Gerrymandering Level 1

We assume that nine people live in a territory represented by a 3×3 grid. Here are the results of the last election between Party **A** and Party **B**.

A	B	A
B	A	B
A	A	B

How many votes did Party A get?	
How many votes did Party B get?	
Who won the election?	

	Number of votes	Percentage
Party A		
Party B		

We decide to divide the 9 people into 3 groups of 3.

First, we split the grid into three groups called **districts**, arranged in vertical lines (each column is one district).

If the election is won by the number of districts won, and not by the total number of votes, who won this election?

How many districts were won by Party A?	
How many districts were won by Party B?	
Who won the election?	

Now, let's try to form the districts horizontally instead.

How many districts were won by Party A?	
How many districts were won by Party B?	
Who won the election?	

Now, choose yourself how to divide the grid into three districts, following these rules:

- Each district must contain exactly three cells.
- The cells of the same district must be connected by a side (horizontally or vertically, and not diagonally).

Try to create districts that favor Party B. Explain how different ways of creating districts can change the result of this election.

« Gerrymandering » = Electoral manipulation

Gerrymandering is when the boundaries of electoral districts are drawn in a certain way to help a party win. Even if this party does not have the majority of votes, it can win more districts by grouping the votes to its advantage.

Gerrymandering Level 2

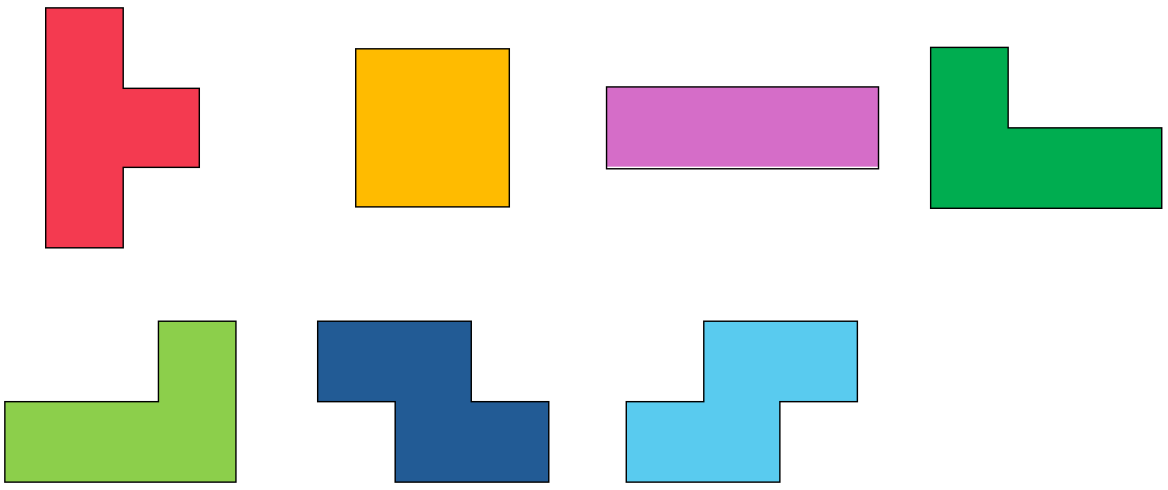
Here is a new case where Party C obtained more votes than Party D. Your mission:

- Find as many ways as possible to create districts of 3 votes (while respecting the previously mentioned rules).
- For each proposal, indicate the party that wins the most districts.

D	D	C
D	C	C
C	D	C

Tetris-style district exploration

Now we work with a 4×4 grid. We decide to create districts containing 4 contiguous cells. Here are the possible shapes of districts up to rotation:



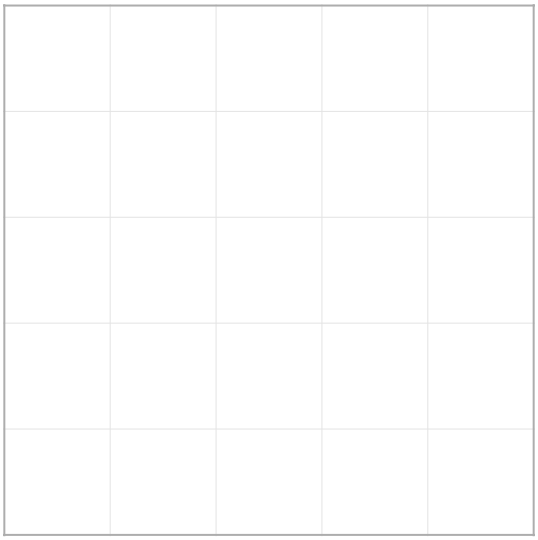
Can you determine many possible ways of decomposing the 4×4 grid with such districts?

Gerrymandering Level 3

There are 25 students in a class who need to elect their class representative. Two candidates are running: Julia and Alex. After the vote, the teacher counts the ballots and obtains the following result:

➔ Alex received 13 votes, and Julia received 12 votes.

Can you arrange the votes for Alex (A) and Julia (J) in the 5×5 grid below such that, if each row is a district of 5 students, **Julia wins the election**?



Could Julia have won the election with fewer than 12 votes? What is the minimum number of votes Julia must obtain to secure victory, using a strategic district division (electoral manipulation)?

Generalization for odd numbers

Number of votes in a district, number of districts	n odd	7
Minimum number of districts needed to win the election		
Minimum number of votes needed in a district to win it		
Minimum number of votes needed to win the election		

What is the minimum percentage needed to win this election ?

Some examples of the minimum number of votes required:

n	minimum number of votes to win	percentage of votes
3		
5		
7		
9		
11		
13		
15		
101		

When the total number of voters becomes **very large**, what does the minimum percentage of votes needed to win the election become?