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Counting Partitions of Graphs

We study the complexity of counting graph partitions described by a symmetric $\{0, 1, *\}$ -matrix M which generalize graph colourings and homomorphisms. The complexity of counting graph homomorphisms have been previously classified, and most turned out to be $\#P$ -complete, with only trivial exceptions. By contrast, we exhibit M -partition problems with interesting non-trivial counting algorithms. We classify the complexity of counting M -partitions for all matrices M of size less than four. Among matrices not accounted for by the existing results on counting homomorphisms, all matrices which do not contain the matrices for independent sets or cliques yield tractable counting problems.