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Non-Commutative Majorization

The notion of majorization of one self-adjoint $n \times n$ matrix by another is a very useful concept in matrix/operator theory. For example, a classical theorem of Schur and Horn states that a diagonal matrix D is majorized by a self-adjoint matrix B if and only if a unitary conjugate of B has the same diagonal as D. Some equivalent characterizations of A being majorized by B include there existing a doubly stochastic matrix that maps the vector or eigenvalues of B to the the vector or eigenvalues of A, tracial inequalities involving convex functions of A and B, and there exists a mixed unitary quantum channel that maps B to A.

Given the prevalence of qunatum information theory, the following is an interesting question in the context of matrix/operator theory: given m-tuples A_1, ..., A_m and B_1, ..., B_m of $n \times n$ matrices, can a mathematical condition be given for when there exists a unital quantum channel Φ such that $\Phi(B_k) = A_k$ for all k. In this talk, we answer this question using non-commutative Choquet Theory as developed by Davidson and Kennedy.

This talk is based on joint works with Kennedy.