

Report for MS Thesis of Lenka Kopfova

To Whom It May Concern

This is a report for the MS Thesis of Lenka Kopfova. The topic of the thesis about obtaining bounds for time to fixation for Moran process.

Setting: The setting is a very clean mathematical problem of characterizing fixation time of a newly arising mutant in a population structure. The focus of this work is in the regime of strong selection, where the mutant has infinite fitness advantage over the residents.

Results: The thesis establishes a number of very strong and surprising results. The key highlights are as follows:

- First, it presents a cubic upper bound for directed graphs. This is a very nice and contrasting mathematical result, as for any fixed fitness advantage the fixation time for directed graphs can be exponential. This is a very nice setting where the exponential barrier is broken.
- Second, it presents a quadratic upper bound for regular graphs and sub-cubic upper bound for undirected graphs. Again this result is very surprising as for fixed fitness advantage the undirected double star graph has a cubic lower bound, and the sub-cubic upper bound for infinite fitness advantage is a surprising and excellent mathematical results.
- Third, it presents optimal bounds for special but important classes of graphs, namely, clique, cycle, star, double star etc.
- Finally, there is a very nice implication related to different notion of times which is explored in the final chapter along with a discussion on open problems.

In my opinion, this is an extremely strong MS thesis. The results of the first two items are very strong and surprising. The thesis is rich in elegant mathematical results. The organization is excellent; it is organized as chapters of: (a) upper bounds; (b) lower bounds; (c) specific graphs; and (d) comparing the notions of time. The introduction gives a nice overview of the area, and clearly states the results of the thesis. The results definitely deserve to be published as a strong paper in a top journal related to theoretical and

mathematical biology. I definitely recommend accepting this as a MS thesis, and would also strongly recommend to consider the thesis for some best thesis awards (this is among the strongest mathematical MS thesis I reviewed in recent times, and hence definitely recommend to possible best MS thesis award).

Yours truly,

Krishnendu Chatterjee

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IST Austria, Phone: +43-2243-9000, Am Campus 1, 3400, Klosterneuburg, www.ist.ac.at