Matroids and binary functions

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A *binary function* is a function $f : 2^E \to \mathbb{C}$ for which $f(\emptyset) = 1$, where E is a finite ground set. Binary functions are closely related to quantum registers. They generalise binary matroids in the sense that any indicator function of a linear space over GF(2) is a $\{0, 1\}$-valued binary function (using the natural correspondence between subsets of E and their characteristic vectors in $\mathrm{GF}(2)^E$); in fact, the author showed in 1993 that *every* matroid has an associated binary function, although it will not necessarily be just $\{0, 1\}$-valued.

In a series of papers over 1993-2019, the author generalised some standard matroid transforms and operations —including rank, deletion, contraction, and duality (via the Hadamard transform) —to binary functions, and gave new versions of them that are parameterised by the complex numbers. In each of these settings, a theory of Tutte-Whitney polynomials was developed.

In this talk we review this work and discuss some recent results.

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