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SIPLIB 2.0

Stochastic Integer Programming Library version 2.0

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Abstract We present a collection of stochastic integer programming problem instances.

Keywords Stochastic Integer Programming · Problem Instances

1 Introduction

- What SIP is?
  Stochastic integer programming is ... The main difficulty in solving stochastic integer programs is that the second-stage value function is not necessarily convex, but only lower semicontinuous (l.s.c.). Thus, the standard decomposition approaches that work nicely for stochastic *linear* programs, break down when second stage integer variables are present (Ahmed and Garcia, 2004).
- SIPLIB?

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  - MIPLIBv5 (last modified 2017): http://miplib.zib.de/
  - Shabbir's SIPLIB (last modified 2015): https://www2.isye.gatech.edu/ sahmed/siplib/
  - Felt et al's SLPlib (last modified 2001): https://www4.uwsp.edu/math/afelt/slpinput/download.html
  - Holmes's POSTS (the most recent reference 1994): http://users.iems.northwestern.edu/ jr-birge/html/dholmes/post.html
- Motivation for SIPLIBv2
  We need more..
- Power of Julia language for large-scale optimization problems
- Contribution
  By SIPLIB 2.0, we mainly provide 1) richer collection of test problems for computational and algorithmic research in SIP with benchmark experimental results, 2) not only SMPS files but also *Julia* files formatted in *StructJuMP* that are easily readable/modifiable.

2 Stochastic Integer Programming

2.1 Formulation

2.1.1 2-Stage Recourse Programs

2.1.2 Chance-constrained Programs

2.1.3 Hybrid Programs

2.2 Algorithms

2.2.1 Stage-wise Decomposition Algorithm

2.2.2 Scenario-wise Decompostion Algorithm

Benders, dual, ...

2.3 Software Libraries

2.3.1 Modeling Languages

2.3.2 Solvers

3 Problem Instances

We introduce the set of problem instances. The instances are available in SMPS and Julia (StructJuMP) file format. characteristics, categorization

3.1 Problem sets in SIPLIP

- DCAP (dynamic capacity acquisition and allocation under uncertainty)
- EXPUTIL (expected utility knapsack problem)
- MPTSP (multi-path traveling salesman problem)
- PROBPORT (portfolio optimization problem)
- SEMI (semiconductor tool purchase problem)
- SMKP (stochastic multiple knapsack problem)
- SIZES (selection of an optimal subset of sizes)
- SSLP (stochastic server location problem)
  Parameters:

- VACCINE (optimal vaccine allocation problem)

3.2 Problem sets in SIPLIP 2.0

4 Implementation of SMPS Writer

We describe our Julia implementation, how to model SIP and generate SMPS files..

5 Solution Report

6 Concluding Remarks