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Fast Enumeration of All Independent Sets of a Graph

An *independent set* of a graph G is a set of vertices of G which are pairwise non-adjacent. There are many applications for which the input is a graph G with a large symmetry group and the goal is to generate either all of the independent sets or all of the maximum independent sets up to isomorphism. We present a very fast practical algorithm for this problem. The tactic can also be applied to many other problems: some examples are generation of all colourings or matchings of a graph up to isomorphism. Two applications are given to illustrate the utility of this algorithm: finding all independent sets of the C60 and C70 fullerenes, and also the problem of finding a maximum set of vertices at distance four or more in the 120-cell.

This is joint work with Patrick Fowler.