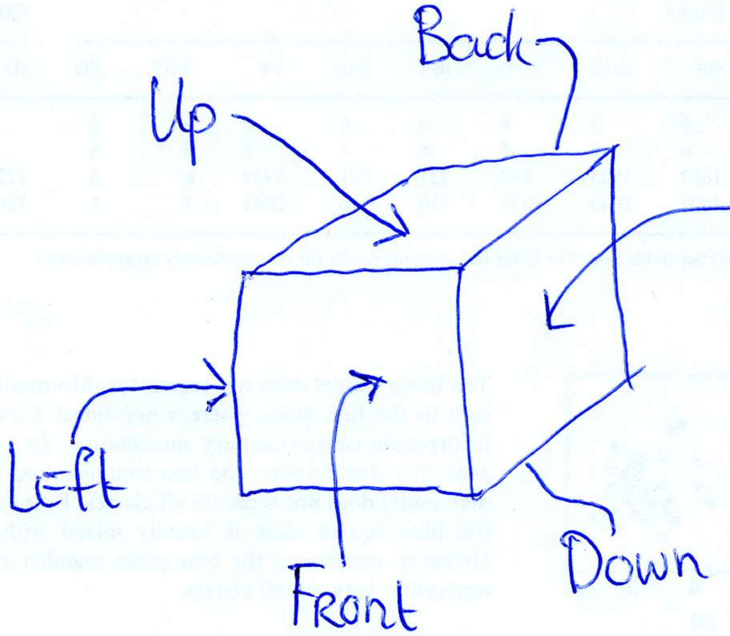
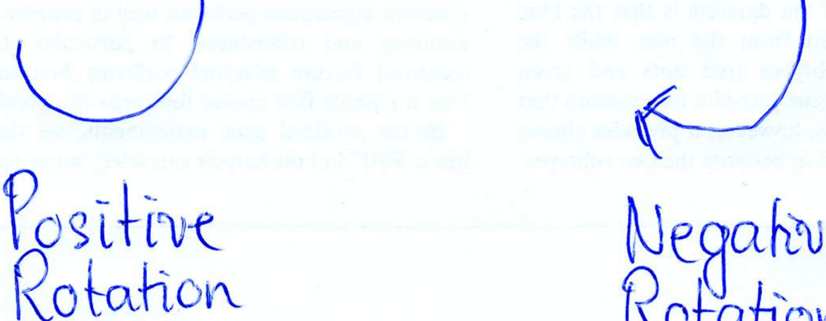
Sides of the Cube



Rotations

For determining the direction of a rotation, we use mathematical orientation:



Positive Rotation

Negative Rotation

Rotations

A rotation has form S_j^i.

- Here S is a surface, so $S \in \{L, R, U, D, F, B\}$
- i specifies the amount of rotation
  - $i=1$: 90 degrees in positive direction, when looking onto the surface
  - $i=-1$: 90 degrees in negative direction when looking onto the surface
  - $i=2$: 180° degrees. (Direction does not matter.)
- j specifies the layer being rotated.
  - $j=1$ is the surface itself
  - $j=2$ is the second layer below the surface.

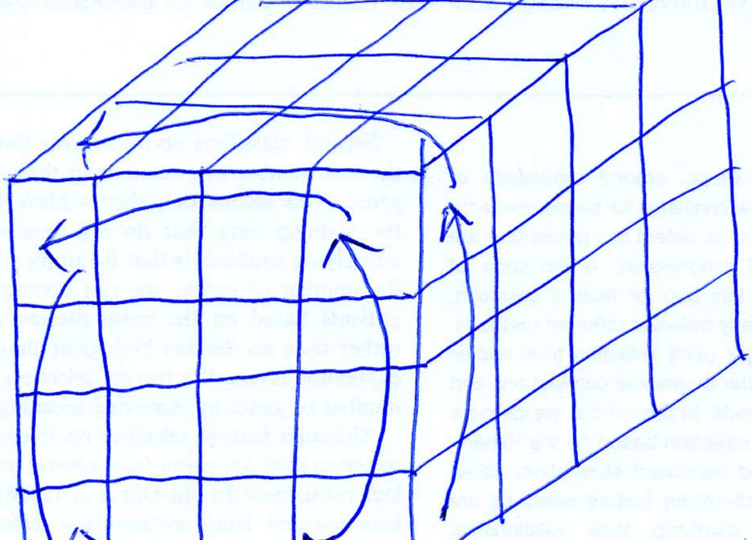
Abbreviations

- When $i=1$, we omit i. S_j is the same as S_j^1.
- We combine rotations with the same S and i. If $j_1 \neq j_2$, then $S^i_{j_1} \cdot S^i_{j_2}$ is the same as $S^i_{j_1,j_2}$.

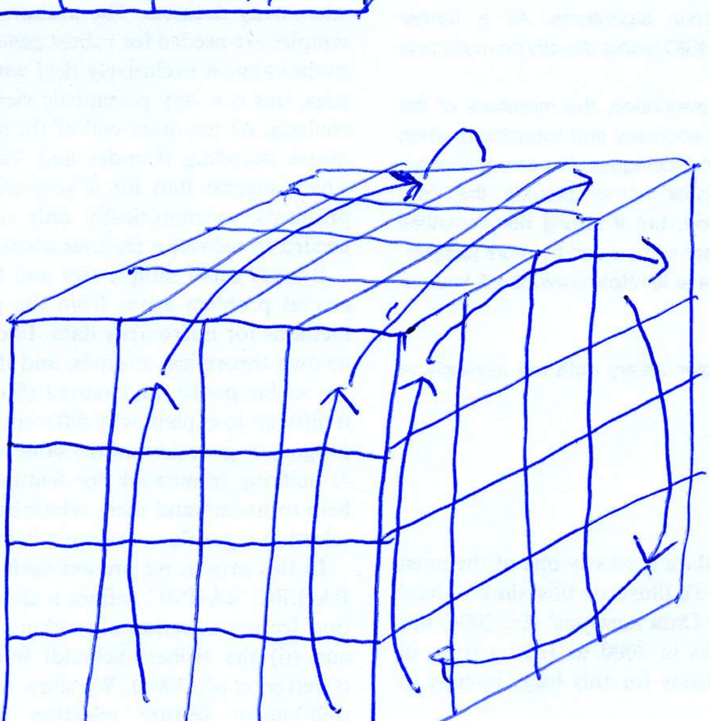
(You don't need to implement the abbreviations.)

Examples (In 4-cube)

F^1:

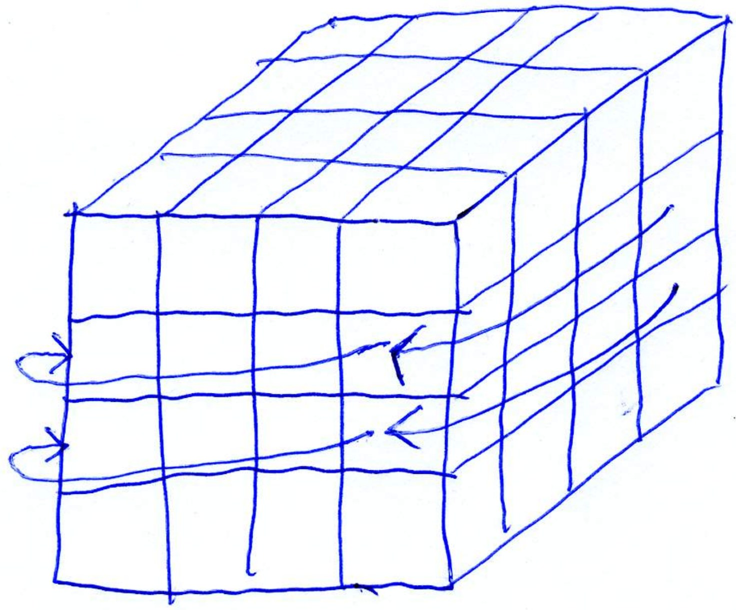


R^{-1}_{13}:

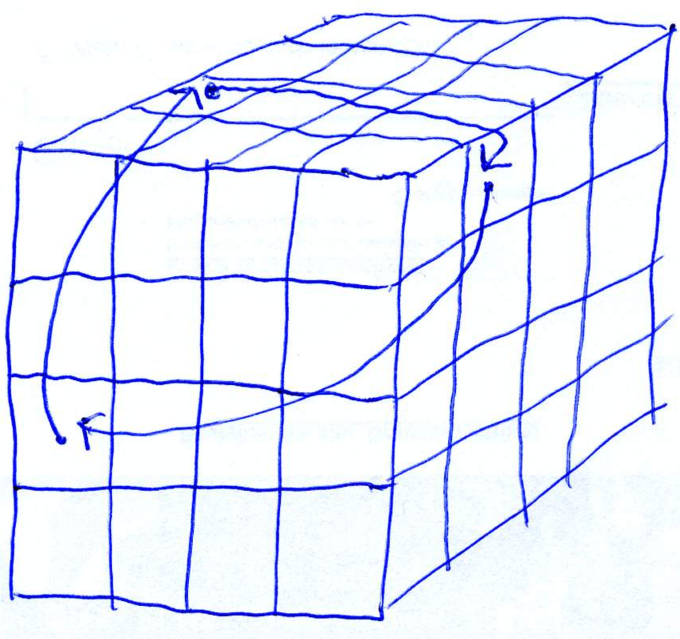


Examples

$D_{2,3}$:



$$L_{1,3} \cdot U \cdot L_3^{-1} \cdot U^{-1} \cdot L_1^{-1} \cdot U \cdot L_3 \cdot U^{-1} \cdot L_3^{-1} :$$



The cube implementation