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Graph coloring games and "nimbers"

There are many variations of graph coloring games. In this project, we discuss a scenario where Alice and Barbara take turns to color the vertices of a given graph, with Alice starting first, so that no adjacent vertices share the same color. The first player who is unable to color a vertex loses the game. We consider the following two versions: 1. Alice uses color A and Barbara uses color B ; 2. both of them use a common color C . Under both versions, we examine various families of graphs and determine which player has a winning strategy. Examples of such families include paths, cycles, rectangular grids, triangular grids, and Cayley graphs, etc. We also prove some general assertions about all graphs. "Nimbers", also known as Grundy numbers, are involved in some of these proofs.