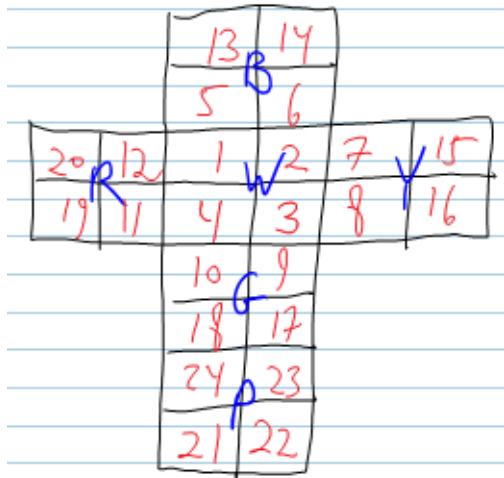


Solving 2x2x2

Pensieve Header: Solving the 2x2x2 Rubik's Cube.



TheGenerators

```
n = 24;
g1 = Cycles[{{1, 2, 3, 4}, {5, 7, 9, 11}, {6, 8, 10, 12}}];
g2 = Cycles[{{13, 14, 6, 5}, {21, 15, 2, 12}, {22, 7, 1, 20}}];
g3 = Cycles[{{7, 15, 16, 8}, {6, 22, 17, 3}, {14, 23, 9, 2}}];
g4 = Cycles[{{10, 9, 17, 18}, {4, 8, 23, 19}, {3, 16, 24, 11}}];
g5 = Cycles[{{20, 12, 11, 19}, {13, 1, 10, 24}, {5, 4, 18, 21}}];
g6 = Cycles[{{24, 23, 22, 21}, {18, 16, 14, 20}, {17, 15, 13, 19}}];
```

TheProgram

```
 $\sigma \circ \tau$  := PermutationProduct[ $\tau$ ,  $\sigma$ ];
Feed[Cycles[{}]] := Null;
Feed[ $\tau$ ] := Module[{i, j, k, l},
  i = Min[PermutationSupport[ $\tau$ ]];
  j = PermutationReplace[i,  $\tau$ ];
  If[Head[ $\sigma_{i,j}$ ] === Cycles,
    Feed[InversePermutation[ $\sigma_{i,j}$ ]  $\circ$   $\tau$ ],
    (*Else*)  $\sigma_{i,j} = \tau$ ;
  For[k = 1, k < n, ++k,
    For[l = k + 1, l  $\leq$  n, ++l,
      If[Head[ $\sigma_{k,l}$ ] === Cycles,
        Feed[ $\sigma_{i,j} \circ \sigma_{k,l}$ ]; Feed[ $\sigma_{k,l} \circ \sigma_{i,j}$ ]]
    ]
  ]];
$RecursionLimit =  $\infty$ ;
```

TheRun

```
Table[Feed[g $\alpha$ ];  $\prod_{i=1}^n (1 + \text{Count}[\text{Range}[n], j_ /; \text{Head}[\sigma_{i,j}] = \text{Cycles}])$ , { $\alpha$ , 6}]
```

TheRun

```
{4, 29160, 3674160, 88179840, 88179840, 88179840}
```

24!

620 448 401 733 239 439 360 000

8! 3⁸

264 539 520

8! 3⁸ / 88 179 840

3

88 179 840 / 24

3 674 160

```
ImageCrop[
  Rasterize[Graphics[{
    EdgeForm[Thin],
    Table[
      If[Head[σi,j] === Cycles || i == j,
        {Red, Rectangle[{i - 1, n - j}, {i, n - j + 1}]},
        {Yellow, Rectangle[{i - 1, n - j}, {i, n - j + 1}]}
      ], {i, n}, {j, i, n}
    ]
  }], AspectRatio → 1 / GoldenRatio, ImageSize → 720], RasterSize → 720]
]
```

