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Computational Hardness of Undirected Geography Nimbers

The outcome class of Undirected Geography positions is known to be solvable in polynomial time using maximum matchings. We show in this talk, however, that determining the nimber value of N-positions is PSPACE-complete. The authors are aware of no other easy impartial rulesets with hard nimbers. The reduction from Directed Geography provides hardness even on planar graphs and graphs with at least a maximum degree of four. As a corollary, we show that it is PSPACE-hard to find a single Undirected Geography position equivalent to the sum of two others. Additionally, it is hard to find the outcome class of the sum of Undirected Geography position, as well as the generalized variant with multiple tokens.