Some topological aspects of combinatorics

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This talk will outline a topological approach to the study of the number of independent sets of a matroid. For any matroid, the collection of independent sets is an abstract simplicial complex, so that one can think of the independent sets of a matroid as being *faces* of this simplicial complex (often called a *matroid complex*). We will discuss some topological decomposition properties of the geometric realization of a matroid complex. These properties are related to the classical notion of a *shelling* of a convex polytope. We will show how the existence of these decompositions lead to numerical conditions on the number of independent sets of the matroid. The lecture will highlight the close connection between these results and analogous problems of counting the number of faces of simplicial polytopes. The talk will not assume any knowledge of matroid theory, however, some familiarity with elementary concepts in graph theory and topology will be helpful.