Minimal and Maximal Soft Open Sets

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Abstract

In this paper, we introduce new types of minimal and maximal sets via soft topological spaces namely minimal and maximal soft open sets and their complements. These sets are depended on the soft open sets. Many interested result are presented to reveal some properties of these new sets.

Keywords: Soft set, soft topology, minimal soft open, maximal soft open.

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1 Introduction

The phenomena of uncertainty can be emerged in many fields such as economy, social and medical sciences, engineering and so on. To deal with such uncertainties many mathematical tools have been introduced such as probability, fuzzy sets, rough sets and etc. However, these tools have their own limitations. In fact the limitations here always associated with the inadequacy of the parametrization tools. Molodtsov \([1]\) initiated another efficient tool, soft set theory, which is more flexible to deal with uncertainty and to treat some limitation obstacles that other tools suffered to handle them. The theory of the soft set has been being investigating intensively and various applications of this theory have been done in many different fields.

Shabir and Naz \([2]\) introduced the concept of the soft topological space. Heavily investigations were followed to this new kind of topological space and many generalizations depending on the generalizations of soft open and closed sets were introduced as well.

On the other hand, the notation of maximal open sets and minimal open sets were introduced by F. Nakaoka and N. Oda in \([3]\) and \([4]\). Many generalizations of these concepts have been introduced depending on the various generalizations of the concept of open set. In this paper we introduced the concepts of maximal and minimal soft open sets.

2 Preliminaries

Definition 2.1. \([1]\) Let \(E\) be a set of parameters and \(A\) be a subset of \(E\), a soft set \(F_A\) on the universe set \(U\) is denoted by the set of ordered pairs:

\[ F_A = \{(x, f_A(x)) : x \in E, f_A(x) \in P(U)\} \]

where \(f_A : E \to P(U)\) such that \(f_A(x) = \emptyset\) if \(x \notin A\).

\(f_A\) is called an approximate function of the soft set \(F_A\). The value of \(f_A\) may be arbitrary, some of them may be empty, or may have nonempty intersection.

Remark 2.1. The set of all soft sets over \(U\) will be denoted by \(S(U)\).
Example 2.1. Suppose that there are eight cars in the universe $U = \{c_1, c_2, c_3, c_4, c_5, c_6, c_7, c_8\}$ and let $E = \{x_1, x_2, x_3, x_4, x_5\}$ is the set of decision parameters such that $x_1 = new, x_2 = expensive, x_3 = high-tech, x_4 = model, x_5 = interior design$. Consider the map $f_A : \text{cars}(\text{attributes}) \to \{\text{cars}(\text{high-tech})\}$. Thus the functional value of $f_A(x_5)$ is the set $\{c \in U : c \text{ is a high-tech}\}$. Now let $A = \{x_2, x_3, x_5\}$ and $f_A(x_2) = \{c_2, c_6\}$, $f_A(x_3) = \{c_1, c_3, c_4\}$ and $f_A(x_5) = \{c_1, c_7, c_8\}$. Then the soft set $F_A = \{(x_2, \{c_2, c_6\}), (x_3, \{c_1, c_3, c_4\}), (x_5, \{c_1, c_7, c_8\})\}$.

Definition 2.2. [5] Let $F_A \in S(U)$, if $f_A(x) = \emptyset$ for all $x \in U$, then $F_A$ is called an empty set, and denoted by $F_\emptyset$.

Example 2.2. Let $U = \{u_1, u_2, u_3, u_4\}$ and $E = \{x_1, x_2, x_3\}$, then $F_\emptyset = \{(x_1, \emptyset), (x_2, \emptyset), (x_3, \emptyset)\}$.

Definition 2.3. [5] Let $F_A \in S(U)$, if $f_A(x) = U$ for all $x \in A$, then $F_A$ is called an $A$-universal soft set and is denoted by $F_A$.

If $A = E$, then $F_E$ is called a universal soft set.

Example 2.3. Let $U = \{u_1, u_2, u_3\}$, $E = \{x_1, x_2, x_3\}$ and $A = \{x_1, x_2\}$, then $F_A = \{(x_1, U), (x_2, U)\}$ and $F_E = \{(x_1, U), (x_2, U), (x_3, U)\}$.

Definition 2.4. [5] Let $F_A, F_B \in S(U)$. Then $F_A$ is a soft subset of $F_B$ if $f_A(x) \subseteq f_B(x)$ for all $x \in E$ and is denoted by $F_A \subseteq F_B$.

If $F_A \neq F_B$, then $F_A$ is a proper soft subset of $F_B$ and is denoted by $F_A \subset F_B$.

Example 2.4. Let $U = \{u_1, u_2, u_3, u_4, u_5\}$, $E = \{x_1, x_2, x_3, x_4, x_5\}$, $A = \{x_1, x_4\}$, $B = \{x_4\}$, $F_A = \{(x_1, \{u_1, u_5\}), (x_4, \{u_2, u_3, u_4\})\}$ and $F_B = \{(x_4, \{u_2, u_3\})\}$. It is clear that $F_B \subset F_A$.

Definition 2.5. [5] Let $F_A, F_B \in S(U)$. Then $F_A$ and $F_B$ are soft equal if $f_A(x) = f_B(x)$ for all $x \in E$ and is denoted by $F_A = F_B$.

Definition 2.6. [5] Let $F_A, F_B \in S(U)$. Then the soft union of $F_A$ and $F_B$ (denoted by $F_A \cup F_B$) is defined by the following: $F_A \cup F_B = f_A(x) \cup f_B(x)$ for all $x \in E$.

Example 2.5. Let $U = \{u_1, u_2, u_3\}$, $E = \{x_1, x_2, x_3\}$, $A = \{x_1, x_2\}$, $B = \{x_2, x_3\}$, $F_A = \{(x_1, \{u_1, u_2\}), (x_2, \{u_2\})\}$ and $F_B = \{(x_2, \{u_1, u_3\}), (x_3, \{u_3\})\}$. Then $F_A \cup F_B = \{(x_1, \{u_1, u_2\}), (x_2, U), (x_3, \{u_3\})\}$.

Definition 2.7. [5] Let $F_A, F_B \in S(U)$. Then the soft intersection of $F_A$ and $F_B$ (denoted by $F_A \cap F_B$) is defined by the following: $F_A \cap F_B = f_A(x) \cap f_B(x)$ for all $x \in E$.

Example 2.6. Let $U = \{u_1, u_2, u_3, u_4\}$, $E = \{x_1, x_2, x_3, x_4\}$, $A = \{x_1, x_4\}$, $B = \{x_1\}$, $F_A = \{(x_1, \{u_1\}), (x_4, \{u_2, u_3, u_4\})\}$ and $F_B = \{(x_1, \{u_1, u_3\})\}$. So $F_A \cap F_B = \{(x_1, \{u_1\})\}$.

Definition 2.8. [5] Let $F_A \in S(U)$. Then the soft complement of $F_A$ (denoted by $F_A^c$) is defined by the approximate function: $F_A^c = f_A^c(x)$, where $f_A^c(x) = U - f_A(x)$ for all $x \in A$.

Example 2.7. Let $U = \{u_1, u_2, u_3\}$, $E = \{x_1, x_2, x_3\}$, $A = \{x_1, x_3\}$ and $F_A = \{(x_1, \{u_2\}), (x_3, \{u_1, u_3\})\}$, then $F_A^c = \{(x_1, \{u_1, u_3\}), (x_3, \{u_2\})\}$.

Definition 2.9. [6] Let $F_A \in S(U)$. $\alpha = (x, \{u\})$ is a nonempty soft element of $F_A$, denoted by $\alpha \in F_A$ if $x \in E$ and $u \in f_A(x)$.

Remark 2.2. The pair $(x, \emptyset)$, where $x \in E$, is called the empty soft element of $F_A$.

Example 2.8. Let $U = \{u_1, u_2, u_3\}$, $E = \{x_1, x_2, x_3\}$ and let $F_A = \{(x_2, \{u_2, u_3\}), (x_3, \{u_1, u_2\})\}$, then the following are nonempty elements in $F_A$:

- $a_1 = (x_2, \{u_2\}) \notin F_A$; since $u_2 \notin f_A(x_2) = \{u_2, u_3\}$
- $a_2 = (x_2, \{u_3\}) \in F_A$; since $u_3 \in f_A(x_2) = \{u_2, u_3\}$
- $a_3 = (x_3, \{u_1\}) \notin F_A$; since $u_1 \notin f_A(x_3) = \{u_1, u_2\}$
- $a_4 = (x_3, \{u_2\}) \notin F_A$; since $u_2 \notin f_A(x_3) = \{u_1, u_2\}$

Definition 2.10. [2] Let $F_E \in S(U)$. A soft topology on $F_E$, denoted by $\tau$, is a collection of soft subsets of $F_E$ satisfying the following properties:

1. $\emptyset, U \in \tau$.
2. $\tau$ is closed under finite intersections.
3. $\tau$ is closed under arbitrary unions.

Example 2.9. Let $U = \{u_1, u_2, u_3\}$, $E = \{x_1, x_2, x_3\}$ and let $F_A = \{(x_2, \{u_2, u_3\}), (x_3, \{u_1, u_2\})\}$, then the following are nonempty elements in $F_A$:

- $a_1 = (x_2, \{u_2\}) \notin F_A$; since $u_2 \notin f_A(x_2) = \{u_2, u_3\}$
- $a_2 = (x_2, \{u_3\}) \in F_A$; since $u_3 \in f_A(x_2) = \{u_2, u_3\}$
- $a_3 = (x_3, \{u_1\}) \notin F_A$; since $u_1 \notin f_A(x_3) = \{u_1, u_2\}$
- $a_4 = (x_3, \{u_2\}) \notin F_A$; since $u_2 \notin f_A(x_3) = \{u_1, u_2\}$

Definition 2.10. [2] Let $F_E \in S(U)$. A soft topology on $F_E$, denoted by $\tau$, is a collection of soft subsets of $F_E$ satisfying the following properties:

1. $\emptyset, U \in \tau$.
2. $\tau$ is closed under finite intersections.
3. $\tau$ is closed under arbitrary unions.
1. \(F_\emptyset, F_E \in \tau\).

2. If \(\{F_E : i \in I \subseteq \mathbb{N}\} \ni \bigcup_{i \in I} F_E \in \tau\).

3. If \(\{F_E : 1 \leq i \leq n, n \in \mathbb{N}\} \ni \bigcap_{i = 1}^n F_E \in \tau\).

Then \(\tau\) is called a soft topology and the pair \((F_E, \tau)\) is called a soft topological space.

**Example 2.9.** Let \(U = \{u_1, u_2, u_3\}, E = \{x_1, x_2, x_3\}, A = \{x_1, x_2\}\), then \((F_A, \tau) = \{F_\emptyset, F_A, F_{A_1}, F_{A_2}, F_{A_3}, F_A\}\) is a soft topological space, where \(F_{A_1} = \{(x_1, \{u_2\})\}, F_{A_2} = \{(x_1, \{u_2\}), (x_2, \{u_2\})\}, F_{A_3} = \{(x_1, \{u_1, u_2\}), (x_2, \{u_2\})\}\).

**Definition 2.11.** Let \((F_A, \tau)\) be a soft topological space and \(\alpha \in F_A\). If there is a soft open set \(F_B\) such that \(\alpha \in F_B\), then \(F_B\) is called a soft open neighbourhood (or soft neighbourhood) of \(\alpha\).

**Definition 2.12.** Let \((F_A, \tau)\) be a soft topological space and \(F_B \subseteq F_A\). Then \(F_B\) is said to be a soft closed if \(F_B\) is a soft open.

**Definition 2.13.** Let \((F_A, \tau)\) be a soft topological space and \(F_B \subseteq F_A\). Then the soft closure of \(F_B\) is the intersection of all soft closed set that contain \(F_B\) and it is denoted by \(\overline{F_B}\).

### 3 Minimal and maximal soft open sets

**Definition 3.14.** A proper nonempty soft open subset \(F_K\) of a soft topological space \((F_A, \tau)\) is said to be minimal soft open if any soft open set which is contained in \(F_K\) is \(F_\emptyset\) or \(F_K\).

**Definition 3.15.** A proper nonempty soft open subset \(F_K\) of a soft topological space \((F_A, \tau)\) is said to be maximal soft open if any soft open set which contains \(F_K\) is \(F_A\) or \(F_K\).

**Example 3.10.** Let \(U = \{u_1, u_2, u_3, u_4\}, E = \{x_1, x_2, x_3, x_4\}, A = \{x_1, x_2, x_3\}\), and let \((F_A, \tau) = \{F_\emptyset, F_A, F_{A_1}, F_{A_2}, F_{A_3}, F_A\}\) be a soft topological space, where \(F_{A_1} = \{(x_1, \{u_1, u_3\}), (x_2, \{u_2, u_4\})\}, F_{A_2} = \{(x_2, \{u_2\})\}, F_{A_3} = \{(x_1, \{u_1, u_2\}), (x_2, \{u_2\})\}\). Then \(F_{A_2}\) is a minimal soft open set and \(F_{A_3}\) is a maximal soft open set.

**Proposition 3.1.** Let \(F_K\) and \(F_H\) be soft open subsets of a soft topological space \((F_A, \tau)\), if \(F_K\) is minimal soft open then \(F_K \cap F_H = F_\emptyset\) or \(F_K \subseteq F_H\).

**Proof.** Suppose that \(F_K \cap F_H \neq F_\emptyset\), so \(F_K \cap F_H \subseteq F_H\). But \(F_H\) is minimal soft open, hence \(F_K \cap F_H = F_K\). Therefore \(F_K \subseteq F_H\).

**Proposition 3.2.** Let \(F_K\) and \(F_H\) be minimal soft open subsets of a soft topological space \((F_A, \tau)\), then \(F_K \cap F_H = F_\emptyset\) or \(F_K = F_H\).

**Proof.** Suppose that \(F_K \cap F_H \neq F_\emptyset\), so \(F_K \cap F_H \subseteq F_H\). But \(F_H\) is minimal soft open, hence \(F_K \cap F_H = F_H\). Therefore \(F_K \subseteq F_H\).

By using the same argument, we get \(F_H \subseteq F_K\). Therefore \(F_K = F_H\).

**Proposition 3.3.** Let \(F_H\) be a minimal soft open set. If \(\alpha \in F_H\), then \(F_H \subseteq F_K\) for any soft open neighbourhood \(F_K\) of \(\alpha\).

**Proof.** Let \(F_K\) be a soft open neighbourhood of \(\alpha\) and suppose \(F_H \not\subseteq F_K\), then \(F_H \cap F_K \neq F_\emptyset\) and it is proper soft open subset of \(F_H\). So we get a contradiction of being \(F_H\) is minimal.

**Proposition 3.4.** Let \(F_K\) be a nonempty finite soft open subset of a soft topological space \((F_A, \tau)\). Then there exists at least one minimal soft open set \(F_H\) such that \(F_H \subseteq F_K\).
Proof. Let $F_K$ be a nonempty finite soft open set. If $F_K$ is minimal then set $F_K = F_H$. Otherwise, there exists a soft open set $F_{K_1}$ such that $F_{K_1} \not\subseteq F_K$. So if $F_{K_1}$ is minimal then set $F_H = F_{K_1}$. Otherwise, there exists $F_{K_2}$ such that $F_{K_2} \not\subseteq F_{K_1} \subseteq F_K$. Now, if $F_{K_2}$ is minimal then set $F_H = F_{K_2}$. Otherwise there exists a finite open soft set $F_K$ such that $F_{K_2} \not\subseteq F_{K_1} \subseteq F_K$. Indeed, since $F_K$ is finite, so if we continue this process we will reach to a final soft open set, say $F_{K_n}$ for some $n \in \mathbb{N}$, which is of course minimal such that $F_{K_n} \not\subseteq F_{K_n-1} \subseteq \ldots \subseteq F_{K_2} \subseteq F_{K_1} \subseteq F_K$. Set $F_H = F_{K_n}$ as required. 

**Proposition 3.5.** Let $F_K$ and $F_H$ be soft open subsets of a soft topological space $(F_A, \tau)$. If $F_K$ is maximal soft open, then $F_K \bigcup F_H = F_A$ or $F_H \subseteq F_K$. 

*Proof.* Suppose that $F_K \bigcup F_H \neq F_A$, so $F_K \subseteq F_K \bigcup F_H$. But $F_K$ is maximal soft open, hence $F_K = F_K \bigcup F_H$. Therefore $F_H \subseteq F_K$. 

**Proposition 3.6.** Let $F_K$ and $F_H$ be maximal soft open sets of a soft topological space $(F_A, \tau)$, then $F_K \bigcup F_H = F_A$ or $F_K = F_H$. 

*Proof.* Suppose that $F_K \bigcup F_H \neq F_A$, so $F_H \subseteq F_K \bigcup F_H$ and $F_K \subseteq F_K \bigcup F_H$. But $F_H$ is maximal soft open, hence $F_K \bigcup F_H = F_H$. Therefore $F_K \subseteq F_H$. 

Using the same argument we get $F_H \subseteq F_K$. Therefore $F_K = F_H$. 

**Proposition 3.7.** Let $F_M$ be a proper nonempty cofinite soft open set of a soft topological space $(F_A, \tau)$. Then there exists at least one cofinite maximal soft open set $F_N$ such that $F_M \subseteq F_N$. 

*Proof.* Let $F_M$ be a proper nonempty cofinite soft open set. If $F_M$ is maximal then set $F_M = F_N$. Otherwise, there exists a proper soft open set $F_{N_1}$ such that $F_M \subseteq F_{N_1}$. So if $F_{N_1}$ is maximal then set $F_N = F_{N_1}$. Otherwise, there exists a proper soft open set $F_{N_2}$ such that $F_M \subseteq F_{N_2} \subseteq F_{N_1}$. Now, if $F_{N_2}$ is maximal then set $F_M = F_{N_2}$. In fact, since $F_M$ is cofinite, so if we continue this process we will reach to a cofinal soft open set, say $F_{N_n}$ for some $n \in \mathbb{N}$, which is of course maximal such that $F_M \subseteq F_{N_1} \subseteq F_{N_2} \subseteq \ldots \subseteq F_{N_n} \neq F_A$. Set $F_N = F_{N_n}$ as required. 

**Proposition 3.8.** Let $F_K$ be a maximal soft open subset of a soft topological space $(F_A, \tau)$ and $\alpha \not\in F_K$. Then $F_K \subseteq F_H$ for any soft open set $F_H$ containing $\alpha$. 

*Proof.* Since $\alpha \not\in F_K$, then for any $F_H$ containing $\alpha$, so we have $F_H \not\subseteq F_K$. Hence by using proposition 3.5 we get $F_K \bigcup F_H = F_A$ and this means $F_K \subseteq F_H$. 

**Proposition 3.9.** Let $F_K$ be a maximal soft open subset of a soft topological space $(F_A, \tau)$. Then either the following holds: 

1. For each $\alpha \in F_K$ and soft open set $F_H$ containing $\alpha$, we have $F_H = F_A$. 

2. There exists a soft open set $F_H$ such that $F_K \subseteq F_H$ and $F_H \subseteq F_A$. 

*Proof.* Suppose (1) does not hold, so there exists $\alpha \in F_K$ and a soft open set $F_H$ containing $\alpha$ such that $F_H \not\subseteq F_A$. So by proposition 3.8 we have that $F_K \subseteq F_H$. 

**Proposition 3.10.** Let $F_K$ be a maximal soft open subset of a soft topological space $(F_A, \tau)$. Then either the following holds: 

1. For each $\alpha \in F_K$ and each soft open neighbourhood set $F_H$ containing $\alpha$, we have $F_K \subseteq F_H$. 

2. There exists a proper soft open set $F_H$ such that $F_K = F_H$. 

*Proof.* Suppose that (2) does not hold, so by proposition 3.8 we get $F_K \subseteq F_H$ for each $\alpha \in F_K$ and each soft open neighbourhood $F_H$ of $\alpha$. 

**Proposition 3.11.** Let $F_K$ be a maximal soft open subset of a soft topological space $(F_A, \tau)$. Then $\tilde{F}_K = F_A$ or $\tilde{F}_K = F_K$. 

*Proof.* Let $F_K$ be a maximal soft open set. By using proposition 3.10 so we have only two cases:
1. From the first condition of proposition \[\text{Proposition 3.10}\] let \(a \in F_k^c\) and each soft open neighbourhood \(F_H\) of \(a\), then 
\(F_k^c \subseteq F_H\). So \(F_k \cap F_H \neq \emptyset\), i.e. \(a \in \tilde{F}_K\). Thus \(F_k^c \subseteq \tilde{F}_K\). But \(F_A = F_K \cup \tilde{F}_K \cup \tilde{F}_K = \tilde{F}_K \subseteq F_A\). Consequently we get \(\tilde{F}_K = F_A\).

2. From the second condition of proposition \[\text{Proposition 3.10}\] there exits a soft open set \(F_H\) such that \(F_k^c = F_H \neq F_A\), so \(F_k^c\) is soft open set and thus \(F_k\) is soft closed, i.e. \(\tilde{F}_K = F_K\).

\[
\text{Proposition 3.11.} \text{ Let } F_C \text{ and } F_D \text{ be soft closed sets of a soft topological space } (F_A, \tilde{\tau}).
\]

1. If \(F_C\) is minimal, then \(F_C \cap F_D = F_\emptyset\) or \(F_C \subseteq F_D\).

2. If \(F_C\) and \(F_D\) are minimal, then \(F_C \cap F_D = F_\emptyset\) or \(F_C = F_D\).

3. If \(F_C\) is maximal, then \(F_C \cup F_D = F_A\) or \(F_D \subseteq F_C\).

4. If \(F_C\) and \(F_D\) are maximal, then \(F_C \cup F_D = F_A\) or \(F_C = F_D\).

\[
\text{Proof.} \text{ (1) Suppose that } F_C \cap F_D \neq F_\emptyset, \text{ so } F_C \cap F_D \subseteq F_C. \text{ But } F_C \text{ is minimal soft closed, hence } F_C \cap F_D = F_C. \text{ Therefore } F_C \subseteq F_D.
\]

(2) Suppose that \(F_C \cap F_D \neq F_\emptyset\), so \(F_C \cap F_D \subseteq F_C\). But \(F_D\) is minimal soft closed, hence \(F_C \cap F_D = F_D\). Therefore \(F_D \subseteq F_C\). But from (1) we have \(F_C \subseteq F_D\). Therefore \(F_C = F_D\).

(3) Suppose that \(F_D \cup F_C \neq F_A\), so \(F_D \cup F_C \subseteq F_D\). But \(F_C\) is maximal soft closed, hence \(F_C = F_C \cup F_D\). Therefore \(F_D \subseteq F_C\).

(4) Suppose that \(F_C \cup F_D \neq F_A\), so \(F_D \cup F_C \subseteq F_D\) and \(F_C \cup F_D \subseteq F_D\). But \(F_D\) is maximal soft closed, hence \(F_C \cup F_D = F_D\). Therefore \(F_C \subseteq F_D\).

Using the same argument, we get \(F_D \subseteq F_C\). Therefore \(F_C = F_D\).

\[
\text{Proposition 3.12.} \text{ Let } F_C \text{ and } F_D \text{ be soft closed sets of a soft topological space } (F_A, \tilde{\tau}).
\]

\[
\text{Proposition 3.13.} \text{ Let } (F_A, \tilde{\tau}) \text{ be a soft topological space. If } F_K \text{ is a proper maximal soft open subset of } F_A, \text{ then } F_K^c \text{ is a minimal soft closed set.}
\]

\[
\text{Proposition 3.14.} \text{ Let } (F_A, \tilde{\tau}) \text{ be a soft topological space. If } F_K \text{ be a proper minimal soft open subset of } F_A \text{ then } F_K \text{ is a minimal soft closed set.}
\]

\[
\text{Proposition 3.15.} \text{ Let } F_C \text{ and } \{F_{D_\lambda} : \lambda \in \Lambda\} \text{ be minimal soft closed subsets of a soft topological space } (F_A, \tilde{\tau}). \text{ If } F_C \neq F_{D_\lambda} \text{ for each } \lambda, \text{ then } (\bigcup_{\lambda \in \Lambda} F_{D_\lambda}) \cap F_C = F_\emptyset.
\]

\[
\text{Proof.} \text{ Suppose } F_K^c \text{ is not minimal soft closed set, so there exists a soft closed set } F_C \text{ such that } F_\emptyset \neq F_C \subseteq F_K^c. \text{ Hence } F_K \subseteq F_K^c \subseteq F_A. \text{ This means that } F_K \text{ is not maximal which is contradicting of being } F_K \text{ is maximal.}
\]

\[
\text{Proposition 3.16.} \text{ A proper nonempty soft closed subset } F_C \text{ of a soft topological space } (F_A, \tilde{\tau}) \text{ is said to be minimal soft closed set if any soft closed set which is contained in } F_C \text{ is } F_\emptyset \text{ or } F_C.
\]

\[
\text{Proposition 3.17.} \text{ A proper nonempty soft closed subset } F_C \text{ of a soft topological space } (F_A, \tilde{\tau}) \text{ is said to be maximal soft closed set if any soft closed set which contains } F_C \text{ is } F_A \text{ or } F_C.
\]
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