2-Absorbing Neutrosophic Weakly Completely Γ-Ideals

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Abstract

The goal of this study is to present a definition of a generalization of neutrosophic prime Γ-ideals in Γ-rings by introducing 2-absorbing neutrosophic weakly completely Γ-ideals of commutative Γ-rings and to propose their properties. Also, we give the notion of 2-absorbing K- Γ-neutrosophic ideals of Γ-rings. Moreover, we acquire a scheme that relationship between definition of 2-absorbing neutrosophic weakly completely Γ-ideals and 2-absorbing K- Γ-neutrosophic ideals of Γ-rings. Finally, we investigate neutrosophic quotient Γ-ring of R induced by the 2-absorbing neutrosophic weakly completely Γ-ideal is a 2-absorbing $\Gamma-$ ring.

Keywords: 2-absorbing; 2-absorbing neutrosophic weakly completely Γ-ideal; 2-absorbing K-neutrosophic Γ-ideal

1 Introduction

Smarandache proposed in[1] the concept of neutrosophic logic. From a philosophical perspective, the neutrosophic set derives its value from real standard or non-standard subsets of $]^{-}0, 1^{+}[$. However, in real scenarios in academic and technical issues, using a neutrosophic set with a value from a real standard or non-standard subset of $]^{-}0, 1^{+}[$ is problematic. For this reason, this research speculates on the future specification of the concept of a neutrosophic set similar to the single-valued neutrosophic set. If X is a space of points (objects), where a general element in X is denoted by a. A single-valued neutrosophic set (SVNS) N on X is represented by the truth function t_N, the indeterminacy function i_N and the falsity function f_N. For each point a in X, $t_N(a), i_N(a), f_N(a) \in [0,1]$. The creation of the neutrosophic notion, which triggered a scientific revolution in the field of algebraic structures, had an impact on the development of the concept of neutrosophic algebraic structures in.[2] Many authors have dealt with it. For more information on single-valued neutrosophic sets, see.[3–8,25]
According to N. Nobusawa, the concept of a Γ-ring is much broader than just a ring in.[9] The requirements for the definition of Γ-rings in Nobusawa's idea were relaxed by W.E.Barnes.[10] In[11–13] researchers developed the structure of Γ-rings and arrived at divergent rationalizations in ring theory.
Badawi proposed the concept of a 2-absorbing ideal, which is actually the general form of the prime ideal in,[14] and also introduced it in.[15,16] At present, reflections on the theory of the 2-absorbing ideal are rapidly making up for lost time. A large number of authors have contributed to it (e.g.,[17–19]). Darani[20] introduced the concept of L-fuzzy 2-absorbing ideals and obtained interesting results. Then, Darani et al.[21] introduced the idea of L-fuzzy 2-absorbing ideals in semirings and presented stimulating results based on it. 2-absorbing primary fuzzy ideals of commutative rings were characterized by Sonmez,[22] and connections between 2-absorbing primary fuzzy ideals and 2-absorbing primary ideals were established.
In commutative neutrosophic algebra, the prime ideals are the remarkably weighty structures and in this paper a fancy algebraic structure of prime neutrosophic Γ-ideals of the commutative Γ-ring is abandoned by the theory of 2-absorbing weakly completely prime ideals. We clarify the notion of 2-absorbing neutrosophic weakly completely Γ -ideal of a Γ-ring and study part of its classification of algebraic situations. For the same reason, we find a definition of the 2-absorbing K-neutrosophic Γ-ideal of a Γ-ring. We determine the image and the inverse image of the 2-absorbing neutrosophic weakly completely Γ-ideal of a Γ-ring and the 2-absorbing K-neutrosophic Γ-ideal of a Γ-ring. We also construct a scheme that connects the relations between

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these terms to the notion of 2-absorbing Γ-ideal. In the end, we establish that the neutrosophic quotient Γ-ring of R induced by the 2-absorbing neutrosophic weakly complete Γ-ideal is a 2-absorbing Γ-ring.

2 Preliminaries

In this part we show the preliminaries on Γ-rings, 2-absorbing and single-valued neutrosophic sets and set operations, which we will call neutrosophic sets. In this study, $L = [0, 1]$ stands for a complete lattice and the Γ-ring R is commutative with $1 \neq 0$ for purity.

Definition 2.1. [23] Let R and Γ be two abelian additive groups. R is called a $\Gamma-$ring if there exists a mapping

$$\begin{aligned} R \times \Gamma \times R &\rightarrow R \\ (x, \alpha, y) &\mapsto x\alpha y \end{aligned}$$

satisfying the following conditions;

1. $(x + y)\, \alpha z = x\alpha z + y\alpha z$,
2. $x\alpha\,(y + z) = x\alpha y + x\alpha z$,
3. $x\,(\alpha + \beta)\, y = x\alpha y + x\beta y$,
4. $x\alpha\,(y\beta z) = (x\alpha y)\,\beta z$

for all $x, y, z \in R$ and all $\alpha, \beta \in \Gamma$. A $\Gamma-$ring R is called commutative if $x\alpha y = y\alpha x$ for any $x, y \in R$ and $\alpha \in \Gamma$.

Definition 2.2. [23] A left (resp. right) ideal of a $\Gamma-$ring R is a subset A of R which is an additive subgroup of R and $R\Gamma A \subseteq A$ (resp,$A\Gamma R \subseteq A$) where,

$$R\Gamma A = \{x\alpha y \mid x \in R, \alpha \in \Gamma, y \in A\}.$$

If A is both a left and a right ideal, then A is called a $\Gamma-$ideal of R.

Definition 2.3. [23] Let R and S be two $\Gamma-$rings, and ρ be a mapping of R into S. Then ρ is called a $\Gamma-$homomorphism if

$$\rho\,(a + b) = \rho\,(a) + \rho\,(b)$$

and

$$\rho\,(a\alpha b) = \rho\,(a)\,\alpha\rho\,(b)$$

for all $a, b \in R$ and $\alpha \in \Gamma$.

Definition 2.4. [24]Let R be a $\Gamma-$ring. A proper ideal P of R is called a prime $\Gamma-$ideal if for all pairs of ideals S and T of R,

$$S\Gamma T \subseteq P \text{ implies that } S \subseteq P \text{ or } T \subseteq P.$$

Proposition 2.5. [24] *If P is an ideal of a $\Gamma-$ring R, then the following conditions are equivalent:*

1. *P is a prime $\Gamma-$ideal of R;*
2. *If $x, y \in R$ and $x\Gamma R\Gamma y \subseteq P$, then $x \in P$ or $y \in P$.*

Definition 2.6. [14]A proper ideal I of commutative ring M is called a 2-absorbing ideal of M if for $x, y, z \in M$ with $xyz \in I$, $xy \in I$ or $xz \in I$ or $yz \in I$.

Theorem 2.7. [16] *Assume that I is a nonzero proper ideal of a ring R and the following conditions are equivalent*
i) I is a 2-absorbing ideal of R.
ii) If $I_1 I_2 I_3 \subseteq I$ for some ideals $I_1,\ I_2,\ I_3$ of R, then $I_1 I_2 \subseteq I$ or $I_1 I_3 \subseteq I$ or $I_2 I_3 \subseteq I$.

Definition 2.8. [24] A proper $\Gamma-$ideal I of a $\Gamma-$ring R is called a 2-absorbing $\Gamma-$ideal of R if for $x, y, z \in R$, $\alpha, \beta \in \Gamma$ with $x\alpha y\beta z \in I$, $x\alpha y \in I$ or $x\beta z \in I$ or $y\beta z$.

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Definition 2.9. [1] A neutrosophic set N on the universe of U is described as

$$N = \{\langle u, t_N(u), i_N(u), f_N(u)\rangle, u \in U\}$$

where $t_N, i_N, f_N : U \to]^-0, 1^+[$ and $^-0 \le t_N(u) + i_N(u) + f_N(u) \le 3^+$.

A neutrosophic set N can be written as

$$N = \sum_{j=1}^{n} \langle t_N(a_j), i_N(a_j), f_N(a_j)\rangle / a_j,\ a_j \in X$$

Since the membership functions t_N, i_N, f_N are defined from X into the unit interval $[0,1]$ as $t_N, i_N, f_N : X \to [0,1]$, a single valued neutrosophic set N will be denoted by a mapping defined as

$$\begin{aligned} N &: X \to [0,1] \times [0,1] \times [0,1] \text{ and} \\ &: X \mapsto (t_N(a), i_N(a), f_N(a)) = N(a) \end{aligned}$$

[4,7] Let N and M be two neutrosophic sets on X. Then,
(1) N is contained in M, denoted as $N \subseteq M$, if and only if $N(a) \le M(a)$. It follows that

$$t_N(a) \le t_M(a),\ i_N(a) \le i_M(a) \text{ and } f_N(a) \ge f_M(a).$$

Two sets N and M is called equal, i.e., $N = M$ if and only if $N \subseteq M$ and $M \subseteq N$.
(2) The union of N and M is denoted by $K = N \cup M$ and defined as $K(a) = N(a) \vee M(a)$ where for all $a \in X$,

$$N(a) \vee M(a) = (t_N(a) \vee t_M(a), i_N(a) \vee i_M(a),\ f_N(a) \wedge f_M(a)).$$

It follows that

$$\begin{aligned} t_C(a) &= \max\{t_N(a), t_M(a)\}, \\ i_C(a) &= \max\{i_N(a), i_M(a)\}, \text{and} \\ f_C(a) &= \min\{f_N(a), f_M(a)\}. \end{aligned}$$

(3) The intersection of N and M is denoted by $L = N \cap M$ and defined as $L(a) = N(a) \wedge M(a)$ where for all $a \in X$,

$$N(a) \wedge M(a) = (t_N(a) \wedge t_M(a), i_N(a) \wedge i_M(a),\ f_N(a) \vee f_M(a)).$$

It follows that

$$\begin{aligned} t_L(a) &= \min\{t_N(a), t_M(a)\}, \\ i_L(a) &= \min\{i_N(a), i_M(a)\}, \text{and} \\ f_L(a) &= \max\{f_N(a), f_M(a)\}. \end{aligned}$$

(4) The complement of N is denoted by N^c and defined as $\forall a \in X$

$$N^c(a) = (f_N(a), 1 - i_N(a), t_N(a)),$$

and also $(N^c)^c = N$.

Proposition 2.10 (11). [5]*Let N, M and K be neutrosophic sets on the common universe X. Then the following conditions hold:*
(1) $N \cup M = M \cup N, N \cap M = M \cap N$.
(2) $N \cup (M \cup K) = (N \cup M) \cup K, N \cap (M \cap K) = (N \cap M) \cap K$.
(3) $N \cup (M \cap K) = (N \cup M) \cap (N \cup K), N \cap (M \cup K) = (N \cap M) \cup (N \cap K)$.
(4) $N \cap \widetilde{\emptyset} = \widetilde{\emptyset}, N \cup \widetilde{\emptyset} = N,\ N \cup \widetilde{X} = \widetilde{X},\ N \cap \widetilde{X} = N$, where $t_{\widetilde{\emptyset}} = i_{\widetilde{\emptyset}} = 0,\ f_{\widetilde{\emptyset}} = 1$ and $t_{\widetilde{X}} = i_{\widetilde{X}} = 1,\ f_{\widetilde{X}} = 0$
(5) $(N \cup M)^K = N^K \cap M^K, (N \cap M)^K = N^K \cup M^K$.

[5] Let N be a neutrosophic set on X and $t, r, s \in [0,1]$. Define the level sets of N as follows:

$$\begin{aligned} N_{(t,r,s)} &= \{a \in X : N(a) \ge (t,r,s)\}, \text{ that is,} \\ t_N(a) &\ge t,\ i_N(a) \ge r \text{ and } f_N(a) \le s. \end{aligned}$$

[5] If $\varphi : X \to Y$ is a function and N, M are neutrosophic sets of X and Y, respectively, then the image of a neutrosophic set N is a neutrosophic set of Y and it is described as for all $b \in Y$,

$$\begin{aligned} \varphi(N)(b) &= \left(t_{\varphi(N)}(b), i_{\varphi(N)}(b), f_{\varphi(N)}(b)\right) \\ &= \left(\varphi(t_N)(b), \varphi(i_N)(b), \varphi(f_N)(b)\right), \end{aligned}$$

where

$$\begin{aligned} \varphi(t_N)(b) &= \left\{ \begin{array}{ll} \vee t_N(a), & \text{if } X \in \varphi^{-1}(b) \\ 0, & \text{otherwise} \end{array} \right\}, \\ \varphi(i_N)(b) &= \left\{ \begin{array}{ll} \vee i_N(a), & \text{if } X \in \varphi^{-1}(b) \\ 0, & \text{otherwise} \end{array} \right\}, \\ \varphi(f_N)(b) &= \left\{ \begin{array}{ll} \wedge f_N(a), & \text{if } X \in \varphi^{-1}(b) \\ 1, & \text{otherwise} \end{array} \right\}. \end{aligned}$$

Also, the preimage of a neutrosophic set M is a neutrosophic set of X and it is given as follows: For all $a \in X$

$$\begin{aligned} \varphi^{-1}(M)(a) &= \left(t_{\varphi^{-1}(M)}(a), i_{\varphi^{-1}(M)}(a), f_{\varphi^{-1}(M))}(a)\right) \\ &= \left(t_M(\varphi(a)), i_M(\varphi(a)), f_M(\varphi(a))\right) = M(\varphi(a)). \end{aligned}$$

3 2-absorbing neutrosophic weakly completely $\Gamma-$ideals of a $\Gamma-$ring

In this part, we will show the concept of prime neutrosophic weakly completely $\Gamma-$ideal and 2-absorbing neutrosophic weakly completely $\Gamma-$ideals of $\Gamma-$ring

Definition 3.1. A neutrosophic $\Gamma-$ideal N of R is called a prime neutrosophic weakly completely $\Gamma-$ideal of R if N is non-constant function and for all $x, y \in R$ and $\alpha \in \Gamma$

$$\begin{aligned} t_N(x\alpha y) &= \max\{t_N(x), t_N(y)\}, \\ i_N(x\alpha y) &= \max\{i_N(x), i_N(y)\}, \\ f_N(x\alpha y) &= \min\{f_N(x), f_N(y)\}. \end{aligned}$$

Definition 3.2. Let $N = \langle t_N, i_N, f_N \rangle$ be a neutrosophic $\Gamma-$ideal of R. Then N is called a 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of R if

$$N(x\alpha y\beta z) = N(x\alpha y) \text{ or } N(x\alpha y\beta z) = N(x\beta z) \text{ or } N(x\alpha y\beta z) = N(y\beta z),$$

in other words

$$\begin{aligned} t_N(x\alpha y\beta z) &= t_N(x\alpha y) \text{ or } t_N(x\alpha y\beta z) = t_N(x\beta z) \text{ or } t_N(x\alpha y\beta z) = t_N(y\beta z), \\ i_N(x\alpha y\beta z) &= i_N(x\alpha y) \text{ or } i_N(x\alpha y\beta z) = i_N(x\beta z) \text{ or } i_N(x\alpha y\beta z) = i_N(y\beta z), \\ f_N(x\alpha y\beta z) &= f_N(x\alpha y) \text{ or } f_N(x\alpha y\beta z) = f_N(x\beta z) \text{ or } f_N(x\alpha y\beta z) = f_N(y\beta z) \end{aligned}$$

for all $x, y, z \in R$ and $\alpha, \beta \in \Gamma$.

Proposition 3.3. *Let N be a non-constant neutrosophic $\Gamma-$ideal of R. N is a 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of R if and only if*

$$\begin{aligned} t_N(x\alpha y\beta z) &= \max\{t_N(x\alpha y), t_N(x\beta z), t_N(y\beta z)\}, \\ i_N(x\alpha y\beta z) &= \max\{i_N(x\alpha y), i_N(x\beta z), i_N(y\beta z)\}, \\ f_N(x\alpha y\beta z) &= \min\{f_N(x\alpha y), f_N(x\beta z), f_N(y\beta z)\} \end{aligned}$$

for all $x, y, z \in R$ and $\alpha, \beta \in \Gamma$.

Theorem 3.4. *Every prime neutrosophic weakly completely $\Gamma-$ideal of R is a 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of R.*

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Proof. Let N be a prime neutrosophic weakly completely $\Gamma-$ideal of R. Then for all $x, y, z \in R$ and $\alpha, \beta \in \Gamma$,

$$\begin{aligned} t_N(x\alpha y\beta z) &= t_N(x) \text{ or } t_N(x\alpha y\beta z) = t_N(y) \text{ or } t_N(x\alpha y\beta z) = t_N(z), \\ i_N(x\alpha y\beta z) &= i_N(x) \text{ or } i_N(x\alpha y\beta z) = i_N(y) \text{ or } i_N(x\alpha y\beta z) = i_N(z), \\ f_N(x\alpha y\beta z) &= f_N(x) \text{ or } f_N(x\alpha y\beta z) = f_N(y) \text{ or } f_N(x\alpha y\beta z) = f_N(z). \end{aligned}$$

Presume that $t_N(x\alpha y\beta z) = t_N(x)$ and $i_N(x\alpha y\beta z) = i_N(x)$ and $f_N(x\alpha y\beta z) = f_N(x)$. From the facts that $t_N(x\alpha y\beta z) \geq t_N(x\alpha y) \geq t_N(x)$ and $i_N(x\alpha y\beta z) \geq i_N(x\alpha y) \geq i_N(x)$ and $f_N(x\alpha y\beta z) \leq f_N(x\alpha y) \leq f_N(x)$ it follows that $t_N(x\alpha y\beta z) = t_N(x\alpha y)$ and $i_N(x\alpha y\beta z) = i_N(x\alpha y)$ and $f_N(x\alpha y\beta z) = f_N(x\alpha y)$. In a similar manner, we can demonstrate that if $t_N(x\alpha y\beta z) = t_N(y)$ or $t_N(x\alpha y\beta z) = t_N(z)$ and $i_N(x\alpha y\beta z) = i_N(y)$ or $i_N(x\alpha y\beta z) = i_N(z)$ and $f_N(x\alpha y\beta z) = f_N(y)$ or $f_N(x\alpha y\beta z) = f_N(z)$, then $t_N(x\alpha y\beta z) = t_N(y\beta z)$ or $t_N(x\alpha y\beta z) = t_N(x\beta z)$ and $i_N(x\alpha y\beta z) = i_N(y\beta z)$ or $i_N(x\alpha y\beta z) = i_N(x\beta z)$ and $f_N(x\alpha y\beta z) = f_N(y\beta z)$ or $f_N(x\alpha y\beta z) = f_N(x\beta z)$. We infer that, N is a 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of R. □

Theorem 3.5. *Let N be a neutrosophic $\Gamma-$ideal of R. The following conditions are equivalent:*

1. *N is a 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of R.*
2. *For every $t, r, s \in [0,1]$, the level subset $N_{(t,r,s)}$ of N is a 2-absorbing $\Gamma-$ideal of R.*

Proof. Let N is a 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of R and let $x, y, z \in R$, $\alpha, \beta \in \Gamma$ and $x\alpha y\beta z \in N_{(t,r,s)}$ for some $t, r, s \in [0,1]$. Then

$$\begin{aligned} \max\{t_N(x\alpha y), t_N(x\beta z), t_N(y\beta z)\} &= t_N(x\alpha y\beta z) \geq t, \\ \max\{i_N(x\alpha y), i_N(x\beta z), i_N(y\beta z)\} &= i_N(x\alpha y\beta z) \geq r, \\ \min\{f_N(x\alpha y), f_N(x\beta z), f_N(y\beta z)\} &= f_N(x\alpha y\beta z) \leq s \end{aligned}$$

It follows that $t_N(x\alpha y) \geq t$ or $t_N(x\beta z) \geq t$ or $t_N(y\beta z) \geq t$ and $i_N(x\alpha y) \geq r$ or $i_N(x\beta z) \geq r$ or $i_N(y\beta z) \geq r$ and $f_N(x\alpha y) \leq s$ or $f_N(x\beta z) \leq s$ or $f_N(y\beta z) \leq s$ which infer that $x\alpha y \in N_{(t,r,s)}$ or $x\beta z \in N_{(t,r,s)}$ or $y\beta z \in N_{(t,r,s)}$. Thus $N_{(t,r,s)}$ is a 2-absorbing $\Gamma-$ideal of R.
On the other hand, let $N_{(t,r,s)}$ is a 2-absorbing $\Gamma-$ideal of R for all $t, r, s \in [0,1]$. For $x, y, z \in R$ and $\alpha, \beta \in \Gamma$, let $t_N(x\alpha y\beta z) = t$ and $i_N(x\alpha y\beta z) = r$ and $f_N(x\alpha y\beta z) = s$. Then $x\alpha y\beta z \in N_{(t,r,s)}$ and $N_{(t,r,s)}$ is 2-absorbing $\Gamma-$ideal it gives $x\alpha y \in N_{(t,r,s)}$ or $x\beta z \in N_{(t,r,s)}$ or $y\beta z \in N_{(t,r,s)}$. Thus $t_N(x\alpha y) \geq t$ or $t_N(x\beta z) \geq t$ or $t_N(y\beta z) \geq t$ and $i_N(x\alpha y) \geq r$ or $i_N(x\beta z) \geq r$ or $i_N(y\beta z) \geq r$ and $f_N(x\alpha y) \leq s$ or $f_N(x\beta z) \leq s$ or $f_N(y\beta z) \leq s$ it follows that $\max\{t_N(x\alpha y), t_N(x\beta z), t_N(y\beta z)\} \geq t = t_N(x\alpha y\beta z)$ and
$\max\{i_N(x\alpha y), i_N(x\beta z), i_N(y\beta z)\} \geq r = i_N(x\alpha y\beta z)$ and
$\min\{f_N(x\alpha y), f_N(x\beta z), f_N(y\beta z)\} \leq s = f_N(x\alpha y\beta z)$. Moreover, by N is a neutrosophic $\Gamma-$ ideal of R, we have

$$\begin{aligned} t_N(x\alpha y\beta z) &\geq \max\{t_N(x\alpha y), t_N(x\beta z), t_N(y\beta z)\}, \\ i_N(x\alpha y\beta z) &\geq \max\{i_N(x\alpha y), i_N(x\beta z), i_N(y\beta z)\}, \\ f_N(x\alpha y\beta z) &\leq \min\{f_N(x\alpha y), f_N(x\beta z), f_N(y\beta z)\}. \end{aligned}$$

Thus

$$\begin{aligned} t_N(x\alpha y\beta z) &= \max\{t_N(x\alpha y), t_N(x\beta z), t_N(y\beta z)\} \text{ and} \\ i_N(x\alpha y\beta z) &= \max\{i_N(x\alpha y), i_N(x\beta z), i_N(y\beta z)\} \text{ and} \\ f_N(x\alpha y\beta z) &= \min\{f_N(x\alpha y), f_N(x\beta z), f_N(y\beta z)\}, \end{aligned}$$

hence N is a 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of R. □

Theorem 3.6. *Let $\varphi : R \to S$ be a surjective $\Gamma-$ring homomorphism. If N is a 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of R which is constant on $Ker\varphi$, $\varphi(N)$ is a 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of S.*

Proof. Presume that $\varphi(N)(x\alpha y\beta z) \neq \varphi(N)(x\alpha y)$ for any $x, y, z \in S$ and $\alpha, \beta \in \Gamma$. Since φ is a surjective $\Gamma-$ring homomorphism

$$\varphi(a) = x,\ \varphi(b) = y,\ \varphi(c) = z \text{ for some } a, b, c \in R.$$

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Thus

$$\begin{aligned}\varphi(t_N)(x\alpha y\beta z) &= \varphi(t_N)(\varphi(a)\alpha\varphi(b)\beta\varphi(c)) = \varphi(t_N)(\varphi(a\alpha b\beta c)) \\ &\neq \varphi(t_N)(x\alpha y) = \varphi(t_N)(\varphi(a)\alpha\varphi(b)) = \varphi(t_N)(\varphi(a\alpha b)) \text{ and}\end{aligned}$$

$$\begin{aligned}\varphi(i_N)(x\alpha y\beta z) &= \varphi(i_N)(\varphi(a)\alpha\varphi(b)\beta\varphi(c)) = \varphi(i_N)(\varphi(a\alpha b\beta c)) \\ &\neq \varphi(i_N)(x\alpha y) = \varphi(i_N)(\varphi(a)\alpha\varphi(b)) = \varphi(i_N)(\varphi(a\alpha b)) \text{ and}\end{aligned}$$

$$\begin{aligned}\varphi(f_N)(x\alpha y\beta z) &= \varphi(f_N)(\varphi(a)\alpha\varphi(b)\beta\varphi(c)) = \varphi(f_N)(\varphi(a\alpha b\beta c)) \\ &\neq \varphi(f_N)(x\alpha y) = \varphi(f_N)(\varphi(a)\alpha\varphi(b)) = \varphi(f_N)(\varphi(a\alpha b))\end{aligned}$$

Since N is constant on $Ker\varphi$,

$$\begin{aligned}\varphi(t_N)(\varphi(a\alpha b\beta c)) &= t_N(a\alpha b\beta c) \text{ and } \varphi(t_N)(\varphi(a\alpha b)) = t_N(a\alpha b), \\ \varphi(i_N)(\varphi(a\alpha b\beta c)) &= i_N(a\alpha b\beta c) \text{ and } \varphi(i_N)(\varphi(a\alpha b)) = i_N(a\alpha b), \\ \varphi(f_N)(\varphi(a\alpha b\beta c)) &= f_N(a\alpha b\beta c) \text{ and } \varphi(f_N)(\varphi(a\alpha b)) = f_N(a\alpha b).\end{aligned}$$

It follows that

$$\begin{aligned}\varphi(t_N)(\varphi(a\alpha b\beta c)) &= t_N(a\alpha b\beta c) \neq t_N(a\alpha b) = \varphi(t_N)(\varphi(a\alpha b)), \\ \varphi(i_N)(\varphi(a\alpha b\beta c)) &= i_N(a\alpha b\beta c) \neq i_N(a\alpha b) = \varphi(i_N)(\varphi(a\alpha b)), \\ \varphi(f_N)(\varphi(a\alpha b\beta c)) &= f_N(a\alpha b\beta c) \neq f_N(a\alpha b) = \varphi(f_N)(\varphi(a\alpha b))\end{aligned}$$

Since N is a 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of R,

$$\begin{aligned}t_N(a\alpha b\beta c) &= \varphi(t_N)(\varphi(a)\alpha\varphi(b)\beta\varphi(c)) = \varphi(t_N)(x\alpha y\beta z) \\ &= t_N(a\beta c) = \varphi(t_N)(\varphi(a\beta c)) = \varphi(t_N)(\varphi(a)\beta\varphi(c)) = \varphi(t_N)(x\beta z)\end{aligned}$$

and

$$\begin{aligned}i_N(a\alpha b\beta c) &= \varphi(i_N)(\varphi(a)\alpha\varphi(b)\beta\varphi(c)) = \varphi(i_N)(x\alpha y\beta z) \\ &= i_N(a\beta c) = \varphi(i_N)(\varphi(a\beta c)) = \varphi(i_N)(\varphi(a)\beta\varphi(c)) = \varphi(i_N)(x\beta z)\end{aligned}$$

and

$$\begin{aligned}f_N(a\alpha b\beta c) &= \varphi(f_N)(\varphi(a)\alpha\varphi(b)\beta\varphi(c)) = \varphi(f_N)(x\alpha y\beta z) \\ &= f_N(a\beta c) = \varphi(f_N)(\varphi(a\beta c)) = \varphi(f_N)(\varphi(a)\beta\varphi(c)) = \varphi(f_N)(x\beta z).\end{aligned}$$

So we get $\varphi(t_N)(x\alpha y\beta z) = \varphi(t_N)(x\beta z)$ and $\varphi(i_N)(x\alpha y\beta z) = \varphi(i_N)(x\beta z)$ and $\varphi(f_N)(x\alpha y\beta z) = \varphi(f_N)(x\beta z)$ or

$$\begin{aligned}t_N(a\alpha b\beta c) &= \varphi(t_N)(\varphi(a)\alpha\varphi(b)\beta\varphi(c)) = \varphi(t_N)(x\alpha y\beta z) \\ &= t_N(b\beta c) = \varphi(t_N)(\varphi(b\beta c)) = \varphi(t_N)(\varphi(b)\beta\varphi(c)) = \varphi(t_N)(y\beta z)\end{aligned}$$

and

$$\begin{aligned}i_N(a\alpha b\beta c) &= \varphi(i_N)(\varphi(a)\alpha\varphi(b)\beta\varphi(c)) = \varphi(i_N)(x\alpha y\beta z) \\ &= i_N(b\beta c) = \varphi(i_N)(\varphi(b\beta c)) = \varphi(i_N)(\varphi(b)\beta\varphi(c)) = \varphi(i_N)(y\beta z)\end{aligned}$$

and

$$\begin{aligned}f_N(a\alpha b\beta c) &= \varphi(f_N)(\varphi(a)\alpha\varphi(b)\beta\varphi(c)) = \varphi(f_N)(x\alpha y\beta z) \\ &= f_N(b\beta c) = \varphi(f_N)(\varphi(b\beta c)) = \varphi(f_N)(\varphi(b)\beta\varphi(c)) = \varphi(f_N)(y\beta z).\end{aligned}$$

Hence we get $\varphi(t_N)(x\alpha y\beta z) = \varphi(t_N)(y\beta z)$ and $\varphi(i_N)(x\alpha y\beta z) = \varphi(i_N)(y\beta z)$ and $\varphi(f_N)(x\alpha y\beta z) = \varphi(f_N)(y\beta z)$. Consequently, $\varphi(N)$ is a 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of S. □

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Theorem 3.7. *Let $\varphi : R \to S$ be a $\Gamma-$ring homomorphism. If $M = \langle t_M, i_M, f_M \rangle$ is a 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of S, $\varphi^{-1}(M)$ is a 2-absorbing neutrosophic weakly completely $\Gamma-$ ideal of R.*

Proof. Presume that $\varphi^{-1}(t_M)(x\alpha y\beta z) \neq \varphi^{-1}(t_M)(x\alpha y)$ and $\varphi^{-1}(i_M)(x\alpha y\beta z) \neq \varphi^{-1}(i_M)(x\alpha y)$ and $\varphi^{-1}(f_M)(x\alpha y\beta z) \neq \varphi^{-1}(f_M)(x\alpha y)$ for any $x, y, z \in R$ and $\alpha, \beta \in \Gamma$. Then,

$$\begin{aligned}\varphi^{-1}(t_M)(x\alpha y\beta z) &= t_M(\varphi(x\alpha y\beta z)) = t_M(\varphi(x)\alpha\varphi(y)\beta\varphi(z)) \\ &\neq \varphi^{-1}(t_M)(x\alpha y) = t_M(\varphi(x\alpha y)) = t_M(\varphi(x)\alpha\varphi(y))\end{aligned}$$

and

$$\begin{aligned}\varphi^{-1}(i_M)(x\alpha y\beta z) &= i_M(\varphi(x\alpha y\beta z)) = i_M(\varphi(x)\alpha\varphi(y)\beta\varphi(z)) \\ &\neq \varphi^{-1}(i_M)(x\alpha y) = i_M(\varphi(x\alpha y)) = i_M(\varphi(x)\alpha\varphi(y))\end{aligned}$$

and

$$\begin{aligned}\varphi^{-1}(f_M)(x\alpha y\beta z) &= f_M(\varphi(x\alpha y\beta z)) = f_M(\varphi(x)\alpha\varphi(y)\beta\varphi(z)) \\ &\neq \varphi^{-1}(f_M)(x\alpha y) = f_M(\varphi(x\alpha y)) = f_M(\varphi(x)\alpha\varphi(y)).\end{aligned}$$

Since M is a 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of S we get that

$$\begin{aligned}t_M(\varphi(x)\alpha\varphi(y)\beta\varphi(z)) &= \varphi^{-1}(t_M)(x\alpha y\beta z) \\ &= t_M(\varphi(x)\beta\varphi(z)) = t_M(\varphi(x\beta z)) \\ &= \varphi^{-1}(t_M)(x\beta z), \text{ and}\end{aligned}$$

$$\begin{aligned}i_M(\varphi(x)\alpha\varphi(y)\beta\varphi(z)) &= \varphi^{-1}(i_M)(x\alpha y\beta z) \\ &= i_M(\varphi(x)\beta\varphi(z)) = i_M(\varphi(x\beta z)) \\ &= \varphi^{-1}(i_M)(x\beta z), \text{ and}\end{aligned}$$

$$\begin{aligned}f_M(\varphi(x)\alpha\varphi(y)\beta\varphi(z)) &= \varphi^{-1}(f_M)(x\alpha y\beta z) \\ &= f_M(\varphi(x)\beta\varphi(z)) = f_M(\varphi(x\beta z)) \\ &= \varphi^{-1}(f_M)(x\beta z)\end{aligned}$$

or

$$\begin{aligned}t_M(\varphi(x)\alpha\varphi(y)\beta\varphi(z)) &= \varphi^{-1}(t_M)(x\alpha y\beta z) \\ &= t_M(\varphi(y)\beta\varphi(z)) = t_M(\varphi(y\beta z)) \\ &= \varphi^{-1}(t_M)(y\beta z), \text{ and}\end{aligned}$$

$$\begin{aligned}i_M(\varphi(x)\alpha\varphi(y)\beta\varphi(z)) &= \varphi^{-1}(i_M)(x\alpha y\beta z) \\ &= i_M(\varphi(y)\beta\varphi(z)) = i_M(\varphi(y\beta z)) \\ &= \varphi^{-1}(i_M)(y\beta z), \text{ and}\end{aligned}$$

$$\begin{aligned}f_M(\varphi(x)\alpha\varphi(y)\beta\varphi(z)) &= \varphi^{-1}(f_M)(x\alpha y\beta z) \\ &= f_M(\varphi(y)\beta\varphi(z)) = f_M(\varphi(y\beta z)) \\ &= \varphi^{-1}(f_M)(y\beta z).\end{aligned}$$

Therefore $\varphi^{-1}(M)$ is a 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of R. □

Corollary 3.8. *Let φ be a $\Gamma-$ring homomorphism from R onto S. φ induces a one to one inclusion preserving correspondence between 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of S in such a way that if N is a 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of R constant on Kerφ, then $\varphi(N)$ is the corresponding 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of S, and if M is a 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of S, then $\varphi^{-1}(M)$ is the corresponding 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of R.*

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Now, we will give the notion of prime $K-$neutrosophic $\Gamma-$ ideal and 2-absorbing $K-$neutrosophic $\Gamma-$ideal of $\Gamma-$ring.

Definition 3.9. Let N be a neutrosophic Γ-ideal of R. Then N is called a prime $K-$neutrosophic $\Gamma-$ ideal of R if

$$N(x\alpha y) = N(0) \text{ implies that } N(x) = N(0) \text{ or } N(y) = N(0)$$

for $x, y \in R$ and $\alpha, \beta \in \Gamma$.

Definition 3.10. Let N be a neutrosophic $\Gamma-$ideal of R. Then N is called a 2-absorbing $K-$neutrosophic $\Gamma-$ideal of R if for all $x, y, z \in R$ and $\alpha, \beta \in \Gamma$

$$N(x\alpha y\beta z) = N(0) \text{ implies } N(x\alpha y) = N(0) \text{ or } N(x\beta z) = N(0) \text{ or } N(y\beta z) = N(0).$$

Theorem 3.11. *Every 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of R is a 2-absorbing $K-$neutrosophic $\Gamma-$ideal of R.*

Proof. Presume that N is a 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of R. If $N(x\alpha y\beta z) = N(0)$ for all $x, y, z \in R$ and $\alpha, \beta \in \Gamma$, then we have

$$\begin{aligned} N(0) &= N(x\alpha y\beta z) \leq N(x\alpha y) \leq N(0) \quad \text{or} \\ N(0) &= N(x\alpha y\beta z) \leq N(x\beta z) \leq N(0) \quad \text{or} \\ N(0) &= N(x\alpha y\beta z) \leq N(y\beta z) \leq N(0). \end{aligned}$$

Since N is a 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of R the following outcome is acquired

$$N(x\alpha y) = N(0) \text{ or } N(x\beta z) = N(0) \text{ or } N(y\beta z) = N(0).$$

We infer that N is a 2-absorbing $K-$neutrosophic $\Gamma-$ideal of R. □

The following example shows that the converse of the above theorem may not be true.

Example 3.12. Let $R = \mathbb{Z}$ and $\Gamma = 2\mathbb{Z}$, so R is a $\Gamma-$ring. Define the neutrosophic $\Gamma-$ideal N of R by

$$N(x) = \left\{ \begin{array}{ll} (1,1,0), & \text{if } x = 0; \\ (1/3, 1/3, 1/4) & \text{if } x \in 27\mathbb{Z} - \{0\}; \\ (1/4, 1/4, 1/3) & \text{if } x \in \mathbb{Z} - 27\mathbb{Z}. \end{array} \right\}$$

Then N is a 2-absorbing $K-$neutrosophic $\Gamma-$ideal. However, for $\alpha, \beta \in 2\mathbb{Z}$ we have

$$f_N(3\alpha 3\beta 15) = 1/4 < 1/3 = \min\{f_N(3\alpha 3), f_N(3\beta 15), f_N(3\beta 15)\}.$$

Thus N is not a 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of R.

Theorem 3.13. *Every prime $K-$neutrosophic $\Gamma-$ ideal of R is a 2-absorbing $K-$neutrosophic $\Gamma-$ideal of R.*

Proof. Let N be a prime $K-$neutrosophic $\Gamma-$ ideal of R. Then for all $x, y, z \in R$ and $\alpha, \beta \in \Gamma$,

$$N(x\alpha y\beta z) = N(0) \text{ implies } N(x) = N(0) \text{ or } N(y) = N(0) \text{ or } N(z) = N(0).$$

Suppose that $N(x) = N(0)$ then by

$$N(0) = N(x) \leq N(x\alpha y) \leq N(x\alpha y\beta z) = N(0),$$

we obtain $N(x\alpha y) = N(0)$ or in the similar manner we can affirm that $N(x\beta z) = N(0)$ or $N(y\beta z) = N(0)$. As a result, N is a 2-absorbing $K-$neutrosophic $\Gamma-$ideal of R. □

Theorem 3.14. *Let $\varphi : R \to S$ be a surjective $\Gamma-$ring homomorphism. If N is a 2-absorbing $K-$neutrosophic $\Gamma-$ideal of R which is constant on $Ker\varphi$, then $\varphi(N)$ is a 2-absorbing $K-$neutrosophic $\Gamma-$ideal of S.*

Proof. The proof is similar to the proof of Theorem 3.6 and so the proof is omitted. □

Theorem 3.15. *Let $\varphi : R \to S$ be a $\Gamma-$ring homomorphism. If N_1 is a 2-absorbing $K-$neutrosophic $\Gamma-$ideal of S, then $\varphi^{-1}(N_1)$ is a 2-absorbing $K-$neutrosophic $\Gamma-$ideal of R.*

Proof. The proof is omitted as it is similar to the proof of Theorem 3.7. □

Corollary 3.16. *Let φ be a $\Gamma-$ring homomorphism from R onto S. φ induces a one to one inclusion preserving correspondence between 2-absorbing $K-$neutrosophic $\Gamma-$ideal of S in such a way that if N is a 2-absorbing $K-$neutrosophic $\Gamma-$ideal of R constant on $Ker\varphi$, then $\varphi(N)$ is the corresponding 2-absorbing $K-$neutrosophic $\Gamma-$ideal of S, and if N_1 is a 2-absorbing $K-$neutrosophic $\Gamma-$ideal of S, then $\varphi^{-1}(N_1)$ is the corresponding 2-absorbing $K-$neutrosophic $\Gamma-$ideal of R.*

Remark 3.17. The subsequent schema abridges upshots of 2-absorbing neutrosophic weakly completely $\Gamma-$ideals of a $\Gamma-$ring.

$$\begin{array}{ccc} \text{Prime Neutrosophic W. C. }\Gamma\text{-I.} & \Longrightarrow & \text{2-abs. Neutrosophic W. C. }\Gamma\text{-I.} \\ \Downarrow & & \Downarrow \\ \text{Prime K-Neutrosophic }\Gamma\text{-I.} & \Longrightarrow & \text{2-abs. K-Neutrosophic W.C. }\Gamma\text{-I.} \end{array}$$

Now, I will elucidate about neutrosophic quotient $\Gamma-$ring of R induced by 2-absorbing neutrosophic weakly completely $\Gamma-$ideal. We recall the notion of neutrosophic quotient $\Gamma-$ring induced by neutrosophic $\Gamma-$ideal of R. Let N be an neutrosophic $\Gamma-$ideal of a $\Gamma-$ring R. For any $x, y \in R$, define a binary relation $\sim$ on R which is a congruence relation of R by $x \sim y$ if and only if

$$N(x-y) = N(0)$$

Let $N[x] = \{y \in R \mid y \sim x\}$ be the equivalence class containing x and $R/N = \{N[x] \mid x \in R\}$ the set of all equivalence classes of R. Define two operations by

$$\begin{aligned} N[x] + N[y] &= N[x+y] \text{ and} \\ N[x]\alpha N[y] &= N[x\alpha y] \end{aligned}$$

for $x, y \in R, \alpha \in \Gamma$. Then R/N is an neutrosophic $\Gamma-$ring with two operations and call it neutrosophic quotient $\Gamma-$ring of R induced by the neutrosophic $\Gamma-$ideal N.

Theorem 3.18. *Let N be a non-constant neutrosophic $\Gamma-$ideal of R. Then N is a 2-absorbing $K-$neutrosophic $\Gamma-$ideal of R if and only if R/N is a 2-absorbing $\Gamma-$ring.*

Proof. Suppose that N is a 2-absorbing $K-$neutrosophic $\Gamma-$ideal of R and let $N[x], N[y], N[z] \in R/N$ be such that $N[x]\alpha N[y]\beta N[z] = N[0]$.
Since $N[x]\alpha N[y]\beta N[z] = N[x\alpha y\beta z]$, we have

$$N(x\alpha y\beta z) = N(x\alpha y\beta z - 0) = (1,1,0) = N(0).$$

Since N is considered to be 2-absorbing $K-$neutrosophic $\Gamma-$ideal of R,

$$N(x\alpha y) = N(0) = (1,1,0) \text{ or } N(x\beta z) = N(0) = (1,1,0) \text{ or } N(y\beta z) = N(0) = (1,1,0).$$

It follows that

$$\begin{aligned} N[x\alpha y] &= N[x]\alpha N[y] = N[0] \text{ or} \\ N[x\beta z] &= N[x]\beta N[z] = N[0] \text{ or} \\ N[y\beta z] &= N[y]\beta N[z] = N[0]. \end{aligned}$$

So, R/N is a 2-absorbing $\Gamma-$ring. Otherwise, presume that R/N is a 2-absorbing $\Gamma-$ring and let $N(x\alpha y\beta z) = N(0) = (1,1,0)$ for $x, y, z \in R$ and $\alpha, \beta \in \Gamma$. Then we have

$$N[x]\alpha N[y]\beta N[z] = N[x\alpha y\beta z] = N[0].$$

As R/N is a 2-absorbing $\Gamma-$ring,

$$N[x\alpha y] = N[0] \text{ or } N[x\beta z] = N[0] \text{ or } N[y\beta z] = N[0]$$

which implies that N is a 2-absorbing $K-$neutrosophic $\Gamma-$ideal of R. □

Corollary 3.19. *If N is a 2-absorbing neutrosophic weakly completely $\Gamma-$ideal of R, then R/N is a 2-absorbing $\Gamma-$ring.*

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4 Conclusion

In this study, we have specified the idea of 2-absorbing neutrosophic weakly completely Γ-ideals of a Γ-ring and 2-absorbing K-neutrosophic Γ-ideals of the Γ-ring. We have given a scheme for the transition between these algebraic structures. Moreover, we have studied that if N is a 2-absorbing neutrosophic weakly completely Γ-ideal, then the neutrosophic quotient Γ- ring of R induced by the neutrosophic $\Gamma-$ ideal is a 2-absorbing Γ-ring. In our upcoming study, we will demonstrate a 2-absorbing neutrosophic vague Γ-ideal of a Γ-ring and a 2-absorbing neutrosophic vague weakly completely Γ- ideal of a Γ- ring, and discuss the associated conditions.

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References

[1] Smarandache, F., "A unifying field in logics: Neutrosophy Logic. Neutrosophy, Neutrosophic Probability, Set and Statistics", American Research, Rehoboth 1998.

[2] Kandasamy, V.W.B., and Smarandache, F., "Some Neutrosophic Algebraic Structures and Neutrosophic N-Algebraic Structures", Hexis, Phonex, Arizona 2006.

[3] Shabir, M., Ali, M., Naz, M., and Smarandache, F., "Soft Neutrosophic Group", Neutrosophic Sets and Systems, Vol.1, pp. 13-25, 2013.

[4] Wang, H., Smarandache, F., Zhang, Y., Sunderraman R., "Single Valued Neutrosophic Sets", Proc. of 10th Int. Conf. on Fuzzy Theory and Technology, Salt Lake City, Utah, July 21-26, 2005.

[5] Cetkin, V., Varol, B.P. and Aygün, H., "On Neutrosophic Submodules Of A Module, Hacettepe Journal of Mathematics and Statistics, Vol. 46(5), pp. 791-799, 2017.

[6] Majumdar, P., and Samanta, S.K., "On Similarity And Entropy Of Neutrosophic Sets", Journal of Intelligent and Fuzzy Systems, Vol. 26(3), pp. 1245-1252, 2014.

[7] Salama, A.A., and Al-Blowi, S.A., "Neutrosophic Set And Neutrosophic Topological Spaces", Iosr Journal of Mathematics, Vol. 3(4), pp. 31-35, 2012.

[8] Olgun, N., and Hatip, A., "On Refined Neutrosophic R-module", IJNS, Vol. 7(2), pp. 87-96, 2020.

[9] Nobusawa, N., "On A Generalization Of The Ring Theory", Osaka Journal Of Mathematics, Vol.1, pp. 81-89, 1964.

[10] Barnes, W.E., "On The $\Gamma-$Rings Of Nobusawa", Pacific Journal Of Mathematics, Vol. 18, pp. 411-422, 1966.

[11] Kyuno, S., "A Gamma Ring With The Right And Left Unities", Mathematica Japonica, Vol. 24(2), pp. 191-193, 1979.

[12] Kyuno, S., "On Prime Gamma Rings", Pacific Journal of Mathematics, Vol. 75(1), pp. 185-190, 1978.

[13] Luh, J., "On The Theory Of Simple $\Gamma-$Rings", Michigan Mathematics Journal, Vol. 16, pp. 65-75, 1969.

[14] Badawi, A., "On 2-Absorbing Ideals Of Commutative Rings", Bulletin of the Australian Mathematical Society, Vol. 75, pp. 417-429, 2007.

[15] Anderson, D.F., and Badawi, A., "On n-Absorbing Ideals Of Commutavie Rings", Commutative Algebra, Vol. 39, pp. 1646-1672, 2011.

[16] Badawi, A., Tekir, U., Yetkin, E., "On 2-Absorbing Primary Ideals In Commutative Rings", Bulletin of the Australian Mathematical Society, Vol. 51(4), pp. 1163-1173, 2014.

[17] Badawi, A., and Darani, A.Y., "On Weakly 2-Absorbing Ideals Of Commutative Rings", Houston Journal of Mathematics, Vol. 39, pp. 441-452, 2013.

[18] Darani, A.Y., and Puczylowski, E.R., "On 2-Absorbing Commutative Semigroups And Their Applications To Rings", Semigroup Forum, Vol. 86, pp. 83-91, 2013.

https://doi.org/10.54216/IJNS.180308

Received: January 28, 2022 Accepted: April 17, 2022

[19] Kumar, P., Dubey, M.K., and Sarohe, P., "Some Results On 2-Absorbing Ideals In Commutative Semirings", Journal of Mathematics and Applications, Vol. 38, pp. 77-84, 2015.

[20] Darani, A.Y., "On $L-$fuzzy 2-Absorbing Ideals", Italian Journal of Pure and Applied Mathematics, Vol. 36, pp. 147-154, 2016.

[21] Darani, A.Y., and Hashempoor, A., "$L-$fuzzy 0-(1- or 2- or 3-) 2-Absorbing Ideals In Semiring", Annals of Fuzzy Mathematics and Informatics, Vol. 7(2), pp. 303-311, 2014.

[22] Sönmez, D., Yeşilot, G., Onar, S., Ersoy, B.A., and Davvaz, B., "On 2-Absorbing Primary Fuzzy Ideals of Commutative Rings", Mathematical Problems in Engineering, Vol. 2017, Article ID 5485839.

[23] Dutta, T.K., and Chanda, T., "Structures Of Fuzzy Ideals Of $\Gamma-$Ring", Bulletin of the Malaysian Mathematical Sciences Society, Vol. 28, pp. 9-18, 2005.

[24] Onar, S., Sonmez, D., Ersoy, B.A., Yesilot, G., Hila, K., "A Study On Fuzzy 2-Absorbing Primary Γ-Ideals In Γ-Rings", Filomat, Vol. 31(18), pp. 5753–5767, 2017.

[25] Yella, B., Akbar R., "On Neutrosophic Γ-Semirings", Neutrosophic Set and Systems, Vol. 47, pp. 338-353, 2021.

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