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Soft M-Ideals and Soft S-Ideals in Soft S-Algebras

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Abstract. In this paper, we first introduce and discuss new classes of ideals in $d-$algebra like $M-$Ideals and $S-$Ideals. Also, we introduce new classes of soft algebras they are called soft $S-$algebras. Next, we use our new connotations to introduce and investigate new concepts in soft $S-$algebras like soft $M-$Ideals and soft $S-$Ideals. In this work, we prove that every $S-$Ideal is $M-$Ideal. Moreover, we show that it is not necessary every $M-$Ideal of $\Im$ is $S-$Ideal of $\Im$ by a counterexample. Also, some properties of our connotations are given.

Keywords: Soft sets theory, $d-$algebras, $d-$ideals, Soft $d-$subalgebras.
MSC 2010: 03G10, 06B10, 06D72.

1. INTRODUCTION

In 1999, D. Molodtsov [4] introduced the concept of soft set theory to solve complicated problems in economics, engineering, and environment. He has formed the rudimentary consequences of this connotation and successfully using the soft set theory into many aspects, like theory of probability smoothness, Riemann integration and so on. Soft set theory has a wider application and its progress is very rapid in different fields. In recently years, soft set theory has been researched in many fields see ([1], [5], [14]-[18]). The connotation of $d-$algebras launched by Neggers and Kimi [20], which is another functional popularization of $BCK-$ algebras. Moreover, they launched the connotations of $d/d^*/d^\#-$ideals, and $d/d^*/d^\#-$subalgebras, in $d-$algebras, and explained the relations among them.

The connotation of $\rho-$algebra which may be considered as a generalization of the concept of $d-$algebra and some connotations like $\rho-$subalgebra, $\rho-$ideal, $\bar{\rho}-$ideal are given [6]. After that, most of them are discussed in different setting such as in fuzzy setting [7] and in permutation setting [8]. An algorithm is given to link between soft setting and permutation setting [9]. The connotations of (transitive) soft edge $d/d^*/d^\#-$algebras, soft $d/d^*/d^\#-$algebras, soft $d/d^*/d^\#-$ ideals, and $d/d^*/d^\#-$idealistics which are introduced by Young et. al. [3]. Next, the connotations of soft edge $\rho/BCL/BCH-$algebras of the power sets which are introduced by S. M. Khalil et. al. (see [10]-[12]). In 2017, the concept of $\sigma-$algebraic soft set is given [13].

In this work, we give and discuss new classes of ideals in $d-$algebra like $M-$Ideals and $S-$Ideals. Also, we introduced soft $S-$algebras as new classes of soft algebras. Next, we use our new connotations to introduce and investigate new concepts in soft $S-$algebras like soft $M-$Ideals and soft $S-$Ideals. In this work, we prove that every $S-$Ideal is $M-$Ideal. Moreover, we show that it is not necessary every $M-$Ideal of $\Im$ is $S-$Ideal of $\Im$ by a counterexample. Some properties of these new connotations are given. The interesting field of this work is to study new connotations of pure algebra in soft setting.

2. PRELIMINARIES

We will recall some basic background needed in our present work.

***2.1 Definition*: ([4])**
Let $\Im$ be an initial universe set and Ω be a set of parameters. We say that the pair (λ,η) is a soft set (S.S) over $\Im$ if λ is a mapping of η into $P(\Im)$, where is the power set of $\Im$.

***2.2 Definition*: ([19])**
Let (λ,π) and (δ,ψ) be two soft sets (S.S)s over $\Im$, then their union is (S.S), say $(\aleph,\omega)$, where $\omega=\pi\bigcup\psi$ and $\forall e\in\omega$, $\aleph(e)=\lambda(e)$ if $e\in\pi-\psi$, $\delta(e)$ if $e\in\psi-\pi$, $\lambda(e)\bigcup\delta(e)$ if $e\in\pi\bigcap\psi$. We write $(\lambda,\pi)\ \coprod\ (\delta,\psi)=(\aleph,\omega)$. Further, for any two (S.S)s (λ,π) and (δ,ψ) over $\Im$ their intersection is the (S.S) $(\aleph,\omega)$ over $\Im$, and we write $(\aleph,\omega)=\ (\lambda,\pi)\prod\ (\delta,\psi)$, where $\psi\ \pi\bigcap\ \omega=$ $.,\forall e\in\omega\ \aleph(e)=\lambda(e)\bigcap\delta(e)$, and

***2.3 Definition*: ([2])**
For any two (S.S)s (λ,π) and (δ,ψ) over the common universe $\Im$, we say (λ,π) is a soft subset of (δ,ψ) if $\pi\subseteq\psi$ and $\forall\ e\in\pi$, $\lambda(e)$ & $\delta(e)$ are identical approximations. We write $(\lambda,\pi)\ \tilde{\subseteq}$ (δ,ψ).

***2.4 Definition*: ([21])**
Assume $(\Im,\Omega)$ and (Γ,η) are soft classes and let $\mu:\Im\rightarrow\Gamma$ and p: $\Omega\rightarrow\eta$ be mappings. Then a mapping $\Theta:(\Im,\Omega)\rightarrow(\Gamma,\eta)$ is defined as: for a (S.S) (λ,π) in $(\Im,\Omega)$, $(\Theta(\lambda,\pi),\psi)$, $\psi=\ p(\pi)$ $\subseteq\eta$ is a (S.S) in (Γ,η) given by $\Theta(\lambda,\pi)(\beta)=\mu\left(\bigcup_{\alpha\in p^{-1}(\beta)\bigcap\pi}\lambda(\alpha)\right)$ for $\beta\in\eta$. $(\Theta(\lambda,\pi),\psi)$ is called a soft image of a (S.S) (λ,π). If $\psi=\eta$, then we shall write $(\Theta(\lambda,\pi),\eta)$ as $\Theta(\lambda,\pi)$.

***2.5 Definition*: ([19])**

Assume (λ,π) and (δ,ψ) are two (S.S)s over a common universe $\Im$. We say (λ,π) **AND** (δ,ψ) is a (S.S) denoted by $(\lambda,\pi)\ \overline{\prod}\ (\delta,\psi)$ and defined as $(\lambda,\pi)\ \overline{\prod}\ (\delta,\psi)=(\aleph,\pi\times\psi)$, where $\aleph(\alpha,\beta)=$ $\lambda(\alpha)\bigcap\delta(\beta)$ for all $(\alpha,\beta)\in\pi\times\psi$.

2.6 Definition: **([19])**
Assume (λ,π) and (δ,ψ) are two (S.S)s over a common universe $\Im$. We say (λ,π) $\boldsymbol{OR}$ (δ,ψ) is a (S.S) denoted by $(\lambda,\pi)\ \overline{\coprod}\ (\delta,\psi)$ and defined as, $(\lambda,\pi)\ \overline{\coprod}\ (\delta,\psi)=(\aleph,\pi\times\psi)$, where $\aleph(\alpha,\beta)=\lambda(\alpha)\cup\delta(\beta)$ for all $(\alpha,\beta)\in\pi\times\psi$.

2.7 Definition: **([20])**
A $d-$algebra (D.A) is a non-empty set $\Im$ with a constant 0 and a binary operation $(\wedge)$ with the following axioms:
(i) $p\wedge p=0$,
(ii) $0\wedge p=0$,
(iii) $p\wedge q=0$ and $q\wedge p=0$ imply that $p=q$, $\forall\ p,q$ in $\Im$.

2.8 Definition**: ([20])**
Assume $(\Im,\wedge,\ 0)$ is a (D.A) and $\phi\neq I\subseteq\Im$. We say that I is a $d-$subalgebra (D.S.A) of (D.A) $\Im$ if $p\wedge q\in I$ whenever $p,q\in I$.

2.9 Definition**: ([20])**
Assume $(\Im,\wedge,\ 0)$ is a (D.A) and $\phi\neq I\subseteq\Im$. We say that I is a $d-$ideal (D.I) of (D.A) $\Im$ if
(1) $p\wedge q\in I$ and $q\in I\rightarrow\ p\in I$,
(2) $p\in I$ and $q\in\Im\rightarrow p\wedge q\in I$.

3. Soft S-Algebras
In this section, some new connotations are introduced and discussed like $M-$Ideal (M.I) $S-$Ideal (S.I), soft S-algebras (S.S.A), soft $M-$Ideals (S.M.I) and soft $S-$Ideal (S.S.I). Also, some of their properties are given.

3.1 Definition**:**
Let $\aleph$ be a subalgebra (S.A) of (D.A) $(\Im,\wedge,0)$ and $\eta\subseteq\Im$, we say η is (M.I) of $\Im$ related to $\aleph$ and denoted by $\eta\prec_M\aleph$ if it such that:
(i) $0\in\eta$,
(ii). $\upsilon\wedge\hbar\quad\forall\hbar\in\aleph-\eta\ \&\ \upsilon\in\eta-\{0\}\rightarrow\hbar\wedge\upsilon=$

3.2 Definition**:**
Let $\aleph$ be a (S.A) of (D.A) $(\Im,\wedge,\ 0)$ and $\eta\subseteq\Im$, we say that η is (S.I) of $\Im$ related to $\aleph$ and denoted by $\eta\prec_S\aleph$ if it such that:
(i) $\phi\neq\eta\subseteq\aleph$,
(ii) $\forall\hbar\in\aleph,\upsilon\in\eta;(\hbar\wedge\upsilon)\in\eta\rightarrow\hbar\in\eta,$
(iii). $=\upsilon\wedge\hbar\quad\forall\hbar\in\aleph-\{0\}\ \&\ \upsilon\in\eta-\{0\}\rightarrow\hbar\wedge\upsilon$

3.3 Example**:**
Let $(\Im,\wedge,0)$ be (D.A) with the following table:

$\wedge$	0	∂	ℓ	$\int$	σ
0	0	0	0	0	0
∂	∂	0	∂	∂	∂
ℓ	ℓ	∂	0	ℓ	ℓ
$\int$	$\int$	∂	ℓ	0	$\int$
σ	σ	∂	ℓ	$\int$	0

(Table 1)

Also, let $\eta = \{0,\sigma\} \subset \aleph = \{0,\int,\sigma\} \subset \Im =$ η and $\Im$ is a (S.A) of $\aleph = \{0,\int,\sigma\}$. Then $\partial,\ell,\int,\sigma\}$ {0, is (M.I) of $\Im$ related to $\aleph$ ($\eta \prec_M \aleph$).

***3.4 Lemma*:**

Let $(\Im,\wedge,0)$ be a (D.A), $\aleph$ be a (S.A) of $\Im$ and $\eta \subseteq \Im$. Then $\eta \prec_M H$, if $\eta \prec_S \aleph$.

Proof:

Suppose that $\eta \prec_S \aleph$, then we consider that it such that:

(i) $\phi \neq \eta \subseteq \aleph$,

(ii) $\forall \hbar \in \aleph, \upsilon \in \eta; (\hbar \wedge \upsilon) \in \eta \to \hbar \in \eta$,

(iii)Now, we want to prove that $. = \upsilon \wedge \hbar \;\; \wedge \upsilon \;\; \forall \hbar \in \aleph - \{0\} \,\&\, \upsilon \in \eta - \{0\} \to \hbar$

(1) $0 \in \eta$,

(2) $\forall \hbar \in \aleph - \eta \,\&\, \upsilon \in \eta - \{0\} \to$ From (i) we have there exists at least one member $.\upsilon \wedge \hbar \;\; \hbar \wedge \upsilon =$. But this $\upsilon \wedge \upsilon \notin \eta \to \upsilon \wedge \upsilon \notin \aleph$). Therefore, if $\eta \subseteq \aleph$ (since $\upsilon \in \aleph$). Also, $\phi \neq \eta$ (since η in υ contradiction, since $\upsilon \in \aleph$ and $\aleph$ is sub-algebra of $\Im$. That means $\upsilon \wedge \upsilon \in \eta$. In other words, $\upsilon \wedge \upsilon = 0 \in \eta$ (since $\upsilon \in \Im$ and $\Im$ is $d-$algebra). Moreover, to prove (2) we assume that $\hbar \in \aleph - \eta \,\&\, \upsilon \in \eta - \{0\}$, since $0 \in \eta$, then we have $\hbar \in \aleph - \{0\}$ and from (iii) we consider that $\hbar \wedge \upsilon = \upsilon \wedge \hbar$. Hence $\eta \prec_M \aleph$.

3.5 Remark:

It is not necessary every (M.I) of $\Im$ is $S-$ Ideal of $\Im$, we will explain that by the following example.

3.6 Example:

Assume $(\Im,\wedge,0)$ is a (D.A) in Example (3.3) and let $\eta = \{0,\int\}$. Hence η is (M.I) of $\Im$ related to $\aleph$, but is not (S.I) of $\Im$ related to $\aleph$, where $\aleph = \{0,\int,\sigma\}$ is a (S.A) of $\Im$ in Example (3.3). Since there exist $\hbar = \sigma \in \aleph, \upsilon = \int \in \eta$ and $(\hbar \wedge \upsilon) = \int \in \eta$, but $\hbar \notin \eta$.

3.7 Definition:

Let $(\Im,\wedge,0)$ be a (D.A) and (λ,π) be a (S.S) over $\Im$. We say (λ,π) is a soft $S-$algebra (S.S.A) over $\Im$ if $\forall \alpha,\; \beta \in \lambda(p) - \{0\} \to \alpha \wedge \beta = \beta \wedge \alpha \in \lambda(p)$, whenever $p \in \Im$.

3.8 Definition:

Let (λ,π) be a (S.S.A) over $\Im$. For any (S.S) say (δ,ψ) overt $\Im$, we say (δ,ψ) is a soft $M-$ideal (S.M.I) of (λ,π) and referred by $(\delta,\psi) \prec_M (\lambda,\pi)$ if it such that:

$(i)\psi \subseteq \pi,$

$(ii)\delta(p) \prec_M \lambda(p), \forall p \in \psi.$

3.9 Definition:

Let (λ, π) be a (S.S.A) over $\Im$. If (δ, ψ) is (S.S) over $\Im$, then we say (δ, ψ) is a soft $S-$ideal (S.S.I) of (λ, π) and referred by $(\delta, \psi) \prec_S (\lambda, \pi)$ if it such that:

$(i)\psi \subseteq \pi,$

$(ii)\ \delta(p) \prec_S \lambda(p), \forall p \in \psi.$

3.10 Example:

Let $(\Im, \wedge, 0)$ be (D.A) in Example (3.3) and let (λ, π) and (δ, ψ) be two (S.S)s over $\Im$ where $\lambda(p) = \{q \in \Im \mid p \wedge q \in \{0, p\}\}$, $\pi = \{0, \int, \sigma\}$, Then $\psi = \{0, \sigma\}$. and $0\}$, $\delta(p) = \{q \in \Im \mid q \wedge p =$ we consider that:

$(i)\ \psi \subseteq \pi,$

$(ii)\ \delta(0) = \{0\} \prec_S \Im = \lambda(0)\ \&\ \delta(\sigma) = \{0, \sigma\} \prec_S \{0, \sigma\} = \lambda(\sigma)$. Hence (δ, ψ). $(\lambda, \pi) \prec_S$

Moreover, let (T, D) be a (S.S) over $\Im$, where $T(p) = \{q \in \Im \mid\ p \wedge q = q \wedge p\}$ and $D = \{0, \int\}$. Then we consider that:

$(i)\ D \subseteq \pi,$

$(ii)\ T(0) = \{0\} \prec_S \Im = \lambda(0)$, but $T(\int) = \{\partial, \ell, \int, \sigma\}$ is not (S.I) of $\Im$ related to $\lambda(\int) = \{0, \int, \sigma\}$. Thus (T, D) is not (S.S.I) of (λ, π). Also, since $0 \notin T(\int) = \{\partial, \ell \int, \sigma\}$, we consider that (T, D) is not (S.M.I) of (λ, π).

***3.11 Remark*:**

It is clearly every (S.S.I) is (S.M.I), but the converse is not true. Therefore a (S.M.I) need not be (S.S.I) by the following example. Let $(\Im, \wedge, 0)$ be (D.A) with the following table:

$\wedge$	0	∂	ℓ	$\int$	σ
0	0	0	0	0	0
∂	∂	0	ℓ	$\int$	σ
ℓ	ℓ	ℓ	0	$\int$	σ
$\int$	$\int$	$\int$	$\int$	0	σ
σ	σ	σ	σ	σ	0

(Table 2)

Define a multi-valued function $\lambda : \pi \to P(\Im)$ t by $\lambda(p) = \{q \in \Im \mid q \wedge p \in \{0, \sigma\}\}$, $\forall p \in \pi = \Im$. Then (λ, π) is a (S.S.A) over $\Im$. Now, let (δ, ψ) be (S.S) overt $\Im$, where $\psi = \{\partial, \ell \int, \sigma\}$ and $\delta : \psi \to P(\Im)$ is defined by $\delta(p) = \{q \in \Im \mid q \wedge p \in \{0, \partial\}\}, \forall p \in \psi$. Then we consider that:

$\delta(\partial)=\{0,\partial\}\prec_M \{0,\partial,\sigma\}=\lambda(\partial),$

$\delta(\ell)=\{0,\ell\}\prec_M \{0,\ell,\sigma\}=\lambda(\ell),$

$\delta(\int)=\{0,\int\}\prec_M \{0,\int,\sigma\}=\lambda(\int),$

$\delta(\sigma)=\{0,\sigma\}\prec_M \Im=\lambda(\sigma).$

Hence (δ,ψ) is (S.M.I) of (λ,π). However, (δ,ψ) is not (S.S.I) of (λ,π), since $\hbar=\ell\in\lambda(\sigma), \upsilon=\sigma\in\delta(\sigma)$ & $(\hbar\wedge\upsilon)=\sigma\in\delta(\sigma),$ but $\ell\notin\delta(\sigma)$.

3.12 Theorem:

Let (λ,π) be a (S.S.A) over $\Im$. If $(\delta,\psi)\prec_S (\lambda,\pi)$ and $(\delta,\psi) \tilde{\subseteq} (\aleph,D)$, for any two (S.S)s over $\Im$, then $(\delta,\psi)\prod(\aleph,D)\prec_S (\lambda,\pi)$.

Proof:

Suppose that $(T,L)=(\delta,\psi)\prod(\aleph,D)$, then by the definition of the soft intersection we have $T(p)=\delta(p)\cap \aleph(p), \forall\, p\in L$, where $L=\psi\cap D$. Now, for any $p\in L$, we have $T(p)=\delta(p)\cap \aleph(p)=\delta(p)$ (since $(\delta,\psi)\tilde{\subseteq}(\aleph,D)$). However, for any $p\in L\to p\in\psi$ and hence $\delta(p)\prec_S \lambda(p)$ (since $(\delta,\psi)\prec_S (\lambda,\pi)$). Therefore, for any $p\in L$ implies that $T(p)\prec_S \lambda(p)$. Then $(\delta,\psi)\prod(\aleph,D)\prec_S (\lambda,\pi).$

3.13 Corollary:

Let (λ,π) be a (S.S.A) over $\Im$. Then $(\delta,\psi)\prod(\delta,D)\prec_S (\lambda,\psi)$, if $(\delta,\psi)\prec_S (\lambda,\pi)$ or $(\delta,D)\prec_S (\lambda,\pi)$, for any multi-valued function $\delta:\Im\to P(\Im)$ and for any two subsets ψ and D of $\Im$.

Proof:

Suppose that $(T,L)=(\delta,\psi)\prod\ (\delta,D)$, we have, where $\forall\, p\in L\ \delta(p),\ T(p)=\delta(p)\cap\delta(p)=$ (since $\forall\, p\in L\ T(p)=\delta(p)\prec_S \lambda(p)$. This implies that $(\delta,\psi)\prec_S (\lambda,\pi)$. Now, if $L=\psi\cap D$. Then $L\subseteq D$) (since $T(p)\prec_S \lambda(p)$ we have $p\in L$, for any $(\delta,\psi)\prec_S (\lambda,\pi)$ Also, if. $L\subseteq\psi$) $.\prec_S (\lambda,\lambda)$ $(\delta,\psi)\prod(\delta,D)$

3.14 Theorem:

Let (λ,π) be a (S.S.A) over $\Im$. Then $(\delta,\psi)\coprod(\aleph,D)\prec_S (\lambda,\pi)$, ifand $(\lambda,\pi)\prec_S$ (δ,ψ) are disjoint. D and ψ in which $\Im$ over $(\aleph,D)$ and (δ,ψ), for any two (S.S)s $(\aleph,D)\prec_S (\lambda,\pi)$

Proof:

Suppose that $(\delta,\psi)\prec_S (\lambda,\pi)$, $(\aleph,D)$ $\prec_S (\lambda,\pi)$) and let (T,L), then for $\coprod(\delta,D)$ (δ,ψ) $=$ every $p\in L$ by the definition of the soft union we have $T(p)=\delta(p),\ if\ p\in\psi\setminus D,$ $T(p)=\aleph(p),\ if\ p\in D\setminus\psi$, and $T(p)=\delta(p)\cup\aleph(p),\ \ if\ p\in\psi\cap D$, where $L=\psi\cup D$. Now, for any $p\in L$ implies that $p\in\psi$ or $p\in D$ (since ψ and D are disjoint). Therefore, for any $p\in L$ we have $T(p)=\delta(p)$ or $M(p)$. However, $\delta(p)\prec_S \lambda(p),\forall p\in\psi$ and $\aleph(p)\prec_S \lambda(p),\forall p\in D$

(since $(\delta,\psi)\coprod$. Hence $T(p)\prec_S \lambda(p), \forall p \in L$). Then $(\aleph, D)\prec_S (\lambda,\pi)$ and (λ,π) $(\delta,\psi)\prec_S$ $(\aleph, D)\prec_S (\lambda,\pi)$.

3.15 Theorem

Let (λ,π) be a soft $S-$algebra over $\Im$. If $(\delta,\psi)\prec_M (\lambda,\pi)$ and $(\delta,\psi)\tilde{\subseteq}(\aleph,\psi)$, for any two (S.S)s over $\Im$, then $(\aleph,\psi)\overline{\prod}(\delta,\psi)\prec_M (\lambda,\pi)$.

Proof:

By the Definition (2.5), $(\aleph,\psi)\overline{\prod}(\delta,\psi)=(T,\psi\times\psi)$, where $T(\alpha,\beta)=\aleph(\alpha)\cap\delta(\beta)$ for all $(\alpha,\beta)\in\psi\times\psi$. Since $(\delta,\psi)\prec_M (\lambda,\pi)$, thenTherefore, we consider . $\forall p\in\psi$ $\lambda(p)$, $\delta(p)\prec_M$ that:

(i) $0\in\delta(p)$,

(ii) $\forall\hbar\in\lambda(p)-\delta(p)\,\&\,\upsilon\in\delta(p)-\{0\}\rightarrow\hbar\wedge\upsilon=\upsilon\wedge\hbar$, $\forall p\in\psi$ .Hence from (i) we have $0\in\delta(b)$ and $0\in\delta(\alpha)\subseteq\aleph(\alpha)$ (since $(\delta,\psi)\tilde{\subseteq}(\aleph,\psi)$). Therefore, $0\in\aleph(\alpha)\cap\delta(\beta)=T(\alpha,\beta)$. Furthermore, and implies that $\delta(\beta).\cap\aleph(\alpha)$ $\subseteq$ $\delta(\alpha)\cap\delta(\beta)$ $\delta(\alpha)\subseteq\aleph(\alpha)\rightarrow$ and hence from (ii) we have $\{\delta(\alpha)\cap\delta(\beta)\}$ $\lambda(\beta)\}-$ $\{\lambda(\alpha)\cap\lambda(\beta)\}-\aleph(\alpha)\cap\delta(\beta)\subseteq\{\lambda(\alpha)\cap$ $\in\{\aleph(\alpha)\cap\delta(\beta)\}-\{0\}\rightarrow\hbar\in\lambda(\beta)-\delta(\beta)\,\&$ $\forall\hbar\in\{\lambda(\alpha)\cap\lambda(\beta)\}-\{\aleph(\alpha)\cap\delta(\beta)\}\,\&\,\upsilon$ $\&\,T(\alpha,\beta)$ $\forall\hbar\in\{\lambda(\alpha)\cap\lambda(\beta)\}-$. This implies that $\upsilon\in\delta(\beta)-\{0\}\rightarrow\hbar\wedge\upsilon=\upsilon\wedge\hbar$. $(\aleph,\psi)\overline{\prod}(\delta,\psi)\prec_M (\lambda,\pi)$. Then $\upsilon\wedge\hbar$ $\upsilon\in T(\alpha,\beta)-\{0\}\rightarrow\hbar\wedge\upsilon=$

3.16 Theorem:

Let (λ,π) be a (S.S.A) over $\Im$. Then $(\delta,\psi)\overline{\coprod}(\aleph,D)\prec_M (\lambda,\pi)$, ifand $(\lambda,\pi)\prec_M$ (δ,ψ) . $\Im$ over $(\aleph,D)$ and (δ,ψ), for any two (S.S)s $(\aleph,D)\prec_M (\lambda,\pi)$

Proof:

By the Definition (2.6), $(\aleph,D)$ $\overline{\coprod}(\delta,\psi)=(T,L)$, where $T(\alpha,\beta)=\aleph(\alpha)\cup\delta(\beta)$ for all $(\alpha,\beta)\in L=D\times\psi$. Since $(\delta,\psi)\prec_M (\lambda,\pi)$ and), then (λ,π) $(\aleph,D)\prec_M$. Therefore, we consider that: $\aleph(p)\prec_M \lambda(p), \forall p\in D$ and $\delta(p)\prec_M \lambda(p), \forall p\in\psi$

(i) $0\in\delta(\beta)$, $(ii)\,0\in\aleph(\alpha)$,

(ii) $\forall\hbar\in\lambda(p)-\delta(p)\,\&\,\upsilon\in\delta(p)-\{0\}\rightarrow\hbar\wedge\upsilon=\upsilon\wedge\hbar$,

$(iiii)$ $\forall\hbar\in\lambda(\alpha)-\aleph(\alpha)\,\&\,\upsilon\in\aleph(\alpha)-\{0\}\rightarrow\hbar\wedge\upsilon=\upsilon\wedge\hbar$, $\forall\beta\in\psi\,\&\,\forall\alpha\in D$.

Now, for every $p=(\alpha,\beta)\in L=D\times\psi$ we have $T(p)=\aleph(\alpha)\cup\delta(\beta)$. That means $0\in T(p), \forall p\in L$, and for any $\hbar\in\{\lambda(\alpha)\cap\lambda(\beta)\}-\{\aleph(\alpha)\cup\delta(\beta)\}\rightarrow\hbar\in\{\lambda(\alpha)\cap\lambda(\beta)\}$ $-\aleph(\alpha)\subseteq\lambda(\alpha)-\aleph(\alpha)$ or $\hbar\in\{\lambda(\alpha)\cap\lambda(\beta)\}-\delta(\beta)\subseteq\lambda(\beta)-\delta(\beta)$. Also, for any $0\neq\upsilon\in T(p)=\aleph(\alpha)\cup$ $\delta(\beta)\rightarrow\upsilon\in\aleph(\alpha)-\{0\}$ or $\upsilon\in\delta(\beta)-\{0\}$. In other words, for any $\hbar\in$ Then $\{0\}\rightarrow\hbar\wedge\upsilon=\upsilon\wedge\hbar.$ $-T(\alpha,\beta)$ $\upsilon\in$ and $\{\lambda(\alpha)\cap\lambda(\beta)\}-T(\alpha,\beta)$, for all $T(\alpha,\beta)\prec_M=\lambda(\alpha)\cap\lambda(\beta)\prec_M \lambda(\beta)$ and $T(\alpha,\beta)\prec_M=\lambda(\alpha)\cap\lambda(\beta)\prec_M \lambda(\alpha)$. $(\delta,\psi)\overline{\coprod}(\aleph,D)\prec_M (\lambda,\pi)$. Hence $(\alpha,\beta)\in L=D\times\psi$

The proof of the following Proposition is straight forward by Definitions (2.4), (3.7), (3.8) and (3.9), so it is omitted.

3.17 Proposition:
(1) If $\Theta : \Im \to \Gamma$ is a soft mapping and an isomorphism of $d-$algebras and (λ,π) is a (S.S.A) over $\Im$, then $\Theta((\lambda,\pi))$ is a (S.S.A) over Γ.

(2) If $\Theta : \Im \to \Gamma$ is a soft mapping and an isomorphism of $d-$algebras and (λ,π) is a (S.S.A) over $\Im$ with $(\delta,\psi) \prec_M (\lambda,\pi)$, then $\Theta((\delta,\psi)) \prec_M \Theta((\lambda,\pi))$ in Γ, for any (S.S) (δ,ψ) over $\Im$.

(3) If $\Theta : \Im \to \Gamma$ is a soft mapping and an isomorphism of $d-$algebras and (λ,π) is a (S.S.A) over $\Im$ with $(\delta,\psi) \prec_S (\lambda,\pi)$, then $\Theta((\delta,\psi)) \prec_S \Theta((\lambda,\pi))$ in Γ, for any (S.S) (δ,ψ) over $\Im$.

Conclusion:

In this work, we introduced and studied new classes of ideals in $d-$algebra like (M.I) and (S.I). Next, we used these connotations to introduce and investigate new concepts in (S.S.A) like (S.M.I) and (S.S.I). In future work, we will initiate a study of $S-$algebras of power set and explained their relations with other algebras of power set, like soft $\rho-$algebra of power set of $\Im$, and soft edge $\rho-$algebra of power set of $\Im$. Moreover, "we will investigate" some new "types" of soft ideal algebras of power sets and give a study on their characterizations using $d-$ideal, $BCK-$ideal, and others.

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