EPSTEIN INSTITUTE SEMINAR ▪ ISE 651

Risk-Averse Set Covering Problems

ABSTRACT - We consider a class of chance-constrained combinatorial optimization problems, which we refer to as probabilistic partial set covering problems (PPSC). Given a pre-specified risk level, epsilon, PPSC aims to find the minimum cost selection of subsets of items such that a target number of items is covered with probability at least 1-epsilon. We show that PPSC admits an efficient probability oracle that computes the coverage probability exactly, under certain distributions of the random variables representing the coverage relation. Using this oracle, we give a compact mixed-integer program that solves PPSC for a special case. For large-scale instances for which an exact oracle-based method exhibits slow convergence, we propose a sampling-based approach that exploits the special structure of PPSC. The oracle can be used as a tool for checking and fixing the feasibility of the solution given by this approach. In particular, we introduce a new class of facet-defining inequalities for a submodular substructure of PPSC, and show that a sampling-based algorithm coupled with the probability oracle provides high-quality feasible solutions to the large-scale test instances effectively. We also present our results on risk-averse set covering problems under another risk measure: conditional value-at-risk.

This is joint work with Hao-Hsiang Wu.

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SPEAKER BIO - Simge Küçükyavuz is an Associate Professor in the Industrial Engineering and Management Sciences Department at Northwestern University. Prior to joining Northwestern, Dr. Küçükyavuz was a faculty member at the University of Washington, The Ohio State University, and the University of Arizona, and a research associate at Hewlett-Packard Laboratories. She received her MSc and PhD degrees in Industrial Engineering and Operations Research from the University of California, Berkeley. Her interests are in mixed-integer programming, large-scale optimization, optimization under uncertainty, and their applications. She received the National Science Foundation CAREER Award in 2011. She is the co-winner of the 2015 ICS (INFORMS Computing Society) Prize. She has served on the editorial boards of several journals, including Mathematical Programming, Mathematical Programming Computation, and Mathematics of Operations Research.

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