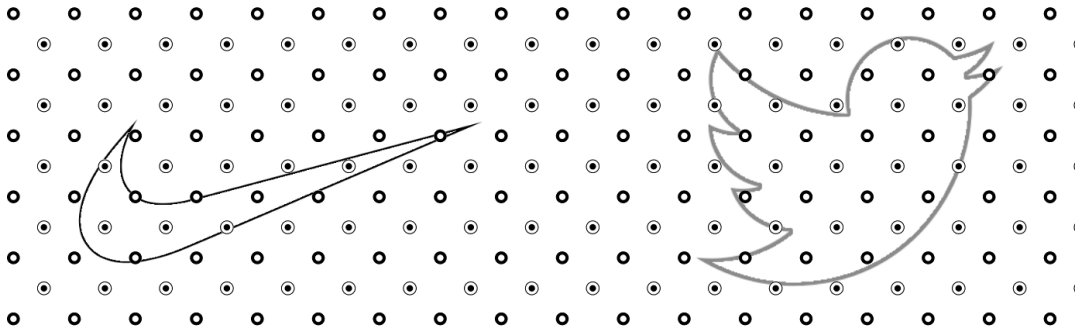
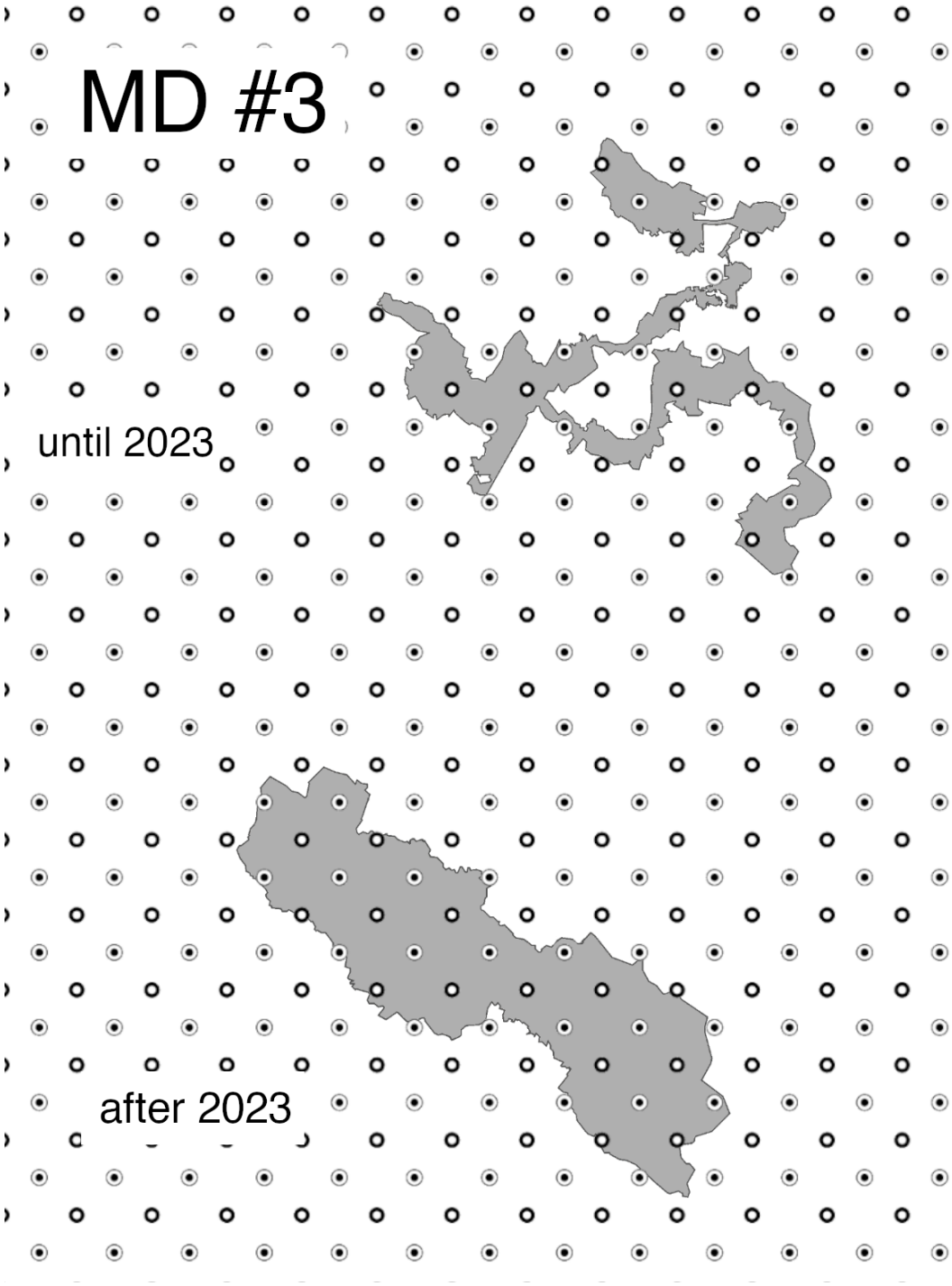
Math 1015: Homework #7

Question 1. a) For each of these pictures, find the convex hull ratio.

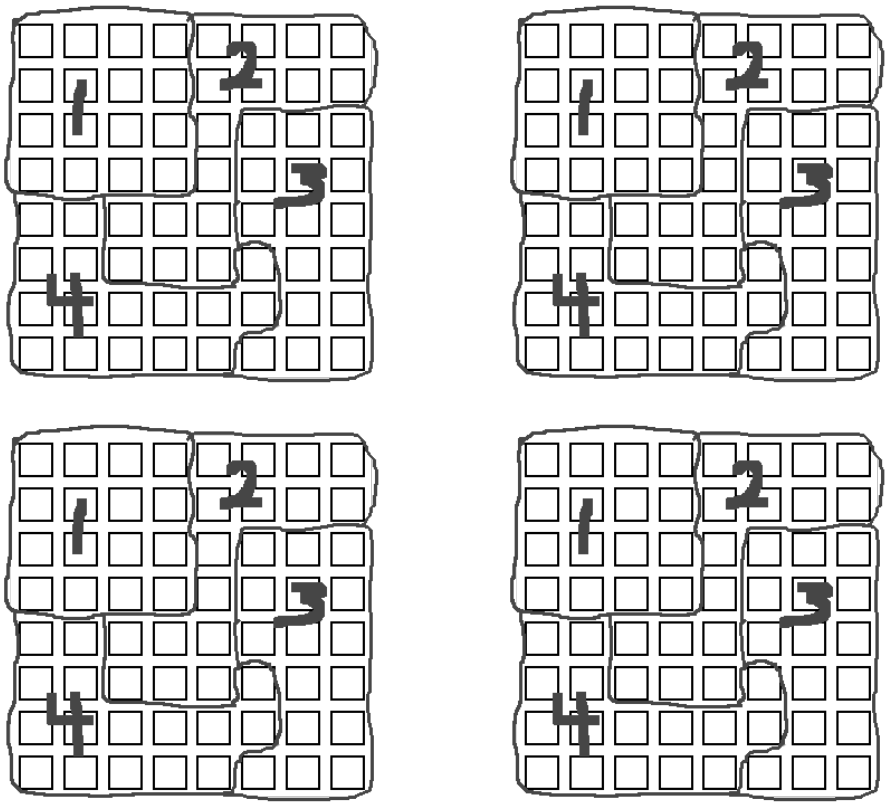


b) According to the Convex Hull ratio, which is the weirder shape?

Question 2. The state of Maryland had absurdly shaped districts, but they changed starting in 2023. Find the convex hull ratio of the old and new versions of MD district #3.



Question 3. a) Find the isoperimetric quotient of each of these 4 districts. (I gave you the picture 4 times so you can draw on one for each district.)

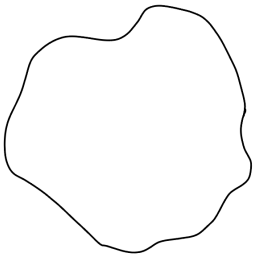


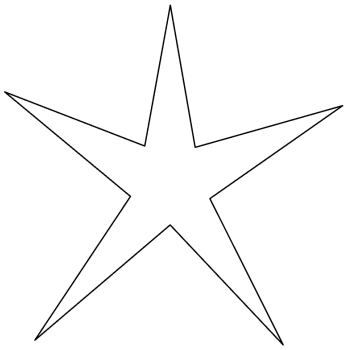
b) According to the isoperimetric quotient, which shape is the weirdest (use a calculator so you can compare the values)? Which is the least weird?

Question 4. Of the three shapes below, each one can be described as one of the following:

- good convex hull ratio, good isoperimetric quotient
- good convex hull ratio, bad isoperimetric quotient
- bad convex hull ratio, bad isoperimetric quotient

Identify which shape fits which description (each of these 3 shapes fits a different one of those 3 descriptions), and explain why in a few words for each one.

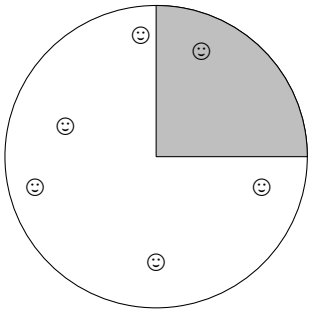




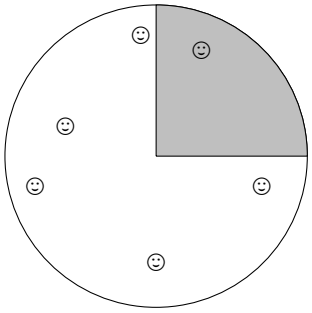
Question 5. Below you will see a cake with a light part and a dark part, and also some smileys. A and B are going to do the 2-person divide-and-choose method. These are their preferences:

- A likes only the dark part
- B likes only the smileys

a) Show what will happen if A is the divider and B is the chooser. (Draw where A's cut might go, and then indicate who will choose which piece.)



b) Show what will happen if B is the divider and A is the chooser.



(There are several possible correct answers to these)