



15 March 2018

## Reference for Christian Bean

I've been Christian's second PhD advisor since the autumn of 2014. Christian and I have a joint paper, with Henning Ulfarsson, published in the Journal of Integer Sequences. It's on permutations simultaneously avoiding a vincular and a covincular pattern. Christian took the lead on this joint research project, which turned out to be quite a bit more demanding than we first thought. "Problems worthy of attack prove their worth by fighting back" as Danish mathematician Piet Hein once quipped.

Since then Christian has coauthored a couple more papers/preprints, but his main contribution has been to the Telescope/ATRAP project. This is a novel effort to make automatic many of the techniques used in studying permutation patterns. It's an extensive project that is partly financed by Rannís and it's principal investigator is Henning Ulfarsson. This exceedingly non-trivial work involves understanding and formalizing techniques, often used in an ad hoc manner, in the literature, and then implementing those techniques in software.

When I first met Christian he was a good programmer and a solid mathematician even though a bit sloppy with details at times. He has since developed his skills very rapidly and is now an expert programmer as well as an expert in Enumerative Combinatorics. He has also learned the hard way (e.g. through programming and debugging) to be a lot more careful with the details.

Christian is the main developer and maintainer of Telescope/ATRAP. This program can already produce results (automatically), with proofs, that a large number of papers have been written on. It has also produced results that are truly original and not yet in the literature. I expect it to have a big impact on the research field of permutation patterns in the future.

Christian has great presentation skills and he has presented his work at several local research seminars as well as international conferences (I've attended at least four of his talks). He's been very helpful in supervising bachelor and master students projects. Further, Christian has taught three full undergraduate courses by himself.

It's been a great pleasure to work with Christian and see him develop into a highly skilled and independent researcher.

Yours sincerely,

Anders Claesson  
Professor of Mathematics  
University of Iceland