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 mixedinteger program that solves PPSC for a special case. For largescale 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 samplingbased 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.



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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 cowinner 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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TUESDAY, FEBRUARY 12, 2019 3:30PM – 4:50PM USC ANDRUS GERONTOLOGY CENTER (GER), ROOM 206