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Oral Presentation O8.4

2-(51, 6, 1) BLOCK DESIGNS

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A graph decomposition problem is a classical problem in combinatorics that involves breaking a large graph into small identical pieces. Mathematicians have a long history working on this type of problem, but many of the problem instancesstill remain unsolved. The major difficulty is that the search space for an answer is usually massive; to check every potential solution manually would take more than a lifetime (or the lifetime of the universe, even!). In this work, we are interested in looking at this old problem in a new way -- we explore it from a computational perspective. Computers are known to be great at doing repetitive task -- can we come up with a procedure for a computer to follow, or, say, encode the problem in a way computer can understand, so that we could use a computer to solve it? We addressed the above questions by translating the graph decomposition problem into the Boolean Satisfiability Problem (SAT), a well-studied problem in computer science. Many efficient algorithms have been proposed in the past two decades. We explore whether the recent advances in the field enable us to solve more unknown cases in the graph decomposition problem.