

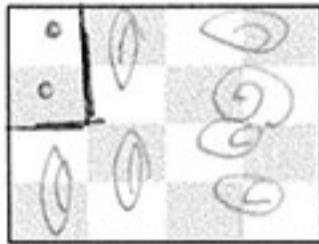
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MA110-Mathematical Explorations

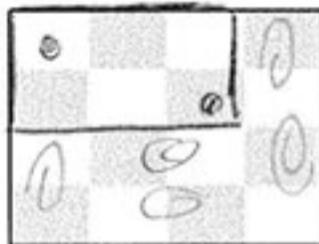
September 30, 2013

Conjecture: When the pennies are on different colored squares then the paper clip always wins.

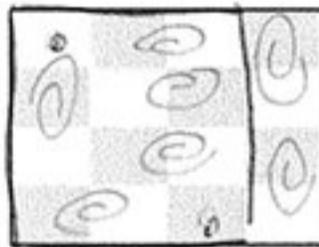
Proof:



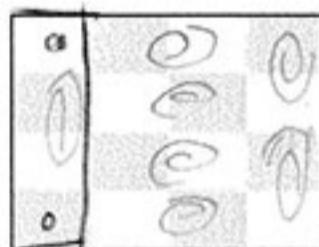
When the two pennies are placed adjacent to each other (both being on 2 different color squares) the pennies act in the way of a paper clip. This is a 1x2 grid. After this grid is made there are an equal number of white and grey squares and therefore the rest of the grid can be filled with paper clips.



These two pennies form a 2x3 grid on the 4x4 square. This grid can be filled with two paper clips regardless of the position on the 4x4 square. After the 2x3 grid is filled with paper clips then there is an equal number of grey and white squares and therefore the rest of the 4x4 square can be filled with paper clips with no squares remaining.



This is a 3x3 grid. This grid can be filled with paper clips. This grid leaves another grid on the square and this grid is 4x1. This grid can also be filled with paper clips with no squares remaining.



This is the 1x4 grid. This grid can be filled with one paper clip. The rest of the 4x4 square is then a 3x3 grid, which was previously explained, and can be filled with paper clips with no remaining squares.

It does not matter where these grids are positioned on the 4x4 square, they will all always work. When pennies are placed on two different colored squares, one of these arrangements will always be the result. These grids all allow for the paper clips to fit one the spaces remaining after you put the two pennies down on the two different colored squares.

Conjecture: When the pennies are on the same colored squares the pennies always wins.

Proof: On the 4x4 checker board, our conjecture that pennies will win and the paper clips lose when the pennies are placed on two of the same colored squares is correct because if

you place two pennies on two different white squares then there will always be two grey squares remaining after you covered all the squares you can with paper clips. These two grey squares cannot be covered with paper clips because in order for them to be covered with paper clips they need to be adjacent from each other and these two squares will be horizontal from each other. This also works when you place the pennies one two different grey squares because there will always be two remaining white squares that are horizontal from each other.