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MAXIMUM ECONOMIC REVENUE FOR FUZZY PRICE IN FUZZY SENSE

Jin-Shieh Su[1], Teng-San Shih[1] and Huey-Ming Lee[2]

[1]Department of Applied Mathematics
[2]Department of Information Management
Chinese Culture University
No. 55, Hwa-kang Road, Yang-Ming-Shan, Taipei, Taiwan
{ sjs; sds; hmlee }@faculty.pccu.edu.tw

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Abstract. *We present a fuzzy optimization problem in business and economics. In this problem, a fuzzy price is determined by using a linear two degree demand functions. The objective is to find the optimal fuzzy revenue, which is derived from the fuzzy price. We use level (λ, 1) interval-valued fuzzy numbers to consider the fuzzy price and the fuzzy revenue. Using signed distance to defuzzify, we can obtain the demand function and revenue function in the fuzzy sense. What follows is that we can find the maximum revenue in the fuzzy sense.*

Keywords: Fuzzy price, Fuzzy revenue, Fuzzy demand, Interval-valued fuzzy set

1. **Introduction.** We study a fuzzy optimization problem in business and economics [11-13]. The traditional methods for solving this problem involve using the extension principle and genetic algorithms [8-10]. However, in [1,5-7,15], triangular fuzzy numbers were used and the extension principle is applied to derive the defuzzified membership function using the centroid method to obtain the optimal solution in the fuzzy sense. In [14], the triangular fuzzy number was used to estimate the missing value in the fuzzy sense. From past experience, we know that deriving the membership function is a very tedious and difficult task. In this paper, we consider a fuzzy price optimization problem in business and economics. We use level (λ, 1) interval-valued fuzzy numbers to consider the fuzzy price and the fuzzy revenue. Signed distance is used to defuzzify to obtain the demand function and revenue function in the fuzzy sense.

The demand function is a two degree polynomial $P(x) = a - bx + cx^2$ and the revenue function is $R(x) = xP(x) = ax - bx^2 + cx^3$. We can find the value of x to maximize $R(x)$. The demand function $P(x) = a - bx + cx^2$ coefficients a, b and c are fixed in a planning period for a monopoly market. However, for a perfect competitive market, a, b and c will vary according to the economic situation. It is reasonable to fuzzify them. If we fuzzify a into a triangular fuzzy number $0 < \Delta_1 < a$, $0 < \Delta_2$, $\tilde{a} = (a - \Delta_1, a, a + \Delta_2)$, all is equal to 1 in the planning period the membership grade for $\tilde{a}$ at point a. This is not reasonable. For this reason, we consider that the membership grade of point a will lie in the interval $[\lambda, 1]$, $0 < \lambda < 1$. Therefore, we fuzzify a, b and c to a level $(\lambda, 1)$ fuzzy numbers $\tilde{a} = [\tilde{a}^L, \tilde{a}^U] = [(a - \Delta_3, a, a + \Delta_4; \lambda), (a - \Delta_1, a, a + \Delta_2)]$, $\tilde{b} = [\tilde{b}^L, \tilde{b}^U] = [(b - \Delta_7, b, b + \Delta_8; \lambda), (b - \Delta_5, b, b + \Delta_6)]$ and $\tilde{c} = [\tilde{c}^L, \tilde{c}^U] = [(c - \Delta_{11}, c, c + \Delta_{12}; \lambda), (c - \Delta_9, c, c + \Delta_{10})]$ to consider the problem in the fuzzy sense. Section 2 presents the preliminaries for Section 3. In Section 3, we consider the demand function to be the second degree polynomial $P(x) = a - bx + cx^2$ in the fuzzy sense. We give an example in Section 4. Section 5 presents the conclusion.