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Short Communication

A rank-based approach to the sequential selection and assignment problem

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Abstract

In the classical sequential assignment problem, "machines" are to be allocated sequentially to "jobs" so as to maximize the expected total return, where the return from an allocation of job j to machine k is the product of the value x_j of the job and the weight p_k of the machine. The set of m machines and their weights are given ahead of time, but n jobs arrive in sequential order and their values are usually treated as independent, identically distributed random variables from a known univariate probability distribution with known parameter values. In the paper, we consider a rank-based version of the sequential selection and assignment problem that minimizes the sum of weighted ranks of jobs and machines. The so-called "secretary problem" is shown to be a special case of our sequential assignment problem (i.e., $m = 1$). Due to its distribution-free property, our rank-based assignment strategy can be successfully applied to various managerial decision problems such as machine scheduling, job interview, kidney allocations for transplant, and emergency evacuation plan of patients in a mass-casualty situation.

Keywords: Job scheduling; Optimal stopping rule; Secretary problem; Sequential decision

1. Introduction

The classical sequential selection and assignment problem in Derman et al. (1972) can be described as follows. There are m machines available to perform n jobs which arrive in sequential order. Associated with the jth job is a random variable X_j which takes on the value x_j. When a job arrives, the decision-maker (DM) must decide whether to assign it at all, and if so, which of the m machines to assign it to. If the

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