Electronic Companion to: A Branch-and-Cut Decomposition Algorithm for Solving Chance-Constrained Mathematical Programs

James Luedtke
University of Wisconsin-Madison
jrluedt1@wisc.edu

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This document is a companion to the article [1], which provides more details of how the instances used for computational experiments in [1] were generated. The author will provide the actual data upon request.

A base instance with n resources and m customer types is generated as follows. First, the resource unit costs $c \in \mathbb{R}^n$ were generated as independent realizations of a $N(1, 0.2)$ random variable (a normally distributed random variable having mean 1 and standard deviation 0.2). These unit costs are also used as "base service rates" for the resources, so that more expensive resources always have higher service rates. Next, a set of base customer service rates $\mu' \in \mathbb{R}^m$ were also generated as independent realizations of a $N(1, 0.2)$ random variable. The service rate of resource i for customer type j, μ_{ij}, was then initially set to $c_i + \mu'_j$. Some of the service rates are then set to zero at random as follows. First, each customer type is randomly determined to be either difficult or easy with equal likelihood. If customer type j is difficult, the values μ_{ij} are set to 0 with probability 0.6, independently for $i = 1, \ldots, n$. If customer type j is easy, the values μ_{ij} are set to 0 with probability 0.3, again independently for $i = 1, \ldots, n$. To avoid generating a customer type with too few resource options, if the number of μ_{ij} values that have been set to 0 reaches $0.7n$, then no more are set to 0.

We next describe how the base distributions for $\tilde{\lambda}, \tilde{\rho}$ and $\tilde{\mu}$ are generated. $\tilde{\lambda}$ is assumed to be a multivariate normal random vector, with mean $\bar{\lambda}$ and covariance matrix $\bar{C}$. The components of the mean vector $\bar{\lambda}$ were generated as indepenent $N(110, 25)$ random variables. The covariance matrix C is generated by first generating a random $m \times m$ matrix X whose entries are independently drawn from the uniform distribution over $[-6.25, 25]$. C is then set to $(1.25/m)X^T X$. This process ensures that C is positive semidefinite. The random vector $\tilde{\rho}$ is modeled as $\tilde{\rho} = \min\{\hat{\rho}, e\}$ where $\hat{\rho}$ is a vector of independent normal random variables. The mean $\bar{\rho}_j$ of $\hat{\rho}_j$ is generated uniformly between 0.9 and 1.0, and the standard deviation of $\hat{\rho}_j$ is 0.05 for all j.

References

[1] Luedtke, J.: A branch-and-cut decomposition algorithm for solving chance-constrained mathematical programs (2012)