Instant Quantum Partial Observations

by Sven Nilsen, 2020

In this paper I discuss the semantics of instant partial observations of quantum functions.

In the paper “Quantum Propagation”, I mentioned that at any given instant, every outcome of a partial observation `g` is equally probable if `f` is semi quantum (all amplitudes have same length):

$g \cdot f$ `g` is a partial observation of a semi quantum function `f`

$f : () \rightarrow \mathbb{B}^n$ `f` is semi quantum $|\exists_{pc}f| \Leftrightarrow \exists_p f$
$g : \mathbb{B}^n \rightarrow \mathbb{B}^m$ $m < n$

For simplicity, I will use `m = 1` the rest of this paper.

The intuition is that assuming some level of theorem proving abilities, one can construct a pair of complex probability amplitudes `a` and `b` in the expanded quantum propagation product:

$(a, b) : \mathbb{C} \times \mathbb{C}$

$\exists_{pc}f \Leftrightarrow x$ Use `x` as shorthand for the complex probabilistic existential path

$a = x_0 x_1^*$ `a` is a basis vector under quantum propagation
$b = x_2 x_3^*$ `b` is a basis vector under quantum propagation

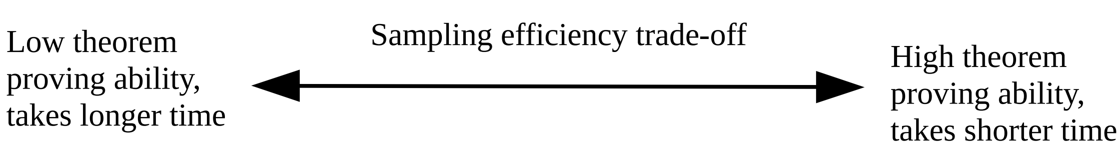
$[0, 1, 2, 3] : ?\mathbb{N}$ Higher order non-deterministic natural numbers (read: samples)

Such that:

$g(0) = g(1)$ $g(2) = g(3)$ $g(0) < g(2)$

There is no coincidence that this was in the paper about “Higher Order Non-Deterministic Diagrams”. I am trying to understand how high the level of theorem proving ability is required to find a sampling algorithm, no matter which partial observation `g` that is chosen.

It is understood that this sampling algorithm is not trivial to write down in its most efficient form, but I assume that it will be unique in the sense that all output pairs will have same statistical properties. Under this assumption, there is a trade-off between theorem proving abilities and time:



Therefore, instant quantum partial observations belongs to a computational complexity class with respect to some oracle where one can take “every path” when interpretated as a statistical limit in itself. For `m` bits in the partial observation, it is not possible to extract more than `m` bits of information.