FORMULATIONS AND METHODS FOR QAP RELATED QUADRATIC MIXED INTEGER PROGRAMMING PROBLEMS

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Abstract

Several quadratic location problems, as several hub location problems, and other quadratic mixed integer programming problems, such as the maximum diversity problem, inherit formulations and/or solution techniques from the quadratic assignment problem (QAP). This talk is a review of such problems and techniques which unfolds a whole new world of potential applications and methodological enhancements based on previous QAP research.
When addressing hub location problems, flow formulations and other linearizations, originally developed for QAP, are rediscovered and several improvements of classical combinatorial optimization techniques are made useful again. Although Benders Decomposition is usually disregarded as a suitable technique for QAP, it is particularly well succeeded for Hub-And-Spoke systems design. Another neglected scheme is the Outer Approximation Method, that when applied to such QAP derived problems is surprisingly efficient on tackling large instances. Several preliminary computation experiments are reported in order to support these developments. Moreover, linearization techniques inherited from QAP studies, such as the Relaxation-Linearization Technique, are as useful as before on improving bounds, but somehow more manageable when considering simpler but related quadratic mixed integer programs. This is the case of the maximum diversity problem, and the cellular systems design, which are properly modeled using former QAP linearizations. Results for RLT-based formulations for the maximum diversity problem are here discussed while the cellular systems design results are well known. The study of QAP is very important as a provider of enhanced solution techniques and formulations. But, a fresh view of the possible application environments and the further implications can deliver new research opportunities and a landscape for a broader utilization of the deployed QAP tools.