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## Advisor's evaluation of the doctoral thesis of Jan Bulánek "The online labeling problem"

Jan's PhD thesis provides a comprehensive treatment of the online labeling problem, a fundamental problem of maintaining a sorted array while inserting new elements. Good algorithms for this problem with amortized complexity  $\Theta(\log^2 n)$  per item are known since beginning of 80's. However, up until now it was not known whether they can be improved or not. The thesis settles this question as well as the question of complexity of various variants and generalizations of the problem. The results appeared in premier conferences such as STOC and their significance is witnessed for example by the fact that Eric Demaine mentions these results in his data structure course at MIT. Thus **the thesis contains original results that greatly meet and exceed requirements for a PhD thesis**. The only clear downside of the thesis is the broken English that pops out throughout the text; I wish the English would have been better.

Since the thesis is based on a joint work with various collaborators I should briefly comment on Jan's contribution to these results. The most technically challenging and important result in the thesis is the lower bound for linear size arrays (Chapter 9). Chronologically this was also the first result of the thesis. The core proof requires considerable amount of new ideas and it is fair to say that about half of them originate with Jan. During my one-year sabbatical leave Jan was left on his own, so he went on to collaborate with his fellow students Babka and Čunát and designed the new reduction for polynomial size arrays (Chapter 6) and extended the lower bound for linear size arrays for slightly super-linear case (Chapter 8). Our earlier attempts to (re)construct such a reduction from a previously published paper went in vain as the original sketch seemed buggy and incomplete at best. On my return we collaborated further with Jan and Mike Saks to prove lower bounds for randomized algorithms (Chapter 7). The basic idea for the upper bound in Chapter 5 originates with Jan as well. Thus it is perfectly safe to say that Jan contributed substantially to each result presented in the thesis, and he clearly demonstrated his ability to carry out independent research.

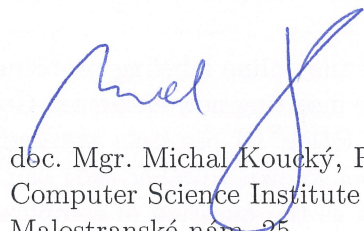
Jan's standing among current doctoral students is also witnessed by him being invited

to the selective China Theory Week and to give an overview presentation of the results at the Workshop on Massive Data Algorithmics (MASSIVE).

It should be noted that Jan wrote the thesis and made a substantial part of the original work while also taking care of his newly born son thus juggling the many responsibilities that new family brings. On a personal note, it was a great pleasure to work with Jan and I hope I will have such good students also in the future.

I fully recommend granting Jan Bulánek the PhD degree.

Sincerely,



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