FOUR-STAGE SELECTION APPROACH WITH THE INITIAL SAMPLE SIZE

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ABSTRACT

We consider the effect of the initial sample sizes on the performance of Four-Stage selection approach that is used in selecting a good enough simulated system, when the number of alternatives is very large. We implement Four-Stage approach on M\M\1 queuing system under some parameter settings, with a different choice of the initial sample sizes to explore the impacts on the performance of this approach. The results show that the choice of the initial sample size does affect the performance of Four-Stage selection approach.

Key Words: Ranking and Selection, Ordinal Optimization, Optimal Computing Budget Allocation, Subset Selection, Indifference-Zone, Initial Sample Size.

INTRODUCTION

We consider optimizing the expected performance of a complex stochastic system that cannot be evaluated exactly, but has to be estimated using simulation. Our goal is to solve the following optimization problem

$$\min_{\theta \in \Theta} J(\theta) \tag{1}$$

where the feasible solution set Θ is a finite, huge and has no structure. Meanwhile, J is the expected performance measure, L is a deterministic function depends on θ and ξ. We can write $J(\theta) = E[L(\theta, \xi)]$, θ is a vector that representing the system design parameters, and ξ represents all the random effect of the system. If we simulate the system to get estimate of $E[L(\theta, \xi)]$, then the confidence interval of this estimate cannot be improved faster than $1/\sqrt{k}$, where k is the number of samples used to get estimates of $J(\theta)$. This rate may be good for some problems with a small number of alternatives but it is not good enough for the class of complex simulation which we consider in this paper. Thus, one could compromise the objective to get a good enough solution rather than doing extensive simulation.

In many selection approaches, sample size in the first stage t_0 plays an important role to the performance of these procedures. In fact, the initial sample size t_0 cannot be too small since we might get poor estimates for the sample mean and variances. On the other hand, t_0 cannot be too large, because in the first stage there exist many noncritical systems and by giving a large number of samples will result in losing a large number of samples and also wasting computation time. However, Chen et al. (2000) and Chen et al. (1999) suggested that t_0 should be between 10 and 20 as a good choice for the initial sample size. Unfortunately, there is no clear formula to calculate an appropriate value of the initial sample size t_0 for the selection approaches, when the number of alternative is large. In this paper, we study the effects of the initial sample size t_0 on the performance of one of the selection approaches; a