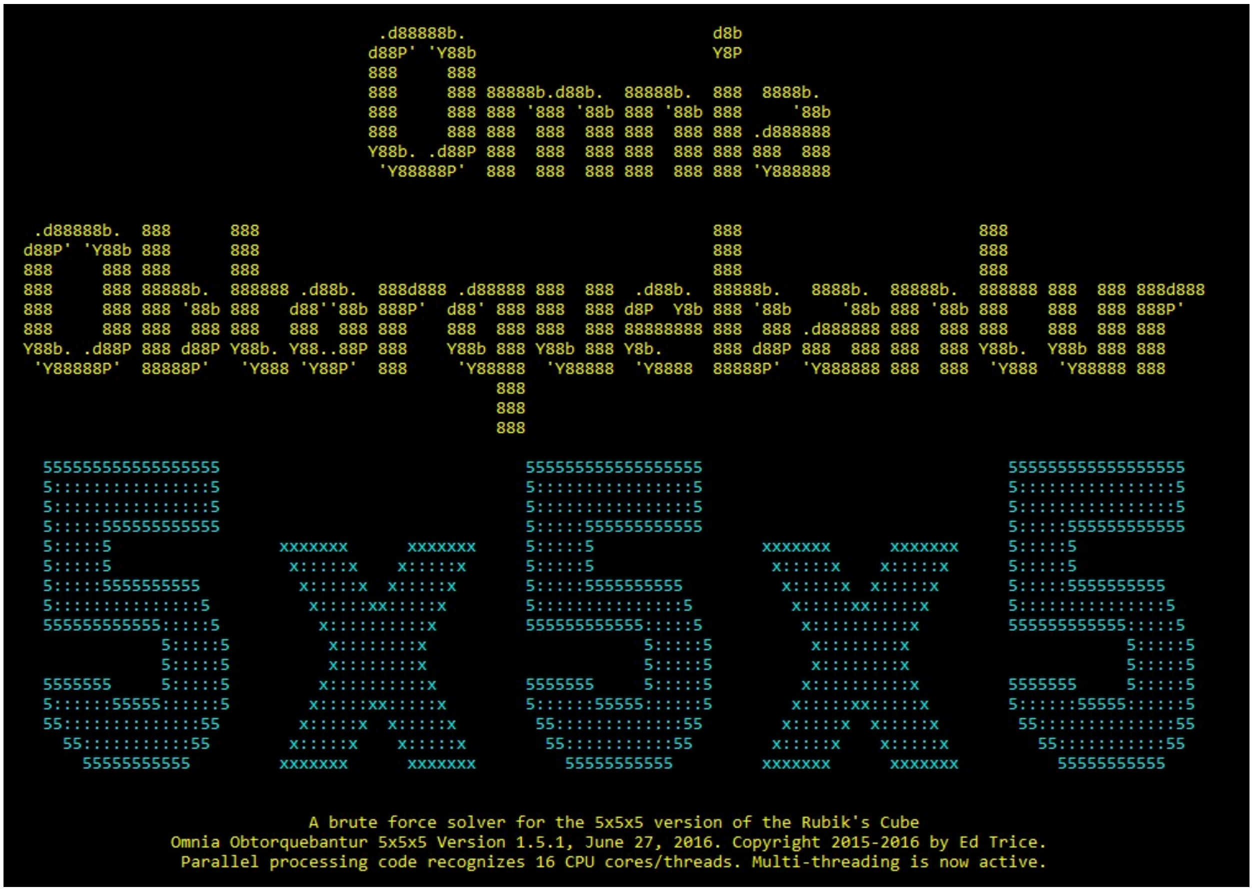
OMNIA OBTORQUEBANTUR 5x5x5



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                                    .d88888b.                         d8b
                                   d88P' 'Y88b                        Y8P
                                   888     888
                                   888     888 88888b.d88b.  88888b.  888  8888b.
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                                   888     888 888  888  888 888  888 888 .d888888
                                   Y88b. .d88P 888  888  888 888  888 888 888  888
                                    'Y88888P'  888  888  888 888  888 888 'Y888888


 .d88888b.  888      888                                              888                        888
d88P' 'Y88b 888      888                                              888                        888
888     888 888      888                                              888                        888
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Y88b. .d88P 888 d88P Y88b. Y88..88P 888    Y88b 888 Y88b 888 Y8b.     888 d88P 888  888 888  888 Y88b.  Y88b 888 888
 'Y88888P'  88888P'   'Y888 'Y88P'  888     'Y88888  'Y88888  'Y8888  88888P'  'Y888888 888  888  'Y888  'Y88888 888
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  5:::::5                  x:::::x    x:::::x      5:::::5                  x:::::x    x:::::x      5:::::5
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              5:::::5          x:::::::::x                     5:::::5          x:::::::::x                     5:::::5
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  55::::::::::::::55        x:::::x  x:::::x       55::::::::::::::55        x:::::x  x:::::x       55::::::::::::::55
    55::::::::::::55       x:::::x    x:::::x        55::::::::::::55       x:::::x    x:::::x        55::::::::::::55
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                             A brute force solver for the 5x5x5 version of the Rubik's Cube
               Omnia Obtorquebantur 5x5x5 Version 1.5.1, June 27, 2016. Copyright 2015-2016 by Ed Trice.
                Parallel processing code recognizes 16 CPU cores/threads. Multi-threading is now active.
```

Brute Force Solver User’s Guide

This version of Omnia Obtorquebantur 5x5x5 (Latin for “all will be turned”) uses a fixed-sized hash table requiring 11 GB of RAM. This hash table stores every unique 5x5x5 cube that can be created in 5 turns from the solved state. As the program begins a solve, it generates moves on the scrambled 5x5x5 cube and compares the result to the pre-computed cubes residing within the hash table. Once a match is found, the moves that created the cube in the hash table are retrieved, and a complete solution combining the generated moves with the hash table moves is shown. The program continues searching until every possible solution is found. The solutions are written to a disk file named **solved_cubes.txt** in the same directory where the program was launched. Sample output is shown below:

```
Solution [0001] =  2R' 3F  2R   [inside 05-TFS] --->  F   2R' 3F' 2R  F'   @ 000000000008584 solved state checks [time = < 1 second]
Solution [0002] =  3R  U2  3R'  [inside 05-TFS] --->  2U  3R  U2  3R' 2U'  @ 000000000010531 solved state checks [time = < 1 second]
Solution [0003] =  3R' D2  3R   [inside 05-TFS] --->  2U  3R' D2  3R  2U'  @ 000000000012224 solved state checks [time = < 1 second]
Solution [0004] =  2L' 3F' 2L   [inside 05-TFS] --->  F'  2L' 3F  2L  F    @ 000000000014975 solved state checks [time = < 1 second]
Solution [0005] =  2U  F   3U   [inside 05-TFS] --->  F'  2U' F   3U' F'   @ 000000000026125 solved state checks [time = < 1 second]
Omnia Obtorquebantur 5x5x5 Version 1.5.5, June 03, 2017. Copyright 2015-2016 by Ed Trice.
```

The solutions are shown in SiGN notation. The first one above shows that **2R' 3F 2R F 2R' 3F' 2R F'** will solve the cube. Notice that only three move were generated, even though this solution contains eight moves. After the program generated **2R' 3F 2R** and applied it to this particular scramble, a 5x5x5 cube was found in the hash table, and the moves that solve that cube were **F 2R' 3F' 2R F.** This saves a tremendous amount of time, essentially finding every solution in 5 fewer moves than would be possible otherwise.

The program reads a text file named **scrambled_cube_colors.txt** which contains the colors of each “sticker” on the cube. The file requires the colors to be read in the following order:

White, red, green, yellow, orange blue.

This should also match your cube’s colors on the top, right, front, bottom, left, and back. A completed solved cube looks like this:

```
WWWWW/WWWWW/WWWWW/WWWWW/WWWWW//
RRRRR/RRRRR/RRRRR/RRRRR/RRRRR//
GGGGG/GGGGG/GGGGG/GGGGG/GGGGG//
YYYYY/YYYYY/YYYYY/YYYYY/YYYYY//
OOOOO/OOOOO/OOOOO/OOOOO/OOOOO//
BBBBB/BBBBB/BBBBB/BBBBB/BBBBB//
```

This file can be edited to give the program any position to solve. It should be noted that even a high-end computer has a maximum “practical” range of 14 moves. Each additional depth requires roughly 42 times as much time to solve. So if the program completes a search to depth 11 in one second, depth 12 will take approximately 42 seconds, depth 13 will take just under 30 minutes, and depth 14 will take over 20 hours. The program will continue searching for as long as you allow, up to a maximum of 54 moves deep.