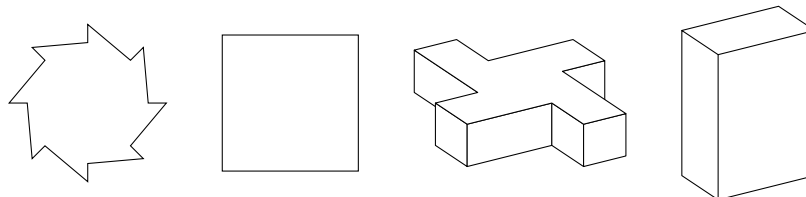


Last week, we talked about the following four mattresses:



Remember that each mattress has 8 possible mattress flipping actions (including the “do nothing” action, and mirror-imaging for some mattresses).

**Problem 1.** Write down a “multiplication table” for the mattress actions.

I’ve already started the table for the first mattress: “ $N$ ” means the “do Nothing” action, and “ $r5$ ” means “rotate clockwise by 5 eighths of a full rotation”, for example. The entry in the “ $r3$ ” row and “ $r6$ ” column is “ $r1$ ”, which means “if I rotate by 3 eighths then 6 eighths, it’s the same as if I just rotated by 1 eighth”.

You’ll need to come up with your own notation for the other mattresses!

	$N$	$r1$	$r2$	$r3$	$r4$	$r5$	$r6$	$r7$	
$N$	$N$	$r1$	$r2$	$r3$	$r4$	$r5$	$r6$	$r7$	
$r1$	$r1$	$r2$	$r3$	$r4$	$r5$	$r6$	$r7$	$N$	
$r2$	$r2$	$r3$	$r4$	$r5$	$r6$	$r7$	$N$	$r1$	
$r3$	$r3$	$r4$	$r5$	$r6$	$r7$	$N$	$r1$	$r2$	
$r4$	$r4$	$r5$	$r6$						
$r5$									
$r6$									
$r7$									

**Problem 2.** Do you notice any cool facts about these tables?

**Problem 3.** Last week, we asked you to figure out some properties of the sets of mattress symmetries. These are the things we asked:

- For each mattress, what's the smallest list of actions you need so that every possible action can be done by doing things on your list in some order?
- Are there any mattresses where it doesn't matter what order you do the actions in?
- How many times do you have to do each action before you get back to where you started?
- For each action, there's something that un-does it. This is sometimes the same action and sometimes a different one — when is it the same?

Do the tables help answer any of these questions?