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An Approach to Quantum State Pooling from Quantum Conditional Independence[1]

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In approaches to quantum theory in which the quantum state is taken to represent an agent's belief, knowledge or information about a physical system, it is legitimate for different agents to assign different states to one and the same physical system. The question then arises of what state they should assign if they get together and share their information about the system. This is the problem of quantum state pooling. The classical counterpart of this problem for probability distributions only has a unique solution under additional assumptions about how the data are collected, such as conditional independence constraints. Recently, Spekkens and Wiseman found a quantum pooling rule analogous to the classical one, which is valid if the differing state assignments arise from making indirect measurements on special classes of tripartite quantum state. We show that this pooling rule applies to a much wider class of tripartite states, and that its validity rests on quantum analogs of conditional independence recently studied by one of the authors, as well as a generalization of the notion of a sufficient statistic to the quantum case. Work done in collaboration with Robert Spekkens, University of Cambridge.

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