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FUZZY TOTAL DEMAND AND MAXIMUM INVENTORY WITH BACKORDER BASED ON SIGNED DISTANCE METHOD

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Abstract. *In this paper we consider the inventory problem with backorder such that both the maximum inventory and total demand quantities are fuzzified as triangular fuzzy numbers. We get the fuzzy total cost through defuzzification by the signed distance method. In this manner we obtain both the total cost and the optimal solution in the fuzzy sense.*

Keywords: Fuzzy inventory, Fuzzy sets, Signed distance, Extension principle

1. **Introduction.** When we discuss the classical inventory with backorder model, we get the total cost function $F(q,s) = \frac{aTs^2}{2q} + \frac{bT(q-s)^2}{2q} + \frac{cr}{q}$, $0 < s < q$; where a is the cost of storing one unit for one day, c is the order cost per cycle, q is the order quantity per cycle, s is the maximum inventory quantity, T is the planning time for the whole period and r is the total demand over the planning time period $[0, T]$. Some fuzzy inventory problems have already been discussed in the literature. Chen and Wang (1994) used fuzzy set concepts in their model. They replaced the cost parameters a, b, c and R in $F(q,s)$ by fuzzy numbers. Also, they solved the fuzzy order quantity problem with a numerical operation based on the function principle. Yao and Lee (1996) solved a fuzzy order quantity problem by fuzzifying q to a fuzzy number with s an ordinary positive real number. Chang, Yao and Lee (1998) used the extension principle to solve a fuzzy order quantity problem by fuzzifying s to a fuzzy number with q an ordinary positive real number. Yao et al. (2000) solved for fuzzy order quantity and fuzzy total demand quantity in an inventory without backorder problem. Li and Zhang (2006) design fuzzy logic controller with interval-valued inference for distributed parameter system. Su (2007) fuzzified total demand by an interval-valued fuzzy set in the crisp case of total cost in the inventory problem without backorder. In Chen et al. (2007) the authors use fuzzy methods to consider issues involving inventory control and production processes.

In the classical inventory model with backorder, a, b, c, T and r are given constants. The time period between placing an order and receiving the goods is also a constant. But sometimes the time period might change due to a transportation problem. Although a, b, c, s and T are given constants, they do affect q and r. It follows that q and r are subject to some kind of uncertainty. In the classical case, q and s are treated as variables (not fuzzy numbers), and we find the optimal solution.