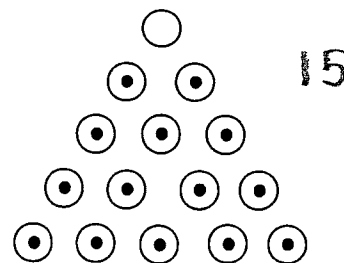


The Math Circle at Canisius,
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The Game of Penny Jumping:

Introduction: Place some pennies onto a nice pattern-board of spots, with some spots left empty. The players take turns jumping a penny over one beside it, to an empty spot in the pattern. The penny which is jumped over is removed. This is sort of like checkers... The player who makes the last jump is the winner.

1. Let's start by creating a nice board of spots to play in. Take ten pennies and arrange them in a triangle on a piece of paper. Spread them out a bit to give each penny a little room, but still forming a triangular pattern lined up horizontally and diagonally. Then draw around each penny to create the nice board of ten spots to play on.

2. Place some pennies on your board and play a few games. How many pennies are left on the board when the game ends? Who wins?

3. Let's be more systematic (that's called the "scientific method"). Start with 3 pennies on the board, but experiment with different starting arrangements. What starting arrangements make the game last the longest?

4. How many 3 penny starting arrangements are there? Are they really all different? Maybe some of these arrangements are geometrically the same; how many *really* different arrangements?

5. Which starting arrangements of 4 pennies let the game end with just one penny on the board? Can you find a starting arrangement of 5 pennies that can continue for 4 moves?

6. You might experiment (“scientific method”) starting with 6, 7, 8... pennies...

7. Instead, let’s start with 9 pennies, with just one open spot. Decide where to put the open spot, and let’s experiment. Try to make as many jumps as possible. Can you get down to just two pennies?

8. The answer to question 7 depends on where you put the open spot to start with...
Can you find positions for the open spot that allow the game to continue until just one penny is left?

9. Let’s try a triangular board of 15 spots. Start with just one empty spot; can you keep jumping until there is just one penny left? The experts claim that it can **always** be done...

10. There are many variations on the penny jumping game, with different boards and different starting positions of the pennies. Usually it is played solitaire, trying to get down to just one penny left. Here are three puzzles to try, on a board where you can only jump vertically and horizontally (not diagonally). Can you end with one penny left?

