Finite-time Performance

- Asymptotics of simulation-optimization algorithms usually don’t “kick in” early enough to be practically relevant
- How can one assess finite-time (non-asymptotic) performance?
- Let Z=f(X) be **true** obj value of solution X returned by optimization algorithm under given computational budget
- Estimate distribution function of Z

Optimal Choice of n and m?

- Get realizations of X by running optimization algorithm X_i i=1, 2, …, n
- Estimate $f(X_i)$ by running simulation at X_i giving (Z_{ij}: i=1, …, n, j = 1, …, m)
- Estimate distribution function at z as

$$\frac{1}{n}\sum_{i=1}^{n} I\left(\frac{1}{m}\sum_{j=1}^{m} Z_{ij} \leq z\right)$$

- Confidence bands (in z)?

Detecting Structure

- Detect structure in problems based on estimated function values only
- Use a kind of hypothesis test
- Maximize likelihood of perturbed function values that ensure structural property holds
- Convexity, unimodality, monotonicity and others

Approximate DP and Sim Opt

- Approximately solve difficult dynamic programming problems
- Can implement greedy policy with respect to approximate value function V(x; a)

$$V(x;a) = \sum_{i=1}^{n} a_i V_i(x)$$

- How to find good coefficients “a”?
- Regression, LP often advocated since fast and plausible

Maybe Use Sim Opt Instead?

- But these methods don’t always give best possible coefficients
- E.g., tetris example does factor of 20 better than best regression/LP method (Szita, Lorincz 06)
- We used direct search on an EMS problem, get far better performance
- Can we design specialized sim-opt algorithms for these kinds of problems?