Example—the ‘superflip’ configuration

Once you have mastered Rubik’s cube, then an interesting exercise is to generate the so-called ‘superflip’ configuration, in which all the corners are correctly solved, while all the edges are flipped.

For the impatient, the superflip sequence of 24 quarter-turn rotations (listed on Randelshofer’s website) is as follows. This converts the solved cube on the left into the configuration shown on the right.

U R R F′ R D′ L R U′ R U′ D F′ U F′ U′ D′ L′ F′ D′ L′

Surprisingly, this sequence is actually equivalent to $\left\{\left(\begin{smallmatrix}\\ \mathsf{M}\end{smallmatrix}\ \begin{smallmatrix}\\ \mathsf{U}'\end{smallmatrix}\right)4,\ [\mathsf{y}],\ [\mathsf{x}']\right\}3$

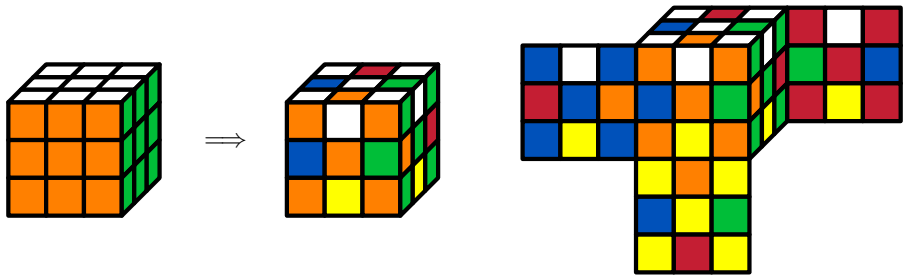

Figure 1: Two images of the superflip configuration.

The code for all this is given below—note that the facelet colours can be written in various ways. Note also the trailing % at the end of each line which is not inside a TikZ picture environment, and the value of placing each TikZ picture environment inside a minipage. Since the default width of a Rubik cube is 4cm (see § 7 Fig 2 in `rubikcube.pdf`), then since the TikZ scale here is 0.5 then the required width of its minipage is equal to $0.5 \times 4\text{cm} = 2\text{cm}$.

```
--------------------
\newcommand{\Rubikbracket}[1]{$\left(\mbox{#1}\right)$}
\newcommand{\Rubikbrace}[1]{$\left\{\mbox{#1}\right\}$}

\begin{center}
\RubikU\RubikR\RubikR\RubikFp\RubikR\RubikDp\RubikL\RubikBp\RubikR%
\RubikUp\RubikR\RubikUp\RubikD\RubikFp\RubikU\RubikFp\RubikUp\RubikDp%
\RubikB\RubikLp\RubikFp\RubikBp\RubikDp\RubikLp
\end{center}

\medskip

{\noindent}Surprisingly,  this sequence is actually equivalent to
\Rubikbrace{\Rubikbracket{\RubikM\RubikUp}4, \Rubiky, \Rubikxp}3

\bigskip
```

```
\begin{figure}[hbt]
\centering
\RubikCubeSolved
\begin{minipage}{2cm}
  \begin{tikzpicture}[scale=0.5]
  \DrawRubikCubeRU
  \end{tikzpicture}
\end{minipage}
\hspace{5mm}$\Longrightarrow$\hspace{5mm}%
\RubikFaceUp   {Y}{B}{Y} {R}{Y}{O} {Y}{G}{Y}%
\RubikFaceDown {W}{G}{W} {R}{W}{O} {W}{B}{W}%
\RubikFaceLeft {R}{Y}{R} {B}{R}{G} {R}{W}{R}%
\RubikFaceRight{O}{Y}{O} {G}{O}{B} {O}{W}{O}%
\RubikFaceFront{G}{Y}{G} {R}{G}{O} {G}{W}{G}%
\RubikFaceBack {B}{Y}{B}%
               {O}{B}{R}%
               {B}{W}{B}%
\begin{minipage}{2cm}
  \begin{tikzpicture}[scale=0.5]
  \DrawRubikCubeRU
  \end{tikzpicture}
\end{minipage}
\hspace{1cm}%
\begin{minipage}{5cm}
  \begin{tikzpicture}[scale=0.5]
  \DrawRubikCubeFlat
  \end{tikzpicture}
\end{minipage}
\caption{Two images of the superflip configuration.}
\end{figure}
-------------------
```

Using the rubikrotation package

This is just a note to show that if this file were run in conjunction with the `rubikrotation` package, using the LaTeX commandline switch `--shell-escape`, then the above figure could be generated more simply by replacing

```
\RubikFaceUp   {Y}{B}{Y} {R}{Y}{O} {Y}{G}{Y}%
\RubikFaceDown {W}{G}{W} {R}{W}{O} {W}{B}{W}%
\RubikFaceLeft {R}{Y}{R} {B}{R}{G} {R}{W}{R}%
\RubikFaceRight{O}{Y}{O} {G}{O}{B} {O}{W}{O}%
\RubikFaceFront{G}{Y}{G} {R}{G}{O} {G}{W}{G}%
\RubikFaceBack {B}{Y}{B}%
               {O}{B}{R}%
               {B}{W}{B}%
```

with the command

```
\RubikRotation{\superflip}%
```

ie, using instead the following code:

```
-----------------
\newcommand{\superflip}{U,R2,Fp,R,Dp,L,Bp,R,Up,R,Up,D,%
Fp,U,Fp,Up,Dp,B,Lp,Fp,Bp,Dp,Lp}

\begin{figure}[hbt]
\centering
\RubikCubeSolved%
\begin{minipage}{2cm}
  \begin{tikzpicture}[scale=0.5]
  \DrawRubikCubeRU
  \end{tikzpicture}
\end{minipage}
\hspace{5mm}$\Longrightarrow$\hspace{5mm}%
\RubikRotation{\superflip}%
\begin{minipage}{2cm}
  \begin{tikzpicture}[scale=0.5]
  \DrawRubikCubeRU
  \end{tikzpicture}
\end{minipage}
\hspace{1cm}%
\begin{minipage}{5cm}
  \begin{tikzpicture}[scale=0.5]
  \DrawRubikCubeFlat
  \end{tikzpicture}
\end{minipage}
\caption{Two images of the superflip configuration.}
\end{figure}
-----------------
```

—— END ——