IJASRM
International Journal of Advanced Scientific Research and Management, Volume 4 Issue 4, April 2019
www.ijasrm.com
ISSN 2455-6378

Extremally Disconnected Space in Soft Bitopological Spaces

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Abstract

The present paper, We give characterizations of extremally disconnected spaces in soft bitopological spaces by utilizing (1,2)*- soft b- open set. Also we discussed the properties of (1,2)*- soft b- submaximal spaces.

Keywords: (1,2)*- soft b- dense, (1,2)*- soft b- submaximal, (1,2)*-soft b- extremally disconnected.

1. Introduction

Soft set theory was first introduced by Molodtsov [7] in 1999 as a general mathematical tool for dealing uncertain fuzzy,not clearly defined objects. Shabir and Naz [8] initiated the study of the soft topological spaces.In 1963, J.C. Kelly [5], first initiated the conceptof bitopological spaces. After then many authors studied some of basic concepts and properties of bitopological space. In 1996, Andrijevic [1] introduced a new class of open sets in a topological space called b- open sets.

Recently, in 2011, Shabir and Naz [8]initiated the study of the soft topological spaces. They defined soft topology as acollection of soft sets over X. Metin Akdag and Alkan Ozkan [6] are defined soft b- open sets and soft b- continuous map studied their properties. In the year 2014, Basavaraj M.Ittanagi [2] initiated the concept of soft bitopological spaces which are defined over an initial universe with a fixed set of parameters.

In the present paper, we introduce the extremally disconnected spaces and submaximal spaces in soft bitopological spaces by utilizing (1,2)*- soft b-open set. we give the characterizations of these spaces.

2. Preliminaries

Throughout this paper, X is an initial universe, E is the set of parameters, P(X) is the power set of X and A is a nonempty subset of E.

Definition 2.1 :[8] A soft set F_A on the universe X is defined by the set of ordered pairs $F_A = \{ (x, f_A(x)) : x \in E\}$, where $f_A : E \to P(X)$ such that $f_A(x) = \phi$ if $x \notin A$. Here f_A is called approximate function of the soft set F_A . The set of all soft sets over X will be denoted by $SS_E(X)$.

Definition 2.2:[8] For two soft sets F_A, F_B over a common universe X,we say that F_A is a soft subset of F_B if
1.A ⊆ B and
2.For all e ∈ A, F (e) and F(e) are identical approximations. We write $F_A \tilde{\subseteq} F_B$. F_A is said to be a soft super set of F_B if F_B is a soft subset of F_A. We denoted it by $F_A \tilde{\supseteq} F_B$.

Definition 2.4:[8] Two soft sets F_A and G_B over the common universe X are said to be soft equal if F_A is a soft subset of G_B and G_B is a soft subset of F_A.

Definition 2.4:[7] Let $F_A, F_B \tilde{\in} SS_E(X)$. Then soft union of F_A and G_B, denoted by $F_A \tilde{\cup} G_B$, defined by $F_{A \tilde{\cup} B} =, F_C$ where C = A∪B, and for all $e \in C$.

$$H(e)=\begin{cases}F(e) & \text{if } e\in A\setminus B\\ G(e) & \text{if } e\in B\setminus A\\ F(e)\cup G(e) & \text{if } e\in A\cap B\end{cases}$$

Definition 2.5:[8] The soft intersection H_C of two soft sets F_A and G_B over a common universe X, denoted by $F_A \tilde{\cap} G_B$, is defined as $C = A \cap B$ and $H(e) = F(e) \cap G(e)$, for all $e \in C$.

Definition 2.6:[8] A soft set F_E over X is said to be a null soft set or empty soft set denoted by φ if for all $e \in E$, $F(e) = \varphi$. It means that there is no element in X related to the parameter $e \in E$.

Definition 2.7:[8] The difference H_E of two soft set F_E and G_E over X, denoted by $F_E \tilde{\setminus} G_E$, is defined as

$H_E = \{H(e)=F(e)\setminus G(e) \text{ for all } e\in E\}$

Definition 2.8:[8] The complement of a soft set F_E, denoted by F_E^C ; $F^C : E \to P(X)$ is mapping given by $F^C(e) = X - F(e)$, $\forall e \in E$ and F^C is called the soft complement function of F .

Definition 2.9:[8] A soft set F_E over X is said to be an absolute soft set denoted by $\tilde{X}$ or $F_{\tilde{E}}$ if for all $e \in E$, $F(e) = X$. Clearly $\tilde{X}^{\tilde{C}} = \varphi$ and $\varphi^C = \tilde{X}$.

Definition2.10:[4] Let $F_E \in SS_E(x)$. We say that $x_e = (e,\{x\})$ is a soft point of F_E if $e \in E$ and $x \in F(e)$.

Definition 2.11:[4] The soft point x_e said to be belonging to the soft set F_E, denoted by $x_e \in F_E$.

Definition 2.12:[3] Let $F_A \tilde{\in} S(X)$. The soft power set of F_A is defined by $\tilde{P}(F_A)$ is defined by $\tilde{P}(F_A) = \{F_{A_i} : F_{A_i} \tilde{\subseteq} F_A \;\; i \in I \subseteq N\}$ and its cardinality is defined by $|\tilde{P}(F_A)| = 2^{\sum_{x\in E}|f_A(x)|}$ where $|f_A(x)|$ is cardinality of $f_A(x)$.

Example 2.13: [3] Let $X= \{x_1, x_2\}$, $E = \{e_1, e_2\}$ and $\tilde{X} = \{(e_1, \{x_1, x_2\}), (e_2, \{x_1, x_2\})\}$. Then the soft subsets over $\tilde{X}$ are $F_{E_1} = \{(e_1, \{x_1\})\}$,

$F_{E_2} = \{(e_1, \{x_2\})\}$, $F_{E_3} = \{(e_1, \{x_1, x_2\})\}$,

$F_{E_4} = \{(e_2, \{x_1\})\}$, $F_{E_5} = \{(e_2, \{x_2\})\}$,

$F_{E_6} = \{(e_2,\{x_1, x_2\})\}$, $F_{E_7} = \{(e_1,\{x_1\}), (e_2,\{x_1\})\}$

$F_{E_8} = \{(e_1, \{x_1\}), (e_2, \{x_2\})\}$,

$F_{E_9} = \{(e_1, \{x_1\}), (e_2, \{x_1, x_2\})\}$,

$F_{E_{10}} = \{(e_1, \{x_2\}), (e_2, \{x_1\})\}$,

$F_{E_{11}} = \{(e_1, \{x_2\}), (e_2, \{x_2\})\}$

$F_{E_{12}} = \{(e_1, \{x_2\}), (e_2, \{x_1, x_2\})\}$,

$F_{E_{13}} = \{(e_1, \{x_1, x_2\}), (e_2, \{x_1\})\}$,

$F_{E_{14}} = \{(e_1, \{x_1, x_2\}), (e_2, \{x_2\})\}$,

$F_{E_{15}} = \tilde{X}$, $F_{E_{16}} = \varphi$.

Definition 2.14:[8] Let $\tilde{\tau}$ be the collection of soft sets over $\tilde{X}$, then $\tilde{\tau}$ is said to be a soft topology on X if statisfies the following axioms.

(i) φ, $\tilde{X}$ belong to $\tilde{\tau}$.

(ii) the union of any member of soft sets in $\tilde{\tau}$ belongs to $\tilde{\tau}$.

(iii) the intersection of any two soft sets in $\tilde{\tau}$ belongs to $\tilde{\tau}$.

The triplet ($\tilde{X}$, $\tilde{\tau}$, E) is called soft topological space over X.

Definition 2.15:[10] Let $\tilde{X}$ be a nonempty soft set on the universe X, $\tilde{\tau}_1$ and are $\tilde{\tau}_2$ two different soft topologies on $\tilde{X}$ .Then $(\tilde{X}, \tilde{\tau}_1, \tilde{\tau}_2, E)$ is called a soft bitopological space.

Definition 2.16: [10] Let $(\tilde{X}, \tilde{\tau}_1, \tilde{\tau}_2, E)$ is be a soft bitopological space and $F_A \tilde{\subseteq} \tilde{X}$. Then F_A is called $\tilde{\tau}_{1,2}$ - open if $F_A = F_B \tilde{\cup} F_C$, where $F_B \tilde{\in} \tilde{\tau}_1$ and $F_C \tilde{\in} \tilde{\tau}_2$. The complement of $\tilde{\tau}_{1,2}$ - open set is called $\tilde{\tau}_{1,2}$ - closed.

Definition 2.17: [10] Let $(\tilde{X}, \tilde{\tau}_1, \tilde{\tau}_2, E)$ is be a soft bitopological space and $F_E \tilde{\in} SS_E(X)$. Then

IJASRM

International Journal of Advanced Scientific Research and Management, Volume 4 Issue 4, April 2019

www.ijasrm.com

ISSN 2455-6378

(i) The $\tilde{\tau}_{1,2}$ - closure of F_E, denoted by $\tilde{\tau}_{1,2}$ -cl (F_E), is defined by $\tilde{\tau}_{1,2}$ -cl (F_E) = $\tilde{\cap}\{H_E : H_E \tilde{\supseteq} F_E ; H_E$ is a $\tilde{\tau}_{1,2}$ - open set$\}$

(ii) The $\tilde{\tau}_{1,2}$ - interior of F_E, denoted by $\tilde{\tau}_{1,2}$ -int(F_E), is defined by $\tilde{\tau}_{1,2}$ -int(F_E) = $\tilde{\cup}\{G_E : G_E \tilde{\subseteq} F_E : G_E$ is a $\tilde{\tau}_{1,2}$ - soft open set$\}$

Definition2.18[9]: Let $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$ be a soft bitopological space and $F_A \tilde{\subseteq} \tilde{X}$ Then F_A is called (1,2)*- soft b-open set(briefly (1,2)* -sb-open) if $F_A \tilde{\subseteq} \tilde{\tau}_{1,2}$ -int($\tilde{\tau}_{1,2}$ -cl (F_A)) $\tilde{\cup}$ $\tilde{\tau}_{1,2}$ -cl ($\tilde{\tau}_{1,2}$ -int(F_A)). The set of all (1,2)*- soft b-open sets are denoted by 1,2)*- SbO($\tilde{X}$).

Definition 2.19[9] : Let $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$ be a soft bitopological space and F_A be a soft set over $\tilde{X}$

(i) (1,2)*-soft b-closure (briefly (1,2)* -sbcl(F_A)) of a set F_A in $\tilde{X}$ defined as the soft intersection of all (1,2)*- soft b-closed supesets of F_A.

(ii) (1,2)*-soft b-interior (briefly (1,2)* -sbint(F_A))of a set F_A in $\tilde{X}$ defined as the soft union of all (1,2)*- soft b-open subsets of F_A .

3. (1,2)*- Soft b-Extremally Disconnected Spaces

In this section, we introduce a new class of soft space called (1, 2)*-soft b- extremally disconnected, and we obtain several characterizations of (1,2)*-soft b- extremally disconnected spaces by utilizing classes of soft sets.

Definition 3.1: A soft bitopological space $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$ is said to be (1,2)*-soft extremally disconnected space if $\tilde{\tau}_{1,2}$ - closure of every $\tilde{\tau}_{1,2}$ - open set of $\tilde{X}$ is $\tilde{\tau}_{1,2}$ - open set in $\tilde{X}$.

Definition 3.2: A soft bitopological space $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$ is said to be (1,2)*-soft b-extremally disconnected space if (1,2)*-soft b-closure of every (1,2)*-soft b-open set of $\tilde{X}$ is (1,2)*-soft b - open set in $\tilde{X}$.

Example 3.3: Let X={x, y, z, a}, E={e_1 }.$\tilde{X}$={(e_1,{x,y,z,a})}. $\tilde{X}$,φ, G_{E3}={(e_1, {x})}, G_{E4}={(e_1,{y})},G_{E5}= {(e_1, {z})},G_{E6}={(e_1,{a})}, G_{E7}=(e_1,{x,y})}, G_{E8}= {(e_1, {x, z})},G_{E9}= (e_1, {x, a})}, G_{E10} = {(e_1,{y, z})}, G_{E11} = {(e_1,{y, a})}, G_{E12}={(e_1,{z, a})}, G_{E13}={(e_1,{x,y,z})},G_{E14}={(e_1, {x,y,a})}, G_{E15}={(e_1, {,y,z,a})}, G_{E16}={(e_1, {x,a,z})}. Consider the soft bitopological space $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$, where $\tilde{\tau}_1$ ={ $\tilde{X}$, φ , G_{E6}, G_{E7}, G_{E14} }, $\tilde{\tau}_2$ = { $\tilde{X}$, φ, G_{E3}}.Then $\tilde{\tau}_{1,2}$ - open set are { $\tilde{X}$, φ, G_{E3}, G_{E6}, G_{E7}, G_{E14}, G_{E9}}, (1,2)*-soft b-open sets are { $\tilde{X}$, φ, G_{E3}, G_{E6}, G_{E7}, G_{E8}, G_{E9}, G_{E12}, G_{E3}, G_{E14}, G_{E16}, G_{E4}}. Then (1,2)*-soft b-closure of every (1,2)*-soft b-open set of $\tilde{X}$ is (1,2)*-soft b - open set in $\tilde{X}$. Hence $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$ is (1,2)*-soft b- extremally disconnected space.

Remark 3.4: Every (1,2)*-soft extremally disconnected space is (1,2)*-soft b- extremally disconnected space but not conversely as shown in the following example.

Example 3.5: Consider the soft bitopological space $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$ given in Example 3.3, where $\tilde{\tau}_1$ ={ $\tilde{X}$, φ , G_{E6}, G_{E7}, G_{E14} }, $\tilde{\tau}_2$ = { $\tilde{X}$, φ, G_{E3}}.Then $\tilde{\tau}_{1,2}$ - open set are{ $\tilde{X}$, φ, G_{E3}, G_{E6}, G_{E7},G_{E14} , G_{E9}}, $\tilde{\tau}_{1,2}$ - open set are { $\tilde{X}$, φ, G_{E13}, G_{E15}, G_{E5}, G_{E12}, G_{E10}}. Here $\tilde{\tau}_{1,2}$ - cl(G_{E6}) = $\tilde{\tau}_{1,2}$ - cl ({(e_1, {a})}) = G_{E12}={(e_1, {z, a})}, which is not a $\tilde{\tau}_{1,2}$ - open set. Therefore, $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$ is a (1,2)*-soft b-extremally disconnected space but not (1,2)*-soft extremally disconnected space

Theorem 3.6 : Let $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$ be soft bitopological space. Then the following statements are equivalent.

IJASRM International Journal of Advanced Scientific Research and Management, Volume 4 Issue 4, April 2019
www.ijasrm.com
ISSN 2455-6378

(i) $\tilde{X}$ is (1,2)*-soft b- extremally disconnected space.

(ii) (1,2)*-sbint(F_E) is (1,2)*-soft b-closed set for each (1,2)*-soft b-closed set F_E of $\tilde{X}$.

(iii) (1,2)*-sbcl((1,2)*-sbcl(F_E))^C = ((1,2)*-sbcl(F_E))^C for each (1,2)*-soft b-closed set F_E of $\tilde{X}$.

(iv) G_E = (1,2)*- sbcl(F_E)^C implies (1,2)*- sbcl(G_E) =((1,2)*- sbcl(F_E))^C for each pair of (1,2)*-soft b-open set F_E and G_E of $\tilde{X}$.

Proof.(i) $\Rightarrow$ (ii) Let F_E be a (1,2)*-soft b-closed set of $\tilde{X}$ .Then F_E^C is (1,2)*-soft b- open. Since $\tilde{X}$ is (1,2)*-soft b-extremally disconnected space , (1,2)*- sbcl(F_E^C) is (1,2)*-soft b- open set. But (1,2)*- sbcl(F_E^C) = ((1,2)*- sbint(F_E))^C. Therefore (1,2)*- sbint(F_E) is (1,2)*-soft b-closed set.

(ii) $\Rightarrow$ (iii) Suppose that F_E is (1,2)*-soft b-open set F_E of $\tilde{X}$ .Then (1,2)*-sbcl((1,2)*-sbcl(F_E))^C = (1,2)*-sbcl((1,2)*-sbint(F_E^C)). By assumption (1,2)*- sbint(F_E^C) is a (1,2)*-soft b-closed set .So (1,2)*-sbcl((1,2)*-sbint(F_E^C)) =(1,2)*-sbint(F_E^C) = (1,2)*-sbcl(F_E))^C.

(iii) $\Rightarrow$ (iv) Let F_E and G_E be (1,2)*-soft b-open set of $\tilde{X}$. We put G_E = ((1,2)*-sbcl(F_E))^C . By assumption, (1,2)*-sbcl(G_E) = (1,2)*-sbcl((1,2)*-sbcl(F_E))^C = ((1,2)*-sbcl(F_E))^C.

(iv) $\Rightarrow$ (i) Let F_E be a (1,2)*-soft b-open set of $\tilde{X}$. Let G_E = ((1,2)*-sbcl(F_E))^C . From the assumption, we obtain that (1,2)*-sbcl(G_E) = ((1,2)*-sbcl(F_E))^C. So ((1,2)*-sbcl(G_E))^C= (1,2)*-sbcl(F_E) . Hence (1,2)*-sbint(G_E^C) = (1,2)*-sbcl(F_E) . Thus (1,2)*-sbcl(F_E) is (1,2)*-soft b-open set of $\tilde{X}$. Then $\tilde{X}$ is (1,2)*-soft b- extremally disconnected space. □

4. (1,2)*-Soft b- Submaximal Space

Definition 4.1: A soft subset F_E of a soft bitopological space $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$ is called (1,2)*-soft dense if $\tilde{\tau}_{1,2}$-cl (F_E) = $\tilde{X}$.

Definition 4.2: A soft subset F_E of a soft bitopological space $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$ is called (1,2)*-soft b-dense if (1,2)*-sbcl (F_E) = $\tilde{X}$.

Proposition: 4.3: Every (1,2)*-soft b-dense set is (1,2)*-soft dense **.**

Proof. Let F_E be (1,2)*-soft b-dense set. Then (1,2)*-sbcl (F_E) = $\tilde{X}$. Since (1,2)*-sbcl (F_E) $\tilde{\subseteq}$ $\tilde{\tau}_{1,2}$-cl (F_E), we have $\tilde{\tau}_{1,2}$-cl (F_E) = $\tilde{X}$ and so F_E is (1,2)*-soft dense. □

The converse of the Proposition 4.3 need not be true as can be seen from the following example.

Example 4.4: Consider the soft bitopological space $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$,where $\tilde{\tau}_1$ ={ $\tilde{X}$, φ , F_{E_4} , $F_{E_{10}}$ }, $\tilde{\tau}_2$ = { $\tilde{X}$, φ , F_{E_1} , F_{E_7} , $F_{E_{13}}$ } and the soft subsets are as in the Example 2.13 . Then $\tilde{\tau}_{1,2}$ - open set are { $\tilde{X}$, φ , F_{E_1} , F_{E_4} , F_{E_7} , $F_{E_{10}}$, $F_{E_{13}}$ } and $\tilde{\tau}_{1,2}$ - closed set are { $\tilde{X}$, F_{ϕ} , $F_{E_{12}}$, $F_{E_{14}}$, $F_{E_{11}}$, F_{E_8} , F_{E_5} }. (1,2)*-soft b-open sets are { $\tilde{X}$, φ , F_{E_1} , F_{E_4} , F_{E_7} , F_{E_6} , F_{E_8} , F_{E_9} $F_{E_{12}}$, $F_{E_{10}}$, $F_{E_{13}}$ } and (1,2)*-soft b-closed sets are { $\tilde{X}$, φ , F_{E_1} , F_{E2} , F_{E_7} , F_{E_3} , F_{E_8} , F_{E_5} , $F_{E_{12}}$, $F_{E_{10}}$, $F_{E_{14}}$ }. Take the soft subset F_{E_7} ={ (e_1, { x_1}), (e_2, { x_1 })} and $\tilde{\tau}_{1,2}$ -cl (F_{E_7}) = { (e_1, { x_1 , x_2})}= F_{E_6} $\neq \tilde{X}$. Thus F_{E_7} is (1,2)*-soft dense but not (1,2)*-soft b- dense set.

Theorem 4.5: If F_E is (1,2)*-soft dense in $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$, then F_E is (1,2)*-soft b-open in $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$.

Proof. Let F_E is (1,2)*-soft dense in $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$. Then $\tilde{\tau}_{1,2}$ -cl (F_E) = $\tilde{X}$. Thus $\tilde{\tau}_{1,2}$ -int ($\tilde{\tau}_{1,2}$ -cl (

F_E)) = $\tilde{X}$, which implies that $F_E \tilde{\subseteq} \tilde{\tau}_{1,2}$-int ($\tilde{\tau}_{1,2}$-cl ($F_E$)) $\tilde{\subseteq}$ $\tilde{\tau}_{1,2}$-int ($\tilde{\tau}_{1,2}$-cl (F_E)) $\tilde{\cup}$ $\tilde{\tau}_{1,2}$-cl ($\tilde{\tau}_{1,2}$-int (F_E)) . Therefore F_E is (1,2)*-soft b-open in $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$. □

Remark 4.6 : In soft bitopological space $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$,(1,2)*-soft b-open set F_E need not be (soft dense set as shown in the following example.

Example 4.7: Consider the soft bitopological space $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$,where $\tilde{\tau}_1$ ={ $\tilde{X}$, φ , F_{E_4}, $F_{E_{10}}$ }, $\tilde{\tau}_2$ = { $\tilde{X}$, φ , F_{E_1}, F_{E_7} , $F_{E_{13}}$ }and the soft subsets are as in the Example 2.13 . Then $\tilde{\tau}_{1,2}$- open set are { $\tilde{X}$, φ , F_{E_1}, F_{E_4} , F_{E_7} , $F_{E_{10}}$, $F_{E_{13}}$ } and the collection of (1,2)*-soft b-open sets are { $\tilde{X}$, φ , F_{E_1}, F_{E_4}, F_{E_7} , F_{E_6}, F_{E_8} , F_{E_9} $F_{E_{12}}$, $F_{E_{10}}$, $F_{E_{13}}$ }. The collection of (1,2)*-soft dense sets of $\tilde{X}$ are { $\tilde{X}$, F_{E_7} , F_{E_9} , $F_{E_{13}}$ }. The (1,2)*-soft b-open sets are φ , F_{E_1}, F_{E_4}, F_{E_7} , F_{E_6}, F_{E_8} , F_{E_9} $F_{E_{12}}$, $F_{E_{10}}$ are not soft dense set .

Definition 4.8 : A soft bitopological space $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$ is called (1,2)*-soft submaximal if every (1,2)*-soft dense subset is $\tilde{\tau}_{1,2}$-open set in $\tilde{X}$.

Definition 4.9 : A soft bitopological space $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$ is called (1,2)*-soft b- submaximal if every (1,2)*-soft dense subset is (1,2)*-soft b - open set in $\tilde{X}$.

Example 4.10 : Let us consider the soft bitopological space $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$ as in the Example 2.13. Define $\tilde{\tau}_1$ ={ $\tilde{X}$, φ , F_{E_1}, F_{E_7} }, $\tilde{\tau}_2$ = { $\tilde{X}$, φ , F_{E_3} } $\tilde{\tau}_{1,2}$- open set are { $\tilde{X}$, φ , F_{E_1}, F_{E_7} , F_{E_8} , $F_{E_{13}}$ } and $\tilde{\tau}_{1,2}$- closed set are { $\tilde{X}$, φ , $F_{E_{11}}$, F_{E_6} , F_{E_5} , $F_{E_{12}}$ }.Then the collection of (1,2)*-soft open sets { $\tilde{X}$, φ , F_{E_1}, F_{E_3}, F_{E_7} , F_{E_8} , F_{E_9} $F_{E_{14}}$, $F_{E_{13}}$ }. The collection of (1,2)*-soft dense sets of $\tilde{X}$ are{ $\tilde{X}$, F_{E_1}, F_{E_3}, F_{E_7} , F_{E_8} , F_{E_9} $F_{E_{14}}$, $F_{E_{13}}$ }. Here all (1,2)*-soft dense sets are (1,2)*-soft b-open set and so $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$ is a (1,2)*-soft b- submaximal space.

Proposition 4.11 : Every (1,2)*-soft submaximal space is (1,2)*-soft b- submaximal .

Proof. Let $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$ be a (1,2)*-soft submaximal space and F_E be a (1,2)*-soft dense subset of $\tilde{X}$. Then F_E is $\tilde{\tau}_{1,2}$- open set in $\tilde{X}$. But every $\tilde{\tau}_{1,2}$- open set is (1,2)*-soft b-open set and so F_E is (1,2)*-soft b-open set. Therefore $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$ is (1,2)*-soft b- submaximal . □

The reverse implication of Proposition 4.11 is not true as it can be seen in the following example.

Example 4.12 : Let (1,2)*-soft b-submaximal space $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$ given in Example 4.10. Here the (1,2)*-soft dense set F_{E_8} = { (e_1, { x_1}), (e_2, { x_2})} is (1,2)*-soft b-open set but not $\tilde{\tau}_{1,2}$- open set in in $\tilde{X}$. Therefore (1,2)*-soft b-submaximal space is not (1,2)*-soft submaximal space.

Proposition 4.13 : Every soft bitopological space is a (1,2)*-soft b-submaximal space.

Proof. Let $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$ be a soft bitopological space and F_E be any (1,2)*-soft dense set of $\tilde{X}$. Then by Theorem 4.5, F_E is (1,2)*-soft b-open set. Therefore $(\tilde{X},\tilde{\tau}_1,\tilde{\tau}_2,E)$ is a (1,2)*-soft b-submaximal space. □

5. Conclusion

In this Paper, the characterizations of a (1,2)*-soft b-extremally disconnected spaces in soft bitopological spaces. Also it is proved that all (1,2)*-soft dense is (1,2)*-soft b-open set. Finally, the propreties of (1,2)*-soft b-submaximal space using (1,2)*-soft dense set.

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