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On the semantics of reversible computation

The study of reversible computation is of some foundational interest as quantum computations and fundamental physical processes are thought to be reversible. These settings, being non-classical, are particularly amenable to category theoretic techniques. The aim of the talk is to present a general structural account of reversible computation using discrete inverse categories and to state a—surprisingly general—equivalence between reversible and non-reversible computations. The importance of the equivalence is that it provides a mechanism for systematically and accurately transporting classical ideas into the reversible world.

Technically this theorem is an equivalence of categories between the category of discrete Cartesian restriction categories and the category of discrete inverse categories. Discrete inverse categories are monoidal inverse categories in which every object naturally carries a Frobenius algebra structure. The unexpected aspect—for me—was that one can uniquely reconstruct a (special sort of) "classical" world from this structure. The talk will introduce these structures and state the result!

This is joint work with Brett Giles.