CASE STUDY: Two stage problems from POSTS site
(recourse, avg, linear)

Background

POSTS (a portable stochastic programming test set) gives a set of multi-stage linear stochastic programming problems with discrete scenarios for testing algorithms, Derek et al. (1995). Every problem has several sets of scenarios. Problems posted at the POSTS website are general linear stochastic programming in SMPS format. We have selected several two-stage problems at POSTS website. For selected problems we converted data to PSG format and solved these problems in PSG RunFile environment. Two-stage problems were formulated using PSG Average function applied to Recourse function.

We reported performance of AORDA Portfolio Safeguard (PSG) 64 bit version conducted on PC with 2.83 MHz processor.

References

1. Derek H. and B. John (1995): Cargill Financial Services (http://users.iems.northwestern.edu/~jrbirge/html/dholmes/post.html#post_0)

Notations

I = number of the first stage decision variables, $i=1,\dots,I$ index of variable;

K = number of the second stage decision variables, $k=1,\dots,K$ index of variable;

$\vec{x} = (x_1, \dots, x_I)$ = vector of the first stage decision variables;

$\vec{y} = (y_1, \dots, y_K)$ = vector of the second stage decision variables;

A = matrix of the first stage linear constraints;

$\underline{b}$, $\overline{b}$ = vectors of lower and upper bounds for the first stage linear constraints;

$\underline{x}_i$, $\overline{x}_i$ = lower and upper bounds for the first stage variables, $i=1,\dots,I$;

$\vec{c}$, $\vec{d}$ = cost vectors for the second stage objective;

T, W = matrices of the second stage linear constraints;

$\underline{y}_k$, $\overline{y}_k$ = lower and upper bounds for the second stage variables, $k=1,\dots,K$;

p_j = probability of scenario $j = 1, \dots, J$;

$L(j)$, $U(j)$ = vectors of lower and upper bounds for the second stage linear constraints for scenario j;

$Q(\vec{x}, j)$ = recourse function for scenario j:

$$Q(\vec{x}, j) = \vec{c}\vec{x} + \min_y\{\vec{d}\vec{y}\}, \; j \in \{1, \dots, J\}$$

subject to

linear constraints for the second stage

$$L(j) \le T\vec{x} + W\vec{y} \le U(j),$$

bounds on the second stage decision variables

$$\underline{y}_k \le y_k \le \overline{y}_k, \; k = 1, \dots, K;$$

$avg(Q(\vec{x}, j))$ = $\sum_{j=1}^{J} p_j Q(\vec{x}, j)$ = Average of Recourse function.

Optimization Problem

minimizing Average of Recourse function

$$\min_x avg(Q(\vec{x}, j)) \tag{CS.1}$$

subject to

linear constraints on the first stage decision variables

$$\underline{b} \leq Ax \leq \overline{b}, \tag{CS.2}$$

bounds on the first stage decision variables

$$\underline{x}_i \leq x_i \leq \overline{x}_i, \ i = 1, \dots, I. \tag{CS.3}$$