Economic Analysis
of Simulation Selection Options

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ABSTRACT: Ranking and selection procedures are standard statistical methods for selecting the best of a finite set of alternatives, given a desired level of statistical evidence for correct selection. Those procedures form the conceptual framework of much work in stochastic simulation optimization, where best is defined in terms of the maximum expected value of simulation output of alternatives. Another approach to simulation optimization is based on almost-sure (or other) convergence to an optimal solution as the number of observations approaches infinity. But managers are trained to make practical decisions based upon economic significance, not on probability bounds or convergence guarantees. When the output of the simulations represent economic value, like the realization of a net present value, an economic approach is warranted. We present a new approach to the discrete optimization problem for stochastic simulation that is based upon maximizing the economic value of decisions that are based upon simulation. We account for the discounting costs due to delays from analysis or even the delay of building the analysis tool itself, and the financial costs of developing the simulation tool and running the analysis. The problem is shown to be related to the class of stoppable bandit problems, we approximate the solution to the problem when there is one simulated alternative via a free boundary problem for a heat equation, but we show that hierarchical policies studied by Glazbrook are not able to provide optimal allocation indices when there are multiple alternatives. Nonetheless, we construct bounds for the optimal $E[\text{NPV}]$ and identify highly effective sub-optimal policies. The work therefore sets the groundwork for an economic approach to simulation that maximizes the net value of decisions made with simulation, as an alternative to approaches that focus on probabilistic properties of algorithms.