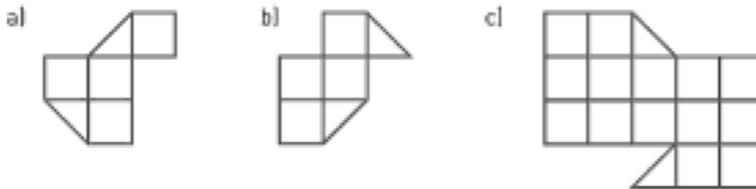# Cat and Mouse and Other Mathematical Games

1   Warm-Up

1. (From last time) Cut each of the shapes in the figure into two parts of the same size and shape. You can cut along grid lines and along diagonals of small squares. The two parts are equal if, after the cut, you can place them on top of each other so they match. It is fine to flip and rotate the shapes.


2   Cricket

2. (From last time) In this problem there is a long straight road.

   (a) A cricket jumps along the road. Every jump takes him 1 meter to the right or to the left. Could it be that in 21 jumps he will end up exactly where he started? Explain.

   (b) Another cricket jumps along the road. On every jump, he leaps 1 meter to the right or to the left. Could it be that in 33 jumps he'll end up at a point 10 meters away from the starting point?

   (c) A brown cricket and a green cricket are sitting on the road 15 meters apart. They start jumping at exactly the same moment. On every jump, each of them leaps 3 meters to the right or to the left. Whenever one jumps, the other jumps too, at the same time. Can they ever land on the same spot simultaneously? Explain.

3   The Game of Cat And Mouse

3. A very polite cat chases an equally polite mouse. They take turns moving on the grid depicted below.
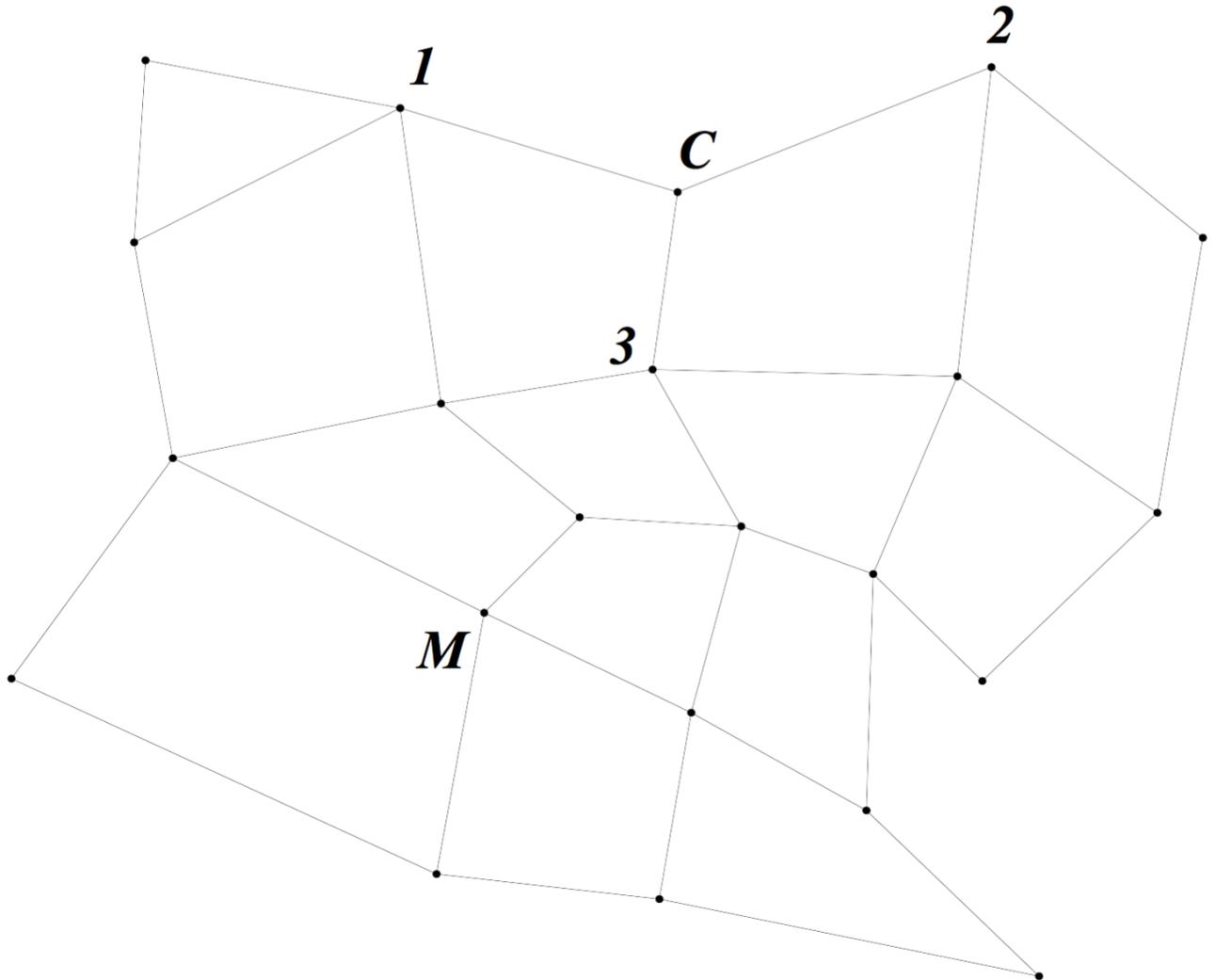

Initially, the cat is at the point labeled C; the mouse is at M. The cat goes first, and can move to any neighboring point connected to it by a single edge. Thus the cat can go to points 1, 2, or 3, but no others, on its first turn. The cat wins if it can reach the mouse in 15 or fewer moves. Can the cat win?

4   Chocolate Bar Games

4. **Break the Bar.** You have a rectangular chocolate bar that is 6 x 8 squares in size. At each step, a player takes one piece of the chocolate and breaks it in two along a single straight line bounded by the squares. For example, you can turn the original bar into a 6 x 2 piece and a 6 x 6 piece, and this latter piece can be turned into a 1 x 6 piece and a 5 x 6 piece. The player who cannot make any more breaks loses.
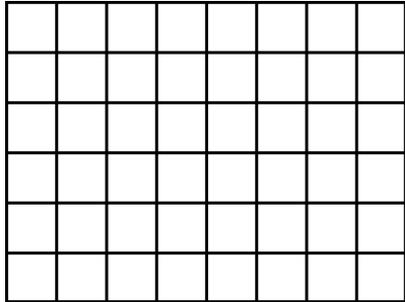
5. **Free a Square.** Two players take turns breaking a rectangular chocolate bar consisting of 5×10 small squares. At each turn, they break along the division lines of the squares. The player who first obtains a single square of chocolate wins.
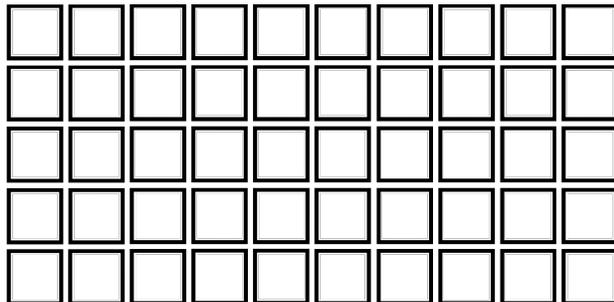
6. **Break the Bar.** Two players take turns breaking a bar of chocolate with 4×8 small squares. The bottom left square is bad and cannot be eaten. At each turn, they may break along one division line and hand the piece containing the bad square to the other player. The player who gets stuck with the single bad square loses.
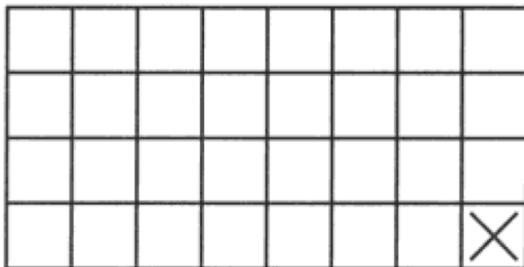
This week's problems are from *Mathematical Circle Diaries, Year 1* by Anna Burago, from *Solve This!* by James Tanton, and from Paul Zeitz.