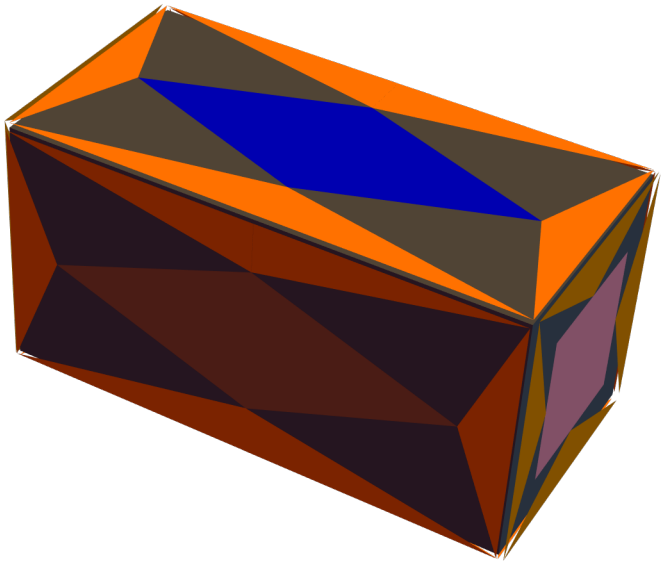
Since this file is not executable much of the code has been removed. To see the rest of the code as .pdf see **currentcodeCrystallography.pdf**

Yale's C1

We will use our boxes, as defined in **currentCodeCrystallography.nb** to illustrate this.

In[48]:=
```
Graphics3D[DBbox[ι], Boxed → False]
```
Out[48]=



C1 will be the group of orientation (color} preserving isometries of this box, they all will be translations, notably

In[49]:=
```
τbx := TranslationTransform[{2, 0, 0}]
τby := TranslationTransform[{0, 1, 0}]
τbz := TranslationTransform[{0, 0, 1}]
```

These generators do not define a group, we an identity and inverses. The inverses are enough since a transformation composed with its inverse give the identity *ι*. Therefore generators for this group are

In[52]:=
```
tasC1 := ⟨|1 → τbx, 2 → τby, 3 → τbz,
  4 → InverseTF[τbx], 5 → InverseTF[τby], 6 → InverseTF[τbz]|⟩
```

A random test point could be

In[53]:=
```
tpc = RandomReal[{-2, 2}, 3]
```
Out[53]=
```
{-1.52631, 1.57582, 0.934421}
```

The distinct length 3 elements of of this group are

In[54]:=
```
C1[3] = transGroup[tasC1, tpc, 3, tol → .001]
```

» number of group elements calculated 63

Out[54]=
```
{{1}, {2}, {3}, {4}, {5}, {6}, {1, 1}, {1, 2}, {1, 3}, {1, 4}, {1, 5}, {1, 6}, {2, 2},
 {2, 3}, {2, 4}, {2, 6}, {3, 3}, {3, 4}, {3, 5}, {4, 4}, {4, 5}, {4, 6}, {5, 5},
 {5, 6}, {6, 6}, {1, 1, 1}, {1, 1, 2}, {1, 1, 3}, {1, 1, 5}, {1, 1, 6}, {1, 2, 2},
 {1, 2, 3}, {1, 2, 6}, {1, 3, 3}, {1, 3, 5}, {1, 5, 5}, {1, 5, 6}, {1, 6, 6}, {2, 2, 2},
 {2, 2, 3}, {2, 2, 4}, {2, 2, 6}, {2, 3, 3}, {2, 3, 4}, {2, 4, 4}, {2, 4, 6}, {2, 6, 6},
 {3, 3, 3}, {3, 3, 4}, {3, 3, 5}, {3, 4, 4}, {3, 4, 5}, {3, 5, 5}, {4, 4, 4}, {4, 4, 5},
 {4, 4, 6}, {4, 5, 5}, {4, 5, 6}, {4, 6, 6}, {5, 5, 5}, {5, 5, 6}, {5, 6, 6}, {6, 6, 6}}
```

We note that the distinct elements here are all the lexicographic ordered lists of the integers 1 - 6 with a few exceptions The identity is given as

In[55]:=
```
GroupFindKey[ι, C1[3], tasC1, tpc]
```

Out[55]=
```
{1, 4}
```

but also as

In[56]:=
```
TasTF[{2, 5}, tasC1]
```

Out[56]=
```
TransformationFunction[( 1 0 0 | 0
                         0 1 0 | 0
                         0 0 1 | 0
                         ------+--
                         0 0 0 | 1 )]
```

In[57]:=
```
TasTF[{3, 6}, tasC1]
```

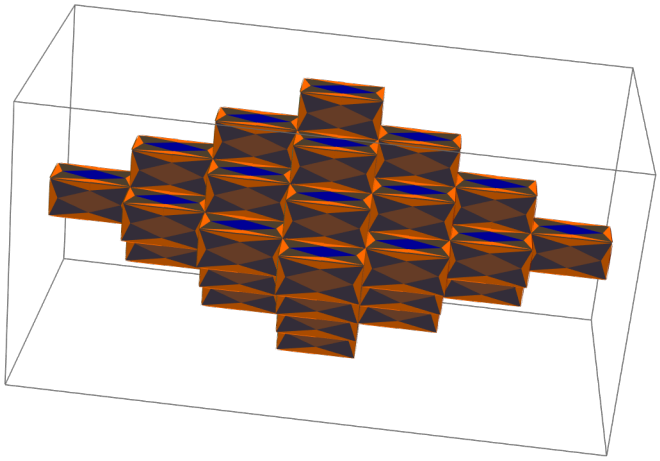
Out[57]=
```
TransformationFunction[( 1 0 0 | 0
                         0 1 0 | 0
                         0 0 1 | 0
                         ------+--
                         0 0 0 | 1 )]
```

which are missing from this distinct list as well as lists containing these pairs.

To check that this a transformation group we look at the action on our boxes

In[58]:=
```
Graphics3D[Table[DBbox[TasTF[α, tasC1]], {α, C1[3]}]]
```

Out[58]=



These are all colored boxes with the same orientation .

Just as the identity appears with three different lists under TasTF so any 3 element list of the numbers 1 to 6 will also give an element of the group, but the same as one listed in the set C1[3]. Moreover longer list will also give transformations in the full infinite group C1 which is the limit of the C1[n]. For example

In[59]:=
```
TasTF[{3, 2, 2, 6, 4}, tasC1]
```

Out[59]=

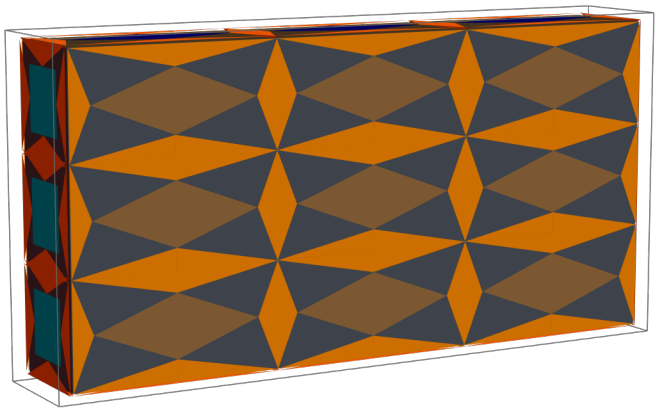
$$\text{TransformationFunction}\left[\left(\begin{array}{ccc|c} 1 & 0 & 0 & -2 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & 1 & 0 \\ \hline 0 & 0 & 0 & 1 \end{array}\right)\right]$$

We can use this to draw other crystals made from this group .

In[60]:=
```
LG3 = {{1, 4}, {1}, {1, 1}, {3}, {3, 1}, {3, 1, 1}, {3, 3}, {3, 3, 1}, {3, 3, 1, 1}};
```

In[61]:=
```
Graphics3D[Table[DBbox[TasTF[α, tasC1]], {α, LG3}]]
```

Out[61]=



which is my 2 dimensional logo. I could go much farther if I wished.