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**Samuel C Gutekunst\*** (scg94@cornell.edu) and **David P Williamson**. *Semidefinite Programming Relaxations of the Traveling Salesman Problem and Their Integrality Gaps.*

The traveling salesman problem (TSP) is a fundamental problem in combinatorial optimization. Several semidefinite programming relaxations have been proposed recently that exploit a variety of mathematical structures including, e.g., algebraic connectivity, permutation matrices, and association schemes. The main results of this paper are twofold. First, de Klerk and Sotirov present an SDP based on permutation matrices and symmetry reduction; they show that it is incomparable to the subtour elimination linear program, but generally dominates it on small instances. We provide a family of simplicial TSP instances that shows that the integrality gap of this SDP is unbounded. Second, we show that these simplicial TSP instances imply the unbounded integrality gap of every SDP relaxation of the TSP mentioned in a survey on SDP relaxations of the TSP of Sotirov. In contrast, the subtour LP performs perfectly on simplicial instances. The simplicial instances thus form a natural litmus test for future SDP relaxations of the TSP. (Received September 06, 2019)