

A COMMON FIXED POINT THEOREM  
IN INTUITIONISTIC Menger (PQM) SPACE WITH USING PROPERTY (E.A.)

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(Received On: 25-11-16; Revised & Accepted On: 17-12-16)

ABSTRACT

In this paper, we prove a common fixed point theorem in intuitionistic menger space with using property E.A. also it a generalization of a result.

Mathematics subject classification: 47A62, 47A63.

Keywords: fixed point, common fixed point, fuzzy set, fuzzy metric space intuitionistic menger space.

1. INTRODUCTION

There have been various speculations of metric space. One such speculation is Menger space presented in 1942 by Menger [102] who utilized dispersion capacities rather than nonnegative genuine numbers as estimations of the metric. Indeed, he supplanted the separation capacity  $d: X \times X \rightarrow R^+$  with a conveyance capacity  $F_{(p,q)}: R \rightarrow [0,1]$  wherein for any number  $x$ , the quality  $F_{(p,q)}(x)$  portrays the likelihood that the separation amongst  $p$  and  $q$  is not exactly. Aamri and Moutawakil [4] and Liu *et al.* [99] individually characterized the property (E.A) and basic property (E.A) and demonstrated some normal settled point hypotheses in metric spaces. Imdad *et al.* [72] developed the aftereffects of Aamri and Moutawakil [4] to semi-metric spaces. Most as of late, Kubiacyk and Sharma [90] characterized the property (E.A) in PM spaces and utilized the same to demonstrate a few results on basic altered focuses wherein creators guarantee their outcomes for strict withdrawals which are in truth demonstrated for compressions.

Kutukcu *et al.* characterized the thought of intuitionistic Menger spaces with the assistance of  $t$ -standards and  $t$ -conorms as a speculation of Menger spaces due to Menger. On the other hand Rezaian *et al.* demonstrate altered point hypothesis for Menger (PQM) space which is changed by Mihet

The point of this section is to demonstrate an altered point hypothesis in Intuitionistic Menger (PQM) space utilizing property E.A. for this first we give a few definitions and known results which are utilized as a part of this section.

**Definition 1.1:** "A binary operation  $T: [0,1] \times [0,1] \rightarrow [0,1]$ , is a  $t$ -norm if  $T$  satisfies the following conditions:

- 1.1 (i)  $T$  is commutative and associative.
  - 1.1 (ii)  $T(a, 1) = a$  for all  $a \in [0,1]$ .
  - 1.1 (iii)  $T(a, b) \leq T(c, d)$  whenever  $a \leq c$  and  $b \leq d$
- For  $a, b, c, d \in [0,1]$ ."

**Definition 1.2:** "A binary operation  $S: [0,1] \times [0,1] \rightarrow [0,1]$  is a  $t$ -conorm if  $S$  satisfies the following conditions:

- 1.2 (i)  $S$  is commutative and associative.
  - 1.2 (ii)  $S(a, 0) = a$  for all  $a \in [0,1]$
  - 1.2 (iii)  $S(a, b) \leq S(c, d)$  whenever  $a \leq c$  and  $b \leq d$
- For  $a, b, c, d \in [0,1]$ ."

**Remark 1.3:** The ideas of  $t$ -norm  $T$  and  $t$ -conorm  $S$  are known as the proverbial skeletons that we use for portraying fuzzy crossing points and unions individually. All through this paper, we will mean  $R = (-\infty, \infty)$  and  $R^{\wedge+} = [0, \infty)$ .

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**Definition 1.4:** A separation circulation capacity is a capacity  $F: R \rightarrow R^+$ , which is left constant on  $R$ , non-diminishing and  $\inf_{(t \in R)} F(t) = 0, \sup_{(t \in R)} F(t) = 1$ . We will mean by  $D$ , the group of all separation dispersion capacities and by  $H$  an extraordinary component of  $D$  characterized by

$$H(t) = \begin{cases} 0, & \text{if } t \leq 0 \\ 1, & \text{if } t > 0 \end{cases}$$

In the event that  $X$  is a nonempty set,  $F: X \times X \rightarrow D$  is known as a probabilistic separation on  $X$ .

**Definition 1.5:** A non-separation appropriation capacity is a capacity  $L: R \rightarrow R^+$ , which is correct consistent on  $R$ , non-expanding and  $\inf_{(t \in R)} L(t) = 1, \sup_{(t \in R)} L(t) = 0$ .

We will indicate by  $E$ , the group of all non-separation appropriation capacities and by  $G$  a unique component of  $E$  characterized by

$$G(t) = \begin{cases} 1, & \text{if } t \leq 0 \\ 0, & \text{if } t > 0 \end{cases}$$

In the event that  $X$  is a nonempty set,  $L: X \times X \rightarrow D$  is known as a probabilistic non-separation on  $X$ .

**Definition 1.6:** A triple  $(X, F, L, T, S)$  is said to be an intuitionistic Menger (PQM) space if  $X$  is a nonempty set,  $F$  is a probabilistic separation and  $L$  is probabilistic non-separation on  $X$  fulfilling the accompanying conditions:

For all  $a, b, c \in X$  and  $x, y > 0$

- $F(a, b)(x) + L(a, b)(x) \leq 1$
- $F(a, b)(x) = 0$
- $F(a, b)(x) = H(x)$  for all  $x > 0$  if and just if  $a = b$
- $F(a, b)(x) = F(b, a)(x)$
- $L(a, b)(0) = 1$
- $L(a, b)(x) = G(x)$  for all  $x > 0$  if and just if  $a = b$
- $L(a, b)(x) = L(b, a)(x)$

On the off chance that moreover, we have the triangle imbalances:

- $F(a, b)(x+y) \geq T(F(a, c)(x), F(c, b)(y))$ .
- $L(a, b)(x+y) \leq S(L(a, c)(x), L(c, a)(y))$ .

Here  $T$  is a  $t$ -norm and  $S$  is a  $t$ -conorm. At that point  $(X, F, L, T, S)$  is said to be an intuitionistic Menger (PQM) space. The capacities  $F(a, b)(x)$  and  $L(a, b)(x)$  signify the level of proximity and level of non-closeness amongst  $a$  and  $b$  as for  $x$  separately.

**Remark 1.7:** Every Menger (PQM) space  $(X, F, T)$  is an intuitionistic Menger (PQM) space of the structure  $(X, F, 1-F, T, S)$  with the end goal that  $t$ -norm  $T$  and  $t$ -conorm  $S$  are related i.e.

$$S(a, b) = 1 - T(1 - a, 1 - b) \text{ for any } a, b \in X.$$

**Illustration 1.8:** (Induced intuitionistic Menger (PQM) space) Let  $(X, d)$  be a metric space. At that point the metric  $d$  actuates a separation appropriation capacity  $F$  characterized by

$$F(a, b)(x) = H(x - d(a, b))$$

what's more, a non-separation circulation capacity  $L$  characterized by

$$L(a, b)(x) = G(x - d(a, b)) \text{ for all } a, b, \in X \text{ and } x \geq 0.$$

At that point  $(X, F, L)$  is an intuitionistic Menger (PQM) space.

We call this intuitionistic Menger (PQM) space actuated by a metric  $d$  the incited intuitionistic Menger (PQM) space. On the off chance that  $t$ -norm  $T$  is  $T(x, y) = \min\{x, y\}$  and  $t$ -conorm  $S$  is  $S(x, y) = \min\{1, x+y\}$  for each of the  $x, y$  belongs  $[0, 1]$ , then  $(X, F, L, T_M, S_M)$  is an intuitionistic Menger (PQM) space.

**Definition 1.10:** "Let  $(X, F, L, T, S)$  be an Intuitionistic Menger (PQM) space.

(i) An arrangement  $\{x_n\}$  in  $X$  is said to be joined to  $x$  in  $X$ , if for each  $\epsilon > 0, \lambda > 0$ , there exists positive whole number  $N$  with the end goal that

$$F(x_n, x)(\epsilon) > 1 - \lambda \text{ and } L(x_n, x)(\epsilon) < \lambda \text{ at whatever point } n \geq N.$$

We compose  $x_{-}(n) \rightarrow x$  as  $n \rightarrow \infty$  or  $\lim_{T(n \rightarrow \infty)} x_{-}n = x$ ."

**Lemma 1.11:** "Let  $(X, F, L, T, S)$  be an intuitionistic Menger space. If there is a constant  $k \in (0, 1)$  such that for  $x, y \in X, t > 0$ ,

1.  $F_{x,y}(kt) \geq F_{x,y}(t)$  and  $L_{x,y}(kt) \leq L_{x,y}(t)$ , then  $x = y$ ."
2. Then  $F_{x,y}(t)$  and  $L_{x,y}(t)$  are continuous functions on  $X \times X \rightarrow (0, \infty)$ ."
3. such that the  $t$ -norm  $T$  and  $t$ -conorm  $S$  is continuous and  $P, Q$  be mappings from  $X$  into itself. Then,  $P$  and  $Q$  are said to be compatible if

$$\lim_{n \rightarrow \infty} F_{PQx_n, QPx_n}(x) = 1 \text{ and } \lim_{n \rightarrow \infty} L_{PQx_n, QPx_n}(x) = 0 \text{ for all } x > 0,$$

whenever  $\{x_n\}$  is a sequence in  $X$  such that

$$\lim_{n \rightarrow \infty} Px_n = \lim_{n \rightarrow \infty} Qx_n = z \text{ for some } z \in X."$$

**Definition 1.13:** "Two self mappings  $P$  and  $Q$  are said to be weakly compatible if they commute at their coincidence points that is  $Px = Qx$ ."

For some  $x \in X$  implies

$$PQx = QPx."$$

**Definition 1.14:** "Let  $P$  and  $Q$  be two self mappings of a Menger space  $(X, F, L, T, S)$ . We say that  $P$  and  $Q$  satisfy the property (E.A) if there exists a sequence  $\{x_n\}$  in  $X$  such that

$$\lim_{n \rightarrow \infty} Px_n = \lim_{n \rightarrow \infty} Qx_n = z \text{ for some } z \in X."$$

**Example 1.16:** Let  $A = [0, +\infty)$ . Define  $X, Y: A \rightarrow A$  by

$$Aa = \frac{5a}{6} \text{ and } a = \frac{3a}{4}, \forall a \in A$$

Consider the sequence  $a_n = \frac{1}{n}$ . Clearly

$$\lim_{n \rightarrow \infty} a_n = \lim_{n \rightarrow \infty} Xa_n = \lim_{n \rightarrow \infty} Ya_n = 0$$

Then  $A$  and  $B$  satisfy  $(F, X)$ .

**Example 1.17:** Let  $A = [2, +\infty)$ . Define  $X, Y: A \rightarrow A$  by

$$Aa = a + 1 \text{ and } a = 2a + 1 \forall a \in A.$$

Suppose that the property (E.A.) satisfies. Then there is a sequence  $\{a_n\}$  in  $A$  satisfying

$\lim_{n \rightarrow \infty} Aa_n = \lim_{n \rightarrow \infty} Bb_n = w$  for some  $w \in A$ , Therefore  $\lim_{n \rightarrow \infty} a_n = w - 1$  and  $\lim_{n \rightarrow \infty} a_n = \frac{w-1}{2}$ . Thus,  $w = 1$ , which is a contradiction since  $1 \notin A$ .

Hence  $U$  and  $V$  do not satisfy (E.A.).

## 2. MAIN RESULTS

**Theorem 2.1:** Assume that " $(A, F, L, T, S)$  be an Intuitionistic Menger (PQM) space with  $T(a, b) = \min \{a, b\}$  and  $S(a, b) = \max \{a, b\}$  for all  $a, b \in [0, 1]$ ."

Let  $X, Y, U, V$  be capacities from  $A$  into itself to such an extent that:

$$X(A) \subset Y(A) \text{ and } X(B) \subset Y(B).$$

$(X, V)$  or  $(Y, U)$  fulfills the property (E.A).

There exists a number  $s \in (0, 1)$  with the end goal that

$$F_{-}(xa, yb)(sa) \geq \min\{F_{-}(Qu, Pv)(x), F_{-}(Qu, Bv)(x), F_{-}(Pv, Bv)(x), @F_{-}(Au, Qu)(x), F_{-}(Au, Pv)(x)\}$$

$L_{-}(Au, Bv)(kx) \leq \min\{L_{-}(Qu, Pv)(x), L_{-}(Qu, Bv)(x), L_{-}(Pv, Bv)(x), @L_{-}(Au, Qu)(x), L_{-}(Au, Pv)(x)\}$  for all  $u, v \in X$ .

2.1 (IV)  $(X, V)$  and  $(Y, U)$  are feebly good,

2.1 (V) One of  $X(X), Y(X), V(X)$  or  $U(X)$  is a shut subset of  $X$ .

At that point  $A, B, P$  and  $Q$  have a remarkable regular altered point in  $X$ .

**Proof:** Assume that (B, P) fulfills the property (E.A). At that point there exists a succession  $\{x_n\}$  in X with the end goal that

$$\lim_{n \rightarrow \infty} Bx_n = \lim_{n \rightarrow \infty} Px_n = z$$

$$\lim_{n \rightarrow \infty} Bx_n \uparrow \lim_{n \rightarrow \infty} Px_n = z \text{ for some } z \in X.$$

Since  $B(X) \subset Q(X)$ , there exists in X a succession  $\{y_n\}$  with the end goal that  $Bx_n = Qy_n$ . Subsequently  $\lim_{n \rightarrow \infty} Qy_n = z$ .

Give us a chance to demonstrate that  $\lim_{n \rightarrow \infty} Ay_n = z$ .

$$F_{Ay_n, Bx_n}(kx) \geq \min \left\{ \begin{array}{l} F_{Qy_n, Px_n}(x), F_{Qy_n, Bx_n}(x), F_{Px_n, Bx_n}(x), \\ F_{Ay_n, Qy_n}(x), F_{Ay_n, Px_n}(x) \end{array} \right\}$$

$$\geq \min \left\{ \begin{array}{l} F_{Bx_n, Px_n}(x), F_{Px_n, Bx_n}(x), \\ F_{Ay_n, Bx_n}(x), F_{Ay_n, Px_n}(x) \end{array} \right\}$$

$$\geq F_{Ay_n, Bx_n}(x)$$

$$L_{Ay_n, Bx_n}(kx) \leq \min \left\{ \begin{array}{l} L_{Qy_n, Px_n}(x), L_{Qy_n, Bx_n}(x), L_{Px_n, Bx_n}(x), \\ L_{Ay_n, Qy_n}(x), L_{Ay_n, Px_n}(x) \end{array} \right\}$$

$$\leq \min \left\{ \begin{array}{l} L_{Bx_n, Px_n}(x), L_{Px_n, Bx_n}(x), \\ L_{Ay_n, Bx_n}(x), L_{Ay_n, Px_n}(x) \end{array} \right\}$$

$$\leq L_{Ay_n, Bx_n}(x)$$

Therefore with the Lemma (1.11)  $Ay_n = Bx_n$ .

Letting  $n \rightarrow \infty$ , we obtain

$$\lim_{n \rightarrow \infty} Bx_n = \lim_{n \rightarrow \infty} Ay_n = z.$$

Suppose  $Q(X)$  is a closed subset of X. Then  $z = Qu$  for some  $u \in X$ .

Subsequently, we have

$$\lim_{n \rightarrow \infty} Ay_n = \lim_{n \rightarrow \infty} Bx_n = \lim_{n \rightarrow \infty} Px_n = \lim_{n \rightarrow \infty} Qy_n = Qu$$

We have

$$F_{Au, Bx_n}(kx) \geq \min \left\{ \begin{array}{l} F_{Qu, Px_n}(x), F_{Qu, Bx_n}(x), F_{Px_n, Bx_n}(x), \\ F_{Au, Qu}(x), F_{Au, Px_n}(x) \end{array} \right\}$$

$$L_{Au, Bx_n}(kx) \leq \min \left\{ \begin{array}{l} L_{Qu, Px_n}(x), L_{Qu, Bx_n}(x), L_{Px_n, Bx_n}(x), \\ L_{Au, Qu}(x), L_{Au, Px_n}(x) \end{array} \right\}$$

Letting  $n \rightarrow \infty$ , we obtain

$$F_{Au, Su}(kx) \geq F_{Au, Su}(x)$$

$$L_{Au, Su}(kx) \leq L_{Au, Su}(x)$$

Therefore with the Lemma 1.11) we have

$$Au = Qu.$$

The weak compatibility of A and Q implies that

$$AQ = QA \text{ and then } AAu = AQu = QAu = QQu.$$

On the other hand, since  $A(X) \subset P(X)$ , there exists a point  $v \in X$ , such that  $Au = Pv$ .

We claim that  $Pv = Bv$

We have

$$F_{Au, Bv}(kx) \geq \min \left\{ \begin{array}{l} F_{Qu, Pv}(x), F_{Qu, Bv}(x), F_{Pv, Bv}(x), \\ F_{Au, Qu}(x), F_{Au, Pv}(x) \end{array} \right\} \geq F_{Au, Bv}(x)$$

$$L_{Au, Bv}(kx) \leq \min \left\{ \begin{array}{l} L_{Qu, Pv}(x), L_{Qu, Bv}(x), L_{Pv, Bv}(x), \\ L_{Au, Qu}(x), L_{Au, Pv}(x) \end{array} \right\}$$

$$\leq L_{Au, Bv}(x).$$

Therefore, with the Lemma (1.11), we have  $Au = Bv$ .

Thus  $Au = Qu = Pv = Bv$ .

The weak compatibility of B and P implies that

$$BPv = PBv \text{ and } PPv = PBv = BPv = BBv.$$

Let us show that  $Au$  is a common fixed point of A, B, Pand Q.

We have

$$F_{Au,AAu}(kx) = F_{AAu,Bv}(kx) \geq \min \left\{ \begin{array}{l} F_{Q Au, Pv}(x), F_{Q Au, Bv}(x), F_{Pv, Bv}(x), \\ F_{AAu, Q Au}(x), F_{AAu, Pv}(x) \end{array} \right\}$$

$$F_{Au,AAu}(kx) \geq F_{AAu,Av}(x)$$

$$L_{Au,AAu}(kx) = L_{AAu,Bv}(kx) \leq \min \left\{ \begin{array}{l} L_{Q Au, Pv}(x), L_{Q Au, Bv}(x), L_{Pv, Bv}(x), \\ L_{AAu, Q Au}(x), L_{AAu, Pv}(x) \end{array} \right\}$$

$$L_{Au,AAu}(kx) \leq L_{AAu,Av}(x)''$$

“Therefore, we have

$$Au = AAu = Q Au$$

That is  $Au$  is a common fixed point of A and Q.

Similarly, we can prove that  $Bv$  is a common fixed point of B and P.

Since  $Au = Bv$ , we conclude that  $Au$  is a common fixed point of A, B, Pand Q.

The proof is similar when  $P(X)$  is assumed to be a closed subset of  $X$ .

The cases in which  $A(x)$  or  $B(x)$  is closed subset of  $X$  are similar to the cases in which  $P(X)$  or  $Q(X)$ , respectively, is closed

Since  $A(X) \subset P(X)$  and  $B(X) \subset Q(X)$ .

If  $Au = Bu = Su = Lu = u$  and  $Av = Bv = Sv = Lv = v$ .

We have

$$F_{u,v}(kx) = F_{Au,Bv}(kx) \geq \min \left\{ \begin{array}{l} F_{Qu,Pv}(x), F_{Qu,Bv}(x), F_{Pv,Bv}(x), \\ F_{Au,Qu}(x), F_{Au,Pv}(x) \end{array} \right\} \geq F_{u,v}(x).$$

$$L_{u,v}(kx) = L_{Au,Bv}(kx) \leq \min \left\{ \begin{array}{l} L_{Qu,Pv}(x), L_{Qu,Bv}(x), L_{Pv,Bv}(x), \\ L_{Au,Qu}(x), L_{Au,Pv}(x) \end{array} \right\} \leq L_{u,v}(x).''$$

Hence we have  $u = v$  and the common fixed point is unique.

Hence the proof.

For three functions, we have the following result:

**Corollary 2.2:** “Let  $(X, F, L, T, S)$  be an Intuitionistic Menger (PQM) space with  $T(x, y) = \min \{x, y\}$  and  $S(x, y) = \max \{x, y\}$  for all  $x, y \in [0, 1]$ .

Let A, B and P be mappings from  $X$  into itself such that:

2.2 (I)  $A(X) \subset P(X)$  and  $B(X) \subset P(X)$

2.2 (II)  $(A, P)$  or  $(B, P)$  satisfies the property (E.A.),

2.2 (III) There exists a number  $k \in (0,1)$  such that

$$F_{Au,Bv}(kx) \geq \min \left\{ \begin{array}{l} F_{Pu,Pv}(x), F_{Pu,Bv}(x), \\ F_{Pv,Bv}(x), F_{Au,Pu}(x), F_{Au,Pv}(x) \end{array} \right\}$$

$$L_{Au,Bv}(kx) \leq \min \left\{ \begin{array}{l} L_{Pu,Pv}(x), L_{Pu,Bv}(x), \\ L_{Pv,Bv}(x), L_{Au,Pu}(x), L_{Au,Pv}(x) \end{array} \right\} \text{ for all } u, v \in X.$$

2.2 (IV) (A, P) and (B, P) are weakly compatible,

2.2 (V) One of  $A(X)$ ,  $B(X)$  or  $P(X)$  is a closed subset of  $X$ .

Then A, B and P have a unique common fixed point in  $X$ .”

**Corollary 2.3:** “Let  $(X, F, L, T, S)$  be a Intuitionistic Menger (PQM) space with  $T(x, y) = \min \{x, y\}$  and  $S(x, y) = \max \{x, y\}$  for all  $x, y \in [0, 1]$ .

Let A and P be mappings from  $X$  into itself such that:

2.3 (I)  $A(X) \subset P(X)$ .

2.3 (II) (A, P) satisfies the property (E.A),

2.3 (III) There exists a number  $k \in (0,1)$  such that

$$F_{Au,Av}(kx) \geq \min \left\{ \begin{array}{l} F_{Pu,Pv}(x), F_{Pu,Av}(x), \\ F_{Pv,Av}(x), F_{Au,Pu}(x), F_{Au,Pv}(x) \end{array} \right\}$$

$$L_{Au,Av}(kx) \leq \min \left\{ \begin{array}{l} L_{Pu,Pv}(x), L_{Pu,Av}(x), \\ L_{Pv,Av}(x), L_{Au,Pu}(x), L_{Au,Pv}(x) \end{array} \right\} \text{ for all } u, v \in X.$$

2.3 (IV) (A, P) be weakly compatible,

2.3 (V) One of  $A(X)$  or  $P(X)$  is a closed subset of  $X$ .

Then A and P have a unique common fixed point in  $X$ .”

## REFERENCES

1. Aage, C. T. and Salunke, J. N.: On fixed point theorems in fuzzy metric spaces, Int. J. Open Prob. Comput. Sci. Math., 3(2) (2010), 123-131.
2. Aage, C.T. and Salunke, J.N.: Some common fixed point theorems in fuzzy metric spaces using compatible of type A-1 and A-2, Kath. Univ. J.Sci.Engg.Tech., 7(1) (2011), 18-27.
3. Aalam, I., Kumar, S. and Pant, B. D.: A common fixed point theorem in fuzzy metric space, Bull. Math. Anal. Appl., 2 (4) (2010), 76-82.
4. Aamri, M. and Moutawakil, D. El.: Some new common fixed point theorems under strict contractive conditions, J. Math. Anal. Appl., 270 (2002), 181-188.
5. Adibi, H., Cho, Y.J., Regan, D. O. and Saadati, R.: Common fixed point theorems in L-fuzzy metric spaces, Appl. Math. Comput., 182 (2006), 820 - 828.
6. Al-Thagafi, M. A. and Shahzad, N.: A note on occasionally weakly compatible maps, Int. J. Math. Anal., 3(2)(2009), 55-58.
7. Alaca, C.: A common fixed point theorem for weak compatible mappings in intuitionistic fuzzy metric spaces, Int. J. P. Appl. Math., 32 (4) (2006), 25-36.
8. Alaca, C.: On fixed point theorems in intuitionistic fuzzy metric spaces, Comm. Korean Math. Soc., 24(4) (2009), 565-579.
9. Alaca, C., Turkoglu, D. and Yildiz, C.: Common fixed points of compatible maps in intuitionistic fuzzy metric spaces, Southeast Asian Bull. Math., 32(2008), 21-33.
10. Alaca, C., Turkoglu, D. and Yildiz, C.: Fixed points in intuitionistic fuzzy metric spaces, Chaos, Solitons and Fractals, 29(2006), 1073-1078.
11. Ali, J., Imdad, M. and Bahuguna, D.: Common fixed point theorems in Menger spaces with common property (E.A), Comput. Math. Appl., 60(12) (2010), 3152-3159.
12. Aliouche, A.: Common fixed point theorems of Gregus type for weakly compatible mappings satisfying generalized contractive conditions, J. Math. Anal. Appl., 341 (2008), 707-719.
13. Altun, I. and Turkoglu, D.: Some fixed point theorems on fuzzy metric spaces with implicit relations, Comm. Korean Math. Soc., 23(1) (2008), 111-124.
14. Altun, I., Turkoglu, D. and Rhoades, B.E.: Fixed points of weakly compatible maps satisfying a general contractive condition of integral type, Fixed Point Theory Appl., article ID 17301 (2007), 9 pages, doi: 10/1155/2007/17301.
15. Assad, N.A. and Kirk, W.A.: Fixed point theorems for set-valued mappings of contractive type, Pacific J. Math., 43(1972), 553-562.
16. Atanassov, K.T.: Intuitionistic fuzzy sets, Cent. Tech. Lib., Bulg. Acad. Sci., Sofia, Bulgaria, Rep. No. 1697/84, (1983).
17. Atanassov, K.T.: Intuitionistic fuzzy sets, Fuzzy sets and systems, 20 (1986), 87-96.
18. Atanassov, K.T.: Intuitionistic fuzzy sets, Heidelberg, Germany, Physica-Verlag, (1999).

19. Atanassov, K.T.: New operations defined over the intuitionistic fuzzy set, Fuzzy sets and systems, 61 (1994), 137-142.
20. Badard, R.: Fixed point theorems for fuzzy numbers, Fuzzy Sets and Systems, 13 (1984), 291-302.
21. Bakry, M.S. and Abu Donia, H.M.: Fixed point theorems for a probabilistic 2-metric spaces, J. K. S.Uni. (Sci.), 22 (2010), 217–221.
22. Balasubramaniam, P., Muralishankar,S. and Pant, R.P.: Common fixed points of four mappings in a fuzzy metric space, J. Fuzzy Math., 10(2)(2002), 379-384.
23. Banach,S.: Sur les operations dans les ensembles abstraits et leur applications aux equations integrales, Fund. Math., 3(1922), 133-181.
24. Banach, S.: Theorie les operations Lineaires, Manograie Matematyeczne, Warsaw, Poland, (1932).
25. Birkhoff,C.D. and Kellogg, O.D.: Invariant points in a Function space, Trans. Amer. Math. Soc., 23(1922), 96-115.
26. Bose, B.K. and Sahani, D.: Fuzzy mappings and fixed point theorems, Fuzzy Sets and Systems, 21 (1987), 53-58.
27. Bouhadjera, H. and Thobie, C.G.: Common fixed point theorems for occasionally weakly compatible maps, ArXiv. 0812.373 [math. FA], 2(2009), 123-131.
28. Bouhadjera, H. and Thobie, C.G.: Common fixed point theorems for pairs of subcompatible maps, ArXiv: 0906.3159v1[math.FA], 17 (2009).
29. Boyd, D.W. and Wong, J.S.W.: On nonlinear contractions, Proc. Amer. Math. Soc., 20(1969), 458–464.
30. Branciari, A.: A fixed point theorem for mappings satisfying a general contractive condition of integral type, Int. J. Math. Math.Sci., 29 (2002), 531-536.
31. Brouwer, L.E.J.: Uber Abbildung Von Mannigfaltigkeiten, Math. Ann., 71(1912), 97-115.
32. Bryant, V.W.: A remark on a fixed point theorem for iterated mappings, Amer. Math. Monthly, 75(1968), 399-400.
33. Chang, S.S., Lee, B.S., Cho, Y.J., Chen, Y.Q., Kang, S.M. and Jung, J.S.: Generalized contraction mapping principles and differential equations in probabilistic metric spaces, Proc. Amer. Math. Soc., 124(23) (1996), 67–76.
34. Chatterjee,S.K.:Fixed point theorems, Computes Reno, Acad. Bulgar. Sci., 25(1972), 727-730.
35. Cho, S.H.: On common fixed point theorems in fuzzy metric spaces, J. Appl. Math. Computing, 20 (1-2) (2006), 523-533.
36. Cho, S. H. and Jung, J. H.: On common fixed point theorems in fuzzy metric spaces, Int. Math. Forum, 29(1) (2006), 1441-1451.
37. Cho, Y.J.: Fixed points in fuzzy metric spaces, J. Fuzzy Math., 5 (4) (1997), 949–962.
38. Cho,Y.J., Murthy,P.P. and Stojakovic, M.: Compatible mappings of type (A) and common fixed points in menger spaces, Comm. Korean Math. Soc., 7(2) (1992), 325-339.
39. Cho, Y.J., Pathak, H.K., Kang, S.M. and Jung, J.S.: Common fixed points of compatible maps of type ( $\beta$ ) on fuzzy metric spaces, Fuzzy Sets and Systems, 93(1998), 99-111.
40. Cho, Y.J., Sedghi,S. and Shobe,N.: Generalized fixed point theorems for compatible mappings with some types in fuzzy metric spaces, Chaos, Solitons and Fractals, 39 (2009), 2233–2244.
41. Cho, Y.J. , Sharma, B.K. and Sahu, D.R.: Semi-compatibility and fixed points, Math. Japon., 42(1)(1995), 91-98.
42. Ciric, Lj. B.: A generalization of Banach's contraction principle, Proc. Amer. Math. Soc., 45 (1974), 267-273.
43. Ciric, Lj.B.: On fixed point of generalized contrations on probabilistic metric spaces, Publ.DE L’Inst. Math.(Beogard)(N.S.), 18(32) (1975), 71-78.
44. Deschrijver, G. and Kerre, E.E.: On the relationship between some extensions of fuzzy set theory, Fuzzy Sets and Systems, 33 (2003), 227-235.
45. Deschrijver, G., Cornelis, C. and Kerre, E.E.: On the representation of intuitionistic fuzzy t-norms and t-conorms, IEEE Transactions on Fuzzy Sys., 12 (2004), 45-61.
46. **Deshpande, B.:** Fixed point and (DS)-weak commutativity condition in intuitionistic fuzzy metric spaces, Chaos, Solitons and Fractals, 42(5) (2009), 2722-2728.
47. Djoudi, A. and Aliouche, A.: Common fixed point theorems of Gregus type for weakly compatible mappings satisfying contractive conditions of integral type, J.Math. Anal. Appl., 329 (1) (2007), 31-45.
48. Djoudi, A. and Merghadi, F.: Common fixed point theorems for maps under a contractive condition of integral type, J. Math. Anal. Appl., 341 (2) (2008), 953-960.
49. Edelstein, M.: A non- expansive mappings of Banach spaces, Proc. Cambridge Phil. Soc., 60(1964), 509-510.
50. Edelstein, M.: An extension of Banach’s contraction principle, Proc. Amer. Math. Soc., 12(1961), 7-10.
51. Edelstein, M.: On fixed and periodic points under contractive mappings, J. London Math. Soc., 37(1962), 74–79.
52. Edelstein, M.: On non- expansive mappings, Proc. Amer. Math. Soc., 15(1964), 689-695.
53. Efe,H.: Some results in L-fuzzy metric spaces, Carpathian J. Math., 24(2) (2008), 37 – 44.
54. EL. Naschie, MS.: ‘t Hooft ultimate building blocks and space–time an infinite dimensional set of transfinite discrete points, Chaos Solitons and Fractals, 25(2005), 521–524.
55. EL. Naschie, MS.: The two slit experiment as the foundation of E-infinity of high energy physics., Chaos, Solitons and Fractals, 25(2005), 509–514.
56. Fang, J. X.: On fixed point theorems in fuzzy metric spaces, Fuzzy sets and Systems, 46 (1992), 107-113.
57. Fang,J.X. and Gao,Y.: Common fixed point theorems under strict contractive conditions in Menger spaces, Nonlinear Anal., 70 (2009), 184–193.
58. Fisher,B.: Common fixed points of four mappings, Bull. Inst. Math. Acad. Sci., 11(1983), 103-113.
59. Fisher,B.: Mappings with a common fixed point, Math. Sem. Notes Kobe Univ., 7 (1979), 81 – 84.

60. Singh, B. and Jain, S.: Weak compatibility and fixed point theorems in fuzzy metric spaces, *Ganita*, 56(2)(2005), 167-176.
61. Singh, B., Jain, A. and Govery, A.K.: Compatibility of type  $(\beta)$  and fixed point theorem in fuzzy metric space, *Appl. Math. Sci.*, 5(11) (2011), 517 – 528.
62. Singh, M., Jain, S. and Sagar, D.: Common fixed points in probabilistic metric space by compatible mappings, *Int. J. Algeb.*, 4(19)(2010), 903 – 911.
63. Som, T.: Some results on fixed point in fuzzy metric spaces, *Soochow J. Math.*, 33(4)(2007), 553-561.
64. Turkoglu, D., Alaca, C. and Yildiz, C.: Compatible maps and compatible maps of type  $(\alpha)$  and  $(\beta)$  in intuitionistic fuzzy metric spaces, *Demonstratio Math.*, 39(3) (2006), 671–684.
65. Vasuki, R.: Common fixed points for R-weakly commuting maps in fuzzy metric spaces, *Indian J. Pure Appl. Math.*, 30 (4) (1999), 419-423.
66. Zadeh, L. A.: Fuzzy sets, *Inform. Control*, 8 (1965), 338–353.

**Source of support: Nil, Conflict of interest: None Declared**

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