Rubik's XV

An expanded version of Jaap Scherpui's Solution

Introduction

The above picture pretty much explains it all; try to get all the red tiles so that they are in ascending order (I thru XVI, with the asterisk as tile #16). After solving, the 4x4 red grid is at the lower-right quadrant of the 5x5 grid, with the vertical levers pointing downward while the horizontal levers are to the right.

If you are already a cube expert, then I strongly urge you to go directly to Jaap's Puzzle Page for the XV solution instead. That site will explain the solution clearly in a few simple paragraphs. However if you are a cube novice, then go ahead and read this site, which will help you solve the XV puzzle tile by tile.

The Levers:

The 3 vertical levers can move independently, along with the single large central horizontal lever. The other 2 horizontal levers have certain restrictions:

- You cannot move the top horizontal lever unless all of the vertical levers are pushed upwards.
- You cannot move the bottom horizontal lever unless all of the vertical levers are pushed downwards.

Terminology:
The three vertical levers are labeled as **L, M and R** *(for Left, Middle, and Right)*. The three horizontal levers are labeled as **T, C, and B** *(for Top, Center and Right)*.

The square in the extreme lower-right is known as the **holding cell**; while the two adjacent squares (directly above and to the left) and the holding cell itself are all referred to as the **danger zone**. There is a reason why they are labeled so; just read on.

The extreme upper row is called **Row Zero**, while the the extreme left column is called **Column Zero**. Because of this, the first column and the first row are actually a tad inward of the 5x5 grid.

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**Notation:**

<table>
<thead>
<tr>
<th><strong>L</strong></th>
<th>Push the LEFT vertical lever <em>(upwards or downwards)</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>M</strong></td>
<td>Push the MIDDLE vertical lever <em>(upwards or downwards)</em></td>
</tr>
<tr>
<td><strong>R</strong></td>
<td>Push the RIGHT vertical lever <em>(upwards or downwards)</em></td>
</tr>
<tr>
<td><strong>T</strong></td>
<td>Push the TOP horizontal lever <em>(left or right)</em></td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>Push the big ol' CENTER horizontal lever <em>(left or right)</em></td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>Push the BOTTOM horizontal lever <em>(left or right)</em></td>
</tr>
</tbody>
</table>
Upward or downward; left or right; Exactly which way does that lever go? The answer is, just move it to the other direction.

The Normal (or Basic) Moves:

<table>
<thead>
<tr>
<th>L C L C</th>
<th>M C M C</th>
<th>R C R C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swaps around 7 (out of 8) tiles on the left half clockwise.</td>
<td>Swaps around 7 (out of 8) tiles on the middle section clockwise.</td>
<td>Swaps around 7 (out of 8) tiles on the right half clockwise.</td>
</tr>
<tr>
<td>C L C L</td>
<td>C M C M</td>
<td></td>
</tr>
<tr>
<td>Swaps around 7 (out of 8) tiles on the left half counter-clockwise.</td>
<td>Swaps around 7 (out of 8) tiles on the middle section counter-clockwise.</td>
<td></td>
</tr>
</tbody>
</table>

Notice how you can control any square in the 4x4 grid except for the single square at the lower-right. For this reason alone, I aptly named it the holding cell.

Free a Tile from the Holding Cell:
You may have to bail a tile out of the holding cell here or there throughout the solution. I will not remind you at each and every time you might need to free a tile, so remember this move! Notice how one tile is released from the holding cell, while another takes its place. All three squares are at risk of landing in the cell, thus the name danger zone.

Initialize the Puzzle:

Reset the Levers

Before you start, you must reset the levers:

- Push the central horizontal lever to the right
- Push all vertical levers upward
- Push the top horizontal lever to the right
- Push all vertical levers downward
- Push the bottom horizontal lever to the right

You only have to do this once; because after each and every move used in this solution, the levers automatically become reset again at the end.

Send the Blank Tile to Row Zero

Use any of the NORMAL MOVES to navigate the blank tile directly underneath the single red cell at Row Zero.

Do the move to swap the blank cell to Row Zero...
If the blank tile is in the **holding cell**, then do the move to release it...

- And continue afterwards to send the **blank tile** to **Row Zero**.

Send the Asterisk Tile into the Holding Cell *(Optional)*

Use any of the **NORMAL MOVES** to navigate the **asterisk** *almost* to the bottom of the fourth column.

Do the move to transfer the **asterisk** to the **holding cell**...

The only reason for this step is to fill the holding cell with a tile that won't be used for awhile. The asterisk won't remain in jail forever, but at least the tiles for the first three columns will be free to solve (without any annoying interruptions).

**Next**

@ Introduction/Notation @ Solve Columns 1 and 2
@ Solve Columns 3 and 4 @ Solve the Back Side

Return to Mathematica
Rubik's XV

An expanded version of Jaap Scherpuis' Solution

Solve Columns 1 and 2 of the Front Side

Solve the 1st Column

Use any of the NORMAL MOVES to navigate tile I to the bottom of the first column.

Next, use any of the the NORMAL MOVES to navigate tile V almost to the bottom of the second column, without disturbing the first column.

If tile V happens to be on the first column, then repeat the move until tile V is in the second column, and then STOP to keep tile I in the first column...

Once tile V is on the second column, then repeat the move until tile V is at the bottom of the second column...
Now repeat the move until tile I is at the bottom of the first column...

Finally, do the move to get tile V almost to the bottom of the second column...

Once tiles I and V are at the set-up position, then do the move to get both tiles together in the first column, with tile V directly below tile I...

Use any of the NORMAL MOVES to navigate tile IX almost to the bottom of the second column, without disturbing the first column.

(If tile IX is in the first column, use the same method as before to get it to the second column at the set-up position.)

Do the move to get all three tiles together in the first column...

Use any of the NORMAL MOVES to navigate tile XIII almost to the bottom of the second column, without disturbing the first column.

(If tile XIII is in the first column, use the same method as before to get it to the second column at the set-up position.)

Do the move to get all four tiles together in the first column...

Solve the 2nd Column

Use any of the NORMAL MOVES to navigate tile II to the bottom of the second column.

Next, use any of the NORMAL MOVES to navigate tile VI almost to the bottom of the third column, without disturbing the second column.
If tile VI happens to be on the second column, then repeat the move until tile VI is in the third column, and then STOP to keep tile II in the second column...

Once tile VI is on the third column, then repeat the move until tile V is at the bottom of the third column...

Now repeat the move until tile II is at the bottom of the second column...

Finally, do the move to get tile VI almost to the bottom of the third column...

Once tiles II and VI are at the set-up position, then do the move to get both tiles together in the second column, with tile VI directly below tile II...

Use any of the the NORMAL MOVES to navigate tile X almost to the bottom of the third column, without disturbing the second column.

(If tile X is in the second column, use the same method as before to get it to the third column at the set-up position.)

Do the move to get all three tiles together in the second column...

Use any of the the NORMAL MOVES to navigate tile XIV almost to the bottom of the third column, without disturbing the second column.

(If tile XIV is in the second column, use the same method as before to get it to the third column at the set-up position.)

Do the move to get all four tiles together in the second column...
@ Introduction/Notation @ Solve Columns 1 and 2
@ Solve Columns 3 and 4 @ Solve the Back Side

Return to Mathematica
Rubik's XV

An expanded version of Jaap Scherpuis' Solution

Solve Columns 3 and 4 of the Front Side

Solve the 3rd Column

Link tile III to tile VII:

Repeat the move until tile III is anywhere in the third column (except the for bottom row)...

If tile VII is directly below it, then tiles III and VII are already linked.

If tiles III and VII are not linked, then repeat the move until tile VII is almost on the bottom of the fourth column...

Do the move to transfer tile VII into the holding cell...

Repeat the move until tile III
Repeat the move until tile III is almost on the bottom of the third column...

Now do the move to link tiles III and VII together...

Repeat the move until tile VII is anywhere in the third column (except for the bottom row)...

If tile XI is directly below it, then tiles VII and XI are already linked.

If tiles VII and XI are not linked, then repeat the move until tile XI is almost on the bottom of the fourth column...

Do the move to transfer tile XI into the holding cell...

Repeat the move until tile VII is almost on the bottom of the third column...

Now do the move to link tiles VII and XI together...

Repeat the move until tile XI is anywhere in the third column (except for the bottom row)...

If tile XV is directly below it, then tiles XI and XV are already linked.

If tiles XI and XV are not linked, then repeat the move until tile XV is almost on the bottom of the fourth column...
Do the move to transfer tile XV into the **holding cell**...  

Repeat the move until **tile XI** is *almost* on the bottom of the third column...

Now do the move to link tiles XI and XV together...

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**Solve the 4th Column**

**Link tile IV to tile III:**

Repeat the move until **tile III** is on top of the third column...

If **tile IV** is on top of the fourth column, then tiles IV and III are *already linked*.

If tiles IV and III are *not linked*, then do the move so that **tile XV** is *out* of the **danger zone**, while **tile IV** is *in* the **danger zone**...

Repeat the move until **tile IV** is in the **holding cell**...

Do the move so that **tile III** is *almost* on top of the fourth column...

Repeat the move until **tiles III and IV** are linked together...

**Finish the last three tiles:**

Repeat the move until **tiles III and IV** are both on the top row...

Check to make sure that the third column is still **intact**, while **tile IV**
is on top of the fourth column.

Do the move to get tiles VIII, XII and the asterisk into the danger zone...

Repeat the move until the asterisk is in the holding cell...

Do the move to rotate tiles VIII and XII back to the fourth column...

Now the fourth column is finished, along with the rest of the puzzle

Next

@ Introduction/Notation  @ Solve Columns 1 and 2  
@ Solve Columns 3 and 4  @ Solve the Back Side

Return to Mathematica
Rubik's XV

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![Magic Square](http://www.geocities.com/abcmcfarren/math/r90/xvside2.htm)

Solve the Back Side

For the back side, you have to come up with a **magic square**, where each row, column and diagonal add up to the same sum. In the example above, they each add up to 15, but you can use any other sum ranging from 12 to 36.

The 9 tiles that appear on the back are the same tiles that lie in the 9 **central squares** on the front. The yellow tiles (1 thru 15) have the same numbers as the red tiles (I thru XV) with the asterisk as zero.

![Magic Square](http://www.geocities.com/abcmcfarren/math/r90/xvside2.htm)

*Magic Square, front side solved*  *Magic Square, back side solved*

*Note how the front and back sides are mirror images of each other*

You must solve the puzzle from the front side, concentrating on those 9 central squares. But instead of solving the 1st column as **I, V, IX and XIII**, solve the 1st column as **II, VII, VI**, and any other tile. The same goes for the next two columns; solve the 2nd column as **IX-V-I-any** (instead of **II-VI-X-XIV**), and solve the 3rd column as **IV-III-VII-any** (instead of **III-VII-XI-XV**). Ignore the 4th column altogether.
Hint: Do not use place a tile on the bottom row that you may need for the magic square itself. If you do, then you'll have to dig it out later on.

So, use the exact same moves you used while solving the front side. In case you have to dig out a tile from the bottom row (without disturbing the Magic Square itself), use these new moves:

B MR C MR
B MR C MR
B LMR C LMR
B LMR C LMR

B R C R
B R C R
B MR C MR
B MR C MR

Visit [Jaap's XV page](http://www.geocities.com/abcmcfarren/math/r90/xvside2.htm) to view all possible Magic Square combinations. While you're at it, go ahead and visit all of his pages for the entire Rubik's 90's collection:

- [Rubik's Fifteen](http://www.geocities.com/abcmcfarren/math/r90/xvside2.htm)
- [Rubik's Dice](http://www.geocities.com/abcmcfarren/math/r90/xvside2.htm)
- [Rubik's Triamid](http://www.geocities.com/abcmcfarren/math/r90/xvside2.htm)
- [Rubik's Tangle](http://www.geocities.com/abcmcfarren/math/r90/xvside2.htm)

@ Introduction/Notation @ Solve Columns 1 and 2
@ Solve Columns 3 and 4 @ Solve the Back Side

Return to Mathematica