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On supra regular generalized star star b- closed sets in supra topological spaces

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Abstract
In this paper a new class of $rg^{**}b^{\mu}$ closed sets is introduced and compared with already existing supra closed sets. Also some of the characteristics of $rg^{**}b^{\mu}$-closed sets are studied, also $rg^{**}b^{\mu}$ neighbourhoods by using $rg^{**}b^{\mu}$-open sets are discussed.

Keywords: $rg^{**}b^{\mu}$ closed set, $rg^{**}b^{\mu}$ neighbourhood, $rg^{**}b^{\mu}$-open set

1. Introduction
In 1970, Levine [6], introduced the concept of generalized closed set and discussed the properties of sets, closed and open, maps, compactness, normal and separation axioms. In 1983 Mashhour *et al* [7] introduced supra topological spaces and studied S-continuous maps and S*-continuous maps. In 2008, Devi *et al* [3] introduced and studied a class of sets called supra α-open and a class of maps called s α –continuous between topological spaces, respectively.
In 2010, Sayed and Noiri [11] introduced and studied a class of sets called supra b-open and a class of maps called supra b-continuous. Ravi *et al* [9] introduced and studied a class of sets called supra g-closed and a class of maps called supra g-continuous respectively. In 2013, Indirani and Sindhu [4] introduced a new class of sets called, regular generalized star b-closed set in topological spaces. In 2014, Banupriya and Indirani [1], introduced Regular generalized star star b-closed sets in topological spaces.
In 2015**,** Chinnapparaj, Sathishmohan. Rajendran. Indirani [2], introduced a new class of sets called, Supra regular generalized star b-closed Set. In this paper a new class of supra closed set called supra regular generalized star star b-closed sets is introduced. We also study $rg^{**}b^{\mu}$ neighbourhoods by using $rg^{**}b^{\mu}$-open sets.

2. Preliminaries
2.1 Definition: [7] Let X be a non-empty set. The subfamily $\mu \subseteq \wp(X)$ where $\wp$ (X) is the power set of X is said to be a supra topology on X if X $\in$ μ,$\emptyset \in$ μ and μ is closed under arbitrary unions.
The pair (X, μ) is called a supra topological space. The elements of μ are said to be supra open in (X, μ). Complements of supra open sets are called supra closed sets.

2.2 Definition: [7] Let A be a subset of (X, μ). Then the supra closure of A is denoted by cl^{μ}(A) = ∩ { B / B is a supra closed set and AÍ B}.

2.3 Definition: [7] Let A be a subset of (X, μ). Then the supra interior of A is denoted by int^{μ}(A)= ∪{ B / B is a supra open set and AÊ B}.

2.4 Definition: [7] Let (X, μ) be a topological space and μ be a supra topology on X. μ is supra topology associated with τ if $\tau \subseteq \mu$.

2.5 Definition: A subset A of a supra topological space (X, μ) is called
(i) Supra semi-open [11] if A $\subseteq cl^{\mu}(int^{\mu}(A))$.
(ii) Supra α-open [3] if A $\subseteq int^{\mu}(cl^{\mu}(int^{\mu}(A)))$.
(iii) Supra pre –open [10] if A $\subseteq int^{\mu}\big(cl^{\mu}(A)\big)$
(iv) Supra r-closed if A $= cl^{\mu}(int^{\mu}(A))$.
(v) Supra b-open set [11] if A $\subseteq cl^{\mu}(int^{\mu}(A)) \cup int^{\mu}(cl^{\mu}(A))$.

2.6 Definition: A subset A of a supra topological space (X, μ) is called
(1) Supra generalized closed set [6] (briefly g^{μ}-closed) if $cl^{\mu}(A)$ ⊆U whenever A ⊆U and U is supra open in (X, μ).
(2) Supra semi-generalized closed set [5] (briefly sg^{μ}-closed) if $scl^{\mu}(A)$ ⊆U whenever A ⊆U and U is supra semi-open in (X, μ).
(3) Supra generalized semi-closed set [5] (briefly gs^{μ}-closed) if $scl^{\mu}(A)$ ⊆U whenever A ⊆U and U is supra open in (X, μ).
(4) Supra generalized α- closed set [2] (briefly $g\alpha^{\mu}$-closed) if $\alpha cl^{\mu}(A)$ ⊆U whenever A ⊆U and U is supra α- open in (X, μ).
(5) Supra α- generalized closed set [2] (briefly αg^{μ}-closed) if $\alpha cl^{\mu}(A)$ ⊆U whenever A ⊆U and U is supra open in (X, μ).
(6) Supra generalized pre- closed set [2] (briefly gp^{μ}-closed) if $pcl^{\mu}(A)$ ⊆U whenever A ⊆U and U is supra open in (X, μ).
(7) Supra generalized pre-regular closed set [12] (briefly gpr^{μ}-closed) if $pcl^{\mu}(A)$ ⊆U whenever A ⊆U and U is supra r-open in (X, μ).
(8) Supra regular generalized closed set [2] (briefly rg^{μ}-closed) if $cl^{\mu}(A)$ ⊆U whenever A ⊆U and U is supra regular open in (X, μ).
(9) Supra generalized regular closed set [2] (briefly gr^{μ}-closed) if $rcl^{\mu}(A)$ ⊆U whenever A ⊆U and U is supra open in (X, μ).
(10) Supra generalized star closed set [8] (briefly $g^{*\mu}$-closed) if $cl^{\mu}(A)$ ⊆U whenever A ⊆U and U is g^{μ} open in (X, μ).
(11) Supra generalized star semi- closed set [2] (briefly $g^{*}s^{\mu}$-closed) if $scl^{\mu}(A)$ ⊆U whenever A ⊆U and U is g^{μ} open in (X, μ).
(12) Supra generalized # closed set [2] (briefly $g^{\#\mu}$-closed) if $cl^{\mu}(A)$ ⊆U whenever A ⊆U and U is αg^{μ} open in (X, μ).
(13) Supra generalized # semi- closed set [2] (briefly $g^{\#}s^{\mu}$-closed) if $scl^{\mu}(A)$ ⊆U whenever A ⊆U and U is supra αg^{μ} open in (X, μ).
(14) Supra regular generalized star b- closed set [2] (briefly $rg^{*}b^{\mu}$-closed) if $bcl^{\mu}(A)$ ⊆U whenever A ⊆U and U is supra rg-open in (X, μ).
(15) Supra generalized star b- closed set [2] (briefly $g^{*}b^{\mu}$-closed) if $bcl^{\mu}(A)$ ⊆U whenever A ⊆U and U is supra g- open in (X, μ).
(16) Supra generalized αb- closed set [1] (briefly $g\alpha b^{\mu}$-closed) if $bcl^{\mu}(A)$ ⊆ whenever A ⊆U and U is supra α- open in (X, μ).
(17) Supra semi generalized b- closed set [1] (briefly sgb^{μ}-closed) if $bcl^{\mu}(A)$ ⊆U whenever A ⊆U and U is supra semi- open in (X, μ). The complements of the above mentioned closed sets are called their respective open sets.

3. $rg^{**}b^{\mu}$-Closed Sets

3.1 Definition: A subset A of a supra topological space(X,μ) is called supra regular generalized star star b-closed set (briefly $rg^{**}b^{\mu}$-closed set) if $rg^{*}bcl^{\mu}(A)$ ⊆U whenever A⊆U and U is supra open in X.

3.2 Theorem: Every supra closed set is $rg^{**}b^{\mu}$-closed set but not conversely.

Proof: Let A be a supra closed set in X such that A⊆U and U is supra open in X. Since A is supra closed,cl^{μ} (A)=A⊆U.By theorem, "Every supra closed set is $rg^{*}b^{\mu}$-closed set", $rg^{*}bcl^{\mu}(A) \subseteq cl^{\mu}(A) = A$.Therefore $rg^{*}bcl^{\mu}(A)$ ⊆U.Hence A is $rg^{**}b^{\mu}$-closed set.

3.3 Example: Let X=$\{a,b,c\}$, with μ={X,$\emptyset$,$\{a,b\},\{b,c\}$} and μ^{c}={X, $\emptyset,\{a\},\{c\}$}.Then {a,c} is $rg^{**}b^{\mu}$-closed set but not supra closed.

3.4 Theorem: Every supra $semi$-closed set is $rg^{**}b^{\mu}$-closed set but not conversely.

Proof: Let A be a supra $semi$- closed set in X such that A⊆U and U is supra open in X. Since A is supra $semi$- closed,scl^{μ} (A)=A⊆U.But every supra semi-closed set is $rg^{*}b^{\mu}$-closed set.Therefore, $rg^{*}bcl^{\mu}(A) \subseteq scl^{\mu}(A) = A$ ⊆U.Therefore $rg^{*}bcl^{\mu}(A)$ ⊆U.Hence A is $rg^{**}b^{\mu}$-closed set.

3.5 Example: Let X=$\{a,b,c,d\}$,with μ={X,$\emptyset$,{b},{b,c},{c,d},{b,c,d}}.Then {a,b,c} is $rg^{**}b^{\mu}$-closed set but not supra semi-closed.

3.6 Theorem: Every supra α-closed set is $rg^{**}b^{\mu}$-closed set but not conversely.

Proof: Let A be a supra α- closed set in X such that A⊆U and U is supra open in X. Since A is supra α- closed,αcl^{μ} (A)=A⊆U.By theorem, "Every supra α- closed set is $rg^{*}b^{\mu}$-closed set", $rg^{*}bcl^{\mu}(A) \subseteq \alpha cl^{\mu}(A) = A$ ⊆U.Therefore $rg^{*}bcl^{\mu}(A)$ ⊆U.Hence A is $rg^{**}b^{\mu}$-closed set.

3.7 Example: Let X=$\{a,b,c,d\}$, with μ={X,$\emptyset$,$\{c\},\{a,b\},\{b,c\},\{a,b,c\}$}.Then {b,c,d} is $rg^{**}b^{\mu}$-closed set but not supra α-closed.

3.8 Theorem: Every supra pre-closed set is $rg^{**}b^{\mu}$-closed set but not conversely.

Proof: Let A be a supra pre- closed set in X such that A⊆U and U is supra open in X. Since A is supra pre- closed,pcl^{μ} (A)=A⊆U.But every supra pre-closed set is $rg^{*}b^{\mu}$-closed set.Therefore,$rg^{*}bcl^{\mu}(A) \subseteq pcl^{\mu}(A) = A$ ⊆U.Therefore $rg^{*}bcl^{\mu}(A)$ ⊆U.Hence A is $rg^{**}b^{\mu}$-closed set.

3.9 Example: Let X=$\{a,b,c,d\}$,with μ={X,$\emptyset$, {d},{b,c},{c,d},{b,c,d}}.Then {a,c,d} is $rg^{**}b^{\mu}$-closed set but not supra pre-closed.

3.10 Theorem: Every supra regular-closed set is $rg^{**}b^{\mu}$-closed set but not conversely.

Proof: Let A be a supra $regular$- closed set in X such that A⊆U and U is supra open in X. Since A is supra $regular$-closed,rcl^{μ} (A)=A⊆U.But every supra regular-closed set is $rg^{*}b^{\mu}$-closed set.Therefore,$rg^{*}bcl^{\mu}(A) \subseteq rcl^{\mu}(A) = A$ ⊆U.Therefore $rg^{*}bcl^{\mu}(A)$ ⊆U.Hence A is $rg^{**}b^{\mu}$-closed set.

3.11 Example: Let X=$\{a,b,c,d\}$,with μ={X,$\emptyset$, {b},{d},{b,d},{b,c},{c,d},{b,c,d}}.Then {a,c} is $rg^{**}b^{\mu}$-closed set but not supra regular-closed.

3.12 Theorem: Every supra b-closed set is $rg^{**}b^{\mu}$-closed set but not conversely.

Proof: Let A be a supra b- closed set in X such that A⊆U and U is supra open in X. Since A is supra b- closed,bcl^{μ} (A)=A⊆U.But every supra b-closed set is $rg^{*}b^{\mu}$-closed set.Therefore,$rg^{*}bcl^{\mu}(A) \subseteq bcl^{\mu}(A) = A$ ⊆U.Therefore $rg^{*}bcl^{\mu}(A)$ ⊆U.Hence A is $rg^{**}b^{\mu}$-closed set.

3.13 Example: Let X=$\{a,b,c,d\}$,with μ={X,$\emptyset$, {a},{a,b},{b,c},{a,b,c}}Then {a,b,d} is $rg^{**}b^{\mu}$-closed set but not supra b-closed.

3.14 Theorem: Every supra g-closed set is $rg^{**}b^{\mu}$-closed set but not conversely.

Proof: Let A be a supra g- closed set in X such that A⊆U and U is supra open in X. Since A is supra g- closed,cl^{μ} (A)⊆U,whenever A⊆U and U is supra open in X. But every supra closed set is $rg^{*}b^{\mu}$-closed set.Therefore,$rg^{*}bcl^{\mu}(A) \subseteq cl^{\mu}(A)$ ⊆U.Therefore $rg^{*}bcl^{\mu}(A)$ ⊆U.Hence A is $rg^{**}b^{\mu}$-closed set.

3.15 Example: Let X=$\{a,b,c,d\}$,with μ={X,$\emptyset$,{a},{c,d},{d,a},{a, c, d}}.Then {a, d} is $rg^{**}b^{\mu}$-closed set but not supra g-closed.

3.16 Theorem: Every supra sg-closed set is $rg^{**}b^{\mu}$-closed set but not conversely.

Proof: Let A be a supra sg- closed set in X such that A⊆U and U is supra open in X. Since A is supra sg-closed, scl^{μ}(A)⊆U,whenever A⊆U and U is supra semi-open in X. But every supra semi-closed set is $rg^{*}b^{\mu}$-closed set.Therefore,$rg^{*}bcl^{\mu}(A) \subseteq scl^{\mu}(A)$ ⊆U.Therefore $rg^{*}bcl^{\mu}(A)$ ⊆U.Hence A is $rg^{**}b^{\mu}$-closed set.

3.17 Example: Let X=$\{a,b,c,d\}$,with μ={X,$\emptyset$, {a},{c},{a,c},{c,d},{a,d},{a,c,d}}.Then {a,b,c} is $rg^{**}b^{\mu}$-closed set but not supra sg-closed.

3.18 Theorem: Every supra gs-closed set is $rg^{**}b^{\mu}$-closed set but not conversely.

Proof: Let A be a supra gs- closed set in X such that A⊆U and U is supra open in X. Since A is supra gs-closed, scl^{μ}(A)⊆U,whenever A⊆U and U is supra open in X..But every supra semi-closed set is $rg^{*}b^{\mu}$-closed set.Therefore,$rg^{*}bcl^{\mu}(A) \subseteq scl^{\mu}(A)$ ⊆U.Therefore $rg^{*}bcl^{\mu}(A)$ ⊆U.Hence A is $rg^{**}b^{\mu}$-closed set.

3.19 Example: Let X=$\{a,b,c,d\}$, with μ={X,$\emptyset$, {a},{c},{a, c},{a, b, c},{b, c, d}}.Then {c} is $rg^{**}b^{\mu}$-closed set but not supra gs-closed.

3.20 Theorem: Every supra $g\alpha$-closed set is $rg^{**}b^{\mu}$-closed set but not conversely.

Proof: Let A be a supra $g\alpha$- closed set in X such that A⊆U and U is supra open in X. Since A is supra gα-closed, αcl^{μ}(A)⊆U whenever, A⊆U and U is supra- α open in X..But every supra α-closed set is $rg^{*}b^{\mu}$-closed set.Therefore, $rg^{*}bcl^{\mu}(A) \subseteq \alpha cl^{\mu}(A)$ ⊆U.Therefore $rg^{*}bcl^{\mu}(A)$ ⊆U.Hence A is $rg^{**}b^{\mu}$-closed set.

3.21 Example: Let X=$\{a,b,c,d\}$,with μ={X,∅, {a},{c},{a,c},{a,b},{b,c},{a,b,c}}.Then {a} is $rg^{**}b^{\mu}$-closed set but not supra $g\alpha$-closed.

3.22 Theorem: Every supra αg-closed set is $rg^{**}b^{\mu}$-closed set but not conversely.

Proof: Let A be a supra αg- closed set in X such that A⊆U and U is supra open in X. Since A is supra αg-closed, αcl^{μ}(A)⊆U whenever, A⊆U and U is supra open in X.But every supra-α closed set is $rg^{*}b^{\mu}$-closed set.Therefore, $rg^{*}bcl^{\mu}(A) \subseteq \alpha cl^{\mu}(A)$ ⊆U.Therefore $rg^{*}bcl^{\mu}(A)$ ⊆U.Hence A is $rg^{**}b^{\mu}$-closed set.

3.23 Example: Let X=$\{a,b,c,d\}$,with μ={X,∅, {a},{b},{a,b},{b,c},{a,c},{a,b,c}}.Then {a,c} is $rg^{**}b^{\mu}$-closed set but not supra αg-closed.

3.24 Theorem: Every supra gp-closed set is $rg^{**}b^{\mu}$-closed set but not conversely.

Proof: Let A be a supra gp- closed set in X such that A⊆U and U is supra open in X. Since A is supra gp-closed, pcl^{μ}(A)⊆U whenever, A⊆U and U is supra open in X..But every supra pre-closed set is $rg^{*}b^{\mu}$-closed set.Therefore, $rg^{*}bcl^{\mu}(A) \subseteq pcl^{\mu}(A)$ ⊆U.Therefore $rg^{*}bcl^{\mu}(A)$ ⊆U.Hence A is $rg^{**}b^{\mu}$-closed set.

3.25 Example: Let X=$\{a,b,c,d\}$,with μ={X,∅, {c},{d},{c,d},{a,d},{a,c},{a,c,d}}.Then {a,d} is $rg^{**}b^{\mu}$-closed set but not supra gp-closed.

3.26 Theorem: Every supra gr-closed set is $rg^{**}b^{\mu}$-closed set but not conversely.

Proof: Let A be a supra gr- closed set in X such that A⊆U and U is supra open in X. Since A is supra gr-closed, rcl^{μ}(A)⊆U whenever, A⊆U and U is supra open in X. But every supra r- closed set is $rg^{*}b^{\mu}$-closed set.Therefore, $rg^{*}bcl^{\mu}(A) \subseteq rcl^{\mu}(A)$ ⊆U.Therefore $rg^{*}bcl^{\mu}(A)$ ⊆U.Hence A is $rg^{**}b^{\mu}$-closed set.

3.27 Example: Let X=$\{a,b,c,d\}$,with μ={X,∅,{b},{c},{a,b},{b,c},{a,c},{a,b,c}}.Then {a} is $rg^{**}b^{\mu}$-closed set but not supra gr-closed.

3.28 Theorem: Every supra g^{*}-closed set is $rg^{**}b^{\mu}$-closed set but not conversely.

Proof: Let A be a supra g^{*}- closed set in X such that A⊆U and U is supra open in X. Since A is supra g^{*}-closed, cl^{μ}(A)⊆U,whenever A⊆U and U is supra g-open.But every supra g-closed set is $rg^{*}b^{\mu}$-closed set and every supra closed set is $rg^{**}b^{\mu}$ set.Therefore, $rg^{*}bcl^{\mu}(A) \subseteq cl^{\mu}(A)$ ⊆U.Therefore $rg^{*}bcl^{\mu}(A)$ ⊆U.Hence A is $rg^{**}b^{\mu}$-closed set.

3.29 Example: Let X=$\{a,b,c,d\}$,with μ={X,∅, {a},{d,c},{a,d},{a,c,d}}.Then {a} is $rg^{**}b^{\mu}$-closed set but not supra g^{*} closed.

3.30 Theorem: Every supra $g^{*}s$-closed set is $rg^{**}b^{\mu}$-closed set but not conversely.

Proof: Let A be a supra $g^{*}s$- closed set in X such that A⊆U and U is supra open in X. Since A is supra $g^{*}s$-closed, scl^{μ}(A)⊆U whenever, A⊆U and U is supra g-open in X..But every supra $semi$-closed set is $rg^{*}b^{\mu}$-closed set.Therefore, $rg^{*}bcl^{\mu}(A) \subseteq scl^{\mu}(A)$ ⊆U.Therefore $rg^{*}bcl^{\mu}(A)$ ⊆U.Hence A is $rg^{**}b^{\mu}$-closed set.

3.31 Example: Let X=$\{a,b,c,d\}$, with μ={X,∅, {c,a},{a,b}}.Then {a} is $rg^{**}b^{\mu}$-closed set but not supra $g^{*}s$ closed.

3.32 Theorem: Every supra $g^{\#}$-closed set is $rg^{**}b^{\mu}$-closed set but not conversely.

Proof: Let A be a supra $g^{\#}$- closed set in X such that A⊆U and U is supra open in X. Since A is supra $g^{\#}$-closed, cl^{μ}(A)⊆Uwhenever A⊆U and U is supra αg- open in X..But every supra closed set is $rg^{*}b^{\mu}$-closed set.Therefore, $rg^{*}bcl^{\mu}(A) \subseteq cl^{\mu}(A)$ ⊆U.Therefore $rg^{*}bcl^{\mu}(A)$ ⊆U.Hence A is $rg^{**}b^{\mu}$-closed set.

3.33 Example: Let X=$\{a,b,c,d\}$,with μ={X,∅,{b},{c},{b,c},{b,d},{c,d},{b,c,d}}.Then {b,d} is $rg^{**}b^{\mu}$-closed set but not supra $g^{\#}$ closed.

3.34 Theorem: Every supra $g^{\#}s$-closed set is $rg^{**}b^{\mu}$-closed set but not conversely.

Proof: Let A be a supra $g^{\#}s$- closed set in X such that A⊆U and U is supra open in X. Since A is supra $g^{\#}s$-closed, scl^{μ}(A)⊆U whenever, A⊆U and U is supra αg-open in X..But every supra semi-closed set is $rg^{*}b^{\mu}$-closed set. Therefore, $rg^{*}bcl^{\mu}(A) \subseteq scl^{\mu}(A)$ ⊆U.Therefore $rg^{*}bcl^{\mu}(A)$ ⊆U.Hence A is $rg^{**}b^{\mu}$-closed set.

3.35 Example: Let X=$\{a,b,c,d\}$,with μ={X,∅, {a},{b},{a,b},{a,b,c},{b,c,d}}.Then {b,d} is $rg^{**}b^{\mu}$-closed set but not supra $g^{\#}s$ closed.

3.36 Theorem: Every supra $rg^{*}b$-closed set is $rg^{**}b^{\mu}$-closed set but not conversely.

Proof: Let A be a supra $rg^{*}b$ - closed set in X such that A⊆U and U is supra open in X. Since A is supra $rg^{*}b$ -closed, $rg^{*}bcl^{\mu}$(A)⊆U.Therefore $rg^{*}bcl^{\mu}(A)$ ⊆U.Hence A is $rg^{**}b^{\mu}$-closed set.

3.37 Example: Let X=$\{a,b,c,d\}$,with μ={X,∅, {a},{b},{a,b},{a,d,c},{b,c,d}}.Then {a,b,c} is $rg^{**}b^{\mu}$-closed set but not supra $rg^{*}b$ closed.

3.38 Theorem: Every supra $g^{*}b$-closed set is $rg^{**}b^{\mu}$-closed set but not conversely.

Proof: Let A be a supra $g^{*}b$ - closed set in X such that A⊆U and U is supra open in X. Since A is supra $g^{*}b$ -closed, bcl^{μ}(A)⊆U,whenever, A⊆U and U is supra g-open in X. But every supra b-closed set is $rg^{*}b^{\mu}$-closed set. Therefore, $rg^{*}bcl^{\mu}(A) \subseteq bcl^{\mu}(A)$ ⊆U.Therefore $rg^{*}bcl^{\mu}(A)$ ⊆U.Hence A is $rg^{**}b^{\mu}$-closed set.

3.39 Example: Let X=$\{a,b,c,d\}$, with μ={X,∅, {a},{d},{a, d}, {a, b, c},{b, c, d}}.Then {a, c, d} is $rg^{**}b^{\mu}$-closed set but not supra $g^{*}b$ closed.

3.40 Theorem: Every supra $g\alpha b$-closed set is $rg^{**}b^{\mu}$-closed set but not conversely.

Proof: Let A be a supra $g\alpha b$ - closed set in X such that A⊆U and U is supra open in X. Since A is supra gαb-closed, bcl^{μ}(A)⊆U whenever A⊆U and U is supra α- open in X..But every supra b-closed set is $rg^{*}b^{\mu}$-closed set.Therefore, $rg^{*}bcl^{\mu}(A) \subseteq bcl^{\mu}(A)$ ⊆U.Therefore $rg^{*}bcl^{\mu}(A)$ ⊆U.Hence A is $rg^{**}b^{\mu}$-closed set.

3.41 Example: Let X=$\{a,b,c,d\}$,with μ={X,∅, {d},{a} {a,c},{c,d},{a,d},{c,d,a}}.Then {a,b,d} is $rg^{**}b^{\mu}$-closed set but not supra $g\alpha b$ closed.

3.42 Theorem: Every supra sgb-closed set is $rg^{**}b^{\mu}$-closed set but not conversely.

Proof: Let A be a supra sgb - closed set in X such that A⊆U and U is supra open in X. Since A is supra sg$b$-closed, bcl^{μ}(A)⊆U whenever A⊆U and U is supra semi- open in X.But every supra b-closed set is $rg^{*}b^{\mu}$-closed set. Therefore, $rg^{*}bcl^{\mu}(A) \subseteq bcl^{\mu}(A)$ ⊆U.Therefore $rg^{*}bcl^{\mu}(A)$ ⊆U.Hence A is $rg^{**}b^{\mu}$-closed set.

3.43 Example: Let X=$\{a,b,c,d\}$,with μ={X,∅, {d},{c},{b,d},{b,c},{c,d},{b,c,d}}.Then {a,c,d} is $rg^{**}b^{\mu}$-closed set but not supra sgb closed.

3.44 Remark: $rg^{**}b^{\mu}$-closed set and rg^{μ}-closed set are independent to each other as seen from the following examples.

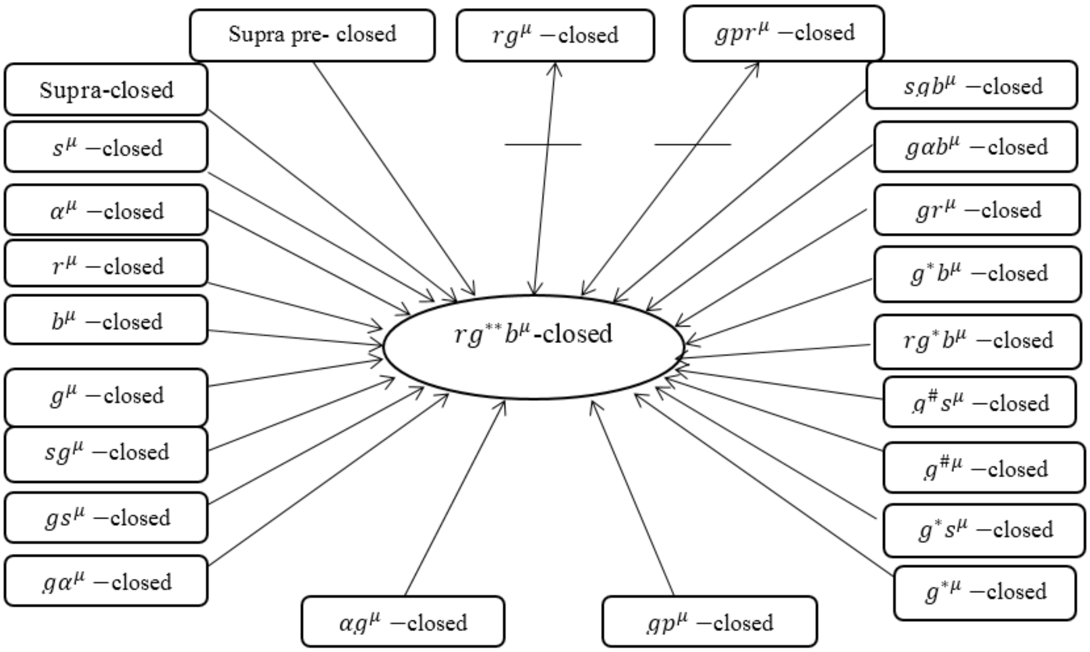
3.45 Example: Let X=$\{a,b,c,d\}$,with μ={X,∅, {b},{d},{b,d},{b,c,d},{a,b,c}}. Then {b,c} is rg^{μ}-closed set but not $rg^{**}b^{\mu}$-closed set.

3.46 Example: Let X=$\{a,b,c,d\}$,with μ={X,∅, {e},{d},{e, d},{c, d}, {b, d},{c, d, e},{b, d, e},{c, b, d},{a, c, d, e},{a, b, d, e},{b, c, d, e}}.Then {b, c, d} is -$rg^{**}b^{\mu}$-closed set but not rg^{μ} closed set.

3.47 Remark: $rg^{**}b^{\mu}$-closed set and gpr^{μ}-closed set are independent to each other as seen from the following examples.

3.48 Example: Let X=$\{a,b,c,d\}$, with μ={X,∅, {a},{c},{a, c},{b, c, d},{a, c, d}}. Then {a, c} is -gpr^{μ}-closed set but not $rg^{**}b^{\mu}$ closed set.

3.49 Example: Let X=$\{a,b,c,d\}$,with μ={X,∅, {c},{d},{c, d},{a, d},{a, c},{a, c, d}}. Then {a,c} is -$rg^{**}b^{\mu}$-closed set but not gpr^{μ} closed set. From the



4. Some Characteristics of $rg^{**}b^{\mu}$-Closed Sets

4.1 Theorem: A set A is $rg^{**}b^{\mu}$-closed set then $rg^{*}bcl^{\mu}(A)\setminus A$ contains no non-empty supra closed set.

Proof: Let F be a supra closed set in X such that F$\subseteq rg^{*}bcl^{\mu}(A) - A$.Then A $\subseteq X\setminus F$.
Since A is $rg^{**}b^{\mu}$-closed set and $X\setminus F$ is supra open then $rg^{*}bcl^{\mu}(A) \subseteq X\setminus F$.
That is $F \subseteq X\setminus rg^{*}bcl^{\mu}(A)$.So $F \subseteq (X\setminus rg^{*}bcl^{\mu}(A))\cap(rg^{*}bcl^{\mu}(A)\setminus A)$.Therefore F=∅.

4.2 Remark: The intersection of any two $rg^{**}b^{\mu}$-closed sets in X need not be $rg^{**}b^{\mu}$-closed set in X.

4.3 Example: Let X=$\{a,b,c,d\}$,with μ={X,∅, {b},{d},{b,d},{a,b,c},{a,c,d}}. The sets {X,∅,{a},{b},{c},{d},{a,b},{a,c},{a,d},{b,c},{c,d},{a,b,c},{a,c,d},{a,b,d},{b,c,d}} are $rg^{**}b^{\mu}$-closed in X.But {a,b,d}∩{b,c,d}={b,d} which is not $rg^{**}b^{\mu}$-closed set in X.

4.4 Remark: The union of any two subsets of $rg^{**}b^{\mu}$-closed sets in X need not be $rg^{**}b^{\mu}$-closed set in X.

4.5 Example: Let X={a,b,c} with μ={X,∅,{b,c},{a,c}}. The sets {X,∅,{a},{b},{c},{a,b}} are $rg^{**}b^{\mu}$-closed set in X.But {a}∪{c}={a,c} which is not $rg^{**}b^{\mu}$-closed set in X.

4.6 Theorem: If A⊆ Y ⊆X and suppose that A is $rg^{**}b^{\mu}$-closed set in X, then A is $rg^{**}b^{\mu}$-closed set relative to Y.

Proof: Given that A⊆ Y ⊆X and A is $rg^{**}b^{\mu}$-closed set in X.To prove A is $rg^{**}b^{\mu}$-closed set relative to Y.Let us assume that A⊆ Y∩ U,where U is supra open in X. Since A is $rg^{**}b^{\mu}$-closed set,A⊆U implies $rg^{*}bcl^{\mu}(A)$ ⊆U. It follows that Y∩ $rg^{*}bcl^{\mu}(A) \subseteq Y$ ∩U, that is A is $rg^{**}b^{\mu}$-closed set relative to Y.

5. Supra Regular Generalized Star Star b-Open Sets

5.1 Definition: A subset A of a supra topological space(X,μ),is called regular generalized star star b-open set(briefly $rg^{**}b^{\mu}$-open set) if A^{c} is $rg^{**}b^{\mu}$-closed set in X.We denote the family of all $rg^{**}b^{\mu}$-open sets in X by $RG^{**}B^{\mu}$-O(X).

5.2 Remark: The union of two $rg^{**}b^{\mu}$-open sets in X is generally not an $rg^{**}b^{\mu}$-open set in X.
5.3 Example: X={a,b,c,d}, with μ={X,∅,{a,b,c},{b,c,d},{a},{d},{a,d}}. The sets{X,∅,{a},{b},{c},{d},{c,d},{b,d},{a,d},{a,c},{a,b},{a,b,c},{a,c,d},{b,c,d},{a,b,d}} are $rg^{**}b^{\mu}$-open in X.But {b}∪{c}={b,c} which is not $rg^{**}b^{\mu}$-open in X.

5.4 Remark: The intersection of two $rg^{**}b^{\mu}$-open sets in X is generally not an $rg^{**}b^{\mu}$-open set in X.
5.5 Example: Let X={a,b,c} with μ={X,∅, {a},{b},{a,b},{a,c},{b,c}}.The sets {X,∅,{a},{b},{a,b},{a,c},{b,c}} are $rg^{**}b^{\mu}$-open in X.But {a,c}∩{b,c}={c} is not an $rg^{**}b^{\mu}$-open set in X.

6. Supra Regular Generalized Star Star b-Neighbour hood S

6.1 Definition: Let x be a point in a supra topological space X.A subset N of X is said to be $rg^{**}b^{\mu}$- neighbourhood of x iff there exists $rg^{**}b^{\mu}$-open set G such that x∈G⊂N.

6.2 Definition: A subset N of a space X is called $rg^{**}b^{\mu}$-neighbourhood of A⊂X iff there exists an $rg^{**}b^{\mu}$-open set G such that A⊂G⊂N.

6.3 Theorem: Every supra neighbourhood N of x ∈X is $rg^{**}b^{\mu}$-neighbourhood of x.

Proof: Let N be a supra neighbourhood of a point x ∈X.To prove that N is an $rg^{**}b^{\mu}$-neighbourhood of x. By the definition of supra neighbourhood,there exists an supra open set G such that x ∈G⊂N.But every supra open set is $rg^{**}b^{\mu}$-open set,G is $rg^{**}b^{\mu}$-open set such that x∈G⊂N.Hence N is an $rg^{**}b^{\mu}$-neighbourhood of x.

6.4 Remark: In general, an $rg^{**}b^{\mu}$-neighbourhood of x∈X need not be a supra neighbourhood of x in X ass seen from the example below.

6.5 Example: Let X={a,b,c} with μ={X,∅, {c},{a,b},{a,c}}.The sets {X,∅,{a},{b},{c}, {a,b},{a,c},{b,c}}.The set {b,c} is $rg^{**}b^{\mu}$-neighbourhood of the point {b},there exists an $rg^{**}b^{\mu}$-open set {b,c} such that b∈{b,c}⊆{b,c}.But {b,c} is not an supra neighbourhood of the point {b},since no supra open set exists such that b∈G⊆{b,c}.

6.6 Remark: The $rg^{**}b^{\mu}$-neighbourhood N of x∈X need not be $rg^{**}b^{\mu}$-open in X.

6.7 Example: X={a,b,c,d} with μ={X,∅,{a},{b},{a,b},{a,b,c},{a,c,d}}. The sets {X,∅,{a},{b},{c},{a,b},{a,c},{a,d},{b,c},{a,b,c},{a,b,d},{a,c,d}} are $rg^{**}b^{\mu}$-open in X.The set {b,d} is $rg^{**}b^{\mu}$-neighbourhood of {b}.since b∈{b}⊆{b,d}.But {b,d} is not $rg^{**}b^{\mu}$-open in X.

6.8 Theorem: If a subset N of a space X is $rg^{**}b^{\mu}$-open,then N is $rg^{**}b^{\mu}$-neighbourhood of each of its points.

Proof: Suppose N is $rg^{**}b^{\mu}$-open.Let x∈N.We claim that N is $rg^{**}b^{\mu}$-neighbourhood of X.For,N is $rg^{**}b^{\mu}$-open set such that x∈N⊂N.Then N is $rg^{**}b^{\mu}$-neighbourhood of x.Since x is an arbitrary point of N,it follows that N is an $rg^{**}b^{\mu}$-neighbourhood of each of its points.

6.9 Theorem: Let X be a supra topological space. If F is $rg^{**}b^{\mu}$-closed subset of X and x∈ F^c.Then there exists an $rg^{**}b^{\mu}$-neighbourhood N of x such that N∩F=∅.

Proof: Let F be $rg^{**}b^{\mu}$-closed subset of X and x∈ F^c.Then F^c is $of\ rg^{**}b^{\mu}$-open set of X.So by theorem 6.8, F^c contains an $rg^{**}b^{\mu}$-neighbourhood N of each of its points.Hence there exists an $rg^{**}b^{\mu}$-neighbourhood N of x such that N⊂ F^c,(i.e.) N∩F=∅.

6.10 Definiton: Let x be a point in supra topological space.The set of all $rg^{**}b^{\mu}$-neighbourhood of x is called the $rg^{**}b^{\mu}$-neighbourhood system at x and is denoted by $rg^{**}b^{\mu}$-N(x).

6.11 Theorem: Let N be $rg^{**}b^{\mu}$-neighbourhood of x∈X and X be a supra topological space.Let $rg^{**}b^{\mu}$-N(X,μ) be the collection of all $rg^{**}b^{\mu}$-neighbourhood of x.Then we have the following reults.

(i) For all x ∈X, $rg^{**}b^{\mu}$-N(x)≠ ∅.
(ii) (ii)N ∈ $rg^{**}b^{\mu}$-N(x)⟹ x ∈ N.
(iii) N ∈ $rg^{**}b^{\mu}$-N(x),M⊃ N ⟹M∈ $rg^{**}b^{\mu}$-N(x).
(iv) N ∈ $rg^{**}b^{\mu}$-N(x) ⟹there exists M∈ $rg^{**}b^{\mu}$-N(x) such that M ⊂N then M∈ $rg^{**}b^{\mu}$-N(y) for every y ∈ M.

Proof

(i) Obvious.
(ii) If N ∈ $rg^{**}b^{\mu}$-N(x),then N is $rg^{**}b^{\mu}$ −neighbourhood of x. Therefore x ∈N.
(iii) Let N∈ $rg^{**}b^{\mu}$-N(x),and M⊃ N.Then there is an $rg^{**}b^{\mu}$-open set G such that x∈G⊂N.Since N⊂M, x∈G⊂N and so M is $rg^{**}b^{\mu}$ −neighbourhood of x. Hence M∈ $rg^{**}b^{\mu}$-N(x).
(iv) Let N ∈ $rg^{**}b^{\mu}$-N(x),then there is an $rg^{**}b^{\mu}$-open set M such that x∈M⊆N. Since M is $rg^{**}b^{\mu}$-neighbourhood of each of its points. Therefore M∈ N ∈ $rg^{**}b^{\mu}$-N(y) for every y∈M.

7. References

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