International Journal of Innovative
Computing, Information and Control
Volume **6**, Number **11**, November **2010**

ICIC International ©2010 ISSN 1349-4198
pp. 5015–5034

VARIABLE LEAD TIME FUZZY INVENTORY SYSTEM UNDER BACKORDER RATE WITH ALLOWED SHORTAGE

Ming-Feng Yang[1], Tien-Shou Huang[2] and Yi Lin[3]

[1]Department of Transportation Science
National Taiwan Ocean University
No. 2, Beining Rd., Jhongjheng District, Keelung City 202, Taiwan
yang60429@mail.ntou.edu.tw

[2]Department of Information Management
National Kaohsiung University of Applied Sciences
415, Chien-Kung Rd., Kaohsiung 807, Taiwan
handsome@cc.kuas.edu.tw

[3]College of Management
National Taipei University of Technology
1, Sec 3, Chung-hsiao E. Rd., Taipei, Taiwan
iwc3706@yahoo.com.tw

Received July 2009; revised November 2009

Abstract. *This paper investigates the backorder rate inventory problem with variable lead time in which can be decomposed into several components, with a crashing cost function for the respective reduced lead time. The objective of this study is to find the optimal order quantity and lead time simultaneously, which is then used to minimize the total inventory cost. Most of the previous publications assumed that the annual demand is deterministic and the backorder rate is in proportion of the discount price offered by the supplier. However, there are many uncertain factors in real world. Therefore, they can be described by fuzzy theory. Here, we employ the theory of fuzziness to integrate the mixture inventory system, and construct the solution procedure to optimize the order quantity and lead time. For each model, we use the signed distance, a ranking method for fuzzy numbers, to estimate the annual demand and backorder rate, and to derive the corresponding optimal solution. For each model, we use the signed distance, a ranking method for fuzzy numbers to estimate the annual demand and backorder rate, and to derive the corresponding optimal solution. Numerical examples are also included to illustrate the procedures of the solution.*
Keywords: Inventory, Fuzzy theory, Lead time, Signed distance, Backorder rate

1. **Introduction.** Lead time has been a popular research subject in today's inventory management. In most past studies such as Naddor [1], Tersine [2] and Vollmann [3], lead time is generally considered as a constant or a stochastic variable. It can not be controlled, which provided general guidelines to discuss methods for reducing the lead time to promote the performance of an inventory system. Liao and Shyu [4] proposed an inventory model with predetermined order quantity and normally distributed demand in which the lead time can be decomposed into several components and is the only variable to minimize the expected total cost. Ouyang et al. [5] took the stock shortages into consideration and treated the total stockout to be a mixture of backorders and lost sales based on Ben-Daya and Raouf's [6] research. Pan et al. [7] developed an optimal reorder point inventory model with variable lead time and backorder discount considerations.