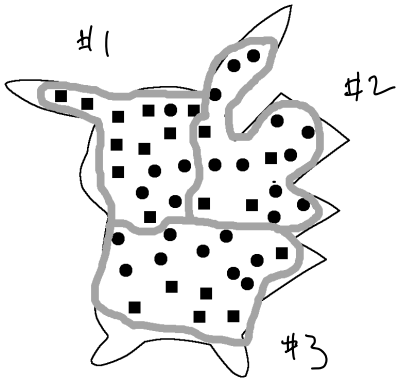
Math 1015: Homework #6

Question 1. Here is one possible districting plan for Pikachuland:



Please compute the efficiency gap for this map. State your final answer as a percentage (use a calculator), and state who is being favored.

Your answer should look like: "The EG is ???% in favor of ???"

district	□	○	total	threshold	□ wasted	○ wasted
1	(10)	5	15	8	2	5
2	4	(11)	15	8	4	3
3	6	(9)	15	8	6	1
			45		12	9

EG is $\frac{12-9}{45} = \frac{3}{45} = \frac{1}{15} = .066$ in favor of ●'s

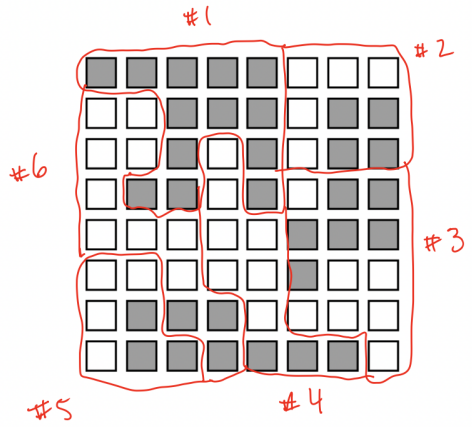
Question 2. The state of Nevada has 4 districts for the US House of Representatives. Look up the data for the Nevada elections in 2022, and compute the efficiency gap. Your answer should look like: "The EG is ???% in favor of ???"

I found the voting numbers on Wikipedia "2022 United States House of Representatives elections in Nevada," in the chart under "Overview". You can simplify things by rounding all numbers to thousands, and ignoring all votes for third-party candidates. Make sure you are using 2022 numbers.

district	D	R	total	thres	D wasted	R wasted
1	116	103	219	110	6	103
2	117	185	302	153	117	32
3	131	121	252	127	4	121
4	117	106	223	112	5	106
			996		132	362

$$EG = \frac{362 - 132}{996} = \frac{230}{996} = 23\% \text{ in favor of D}$$

Question 3. Here is a map in 6 districts:



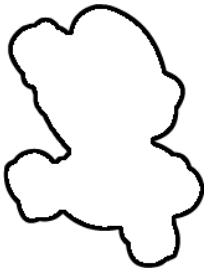
Please compute the efficiency gap for this map. State your final answer as a percentage (use a calculator), and state who is being favored.

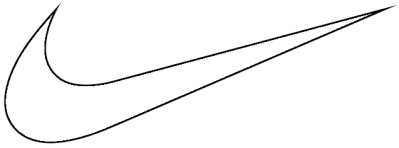
Your answer should look like: "The EG is ???% in favor of ???"

district	D	L	total	thres	D wasted	L wasted
1	13	0	13	7	6	0
2	4	5	9	5	4	0
3	6	7	13	7	6	0
4	3	7	10	6	3	1
5	3	4	7	4	3	0
6	3	9	12	7	3	2
			64		25	3

$$EG = \frac{25-3}{64} = 34\% \text{ in favor of } L.$$

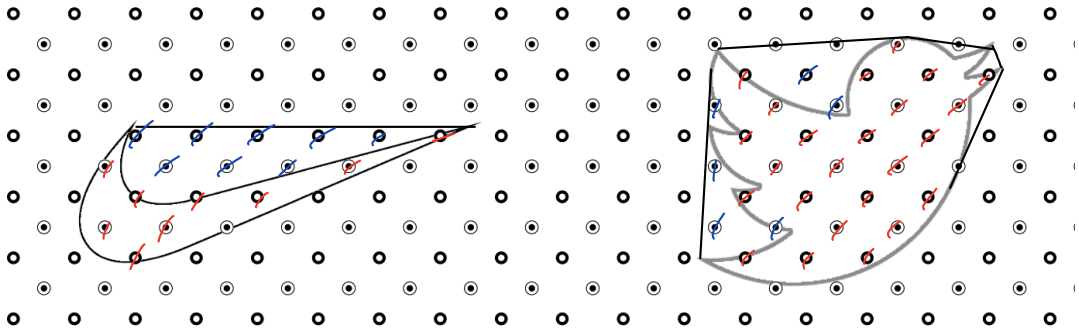
Question 4. For each of these pictures, draw the convex hull. (You can scribble right on top of it.)





Question 5. Think of a nice logo from some real company or product. Draw or paste in the original logo by itself (you can just draw the outline, like I did above), and then draw it again with the convex hull on top of it.

Question 6. a) For each of these pictures, find the convex hull ratio.



OG: 9
CH: 17

CHR: $\frac{9}{17} = .529$

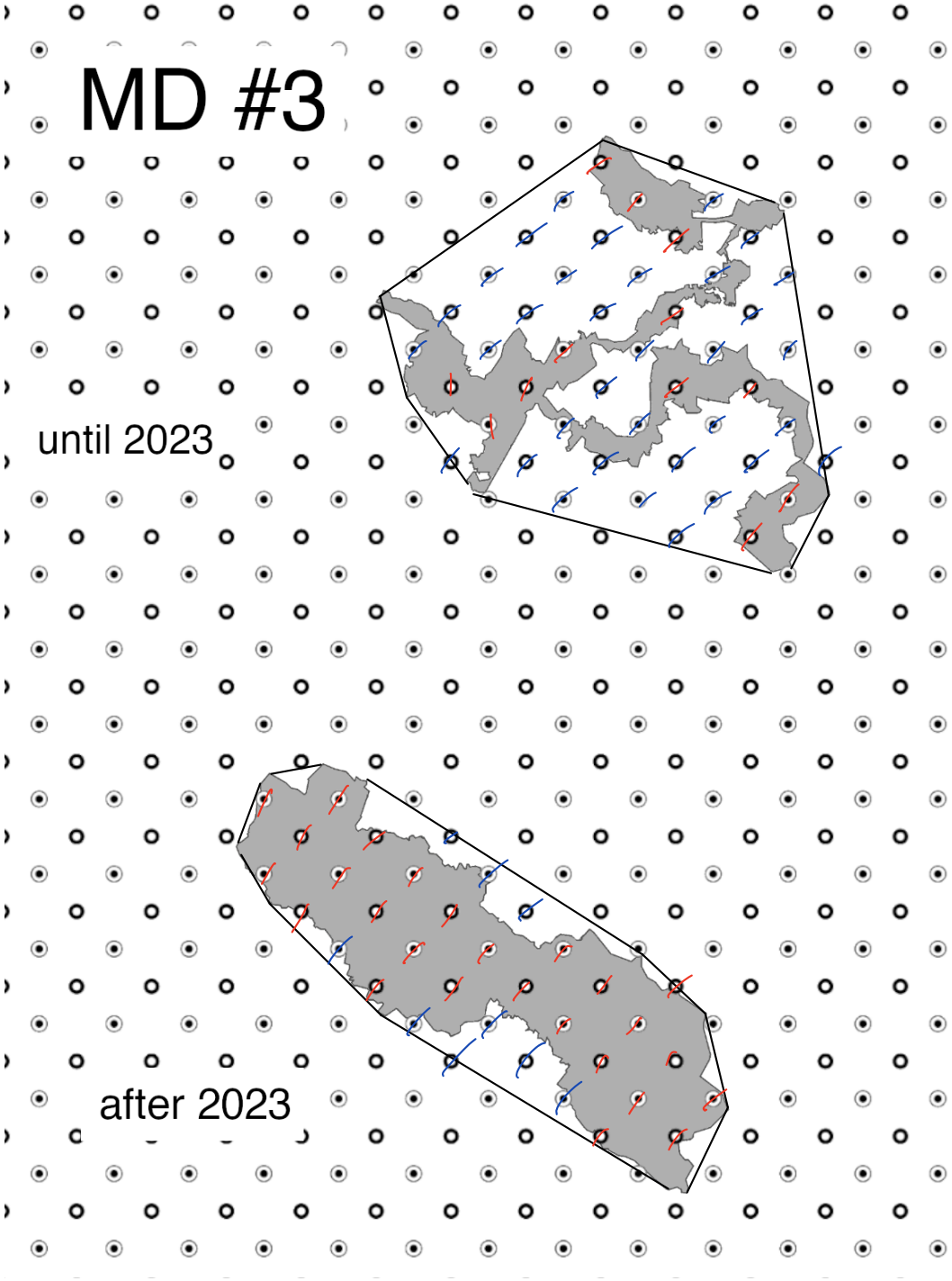
OG: 24
CH: 30

CHR: $\frac{24}{30} = .8$

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

The Nike is closer to 0,
so that's the weirder one.

Question 7. 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.



OG: 12
CH: 46
CHR: $\frac{12}{46} = .26$

OG: 26
CH: 35
$\frac{26}{35} = .74$