# Exact approaches for the adjustable robust resource-constrained project scheduling problem

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The resource-constrained project scheduling problem (RCPSP) deals with the sequencing of interrelated activities that are usually related by precedence constraints and simultaneous use of scarce resources. When uncertainty comes into play, the problem becomes more involved both from a modeling and a computational viewpoint. In this talk, we study a two-stage robust optimization approach of the RCPSP ([2]). The resulting problem belongs to the class of robust adjustable optimization models, that have been recently proposed ([1]) and quickly emerged as a cutting-edge research area that provides a way to handle dynamic decision-making problems, where the strategy can be adjusted to information revealed over time. In particular, in the first stage, prior to any knowledge of the realization of uncertainty, sequencing and resource allocation decisions are made. During the project, the value for activity durations realizes and the starting times can be set, depending on the uncertain parameters and on the completion times of predecessor tasks. While there are many high level similarities with the stochastic paradigm, the robust optimization approach yields more computational tractable problems, amenable to decomposition methods. Considering the case where the uncertainty set is polyhedral with a budget of uncertainty constraint, we present two different exact solution approaches, relying on a general decomposition scheme, where the original problem is broken into a deterministic master problem and a robust subproblem, then solved by a specialized solution method.

We have carried out an extensive computational experimentation aimed at investigating and comparing the performance of the two different methods on standard benchmark instances from the literature.

## References

[1] Ben-Tal, A., Goryashko, A., Guslitzer, E., and Nemirovski, A., Adjustable robust solutions of uncertain linear programs, Mathematical Programming 99(2): 351–376, 2004.

[2] Bruni, M.E., Di Puglia Pugliese, L., Beraldi, P., Guerriero, F., An adjustable robust optimization model for the resource-constrained project scheduling problem with uncertain activity durations, Omega, in press.