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A topology-free topological method (3 hours)

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Over the last dozen years or so, certain topological methods have been developed and used to prove a family of results related to the following general problem. Let G be a graph whose vertex set is partitioned into nonempty sets V_1, \dots, V_r . What conditions will guarantee that G contains an independent set $\{v_1, \dots, v_r\}$ such that $v_i \in V_i$ for each i ? This family of results includes theorems on matchings in hypergraphs, list colouring, strong colouring, and Aharoni's proof of Ryser's long-standing conjecture on packing and covering in tripartite hypergraphs. The topological arguments used are based on the notion of topological connectivity of simplicial complexes. In these lectures we show how to develop this theory using only elementary combinatorial arguments. Thus we avoid any explicit use of topology, though topological intuition still plays a role.

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