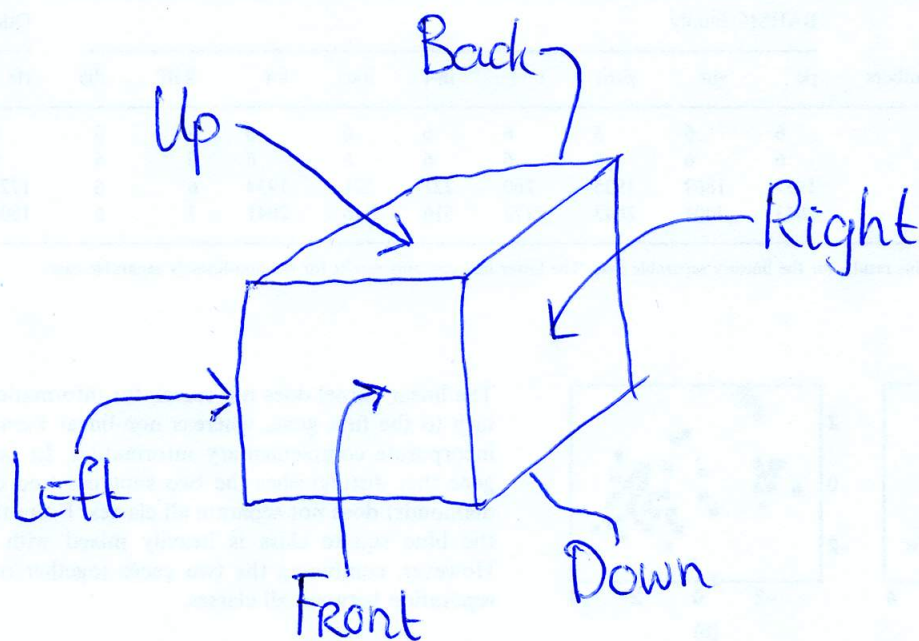


# Sides of the Cube

①



## Rotations

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



Positive  
Rotation



Negative  
Rotation

# Rotations

②

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.

$i=1$ : go degrees in positive direction,  
when looking onto the surface

$i=-1$ : go 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

3

◦ 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  $S_{j_1}^i \cdot S_{j_2}^i$  is the same as  $S_{j_1, j_2}^i$ .

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

