Universität
Konstanz

Logik
Kolloquium

20. Januar 2020, 15:15 – 16:45 Uhr
Universität Konstanz, Raum F 420

An introduction to Non-Archimedean Probability

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Abstract:

In this talk I will give an introduction to both the philosophical and mathematical aspects of non-Archimedean Probability theory. We start with motivations: why might philosophers seek an alternative notion when, in mathematics, the definitions of Kolmogorov are standard? One motivation is the idea of a fair lottery on a countably infinite set - e.g. the natural numbers - seems to make sense, but this cannot be modelled by a standard (Kolmogorov) probability function. Another motivation is that the Kolmogorov axioms entail that to model a fair lottery on an uncountable set, a probability function must give probability zero to any point-event. So, for instance, when throwing a dart at a dart board, the probability of hitting any point on the board is zero, despite the probability of hitting some point on the board being 1 (or close to it).
These considerations lead us to non-Archimedean Probability, where an event, such as the dart hitting a particular point, is given an infinitesimal probability, smaller than any positive real number but still greater than zero. I explore one such theory of non-Archimedean Probability, where the probability functions satisfy a type of "perfect" additivity which makes sense for sets of any cardinality. I will explore some of the interesting mathematical aspects of this theory, as well as its philosophical advantages.