INDEXED MONOIDAL STRUCTURES AND REGULAR DOUBLE HYPERDOCTRINES

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The semantics for logical quantification is subject to the Beck-Chevalley and Frobenius conditions, and it is well-known that the former is representable: they correspond to double functors out of a span double category. I'll talk about how the Frobenius law can also be captured from the double-categorical point of view — it corresponds to the double functor additionally having a symmetric monoidal structure for which the monoidal laxators are companion commuters (in the sense of Paré). This suggests a notion of regular double hyperdoctrine, which generalises the usual regular hyperdoctrines and neatly splits apart and organises the different settings of the logic that we may want to fine tune. Syntax is handled by a domain double category, the flavour of adjunction being used for the semantics of quantification is determined by the codomain double category, and the type of conjunction on propositions (which may be a non-cartesian tensor product) is defined by the monoidal structure of the semantics functor. If time permits, I'll explain how these ideas can be used to recover a form of graphical regular logic useful for the study of specifications of systems that compose operadically.