

Report on the habilitation thesis "Kategoriálny prístup k pravdepodobnosti" (the author of the thesis is Martin Papčo)

In the series of 10 papers (2004 – 2015) the author studies the relation between the classical and generalized (resp. fuzzy) probability when viewed category-theory-wise. He manages to justify this approach and derive quite a few interesting results. His effort brought about a very good habilitation thesis.

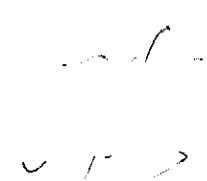
In the first part of the thesis the author presents some reasons "why to go categorical". He demonstrates a rather broad knowledge of mathematical structures and (intellectual) applications of category theory. The choice of references is carefully thought-out and makes the introduction well readable. (The apology for the category theory nowadays, however, may be a bit of the proverbial breaking into the open door. Though some opponents still remain among leading mathematicians, the category theory has found its place in almost any field of modern mathematics.)

Let us review – in a simplified form – some of the results of the thesis. After introducing the category ID of the convergence D-posets with the sequentially continuous D-morphisms, the author establishes a duality of ID and a certain subcategory (called MID) of the category of generalized measurable spaces. Then he finds interesting epireflective subcategories of ID and MID. Further, he substantially contributes to the analysis of the fuzzy random variables the latter being introduced by Bugajski and Gudder. In the sequel, he deals with the category IE of effect algebras. He shows the isomorphism between IE and ID and studies some other categorical phenomena. Then he goes on in the categorical approach of "fuzzification" showing that the corresponding functor allows for an extension to an epireflector. Next, he finds (and applies) an integral representation of sequentially continuous D-morphisms on generalized Łukasiewicz tribes. As a result, he again proves the virtue of the category ID. He then deals with the ultraproduct technique and the approximate continuity. Elsewhere, he pursues statistical maps and random walks. In the continuation of the thesis, the author introduces the category SnD based on an n-dimensional simplex and presents its useful properties in a generalized probability theory. In some other research, the author considers categories of probability spaces and observables – some categories CP and FP – and clarifies their properties. A subcategory of FP is seen to be isomorphic with CP. Finally, he indicates a tensor modification of ID-probabilities and comments on further considerations.

The style of the thesis is very good and professional. Some minor clerical errors are attached after the report proper (over). They do not negatively affect the quality of the thesis. Potential questions of the reviewer are included in the attachment, too. – I hesitate to comment on the candidate teaching and organisational ability. I do not know him so well. From what I can tell after listening to his presentations at international conferences, I believe that also in this aspect the candidate meets the requirements asked for a docent.

Resume: The thesis satisfies the standard criteria for the habilitation. Dr. Martin Papčo considerably contributes to topical questions of probability theory and category theory. I quite value his research effort. Thus, I r e c o m m e n d that Dr. Martin Papčo be awarded, after a successful defence, the title docent.

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