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# Relaxations of the matroid axioms I: Independence, Exchange and Circuits

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## Abstract

Motivated by a question of Duval and Reiner about higher Laplacians of simplicial complexes, we describe various relaxations of the defining axioms of matroid theory to obtain larger classes of simplicial complexes that contain pure shifted simplicial complexes. The resulting classes retain some of the matroid properties and allow us to classify matroid properties according to the relevant axioms needed to prove them. We illustrate this by discussing Tutte polynomials. Furthermore, we extend a conjecture of Stanley on h-vectors and provide evidence to show that the extension is better suited than matroids to study the conjecture.

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