Stochastic Activity Network (SAN) Duration

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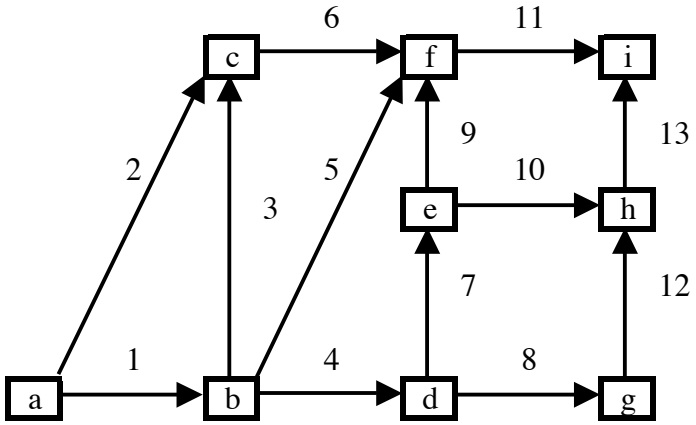
(Continuous variables, unconstrained - deterministic upper and lower bounds on vars only)
Problem Statement: Consider the following stochastic activity network (SAN) where the arcs are labeled from 1 through 13. (SANs are also known as PERT networks, and are used in planning large-scale projects. This SAN is adapted from Avramidis, A.N., Wilson, J.R. (1996). Integrated variance reduction strategies for simulation. Operations Research 44, 327–346.) Each arc i is associated with a task with random duration X_i. Task durations are independent.



Suppose that X_i is exponentially distributed with mean θ_i for each i. Suppose that we can select $\theta_i > 0$ for each i, but there is an associated cost. In particular, we want to minimize $ET(\theta) + f(\theta)$, where $T(\theta)$ is the (random) duration of the longest path from a to i and $f(\theta) = \sum_{i=1}^{9} \theta_i^{-1}$. We require that $\theta_i \in [0.01, 100]$ for each i.

Starting Solution(s): Start from $\theta_0 = [1, 1, \ldots, 1]$. If multiple initial solutions are required, sample uniformly from $[0.5, 5]^{13}$.

Measurement of Time: One evaluation of the longest path (and its gradient).

Recommended budgets: 10,000 and 100,000

Optimal Solutions: Unknown

Known Structure: The objective function $ET(\theta) + f(\theta)$ is convex in θ. An IPA estimator of the gradient is also given in the code.