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## LICS2021 submission 207

1 message

LICS2021 <lics2021@easychair.org>  
 To: Luke Ong <Luke.Ong@cs.ox.ac.uk>

22 March 2021 at 07:22

Dear authors,

we have the following question about your submission  
 to LICS2021 entitled

Supermartingales, Ranking Functions and Probabilistic Lambda Calculus.

We received an additional review during the discussion phase. It mentions a question for rebuttal. It would have been unfair not to seek your response but please try to do it quickly (if you wish to respond of course) considering the advanced stage of the LICS PC.

all the best  
 Leonid

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This paper extends expectation-based reasoning for (positive) almost-sure termination from first-order imperative programs a la [18,25] to higher-order functional programs, i.e. to a probabilistic lambda calculus. One could argue that this extension is rather straight-forward. I would instead say that it is rather clean and hence very valuable. Furthermore, "executing" lambda-terms is much less straight-forward than executing first-order programs due to (a) potentially many intermediate reduction steps until reaching another reduction of the Y-combinator (analogous to reaching the loop-head in a first-order program) and (b) potentially ambiguous reduction orders. Both (a) and (b) pose technical difficulties in lifting the (P)AST proof rules from first-order to higher order. The solution proposed for (a) - sparse ranking functions - is again a very clean and easy to comprehend solution. The solution for (b), I had difficulties understanding, which is partly because I am not an expert on lambda calculi.

Overall, I would - perhaps weakly - support acceptance of this paper. Why weakly? I found the paper rather dense, Section VI (Confluent Trace Semantics) in particular. I believe, it is quite difficult to read this paper, if one does not speak (simply typed) lambda fluently and I also believe that this aspect could well be improved significantly in order to make the paper more accessible to a wider audience.

Questions for Rebuttal:

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Regarding Theorem V.15: Could you elaborate on why exactly this theorem does NOT solve the open problem of completeness of antitone ranking supermartingales? Where/what exactly is the gap? What's missing to prove completeness? Furthermore, what does Theorem V.15 tell us, intuitively?

More Detailed Comments:

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p2: high-order -> higher-order

p2: The role of the environment Gamma is not at all clear here. Only in Figure 1 it is needed and without explanation, Figure 1 is very difficult to understand for someone who is not fluent in lambda calculi. Please explain the role of Gamma and provide some intuition on the Y-combinator in order to make the paper more accessible to non-lambda-experts.

p2, Section II.B begins with "This version...". Which version is meant here? Furthermore, the second sentence is entirely unclear to me. And the first two paragraphs of this subsection I find rather dense and lacking intuition. This could be improved quite easily.

p3, Definition III.1 Please put a space after the superscript 2 in  $N^2$ . I first thought the authors mean a pair  $N \times N$  instead of a footnote.