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The effects of k-opt algorithms on the efficiency of the Snakes and Ladders heuristic for finding Hamiltonian cycles in graphs

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I present my research on the effects of using standard k-opt algorithms in conjunction with the Snakes and Ladders heuristic (SLH) proposed by Baniasadi, Ejov, Filar, Haythorpe, and Rossomakhine in their paper *Deterministic "Snakes and Ladders" Heuristic for the Hamiltonian Cycle Problem*. As noted by Baniasadi et al., replacing the first stage of SLH with an efficient k-opt algorithm has the potential to improve the performance of the heuristic. My research consisted of experimenting with various previously-developed k-opt algorithms to investigate how they compare to SLH. The Hamiltonian Cycle Problem (HCP) is one of the most significant problems in mathematics, and is known to be NP-complete. SLH tackles this problem by repeatedly searching for Hamiltonian cycles with an upper-bound on computation steps, forcing the heuristic to finish in polynomial time. To determine if the performance of SLH could be improved, I implemented a selection of standard k-opt algorithms to replace the first stage of the heuristic. I used step-counting to measure performance in order to eliminate various uncontrolled variables. As anticipated, results were mixed, with some algorithms performing generally better than the first stage of SLH and others performing generally worse. My subsequent analysis of the data includes performance comparisons across a variety of tested graphs, as well as projections of how the tested algorithms would affect the overall performance of SLH when used in place of the first stage. My poster will provide background information on HCP, as well as a breakdown of SLH and information on the alternative k-opt algorithms that were tested. The poster will also include a summary of my testing process, and the resulting data will be presented along with detailed analysis.

References:

Baniasadi, Pouya et al., *Deterministic "Snakes and Ladders" Heuristic for the Hamiltonian Cycle Problem.* Mathematical Programming Computation 6(1), 55-75, 2014.