

Single Machine Scheduling with Stochastic Processing Times or Stochastic Due-Dates to Minimize the Number of Early and Tardy Jobs

H. M. Soroush*

Department of Statistics and Operations Research, College of Science, Kuwait University, P.O. Box 5969, Safat 13060, Kuwait

Received December 2005; Revised February 2006; Accepted March 2006

Abstract—We study a single machine scheduling problem in which processing times or due-dates are non-negative independent random variables and random weights (or penalties) are imposed on both early and tardy jobs. The objective is to find an optimal sequence that minimizes the expected total weighted number of early and tardy jobs. We explore three scenarios of the problem including a scenario with deterministic processing times and stochastic due-dates, a scenario with stochastic processing times and deterministic due-dates, and a scenario with stochastic processing times and stochastic due-dates. These problem scenarios are NP-hard to solve; however, when there are special structures on the stochasticity of processing times or due-dates, we establish certain conditions under which the various resulting cases are solvable exactly. We also approximate the solutions for the general versions of these cases. The proposed exact and approximate solution methods as well as our illustrative examples demonstrate that variations in processing times, due-dates, and earliness/tardiness penalties affect scheduling decisions. Furthermore, we show that the problem studied here is general in the sense that its special cases such as the stochastic problem of minimizing the expected weighted number of tardy jobs and the stochastic problem of minimizing the expected weighted number of early jobs are both solvable by the proposed exact or approximate methods.

Keywords—Scheduling, Single machine, Stochastic, Number of early and tardy jobs

* Corresponding author's email: hsoroush@kuc01.kuniv.edu.kw
1813-713X copyright © 2006 ORSTW