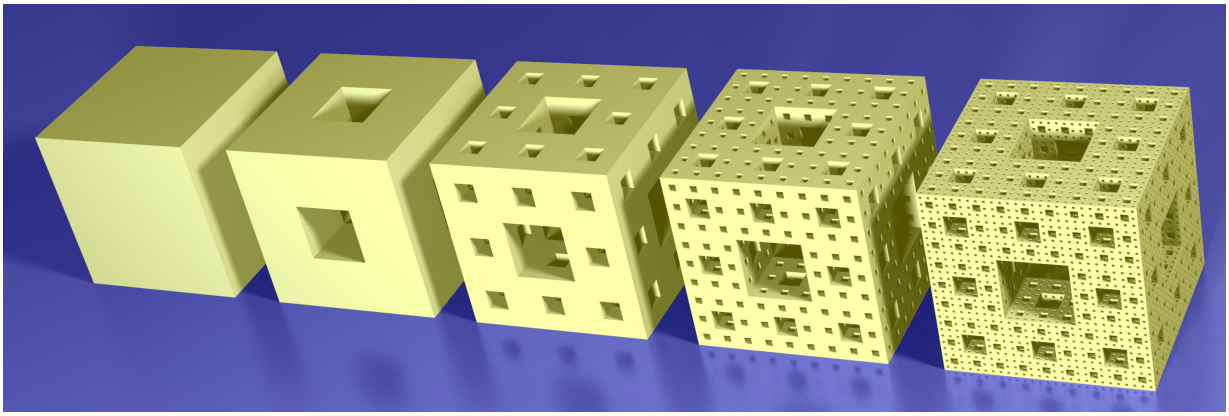
3D Fractals

There are lots of different three-dimensional fractals, many of which can be made using a repeated process.

Menger Sponge

A Menger Sponge is the three-dimensional version of the Sierpinski Carpet - it's made by splitting a cube into 27 smaller cubes, and removing 7 of them leaving a frame with a hole in each face. This is then repeated for each of the remaining smaller cubes, and so on.



Construction of a Menger Sponge: based on an image by Niabot, CC-BY 3.0, via Wikimedia Commons

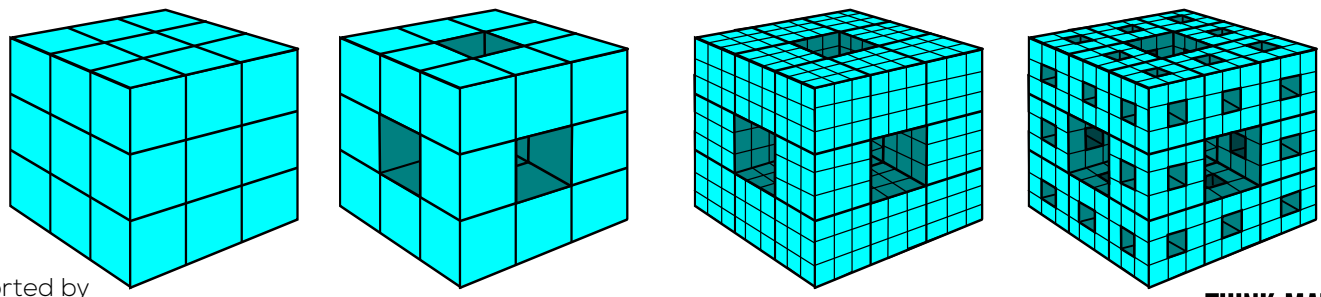
Questions

1. For the Menger Sponge:

   - How many small cubes are there in the first stage, after you remove one set of 7 cubes? If you split each of these cubes into smaller cubes, and remove 7 from each to make the stage 2 Menger Sponge, how many of these smaller cubes do you have?

   - If the whole cube measured 27cm along the edge, what is the length of the edge of one of the small cubes making up a stage 3 sponge?

   - BONUS: What fraction of the volume of the whole cube is removed to go from Stage 1 to Stage 2? (Hint: It's not 7/27)).



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