

Gerrymandering

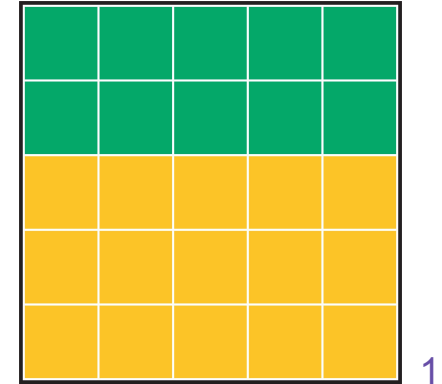


App

jrmf.org

Gerrymandering

In a town of 25 people, there are 15 yellow voters and 10 green voters arranged in the map on the right. Before an election, these 25 people are split up into 5 districts with 5 people in each district. Below are two examples of how these districts could be drawn.



1



Districts	
5 Yellow	0 Green
Winner: Yellow	



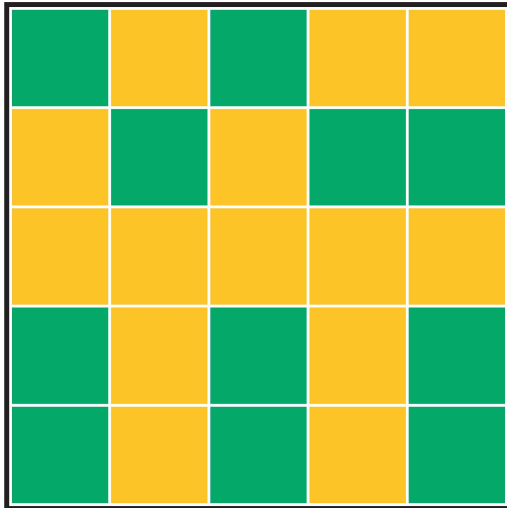
Districts	
2 Yellow	3 Green
Winner: Green	

The winner of each district is the color that shows up the most in that district. The winner of the election is the color that wins the most districts. In the example on the right, green won the election even though there are fewer green voters. Drawing districts to enable this is called gerrymandering.

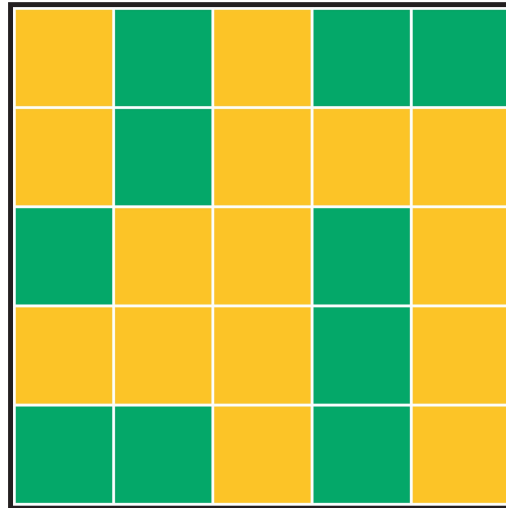


Explorations

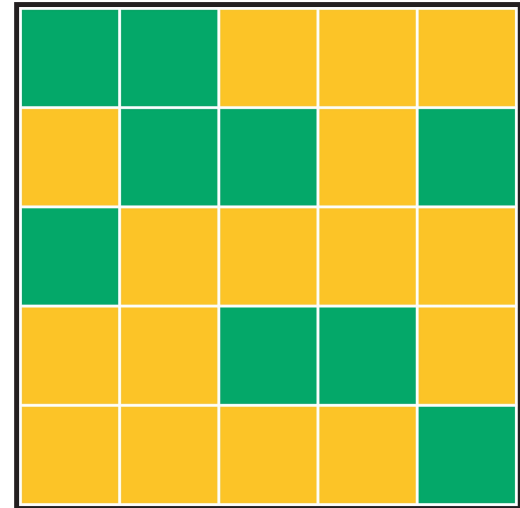
Is it possible to gerrymander each of the maps below so that green wins the election? If so, how? If not, why not?



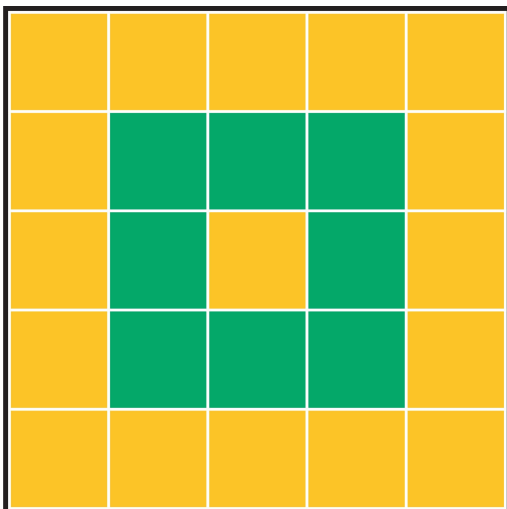
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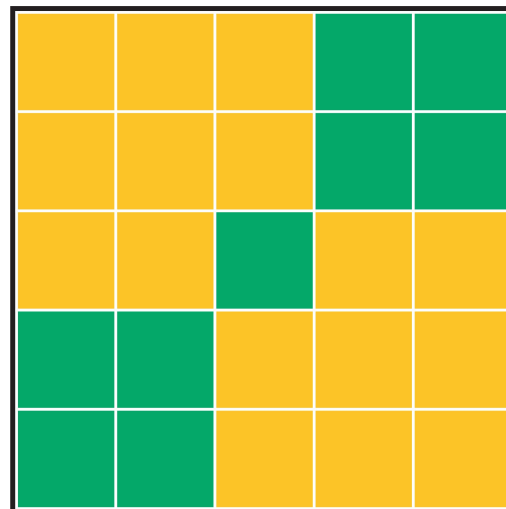
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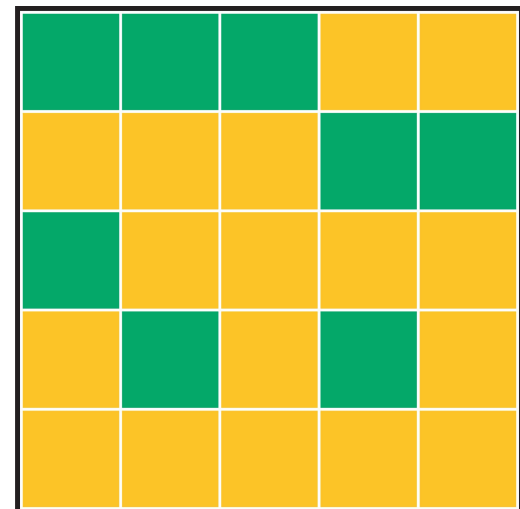
4



5



6



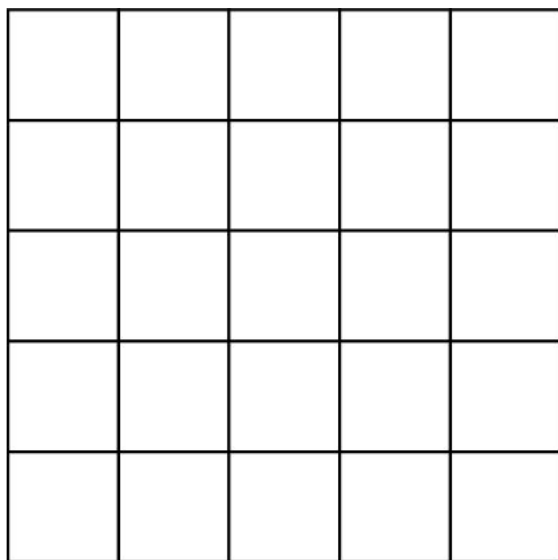
7



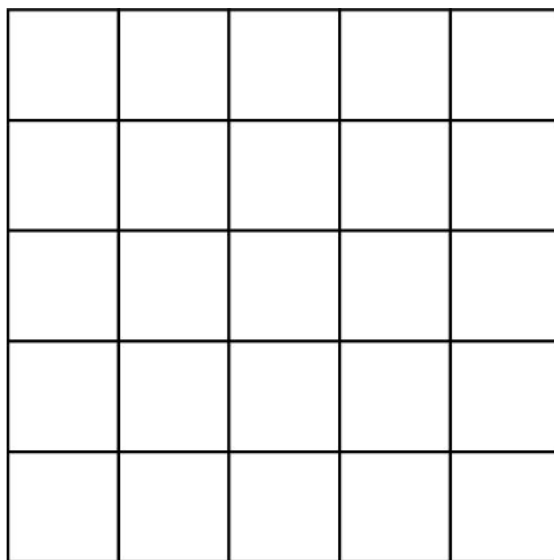
Impossible Maps

Can you color a different-looking map with exactly 9 green squares so that it's impossible for green to win, no matter how the map is divided?
 Can you color a map with 10 green squares so that it's impossible for green to win? 11 green squares?

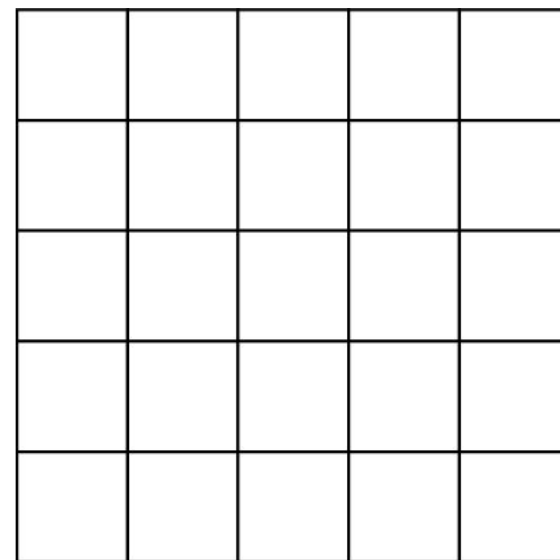
9 Green Squares



10 Green Squares

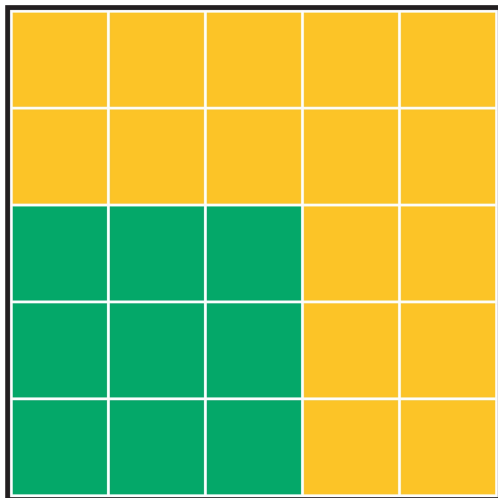


11 Green Squares

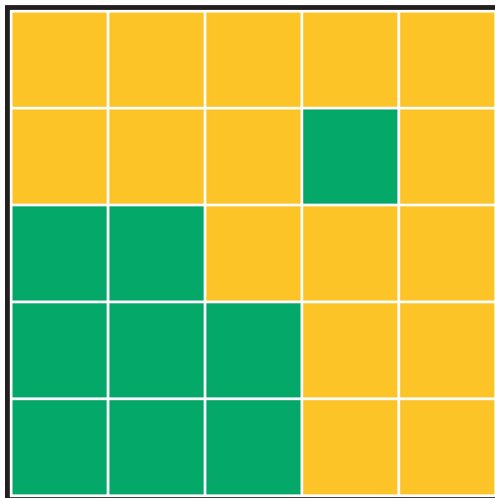


More Explorations

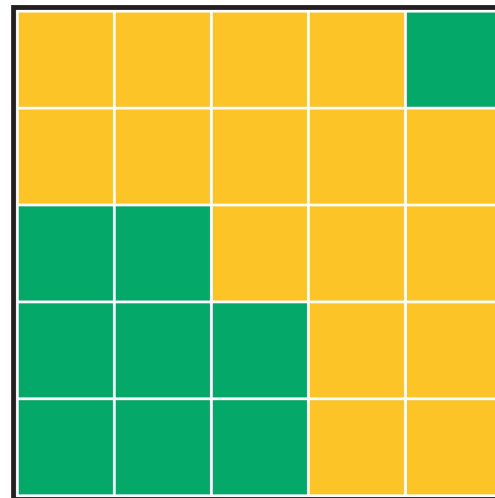
Is it possible to gerrymander each of the maps below so that green wins the election? If so, how? If not, why not?



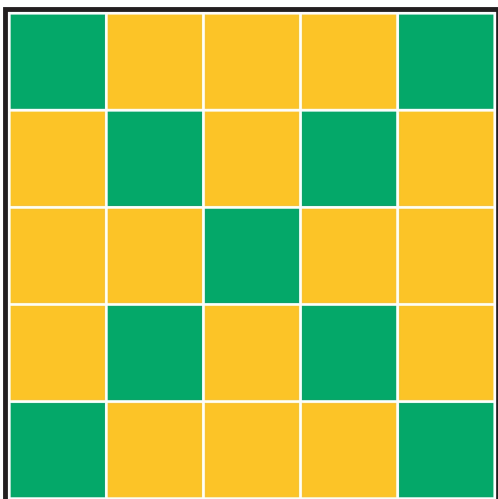
8



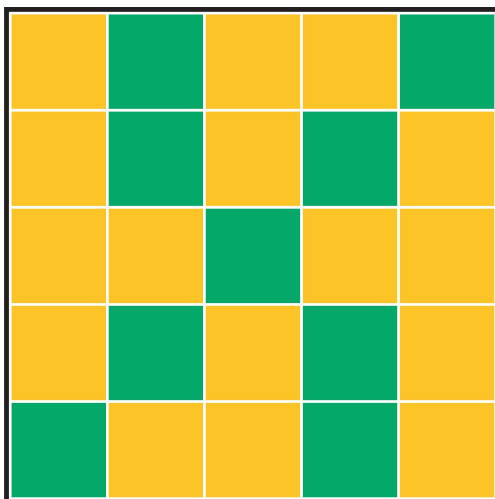
9



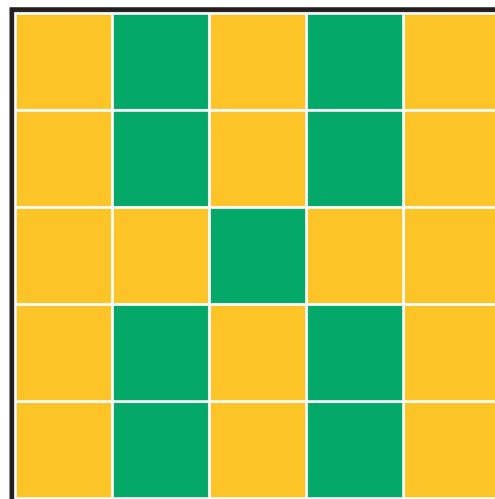
10



11



12

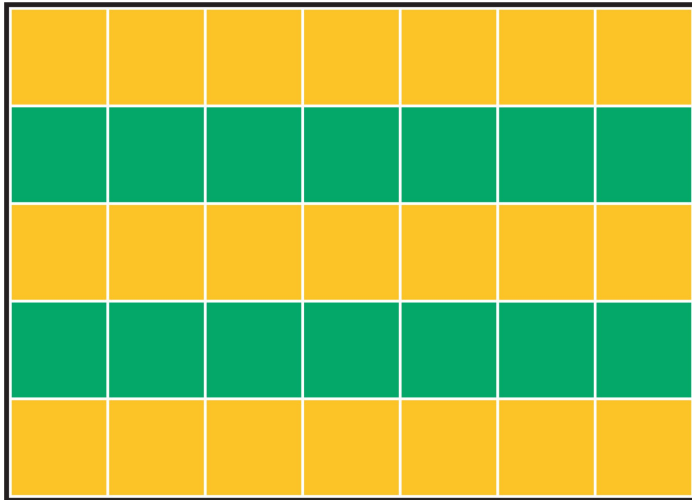


13

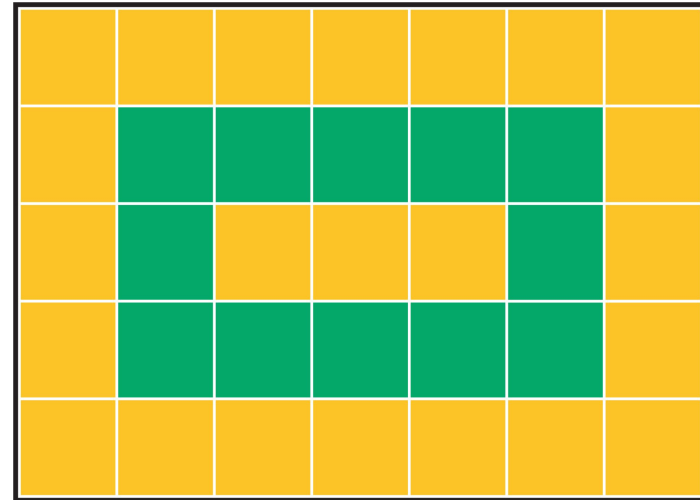


Large Maps

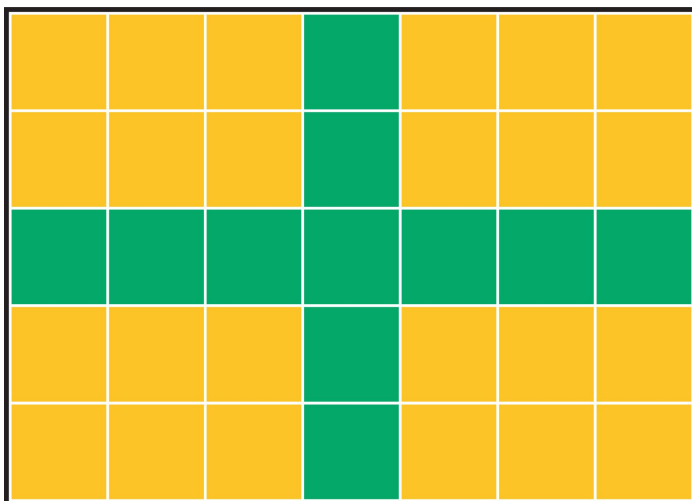
Each town below has 35 people in it. Can you gerrymander each town into 7 districts with 5 people in each district so that green wins? If so, how? If not, why not?



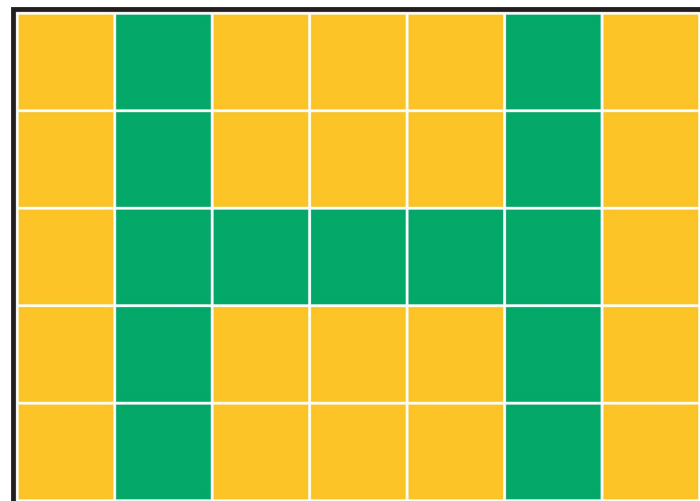
14



15



16

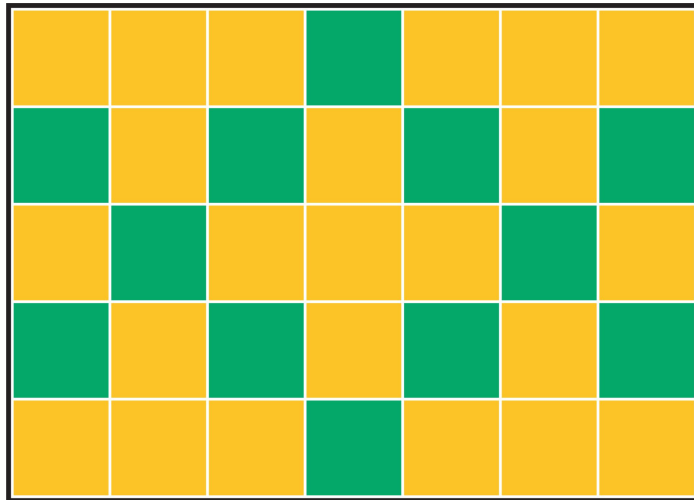


17

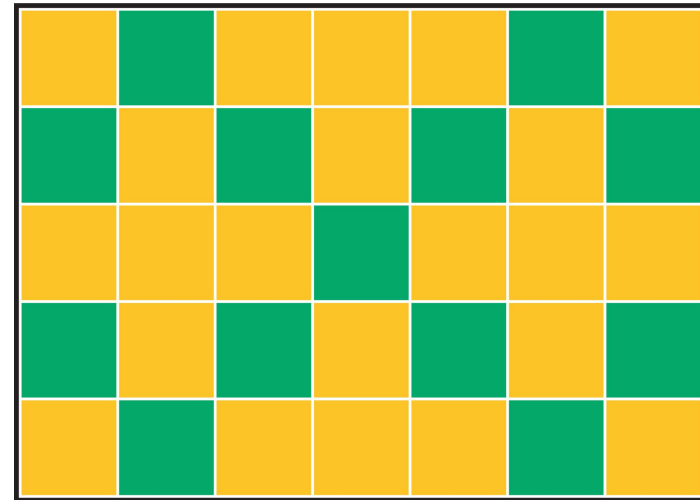


More Large Maps

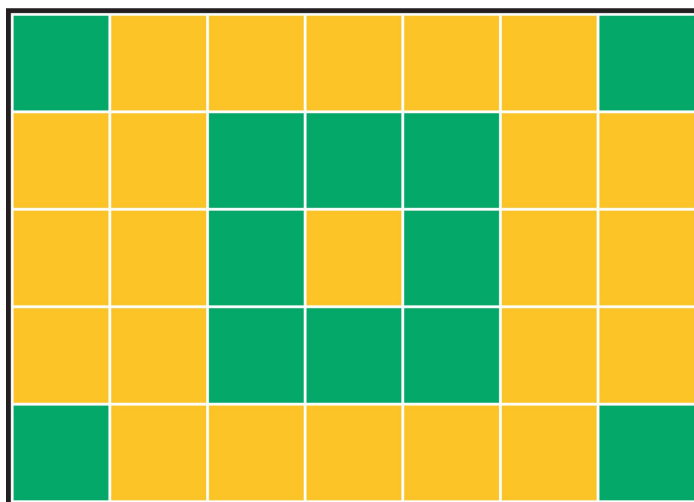
Each town below has 35 people in it. Can you gerrymander each town into 7 districts with 5 people in each district so that green wins? If so, how? If not, why not?



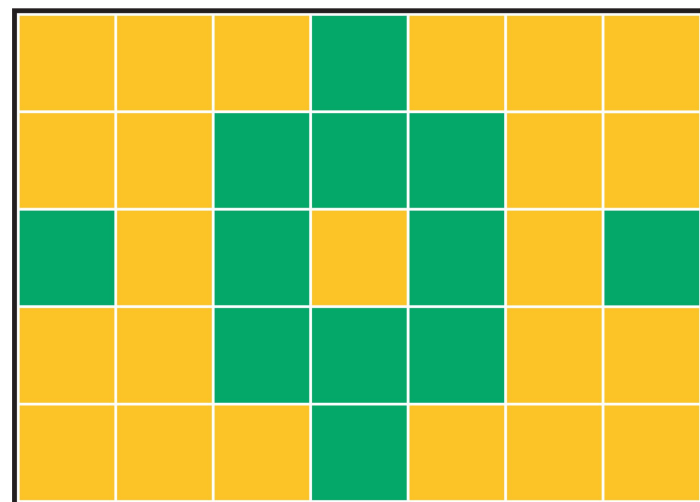
18



19



20



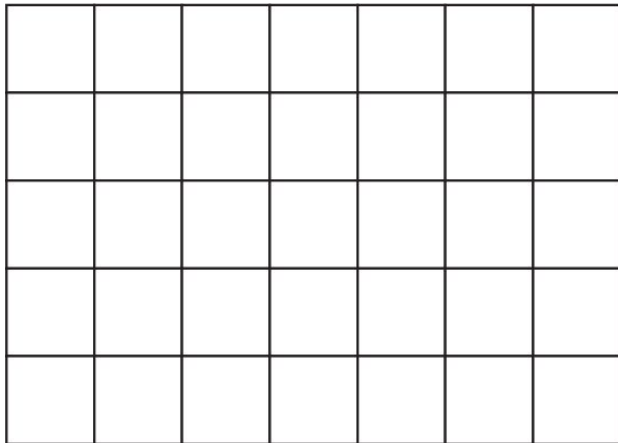
21



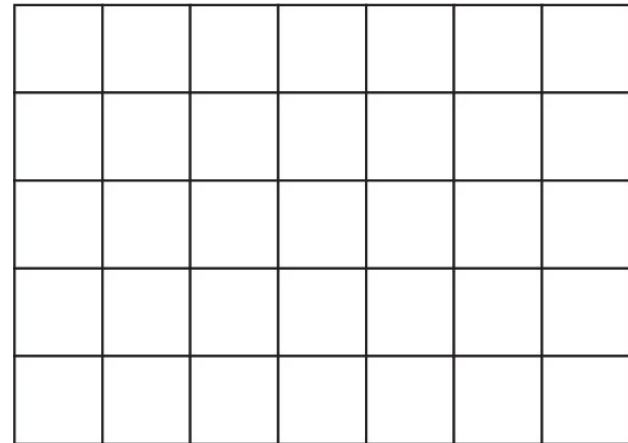
JRMF Impossible Large Maps

Can you color a different-looking map with exactly 12 green squares so that it's impossible for green to win, no matter how the map is divided?
13 green squares? 14 green squares? 15 green squares?

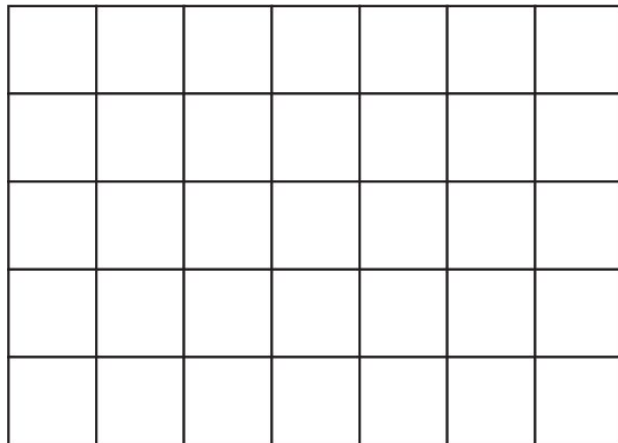
12 Green Squares



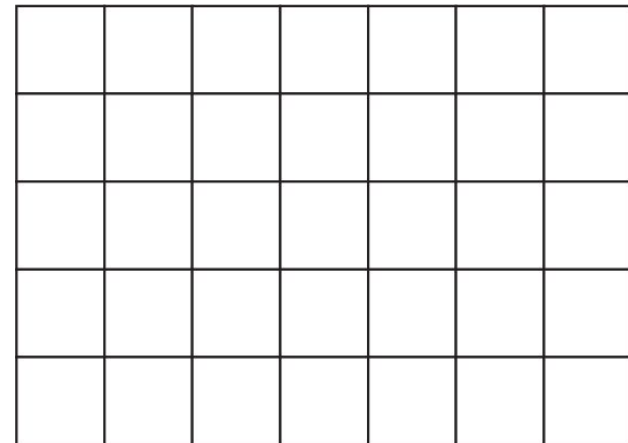
13 Green Squares



14 Green Squares

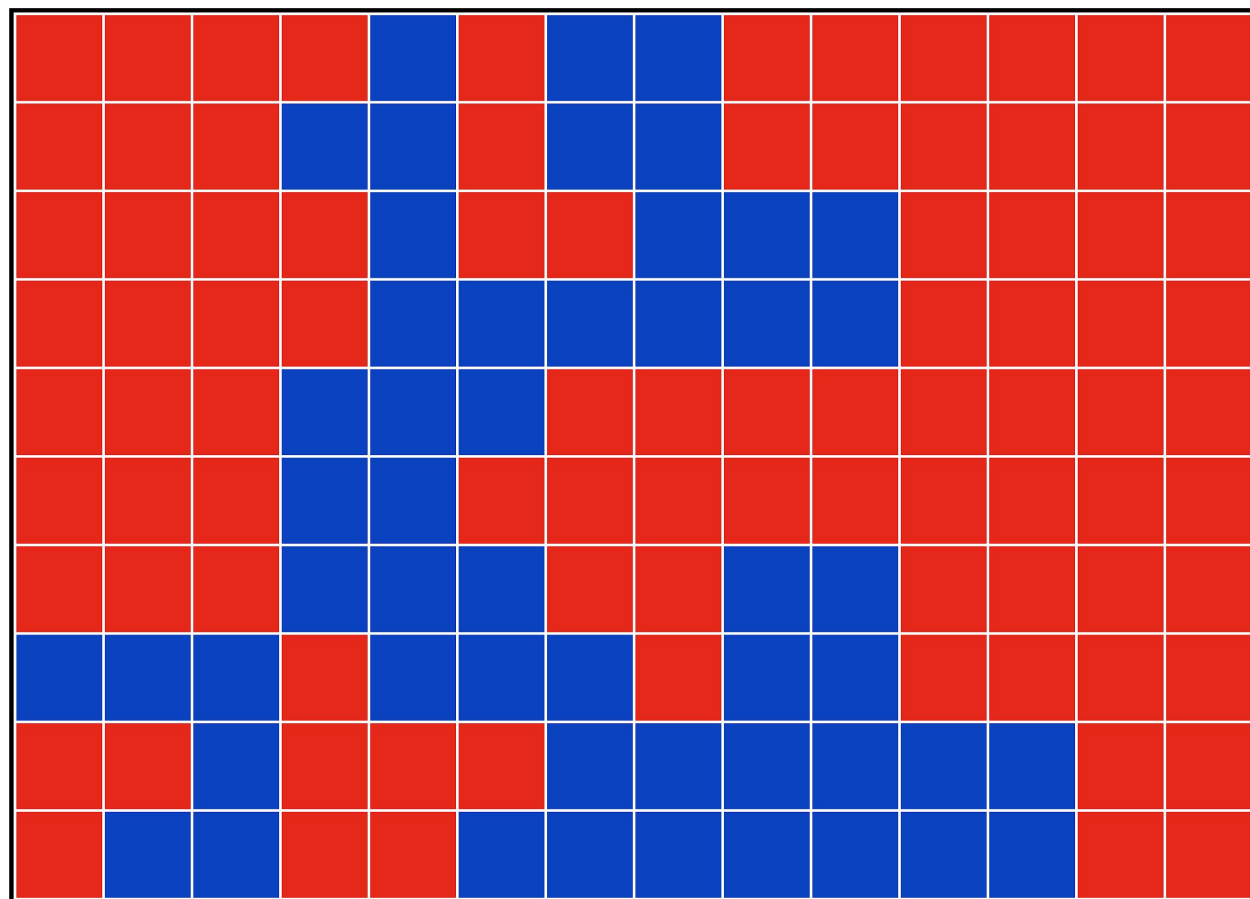


15 Green Squares



Voting in Colorado

In the 2012 US election, the voting map for Colorado looked similar to the map below. Colorado is divided into 7 districts with 20 squares in each district. Can you gerrymander the map below so that blue wins the election? If not, why not? If so, in how many different ways can you do it?



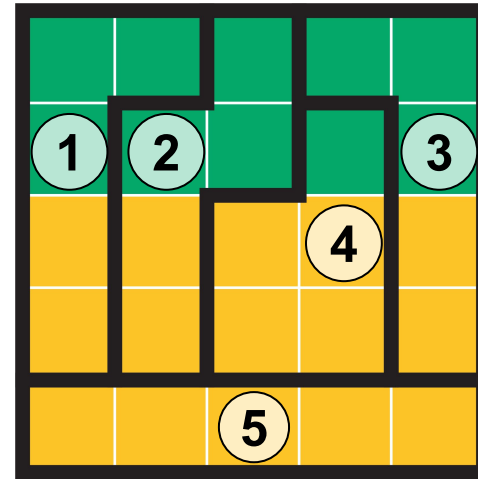
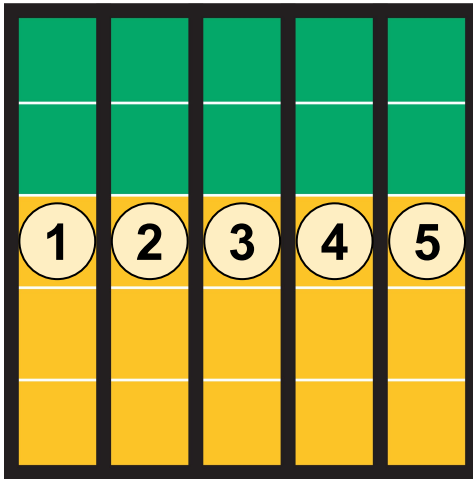
22

Source: <https://fivethirtyeight.com/features/rig-the-election-with-math/>



Wasted Votes

One way to measure the fairness of an election is to count the number of wasted votes. A wasted vote is any vote that does not help to decide who wins a district. In a district with 5 people, only 3 people's votes matter. The other two people's votes are wasted votes, no matter who they vote for.



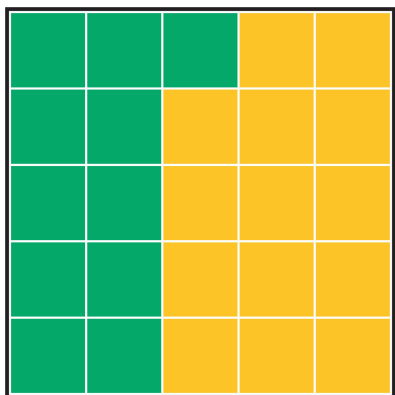
District	Winner	Green Wasted Votes	Yellow Wasted Votes
1	Yellow	2	0
2	Yellow	2	0
3	Yellow	2	0
4	Yellow	2	0
5	Yellow	2	0

District	Winner	Green Wasted Votes	Yellow Wasted Votes
1	Green	0	2
2	Green	0	2
3	Green	0	2
4	Yellow	1	1
5	Yellow	0	2

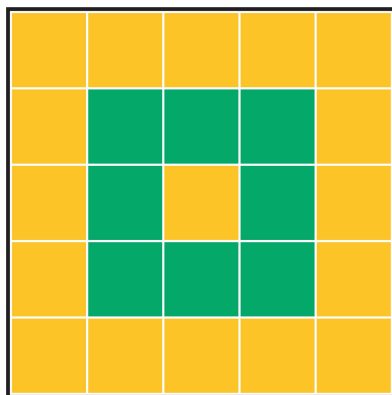


Equally Wasteful

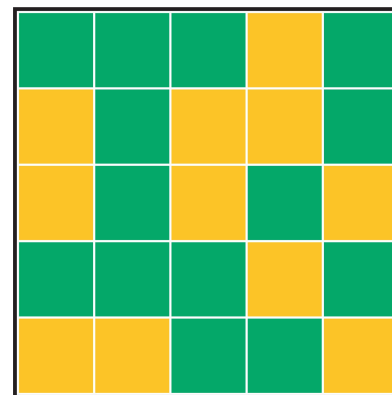
Can you divide each of the following maps into 5 districts with 5 people so that there is an equal number of green and yellow wasted votes? Green does not need to win the election.



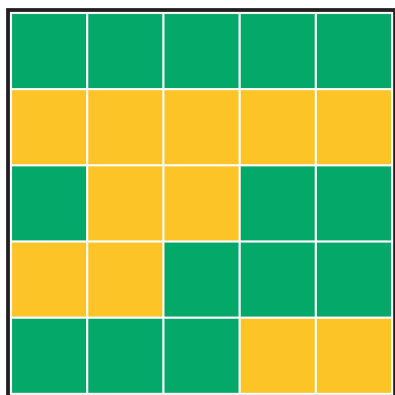
23



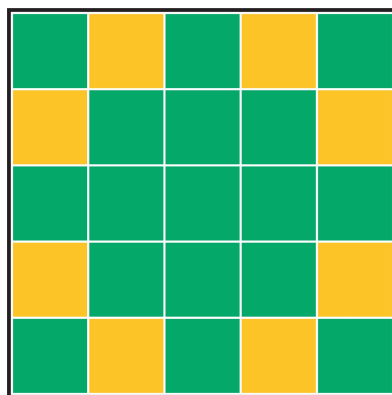
24



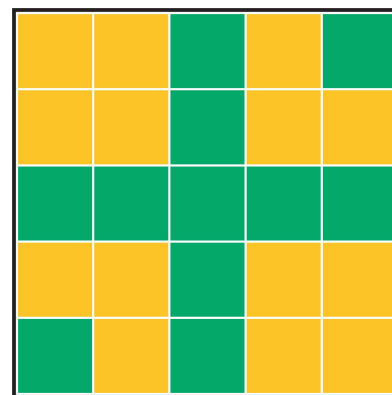
25



26



27



28

Do you think that this restriction leads to a fair election? If so, why? If not, how could you make these elections fairer?



Even Larger Maps

For each of the situations below:

- Create a map so that it is possible for green to win using as few green squares as possible.
- Create a map so that it is impossible for green to win using as many green squares as possible.
- Create a map so that there is the same number of green wasted votes as yellow wasted votes.
- Use the Larger Maps Grid page to create your maps.

7 x 7 Map: 7 districts with 7 people	7 x 11 Map: 7 districts with 11 people	11 x 11 Map: 11 districts with 11 people
11 x 13 Map: 11 districts with 13 people	13 x 13 Map: 13 districts with 13 people	$n \times m$ Map: n districts with m people



