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On Soft $\pi g*b*$ - closed sets in soft topological spaces

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Abstract
The aim of this paper is to introduce a new class of sets called soft π generalized*b*-closed set (briefly soft πg*b*-closed) in soft topological space which is defined over the universe of the given set with a fixed set of parameters. Further, we investigate its properties and its relationship with other soft closed.

Keywords: soft sets, soft topological space, soft πg*b*-closed sets, soft πg*b*-continuous function, soft πg*b*-$T_{1/2}$-space

1. Introduction

Molodtsov [1] initiated the concept of soft set theory as a new mathematical tool and presented the fundamental results of the soft sets. soft systems provide a general framework with the involvement of parameters. soft set theory has a wider application and its progress is very rapid in different fields. Levine [2] introduced g-closed sets in general topology. Kannan [3] introduced soft g-closed sets in soft topological spaces. Muhammad Shabir and Munazza Naz [4] introduced soft topological spaces and the notions of soft open sets, soft closed sets, soft closure, soft interior points. The idea of soft πgb-closed sets were introduced by D. Sreeja and C. Janaki [5].

The concept of πg^b*-closed sets sets in topological spaces was introduced by Vaiyomathi. K [6]. In this paper, we introduce and study soft πg*b*-closed sets sets in soft topological spaces and obtain its relationship with other soft closed sets. Further, we obtain the basic results and properties.

2. Preliminaries

Let U be an initial universe set and E be a collection of all possible parameters with respect to U, where parameters are the characteristics or properties of objects in U. Let P(U) denote the power set of U, and let A ⊆ E.

Definition 2.1. [7]: Let X, be an initial universal set and E be the set of parameters.

Let P(X) denote the power set of X, and $A \tilde{\subseteq} E$. The pair (F, A) is called a soft set over X, where F is a mapping given by F : A→ P(X).

Definition 2.2. [3]: A soft set (F,E) over is said to be
i) A null soft set, denoted by ϕ, if ∀ e∈ E, F(e) =ϕ.
ii) An absolute soft set, denoted by X, if e∈ E, F(e) = X.

Definition 2.3. [3]: Let τ be the collection of soft sets over X,then τ is said to be a soft Topology on X if
i) Φ, X are belongs to τ.
ii) The union of any number of soft sets in τ belongs to τ.
iii) The intersection of any two soft sets in τ belongs to τ.

The triplet (X, τ, E) is called a soft topological space over X and any member of τ is known as soft open set in X. The complement of a soft open set is called soft closed set over X.

Definition 2.4. [3]**:** Let (X, τ, E) be a soft topological space over X and (F, E) be a soft set over X Then

i) soft interior of a soft set (F, E) is defined as the union of all soft open sets contained in (F,E). Thus int(F,E) is the largest soft open set contained in (F,E).
ii) soft closure of a soft set (F, E) is the intersection of all soft closed super sets (F,E). Thus cl(F,E) is the smallest soft closed set over X, which contains (F,E).

Definition 2.5 [7]**:** A pair (F,A) is called a soft set over U, where F is a mapping given by F : A → P(U). In other words, a soft set over U is a parameterized family of subsets of the universe U. For a particular e ∈ A. F(e) may be considered the set of e-approximate elements of the soft set (F,A).

Definition2.6
A soft subset (A,E) of X is called

i) a soft pre-open[9] set if (A,E) $\tilde{\subseteq}$ Int (Cl(A,E)).
ii) a soft α-open[9] if (A,E) $\tilde{\subseteq}$ Int(Cl(Int(A,E)))
iii) a soft b-open[9] if (A,E) $\tilde{\subseteq}$ Cl(Int(A,E)) Int(Cl(A,E))
iv) a soft regular open[9] if (A,E)= Int(Cl(A,E)).

The complement of the soft pre-open, soft α-open, soft b-open, soft regular open sets are their respective soft pre -closed,soft α-closed, soft b-closed and soft regular closed sets.

Definition 2.7 [11]**:** Let A subset (A,E) of a soft topological space (X, τ, E) is called a soft g - closed set if cl(A,E)) $\tilde{\subseteq}$ (U,E) whenever (A,E) $\tilde{\subseteq}$ (U,E)and (U,E) is soft open in (X, τ, E).

Definition 2.8 [12]**:** Let A subset (A,E) of a soft topological space (X, τ, E) is called a soft πg - closed set if cl(A,E)) $\tilde{\subseteq}$ (U,E) whenever (A,E) $\tilde{\subseteq}$ (U,E) and (U,E) is soft π-open in (X, τ, E).

Definition 2.9 [10]**:** Let A subset (A,E) of a soft topological space (X, τ, E) is called a soft πgb - closed set if (bcl(A,E)) $\tilde{\subseteq}$ (U,E) whenever (A,E) $\tilde{\subseteq}$ (U,E) and (U,E) is soft π-open in (X, τ, E)

Definition 2.10 [9]**:** Let A subset (A,E) of a soft topological space (X, τ, E) is called a soft πgr - closed set if rcl(A,E)) $\tilde{\subseteq}$ (U,E) whenever (A,E) $\tilde{\subseteq}$ (U,E) and (U,E) is soft π-open in (X, τ, E)

Definition 2.11 [8]**:** Let A subset (A,E) of a soft topological space (X, τ, E) is called a soft πgp - closed set if pcl(A,E)) $\tilde{\subseteq}$ (U,E) whenever (A,E) $\tilde{\subseteq}$ (U,E) and (U,E) is soft π-open in (X, τ, E)

3. Soft πg*b*-closed sets and Soft πg*b*-open sets

Definition 3.1: Let A subset (A,E) of a soft topological space (X, τ, E) is called a soft πg*b*- closed set if int(bcl(A,E)) $\tilde{\subseteq}$ (U,E) whenever (A,E) $\tilde{\subseteq}$ (U,E) and (U,E) is soft πg-open in (X, τ, E)

Definition 3.2: Let A subset (A,E) of a soft topological space (X, τ, E) is called a soft π^g- closed set if gcl(A,E) $\tilde{\subseteq}$ (U,E) whenever (A,E) $\tilde{\subseteq}$ (U,E) and (U,E) is soft π-open in (X, τ, E).

Definition 3.3: Let A subset (A,E) of a soft topological space (X, τ, E) is called a soft π*g-closed set if cl(int(A,E)) $\tilde{\subseteq}$ (U,E) whenever (A,E) $\tilde{\subseteq}$ (U,E) and (U,E) is soft π-open in (X, τ, E)

Definition 3.4: Let A subset (A,E) of a soft topological space (X, τ, E) is called a soft πgb*- closed set if int(bcl(A,E)) $\tilde{\subseteq}$ (U,E) whenever (A,E) $\tilde{\subseteq}$ (U,E) and (U,E) is soft π-open in (X, τ, E)

Theorem 3.5: Every soft closed set in a soft topological space is soft πg*b*-closed set.

Proof: Let(A,E)be soft closed set of (X, τ, E), such that (A,E) $\tilde{\subseteq}$ (U,E)and (U,E)is soft πg-open in (X, τ, E). since bcl(A,E) $\tilde{\subseteq}$ cl(A,E) = (A,E). Since every soft πgr- closed setis soft πgb- closed. We have, int(bcl(A,E) $\tilde{\subseteq}$ int(A,E) $\tilde{\subseteq}$ int(U,E) =(U,E). Hence (A,E) is soft πg*b*- closed set.

Theorem 3.6: Every soft α- closed set in a soft topological space is soft πg*b*- closed set.

Proof: Let(A,E)be soft α-closed set of (X, τ, E), such that (A,E) $\tilde{\subseteq}$ (U,E) and (U,E)is soft πg-open in(X, τ, E). since bcl(A,E) $\tilde{\subseteq}$ αcl(A,E) = (A,E). Since every soft α- closed set is soft b-closed. We have, int(bcl(A,E) $\tilde{\subseteq}$ int(A,E) $\tilde{\subseteq}$ int(U,E) =(U,E). Hence (A,E)issoft πg*b*- closed set.

Theorem 3.7: Every soft g - closed set in a soft topological space is soft πg*b*- closed set.

Proof: Let(A,E)be soft g - closed set of (X, τ, E), such that (A,E) $\tilde{\subseteq}$ (U,E)and(U,E)is soft πg-open in (X, τ, E).Also cl(A,E) $\tilde{\subseteq}$ (U,E). since bcl(A,E) $\tilde{\subseteq}$ cl(A,E) $\tilde{\subseteq}$ (U,E). Every soft πg- open set is open. We have, int(bcl(A,E) $\tilde{\subseteq}$ int(A,E) $\tilde{\subseteq}$ int(U,E) =(U,E). Hence (A,E) is soft πg*b*- closed set.

Theorem 3.8: Every soft πg- closed set in a soft topological space is soft πg*b*- closed set.

Proof: Let(A,E)be soft πg- closed set of (X, τ, E), such that (A,E) $\tilde{\subseteq}$ (U,E)and(U,E)is soft πg-open in(X, τ, E). Also cl(A,E) $\tilde{\subseteq}$ (U,E). sincebcl(A,E) $\tilde{\subseteq}$ rcl(A,E) = (A,E).Every soft πg- closed set is soft πgb- closed. We have, int(bcl(A,E) $\tilde{\subseteq}$ int(A,E) $\tilde{\subseteq}$ int(U,E) =(U,E). Hence(A,E)issoft πg*b*- closed set.

Theorem 3.9: Every soft π^g-closed set in a soft topological space is soft πg*b*-closed set.

Proof: Let(A,E)be soft π^g- closed set of (X, τ, E), such that (A,E) $\tilde{\subseteq}$ (U,E)and(U,E) is soft πg-open in (X, τ, E). Also gcl(A,E) $\tilde{\subseteq}$ (U,E). sincebcl(A,E) $\tilde{\subseteq}$ gcl(A,E) = (A,E). Every soft πg- closed set is soft πgb-closed. We have, int(bcl(A,E) $\tilde{\subseteq}$ int(A,E) $\tilde{\subseteq}$ int(U,E) =(U,E). Hence(A,E)issoft πg*b*- closed set.

Theorem 3.10: Every soft π*g-closed set in a soft topological space is soft πg*b*-closed set.

Proof: Let(A,E)be soft π*g- closed set of (X, τ, E), such that (A,E) $\tilde{\subseteq}$ (U,E)and(U,E)is soft πg-open in (X, τ, E). Also cl(int(A,E)) $\tilde{\subseteq}$ (U,E). since bcl(A,E) $\tilde{\subseteq}$ cl(int(A,E)) = (A,E).Wehave, int(bcl(A,E) $\tilde{\subseteq}$ int(U,E) =(U,E). Hence(A,E)issoft πg*b*- closed set.

Theorem 3.11: Every soft πgb -closed set in a soft topological space is soft πg*b*- closed set.

Proof: Let(A,E)be soft πgb - closed set of (X, τ, E), such that (A,E) $\tilde{\subseteq}$ (U,E)and(U,E)issoft πg -openin (X, τ, E) .Also bcl(A,E) $\tilde{\subseteq}$ (U,E). since bcl(A,E) = (A,E). since every soft π - closed setis soft πg - closed. We have,int(bcl(A,E) $\tilde{\subseteq}$ int(A,E) $\tilde{\subseteq}$ int(U,E) =(U,E). Hence(A,E)issoft πg*b*- closed set.

Theorem 3.12: Every soft πgb*-closed set in a soft topological space is soft πg*b*- closed set.

Proof: Let(A,E)be soft πgb*- closed set of (X, τ, E), such that (A,E) $\tilde{\subseteq}$ (U,E)and(U,E)is soft πg-open in (X, τ, E).Also int(bcl(A,E) $\tilde{\subseteq}$ (U,E). since every soft π-closed setis soft πg- closed. Hence(A,E)issoft πg*b*- closed set.

Theorem 3.13: Every soft πgp-closed set in a soft topological space is soft πg*b*- closed set.

Proof: Let(A,E)be soft πgp- closed set of (X, τ, E), such that (A,E) $\tilde{\subseteq}$ (U,E)and(U,E)is soft πg-open in (X, τ, E). Also, pcl(A,E) $\tilde{\subseteq}$ (U,E). sincebcl(A,E) $\tilde{\subseteq}$ pcl(A,E) = (A,E).since every soft πgp- closed set is πgb- closed. We have, int(bcl(A,E) $\tilde{\subseteq}$ int(A,E) $\tilde{\subseteq}$ int(U,E) =(U,E). Hence(A,E)is soft πg*b*- closed set.

Theorem 3.14: Every soft πgr-closed set in a soft topological space is soft πg*b*- closed set.

Proof: Let(A,E) be soft πgr- closed set of (X, τ, E), such that (A,E) $\tilde{\subseteq}$ (U,E) and (U,E)is soft πg-open in (X, τ, E).Also rcl(A,E) $\tilde{\subseteq}$ (U,E). sincebcl(A,E) $\tilde{\subseteq}$ rcl(A,E) = (A,E). since every soft πgr- closed setis soft πgb- closed. We have, int(bcl(A,E) $\tilde{\subseteq}$ int(A,E) $\tilde{\subseteq}$ int(U,E) =(U,E). Hence(A,E)is soft πg*b*- closed set.

Remark 3.15
Converse oftheabove theorems need not be true as seen in the following example.

Example 3.16
Let X ={a,b,c}, E = {e_1,e_2}. Let F_1, F_2,…, F_7 are functions fromE to P(X) and aredefined as follows :
$F_1(e_1)$ = {a}, $F_1(e_2)$ = {ϕ},$F_2(e_1)$ = {b}, $F_2(e_2)$ = {c}, $F_3(e_1)$ = {c}, $F_3(e_2)$ = {a},
$F_4(e_1)$ = {a,b}, $F_4(e_2)$ = {c}, $F_5(e_1)$ = {a,c}, $F_5(e_2)$ = {a}, $F_6(e_1)$ = {b,c}, $F_6(e_2)$ = {a,c},
$F_7(e_1)$ = {X}, $F_7(e_2)$ ={a,c}.
Then τ = {ϕ, X , (F_1,E),(F_2,E),…,(F_7,E)is a soft topology and elements in τ are soft open sets

1. The soft set (A,E) = {{a},{b,c}},{{b,c},{b}} are soft πg*b*- closed set but not soft closed.
2. (ii)The soft set (B,E)={{a,b},{a,b}},{{b,c},{b,c}}are soft πg*b*- closed set but not soft α - closed.
3. The soft set (C,E) = {{b},{a,c}},{{a,b},{a}} are soft πg*b*- closed set but not soft g – closed.
4. The soft set (D,E) ={{a},{a}},{{b},{c}} are soft πg*b*- closed set but not soft πg - closed.
5. The soft set (E,E) ={{a,c},{a,c}},{{c},{a}}are soft πg*b*-closed set but not soft π^g- closed.
6. The soft set (F,E) = {{a},{c}},{{c},{a,c}}are soft πg*b*- closed set but not soft π*g- closed.
7. The soft set (G,E) = {{a,b},{a,c}},{{a,c},{c}} are soft πg*b*- closed set but not soft πgb - closed.
8. The soft set (H,E) = {{X},{a,c}}are soft πg*b*- closed set but not soft $\pi gb *$ - closed.
9. The soft set(I,E) = {{a},{a,c}}},{{b,c},{a,c}} are soft πg*b*-closed set but not soft πgp - closed.
10. The soft set (J,E)={{b,c},{c}},{{c},{c}} are soft πg*b* - closed set but not soft πgr - closed.

Remark 3.17
By the above results we have the following diagram

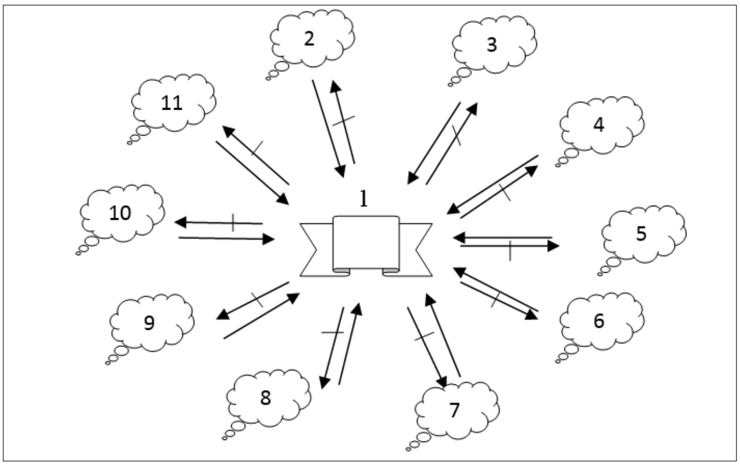

Fig 1

1. soft πg*b*-closed set
2. softclosed set
3. soft- closed set
4. soft g- closed set
5. soft- closed set
6. soft π^g- closed set
7. soft-closed set
8. soft-closed set
9. softπgb*- closed set
10. soft-closed set
11. soft- closed set

4. Soft πg*b* - continuous functions
Definition 4.1
Let (X,τ , A) and (Y,σ ,B) between two soft topological spaces and f : (X,τ , A) $\rightarrow$ (Y,σ ,B) be a function.Then the functionfis
(i) soft πg*b*- continuousiff $^{-1}$(G,B)is soft πg*b*- closed in (X,τ ,A)for every soft closed set (G,B)of(Y,σ ,B)

Definition 4.2
Let (X,τ , A) and (Y,σ ,B)between two soft topological spaces and f : (X,τ , A) $\rightarrow$ (Y,σ ,B)

be a function.Then the functionfis
(i) soft πg*b*- continuousiff (G,A)is soft πg*b*- continuous in (Y, σ ,B) for every soft continuous set (G,A)of(X, τ ,A)
(ii) soft πg*b*- closediff (G,A)is soft πg*b*- closed in (Y, σ ,B) for every soft closed set (G,A)of(X, τ ,A)

Theorem 4.3
i) Every soft continuous is soft πg*b*-continuous.
ii) Every soft α - continuous is soft πg*b*- continuous.
iii) Every soft g- continuous is soft πg*b*-continuous.
iv) Every soft πg - continuous is soft πg*b*-continuous.
v) Every soft π^g- continuous set is soft πg*b*-continuous.
vi) Every soft π*g-continuous is soft πg*b*-continuous.
vii) Every soft πgb -continuous is soft πg*b*-continuous.
viii) Every soft $\pi gb*$ -continuous is soft πg*b*-continuous.
ix) Every soft πgp -continuous is soft πg*b*-continuous.
x) Every soft πgr -continuous is soft πg*b*-continuous

Proof
Let(G,B)beasoft closedin Y.
sincefissoftcontinuous.f^{-1}(G,B)is softclosedinX.
sinceeveryclosedset issoftπg*b*- closed.f^{-1}(G,B)issoftπg*b*- closed.
Hencefissoftπg*b*- continuous. Theproofisobvious.

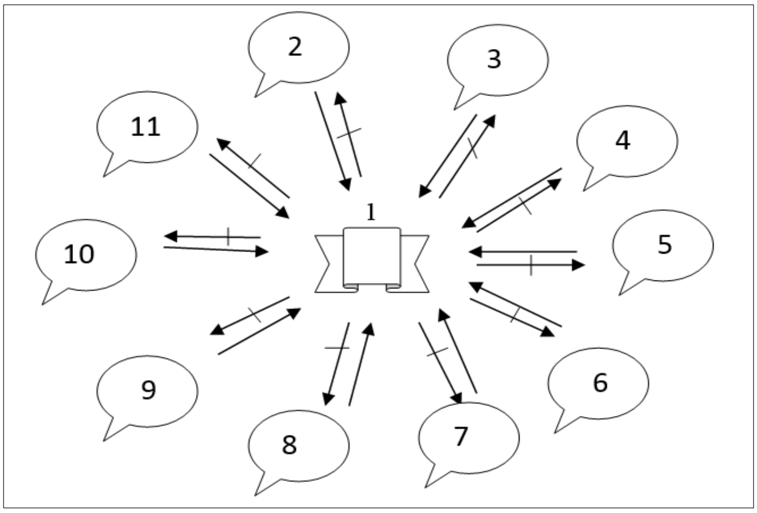

Fig 2

1. soft πg*b*- continuous
2. soft continuous
3. soft- continuous
4. soft g- continuous
5. soft- continuous
6. soft π^g – continuous
7. soft π*g-continuous
8. soft-continuous
9. soft πgb*- continuous
10. soft-continuous
11. soft- continuous

Example 4.4
Let X ={a,b,c}=Y, E = {e_1,e_2}. Let F_1, F_2,…, F_7 are functions fromE to P(X) and
aredefined as follows :
$F_1(e_1)$ = {b,c}, $F_1(e_2)$ = {X},$F_2(e_1)$ = {a,c}, $F_2(e_2)$ = {a,b}, $F_3(e_1)$ = {a,b}, $F_3(e_2)$ = {b,c},
$F_4(e_1)$ = {c}, $F_4(e_2)$ = {a,b}, $F_5(e_1)$ = {b}, $F_5(e_2)$ = {b,c}, $F_6(e_1)$ = {a}, $F_6(e_2)$ = {b},
$F_7(e_1)$ = { ϕ }, $F_7(e_2)$ ={b}.

Then τ_1 = { ϕ , X, (F_1,E),(F_2,E),…,(F_7,E)is a soft topology and elements in τ are soft open sets. Let G_1,G_2,…,G_7 arefunctionsfrom Eto P(Y)andaredefinedas follows :
$G_1(e_1)$ = {X}, $G_1(e_2)$ = {b}, $G_2(e_1)$ = {X}, $G_2(e_2)$ = {b,c}, $G_3(e_1)$ = {a}, $G_3(e_2)$ = {a,c},
$G_4(e_1)$ = {a,b}, $G_4(e_2)$ = {a}, $G_5(e_1)$ = {a,b}, $G_5(e_2)$ = {a,c}, $G_6(e_1)$ = {a,c}, $G_6(e_2)$ = {c},
$G_7(e_1)$ = {a,c}, $G_7(e_2)$ = {a,c}

Then τ_2 = { ϕ , $\tilde{X}$, (G_1,E),(G_2,E),…,(G_7,E)is a soft topologyon Y.
Letf :X $\rightarrow$ Y be an identitymap.
Heretheinverseimageof the soft closed set (A,E)={{a},{a,c}},{{a,b},{a}},{{a,b},{a,c}},

{{a,c},{c}},{{a,c},{a,c}}in Y is not soft closed, soft α -closed, soft g –closed, soft π g- closed, soft π^ g-closed, soft $\pi * g$ -closed, soft πgb -closed, soft πgr -closed, soft πgp -closed
in X. Hence f is πg*b*-continuous but not soft continuous, soft α - continuous, soft g – continuous, soft π g- continuous, soft π^g- continuous, soft $\pi * g$ - continuous, soft πgb - continuous, soft πgp - continuous, soft πgr - continuous.

Theorem 4.5

(a) Let f :(X, τ ,A) $\rightarrow$ (Y, σ ,B)be a soft function, then the following statements are equivalent.
(i)f is soft πg*b*-continuous
(ii)The inverse image of every soft open set in Y is also soft πg*b*-open in X.
(b) Iff :(X, τ ,A) $\rightarrow$ (Y, σ ,B)is soft $\pi g * b *$ - continuous,
thenf(s $\pi g * b *$ -cl(A,E)) $\tilde{\subseteq}$ s-cl(f(A,E)for every subset(A,E)of X.

Proof

a. (i) $\Rightarrow$ (ii) Let (G,B) $\in$ SO(Y), then (Y-(G,B)) $\in$ SC(Y).
Since f is soft πg*b*- continuous, f^{-1}(Y-(G,B)) $\in$ S π G*B*C(X).
HenceX- (f^{-1}(G,B)) $\in$ S π G*B*C(X).
Then f^{-1}(G,E) $\in$ S π G*B*O(X).
b. (ii) $\Rightarrow$ (i) Follows from definition.
Let (A,E) $\tilde{\subseteq}$ X.
Since f is soft πg*b*- continuous and(A,E) $\tilde{\subseteq}$ f^{-1}(s-cl(f(A,E))),
We obtain s πg*b*- cl((A,E)) $\tilde{\subseteq}$ f^{-1}(scl(f(A,E)))and
then f(s πg*b*-cl((A,E)) $\tilde{\subseteq}$ s-cl(f(A,E))).

Theorem 4.6

If a soft function f : (X, τ ,A) $\rightarrow$ (Y, σ ,B)is soft $\pi g * b *$ - closed,
then $s \pi g * b *$ - cl(f(A,E)) $\tilde{\subseteq}$ f(s-cl(f(A,E))for every subset (A,E) of (X, τ ,E)

Proof

Let(G,A) $\tilde{\subseteq}$ X.
Since f is soft $\pi g * b *$ - closed and f((G,A) $\tilde{\subseteq}$ f(s-cl(G,A)),
We obtain $s \pi g * b *$ - cl(f(G,A)) $\tilde{\subseteq}$ $s \pi g * b *$ - cl(f(s-cl(G,A)))
Since f(s-cl(G,A)) is soft $\pi g * b *$ -closed in (Y, σ ,B),
$s \pi g * b *$ - cl(f(s-cl(G,A))) = (f(s-cl(G,A)) for every soft set (A,E) of (X, τ ,E).
Hence $s \pi g * b *$ - cl(f(G,A)) $\tilde{\subseteq}$ f(s-cl(G,A))for every soft set (G,A) of a soft topological space (X, τ ,E).

5. Soft πg*b*- $T_{1/2}$ Spaces

Definition 5.1

A soft topological space X is called
1. Soft πg*b*-$T_{1/2}$ space if every soft πg*b*-closed set is soft b – closed.
2. soft $\pi g * b *$ -space if every soft πg*b*-closed set is soft closed.
3. soft $T_{\pi g*b*}$-space if every soft πg*b*-closed set is soft πg – closed.

Theorem 5.2

Fora soft topological space (X, τ ,E)the following are equivalent
(i) X is soft $\pi g * b *$ -$T_{1/2}$ space.
(ii) Every singleton set is either soft π -closed or soft b-open.

Proof

To prove(i) $\Rightarrow$ (ii) : Let X is soft $\pi g * b *$ -$T_{1/2}$ space.
Let(A,E) be a soft singleton set in X and assume that(A,E) is not soft π -closed.
Thenclearly X - (A,E)is not soft π -open.
Hence X - (A,E)is trivially a soft $\pi g * b *$ -closed.
since X is soft $\pi g * b *$ -$T_{1/2}$ space, X - (A,E)issoft b-closed.

Therefore(A,E)is soft b – open.

To prove(ii) $\Rightarrow$ (i): Assume that every singleton of X is either soft πg -closed or soft b-open.

Let (A,E)bea $\pi g * b *$ -closed set. Let (A,E) $\in$ bcl(A,E).

Case (i)

Letthe singleton set (F,E)be soft π -closed.
Suppose(F,E) does not belong to (A,E).
Then (F,E) $\in$ bcl(A,E) – (A,E), (F,E) $\in$ (A,E).
Hence bcl(A,E) $\tilde{\subset}$ (A,E).

Case (ii)

Let the singleton set (F,E)be soft b-open.
since (F,E) $\in$ bcl (A,E).
We have(F,E) $\cap$ (A,E) $\neq \phi$ implies that (F,E) $\in$ (A,E).

In both the cases bcl(A,E) $\tilde{\subset}$ (A,E) or equivalently (A,E)is soft b-closed.

Theorem 5.3

For a soft topological space (X, τ ,E) the following are equivalent

(i) X is soft $\pi g * b *$ -$T_{1/2}$ space.

(ii) For every soft subset (A,E) of X, (A,E) is $\pi g * b *$ -open iff (A,E) is soft b-open.

Proof

To prove(i) $\Rightarrow$ (ii) : Let the soft topological space X be soft $\pi g * b *$ -$T_{1/2}$ and

Let(A,E) be a soft $\pi g * b *$ - open soft subset of X.

ThenX – (A,E)is soft $\pi g * b *$ - closed and so X - (A,E) is soft b-closed.

Hence(A,E)is soft b-open.
Conversely, let(A,E)be asoft b-open subsetof X.
ThusX – (A,E)soft b- closed.
Since every soft b-closed set is soft $\pi g * b *$ - closed

ThenX – (A,E)is soft $\pi g * b *$ - closed.

Hence(A,E)is soft $\pi g * b *$ - open.

To prove(ii) $\Rightarrow$ (i) : Let(A,E) be a soft $\pi g * b *$ - closed subset of X.

ThenX – (A,E)is soft $\pi g * b *$ - open.

BythehypothesisX - (A,E) is softb-open.
Thus(A,E)issoftb-closed. Since every soft $\pi g * b *$ - closed is soft b-closed,

X is soft $\pi g * b *$ -$T_{1/2}$ space.

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