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Generalized best choice problem based on the information economics approach

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We consider the problem of choosing the 'best choice' among a certain number of objects that are presented to a decision-maker in sequential order. Such a sequential selection problem is commonly referred to as the 'best choice problem', and its optimal stopping rule has been obtained either via the dynamic programming approach or via the Markovian approach. Based on the theory of information economics, we propose in the paper the third approach to a generalized version of the best choice problem that is intuitively more appealing. Various types of the best choice problem, such as (1) the classical secretary problem, (2) no information group interview problem, and (3) full information best choice problem with a random walk process, are shown to be special cases of the generalized best choice problem. The modelling framework of information economics has potential for building theory that ultimately would produce practical stopping rules.

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Introduction

In many decision situations such as selling a house or seeking a job, it can be construed that the decision-making unit or, more simply, the decision-maker (DM) receives a sequence of offers one at a time. Following an evaluation of each offer, the DM must decide whether to take the offer on hand or reject it and consider the next one. If the decision is irrevocable, the question is when to make the positive decision of accepting an offer. If the decision is made too early in the search process, the DM could have found better offers at a later stage. If made too late, however, the DM may have already passed over the best opportunities.

This class of sequential search and selection problems is variously referred to as the job search problem, secretary problem, candidate problem, best choice problem, parking spot problem, beauty contest problem, house-selling problem, optimal stopping problem, persistence problem, dowry problem, marriage problem, bachelor's dilemma, or streetwalker's dilemma.

In the paper, we formulate and discuss a series of sequential decision problems that are based on the following assumptions.

Assumption 1 One by one, a sample of n measurements is drawn from a population with continuous distribution function $F(x)$. The continuity assures that ties have probability 0.

Assumption 2 The total number of measurements n is known to the DM *a priori*.

Assumption 3 After each draw, the DM, who may (or may not) know the form of the distribution function $F(x)$ and its parameter values, is informed of its value x_j (or its relative rank), whereupon the DM must decide whether or not to choose that draw.

Assumption 4 There is no recall allowed; that is, a draw once rejected may not be chosen later on.

Assumption 5 The DM is very particular and will be satisfied with nothing but the very best. Thus, the problem is to find the rule or strategy that maximizes the probability of successfully choosing the 'best choice' among n measurements.

Owing to Assumption 5, the sequential decision problem considered in this paper is widely referred to as the *best choice* problem. In a managerial decision situation, the sequentially observed random variable X_j in Assumption 3 may represent the jth bid in the house-selling problem, the value of the jth offer in the job search problem, the market price of an asset on the jth day, or the rate of return associated with the jth investment opportunity in the investment problem.

The cumulative distribution function $F(x)$ in Assumptions 1 and 3 may or may not be known to the DM *a priori*. Thus, depending on the assumption made on the distribution function $F(x)$, the best choice problems can be divided into two cases. In the *no information* case, on one hand, we

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