Mathematical Games I

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- Task: Articulating a winning strategy
- In the process, students refine their understanding of what it means to solve a problem according to the accepted standards of a mathematical argument.

Problem.

Suppose we have 2×7 cadbury dairy milk chocolate. Two players take turns in breaking the chocolate into two pieces along the lines. In every turn, a player breaks the chocolate into two pieces. The player who is not able to break further looses. Who is the winner? player 1 or player 2?

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Solution. Initially, there is one piece of chocolate. At the end of the game there are 14 pieces. During every breaking, number of pieces increases by one. No matter how the game proceeds, the first player always wins.

Problem.

Numbers from 1 to 20 are written in a row. Two players take turn putting minus and plus signs between the numbers. When the process is done, the the number is evaluated. If the number is odd, first player wins. If the number is even, second player wins.
Who is the winner?

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Answer. Second player wins.

Solution. Note that

$$odd \pm odd = even$$

and

$$even \pm even = even$$

Since there are 10 odd numbers, whatever be the signs placed, second player always wins.

Problem.

Ten 1's and ten 2's are written on the blackboard. A move consists of erasing two numbers on the board and replacing it by one number according to the rule: If the two numbers are identical replace it with 2. If they are different, then replace them with 1. First player wins if 1 is left at the end, else second player wins (if 2 remains). Who wins?

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Solution. Note that the parity of 1 does not change. So, the second player wins.

Activity: A game with strategy

There are two piles with 5 pebbles each. In each turn, a player removes some number of pebbles (at least 1) from only one pile. The player who empties the board wins.

What is the strategy to win? Who has the winning strategy, first player or the second?

Experiment, play with the pebbles ...