# Parameterized Complexity Dichotomy for $(r, \ell)$-Vertex Deletion

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**Abstract:**

For two integers $r, \ell \geq 0$, a graph $G = (V, E)$ is an $(r, \ell)$-*graph* if $V$ can be partitioned into $r$ independent sets and $\ell$ cliques. In the parameterized $(r, \ell)$-Vertex Deletion problem, given a graph $G$ and an integer $k$, one has to decide whether at most $k$ vertices can be removed from $G$ to obtain an $(r, \ell)$-graph. This problem is NP-hard if $r + \ell \geq 1$ and encompasses several relevant problems such as Vertex Cover and Odd Cycle Transversal. The parameterized complexity of $(r, \ell)$-Vertex Deletion was known for all values of $(r, \ell)$ except for $(2, 1)$, $(1, 2)$, and $(2, 2)$. We prove that each of these three cases is FPT and, furthermore, solvable in single-exponential time, which is asymptotically optimal in terms of $k$. We consider as well the version of $(r, \ell)$-Vertex Deletion where the set of vertices to be removed has to induce an independent set, and provide also a parameterized complexity dichotomy for this problem.