/texmf-local/` directory tree. For example, on a Linux platform with a standard T<sub>E</sub>X Directory Structure (TDS), then:

```
*.sty → /usr/local/texlive/texmf-local/tex/latex/rubik/
*.pdf → /usr/local/texlive/texmf-local/doc/rubik/
```

FILE DATABASE: Finally, (depending on your system) update the T<sub>E</sub>X file database. For example, on a Linux platform this is achieved using the `texhash` command.

### 3.2 The `rubikpatternsLIST` file

Note that the package includes a ‘`rubikpatternsLIST`’ file (`rubikpatternsLIST.pdf`), as well as the source file (`rubikpatternsLIST.tex`), and associated `.sh` (Linux) and `.bat` (Microsoft) batch files, which can be used to facilitate processing the source `.tex` file. The file `rubikpatternsLIST.pdf` showcases the Rubik cube patterns made available in this package.

Note that should you need to generate the file `rubikpatternsLIST.pdf` from the source file (`rubikpatternsLIST.tex`) you will require the `RUBIKCUBE` and `RUBIKROTATION` packages to be installed, and will also need to use the `--shell-escape` command-line option (see Section ?? for details).

### 3.3 Usage

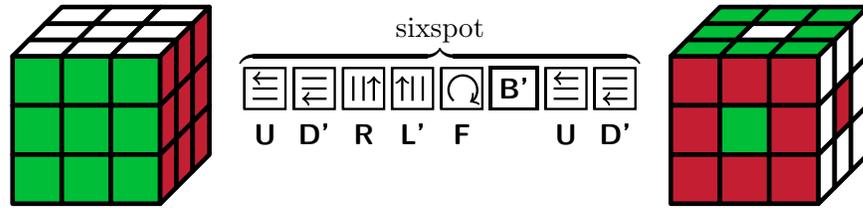
Load the packages `RUBIKCUBE`, `RUBIKROTATION` and `RUBIKPATTERNS` in the T<sub>E</sub>X file preamble *after* loading the TikZ package; for example, as follows:

```
\usepackage{tikz}
\usepackage{rubikcube,rubikrotation,rubikpatterns}
```

Since the sequence macros made available by this package are accessed using commands provided by the `RUBIKCUBE` and `RUBIKROTATION` packages, please read the documentation of these packages.

## 4 Rubik patterns

A Rubik pattern is the configuration generated by a sequence of rotations (or ‘moves’) from some initial starting configuration (typically a ‘solved’ configuration). For example, ‘sixspot’ is a well known pattern generated from a solved Rubik cube by the rotation sequence `U,Dp,R,Lp,F,Bp,U,Dp`, as follows:



The code for the above image is as follows:

```

\noindent\hfil%
\RubikCubeSolvedWB%
\ShowCube{2.4cm}{0.6}{\DrawRubikCubeRU}%
\RubikRotation{\SixSpot}%
\quad\SequenceBraceA{sixspot}{\ShowSequence}{\Rubik}{\SequenceLong}}\quad%
\ShowCube{2.4cm}{0.6}{\DrawRubikCubeRU}%
\hfil%

```

Note that the appearance of a pattern generated by a given rotation sequence is, of course, sensitive to (a) the particular colour configuration of the solved cube used, and (b) the initial orientation of the Rubik cube.

Consequently the appearance generated by a given sequence may appear slightly different from that on some websites, although the colour configuration (pattern's *geometry*) will, of course, be the same (isomorphic). You may therefore need to adjust the pre- (and possibly the post-) x,y,z rotations in order to obtain a particular configuration as displayed elsewhere.

#### 4.1 Sequence macros

Each of the rotation sequences of 'patterns' made available by the RUBIKPATTERNS package is defined in the file `rubikpatterns.sty` in the following compact macro form. For example, the rotation sequence associated with the pattern known as 'SixSpot' (shown in the figure above) is defined as follows:

```

\newcommand{\SixSpot}{[SixSpot],U,Dp,R,Lp,F,Bp,U,Dp,<(8q*, 8f*)>}
\newcommand{\sixspot}{\SixSpot}

```

The macro name is `\SixSpot` (the lower-case version `\sixspot` can also be used). Note that the second argument which includes the rotation sequence, also includes the pattern name in square brackets `[SixSpot]` as the first element in the sequence. Additional metadata (held by the macro `\SequenceInfo`) is appended in angle brackets (separated by a comma) as follows: `<(8q*, 8f*)>`. For details see the RUBIKROTATION package documentation.

## 4.2 List of macros

The following is a list of the macro names of all the Rubik patterns supplied by the RUBIKPATTERNS package. Note that for convenience each macro-name listed has an equivalent lower-case version. See the companion file `rubikpatternsLIST.pdf` for a detailed list showing each pattern and its associated sequence<sup>2</sup>.

All the pattern names encoded here (as macros) are well-known and widely available. However, some pattern names have been slightly modified in order to avoid spaces and to keep them as similar to the original as possible. On finding different sequences which generate the same pattern, then the shortest sequence has been selected (they can be readily distinguished by their metadata).

Finally, we note that there is a serious need for a standardised one-word nomenclature in order to avoid confusion, and to facilitate computerisation and an electronic database. Such a notation also needs to accommodate those sequence variations which generate the same pattern. We welcome suggestions and/or help for improvement.

```

\PonsAsinorum
\CheckerboardsThree
\CheckerboardsSix
\Stripes
\CubeInCube
\CubeInCubeInCube
\ChristmasCross
\PlummersCross
\Anaconda
\Python
\BlackMamba
\GreenMamba
\FemaleRattlesnake
\MaleRattlesnake
\FemaleBoa
\MaleBoa
\FourSpot
\SixSpot
\OrthogonalBars
\SixTs
\SixTwoOne
\ExchangedPeaks
\TwoTwistedPeaks
\FourTwistedPeaks
\ExchangedChickenFeet
\TwistedChickenFeet
\ExchangedRings
\TwistedRings
\EdgeHexagonTwo

```

---

<sup>2</sup>We show all these images in a separate file (`rubikpatternsLIST.pdf`) purely because generating them requires using the L<sup>A</sup>T<sub>E</sub>X command-line option `--shell-escape` in conjunction with the RUBIKROTATION package.

```
\EdgeHexagonThree
\TomParksPattern
\RonsCubeInCube
\TwistedDuckFeet
\ExchangedDuckFeet
\Superflip
```

Note that the particular superflip sequence made available by this package (shown in `rubikpatternsLIST.pdf`) is due to Reid (1995), and is detailed on the Kociemba webpage <http://www.kociemba.org/math/oh.htm>. Indeed, this was the first sequence to define the ‘20-move’ (HTM) upper boundary for solving a Rubik cube (see Rokicki *et al.*, 2013).

The superflip configuration is also significant since it is its own inverse. For example, the following two `\RubikRotation` commands will generate the same configuration (starting from a solved cube):

```
\RubikRotation{\superflip}
\RubikRotation{\superflip,<inverse>}
```

This property is shown as one of the examples in the Rubik bundle file `rubikexamples.pdf`.

## 5 Change history

- Version 4.0 (March 2017)
  - First release of this package.

## 6 References

- Fridrich website (Fridrich J). See the ‘Pretty patterns’ webpage <http://www.ws.binghamton.edu/fridrich/ptrns.html>
- Kociemba website (Kociemba H). <http://www.kociemba.org/cube.htm> —for superflip see: <http://www.kociemba.org/math/oh.htm>
- Randelshofer website (Randelshofer W). Pretty patterns. <http://www.randelshofer.ch/rubik/patterns/U080.01.html>
- Reid M. Patterns. <http://www.cflmath.com/Rubik/patterns.html>
- Reid M. (1995). Superflip requires 20 face turns. (January 1995) <http://www.math.ucf.edu/~reid/Rubik/CubeLovers/> (see Section 7.2.1) [cited from Rokicki *et al.*, 2013].  
(Note: easier to use is the following html indexed version of the archive of the Cube-Lovers usenet group (1982–1997) <http://www.math.rwth-aachen.de/~Martin.Schoenert/Cube-Lovers/>)

- Rokicki T, Kociemba H, Davidson M and Dethridge J (2013). The diameter of the Rubik's cube is twenty. *SIAM. J. Discrete Math.*, **27**, 1082–1105. <http://tomas.rokicki.com/rubik20.pdf>

## 7 The code (rubikpatterns.sty)

### 7.1 Package heading

```

1 (*rubikpatterns)
2 \def\RPfileversion{5.0}%
3 \def\RPfiledate{2018/02/25}% 25 February 2018
4 \NeedsTeXFormat{LaTeX2e}
5 \ProvidesPackage{rubikpatterns}[\RPfiledate\space (v\RPfileversion)]
\rubikpatterns First we create a suitable logo
6 \newcommand{\rubikpatterns}{\textsc{rubikpatterns}}
```

### 7.2 Patterns

#### 7.2.1 Superflip

This particular superflip sequence is from the Kociemba website (his Oh webpage). It is due to Reid (1995).

```

7 \newcommand{\Superflip}{[Superflip] ,Dp,R2,Fp,D2,F2,U2,Lp,R,Dp,R2,B,F,Rp,%
8 U2,Lp,F2,Rp,U2,Rp,Up,<(20f*)>}%
9 \newcommand{\superflip}{\Superflip}
```

#### 7.2.2 Reid data

These named sequences are derived from the Reid website.

```

10 \newcommand{\PonsAsinorum}{[PonsAsinorum] ,F2,B2,R2,L2,U2,D2,%
11 <(12q*, 6f*)>}%
12 \newcommand{\ponsasinorum}{\PonsAsinorum}%
13 \newcommand{\CheckerboardsThree}%
14 {[CheckerboardsThree] ,F,B2,Rp,D2,B,R,U,Dp,R,Lp,Dp,Fp,R2,D,F2,Bp,%
15 <(20q*, 16f*), order 3>}%
16 \newcommand{\checkerboardsthree}{\CheckerboardsThree}%
17 \newcommand{\CheckerboardsSix}%
18 {[CheckerboardsSix] ,R2,L2,U,B,L2,Dp,F,B2,R,Lp,Fp,B,R,D,F2,Lp,Up,%
19 <(17f*, 22q), order 6>}%
20 \newcommand{\checkerboardssix}{\CheckerboardsSix}%
21 \newcommand{\Stripes}{[Stripes] ,F,U,F,R,L2,B,Dp,R,D2,L,Dp,B,R2,L,F,U,F,%
22 <(20q*, 17f*)>}%
23 \newcommand{\stripes}{\Stripes}%
24 \newcommand{\CubeInCube}{[CubeInCube] ,F,L,F,Up,R,U,F2,L2,Up,Lp,B,Dp,Bp,L2,U,%
25 <(18q*, 15f*)>}%
26 \newcommand{\cubeincube}{\CubeInCube}%
27 \newcommand{\CubeInCubeInCube}%
```

```

28  {[CubeInCubeInCube],Fp,U,Bp,Rp,U,F2,U2,Fp,Up,F,U2,D,Bp,Dp,R2,B2,Up,%
29  <(17f*, 22q)>}%
30 \newcommand{\cubeincubeincube}{\CubeInCubeInCube}%
31 \newcommand{\ChristmasCross}{[ChristmasCross],U,F,Bp,L2,U2,L2,Fp,B,U2,L2,U,%
32  <(16q*, 11f*)>}%
33 \newcommand{\christmascross}{\ChristmasCross}%
34 \newcommand{\PlummersCross}%
35  {[PlummersCross],R2,Lp,D,F2,Rp,Dp,Rp,L,Up,D,R,D,B2,Rp,U,D2,%
36  <(20q*, 16f*)>}%
37 \newcommand{\plummerscross}{\PlummersCross}%
38 \newcommand{\Anaconda}{[Anaconda],L,U,Bp,Up,R,Lp,B,Rp,F,Bp,D,R,Dp,Fp,%
39  <(14q*, 14f*)>}%
40 \newcommand{\anaconda}{\Anaconda}%
41 \newcommand{\Python}{[Python],F2,Rp,Bp,U,Rp,L,Fp,L,Fp,B,Dp,R,B,L2,%
42  <(16q*, 14f*)>}%
43 \newcommand{\python}{\Python}%
44 \newcommand{\BlackMamba}{[BlackMamba],R,D,L,Fp,R,Lp,D,Rp,U,Dp,B,Up,Rp,Dp,%
45  <(14q*, 14f*)>}%
46 \newcommand{\blackmamba}{\BlackMamba}%
47 \newcommand{\GreenMamba}{[GreenMamba],R,D,R,F,Rp,Fp,B,D,Rp,Up,Bp,U,D2,%
48  <(14q*, 13f*)>}%
49 \newcommand{\greenmamba}{\GreenMamba}%
50 \newcommand{\FemaleRattlesnake}%
51  {[FemaleRattlesnake],U2,Dp,L2,D,B,U,Bp,Rp,L2,U2,F,Up,F,R,%
52  <(18q*, 14f*)>}%
53 \newcommand{\femalerattlesnake}{\FemaleRattlesnake}%
54 \newcommand{\MaleRattlesnake}%
55  {[MaleRattlesnake],Rp,Fp,U,Fp,U2,R,L2,B,Up,Bp,Dp,L2,U2,D,%
56  <(18q*, 14f*)>}%
57 \newcommand{\malerattlesnake}{\MaleRattlesnake}%
58 \newcommand{\FemaleBoa}{[FemaleBoa],R,Up,R2,U2,F,D2,R2,Up,Dp,R,Dp,Fp,%
59  <(16q*, 12f*)>}%
60 \newcommand{\femaleboa}{\FemaleBoa}%
61 \newcommand{\MaleBoa}{[MaleBoa],F,D,Rp,U,D,R2,D2,Fp,U2,R2,U,Rp,%
62  <(16q*, 12f*)>}%
63 \newcommand{\maleboa}{\MaleBoa}%
64 \newcommand{\FourSpot}{[FourSpot],F2,B2,U,Dp,R2,L2,U,Dp,%
65  <(12q*, 8f*)>}%
66 \newcommand{\fourspt}{\FourSpot}%
67 \newcommand{\SixSpot}{[SixSpot],U,Dp,R,Lp,F,Bp,U,Dp,%
68  <(8q*, 8f*)>}%
69 \newcommand{\sixspot}{\SixSpot}%
70 \newcommand{\OrthogonalBars}%
71  {[OrthogonalBars],F,Rp,U,L,Fp,Lp,F,Up,R,U,Lp,Up,L,Fp,%
72  <(14q*, 14f*)>}%
73 \newcommand{\orthogonalbars}{\OrthogonalBars}%
74 \newcommand{\SixTs}{[SixTs],F2,R2,U2,Fp,B,D2,L2,F,B,%
75  <(14q*, 9f*)>}%
76 \newcommand{\sixts}{\SixTs}%
77 \newcommand{\SixTwoOne}{[SixTwoOne],U,B2,D2,L,Bp,Lp,Up,Lp,B,D2,B2,%

```

```

78 <(15q*, 11f*)>%
79 \newcommand{\sixtwoone}{\SixTwoOne}%
80 \newcommand{\ExchangedPeaks}%
81   {[ExchangedPeaks],F2,R2,D,R2,U,D,F2,Dp,Rp,Dp,F,L2,Fp,D,R,Up,%
82   <(16f*, 21q)>}%
83 \newcommand{\exchangedpeaks}{\ExchangedPeaks}%
84 \newcommand{\TwoTwistedPeaks}%
85   {[TwoTwistedPeaks],F,D2,B,R,Bp,Lp,F,Dp,L2,F2,R,Fp,Rp,F2,Lp,Fp,%
86   <(16f*, 20q)>}%
87 \newcommand{\twotwistedpeaks}{\TwoTwistedPeaks}%
88 \newcommand{\FourTwistedPeaks}%
89   {[FourTwistedPeaks],Up,D,B,Rp,F,R,Bp,Lp,Fp,B,L,F,Rp,Bp,R,Fp,Up,D,%
90   <(18q*, 18f*)>}%
91 \newcommand{\fourtwistedpeaks}{\FourTwistedPeaks}%
92 \newcommand{\ExchangedChickenFeet}%
93   {[ExchangedChickenFeet],F,Lp,Dp,Bp,L,F,U,Fp,Dp,F,L2,Bp,Rp,U,L2,Dp,F,%
94   <(19q*, 17f*)>}%
95 \newcommand{\exchangedchickenfeet}{\ExchangedChickenFeet}%
96 \newcommand{\TwistedChickenFeet}%
97   {[TwistedChickenFeet],F,Lp,D,Fp,Up,B,U,F,Up,F,Rp,F2,L,Up,Rp,D2,%
98   <(18q*, 16f*)>}%
99 \newcommand{\twistedchickenfeet}{\TwistedChickenFeet}%
100 \newcommand{\ExchangedRings}%
101   {[ExchangedRings],F,U,Dp,Lp,B2,L,Up,D,F,U,R2,L2,Up,L2,F2,%
102   <(15f*, 20q)>}%
103 \newcommand{\exchangedrings}{\ExchangedRings}%
104 \newcommand{\TwistedRings}%
105   {[TwistedRings],F,D,Fp,D2,Lp,Bp,U,L,D,R,U,Lp,Fp,U,L,U2,%
106   <(18q*, 16f*)>}%
107 \newcommand{\twistedrings}{\TwistedRings}%
108 \newcommand{\EdgeHexagonTwo}%
109   {[EdgeHexagonTwo],U,B2,Up,Fp,Up,D,Lp,D2,L,U,Dp,F,Dp,L2,B2,Dp,%
110   <(20q*, 16f*) order2>}%
111 \newcommand{\edgehexagontwo}{\EdgeHexagonTwo}%
112 \newcommand{\EdgeHexagonThree}%
113   {[EdgeHexagonThree],F,L,B,U,L,F2,B2,Rp,F2,B2,Up,Bp,Lp,Fp,%
114   <(14f*, 18q) order 3>}%
115 \newcommand{\edgehexagonthree}{\EdgeHexagonThree}%
116 \newcommand{\TomParksPattern}%
117   {[TomParksPattern],L,U,F2,R,Lp,U2,Bp,U,D,B2,L,F,Bp,Rp,L,Fp,R,%
118   <(20q*, 17f*)>}%
119 \newcommand{\tomparkspattern}{\TomParksPattern}%
120 \newcommand{\RonsCubeInCube}%
121   {[RonsCubeInCube],L2,D2,Lp,D2,B2,L2,B2,Lp,D2,L2,B2,Lp,B2,%
122   <(13f*, 23q)>}%
123 \newcommand{\ronscubeincube}{\RonsCubeInCube}%
124 \newcommand{\TwistedDuckFeet}%
125   {[TwistedDuckFeet],F,Rp,B,R,U,Fp,Lp,Fp,U2,Lp,Up,D2,B,Dp,F,Bp,U2,%
126   <(20q*, 17f*)>}%
127 \newcommand{\twistedduckfeet}{\TwistedDuckFeet}%

```

```

128 \newcommand{\ExchangedDuckFeet}%
129   {[ExchangedDuckFeet],U,F,R2,Fp,Dp,R,U,B2,U2,Fp,R2,F,D,B2,R,Bp,%
130   <(21q*, 16f*)>}%
131 \newcommand{\exchangedduckfeet}{\ExchangedDuckFeet}%
----- End of this package -----
132 </rubikpatterns>

```

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