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A Simple approach to solving Penalty method by Ranking

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Abstract

Penalty Method is a well-known topic and it is used very often in solving problems of Engineering and Management. Numerical examples show that fuzzy ranking method offers an effective way for handling the fuzzy penalty method.

Keywords

Fuzzy Number, Penalty Method, Fuzzy Ranking Method.

Introduction

Ranking fuzzy numbers is an important tool in decision making. In fuzzy decision analysis, fuzzy quantities are used to describe the performance of alternatives in modelling a real world problem. Various ranking procedures have been developed since 1976 when the theory of fuzzy sets was first introduced by Zadeh in 1965. In this paper , a new form of fuzzy number named as triangular fuzzy number, is introduced and its arithmetic operations are defined. Finally the LPP solved by using penalty method.

Preliminaries

Definition -1

A fuzzy set A of the universe of discourse x is called a normal fuzzy set implying that there exist atleast one x€X such that $\mu_A(x)$ =1.

Definition -2

A fuzzy number is a normal triangular fuzzy number denoted by (a_1 , a_2 , a_3) where $a_1 \leq a_2 \leq a_3$ are real numbers and its membership function is given below.

$$\mu_{\tilde{A}}(x) = \begin{cases} w(x-a / b-a) & a \leq x \leq b \\ w & b \leq x \leq c \\ w(x-d / d-c) & c \leq x \leq d \end{cases}$$

Ranking of Triangular fuzzy number

The ranking of the generalized triangular fuzzy numbers $\tilde{A} = (x_1 , x_2 , x_4 ; w)$ i.e. $x_3 = x_4$. The centroids is given by

$$R(\tilde{A}) = G_{\tilde{I}} (x_0 , y_0) = (2x_1 + 7x_2 + x_4 / 9) (700/18)$$

Numerical Example

Maximize $z = (0.2 , 0.3 , 0.6; 0.75) x_1 + (0.3 , 0.8 , 0.1; 0.6) x_2$

Subject to constraints

$$(0.4 , 0.6 ,0.2 ; 0.1) x_1 + (0.1 , 0.1 , 0.3; 0.6) x_2 \geq (0.1 , 0.3 , 0.4 , 0.8)$$

$$(0.1 , 0.2 , 0.5; 0.6) x_1 + (0.4 , 0.7 , 0.8; 0.9) x_2 \leq (0.3 , 0.5 , 0.4; 0.9)$$

Solution

Introducting the non negative slack variable s_1 and surplus variable s_2 , the standard form of LPP becomes

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Max $z = 0.1x_1 + 0.16x_2 + 0s_1 + 0s_2$

Subject to constraints

$0.02x_1 + 0.3x_2 + s_1 + 0s_2 = 0.09$

$0.05x_1 + 0.25x_2 + 0s_1 – s_2 = 0.175$

$x_1 , x_2 , s_1 , s_2 \geq 0$

But this will not get a feasible solution . So we add the artificial variable R_1 Iin the objective function.

Max $z = 0.1x_1 + 0.16x_2 + 0s_1 + 0s_2 - \mu R_1$

Subject to constraints

$0.02x_1 + 0.3x_2 + s_1 + 0s_2 = 0.09$

$0.05x_1 + 0.25x_2 + 0s_1 – s_2 + R_1 = 0.175$

The initial basic feasible solution is given by $s_1 = 0.09$; $R_1 = 0.175$ (Here $x_1 = x_2 = s_2 = 0$; non basic variable).

Initial Iteration

			Cj =	0.1	0.16	0	0	-μ	
	CB	YB	XB	X_1	X_2	S_1	S_2	R_1	Ratio
	0	S_1	0.09	0.02	0.3*	1	0	0	0.3
	-μ	R_1	0.175	0.05	0.25	0	-1	1	0.7
Zj - Cj			-0.175μ	-0.05μ-0.01μ	0.25μ-0.16	0	μ	0	

Since there are some Zj –Cj < 0 , the current basic feasible solution is not optimal. The non basic variable x_2 enters the basis and the basic variable s_1 skip.

Second Iteration

				0.1	0.16	0	0	-µ	
	CB	YB	XB	X_1	X_2	S_1	S_2	R_1	Ratio
	0.16	X_2	0.3	0.67	1	3.3	0	0	0.4
	-µ	R_1	0.1	0.12	0	-0.83	-1.25	1	0.8
Zj - Cj			-0.048-0.10µ	-0.12µ+0.0072	0	0.83µ-0.528	1.25µ	0	

Enter x_1 and skip R_1

				0.1	0.16			
	CB	YB	XB	X_1	X_2	S_1	S_2	R_1
	0.16	X_2	-0.25	0	1	7.9	-0.83	-0.67
	0.1	X_1	0.83	1	0	6.9	10.4	8.3
Zj - Cj			0.043	0	0	1.95	47.8	0.72

Therfore max z = 0.043 at x_1 = 0.1 and x_2 = 0.16

Conclusion

We can easily calculated for fuzzy triangular and trapezoidal numbers using this ranking formula and applying penalty method.

REFERENCES

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1. Zadeh, L.A., Fuzzy set, Information and control, Vol.8, No.3, pp.338-353, 1965

2. Dubois. D and Prade. H, Operations on Fuzzy number. International journal of systems science, vol.9, no.6, pp.613-626, 1978

3. Heilpern. S, Representation and application of fuzzy numbers, Fuzzy sets and vol.91, no.2, pp.259-268, 1997.

4. Klir G.J., Fuzzy sets : An overview of fundamentals, Applications and personal views, Beijing Normal University press, 2000, pp.44-49.

5. Fuller. R and Majiender. P on weighted possibilisitc mean and variance of fuzzy number, Fuzzy sets and systems vol.136, pp.363-374, 2003

6. Klir G.J fuzzy arithmetic with requisite constraints fuzzy sets system vo.91, pp.165-175. 1997

7. Lee H.M., and Lin. L using weighted triangular fuzzy number to evaluate the rate of aggregative risk in software developments, proceeding of the 7th international conference on machine leaning and cybernetics ICMLC, vol.7, 2008 , pp.3763-3767.

8. Sancher. D, Deigado. M and Avila. M RL numbers AN culternative to fuzzy number for the representation of imprecise quantities, 2008 IEEE international conference on fuzzy system 2008, pp.2058-2065.

9. Shan – HUO Chen and GUO – Chinli, Representation Ranking and Distance of fuzzy number with exponential membership function using Grade mean integration method Tamsui oxford journal of mathematical sciences vol.16(2) pp.123-131, 2000

10. Taleshian. A and Rezuani. S transformations in fuzzy planer, journal of physical sciences vol.14, 2010, 1-11