2.2. Definition. [2,3]. Assume X be a universal set and $Q \neq \emptyset$. A Q −fuzzy subset N of X is a function $X \times X \rightarrow [0,1]$." The union of two Q −fuzzy subsets N and M is defined as

$$N \cup M = \{\max(\mu_N(\tilde{\theta}, \hat{u}), \mu_M(\tilde{\theta}, \hat{u})): \tilde{\theta} \in X, \hat{u} \in Q\}$$

The intersection of two Q −fuzzy subsets N and M is defined as

$$N \cap M = \{\min(\mu_N(\tilde{\theta}, \hat{u}), \mu_M(\tilde{\theta}, \hat{u})): \tilde{\theta} \in X, \hat{u} \in Q\}$$

2.3. Definition[3]. Let I be unit interval $[0,1]$, $k \in Z^+$ (positive integer), X be universal set and $Q \neq \emptyset$. A multi Q −fuzzy set N_Q in X and Q is a set of ordered sequences,

$$N_Q = \{\max(\mu_j(\tilde{\theta}, \hat{u})): \tilde{\theta} \in X, \hat{u} \in Q\}$$

Where $\mu_j: X \times Q \rightarrow I^K$ The function $\mu_j(\theta, \hat{u})$ is termed as membership function of multi Q-fuzzy set N_Q, and $\sum_{j=0}^{k} \mu_j(\tilde{\theta}, \hat{u}) \leq 1, for\ j = 1,2,3, \ldots, k. k$ is the dimension of multi Q fuzzy set N_Q.The set of all multi- Q − fuzzy set of dimension k in X and Q is denoted by $M^k FQ(X)$."

2.4. Definition[4]. Let X be a universal set,E be the set of parameters, $Q \neq \emptyset$. Let $M^k FQ(X)$ is the power set of all multi Q −fuzzy subsets of X with dimension $k = 1$. Let $D \subseteq E$. A pair $(F_{Q,}D)$ is referred as Q −fuzzy soft set (in short QF −soft set)over X where $F_{Q,}$ is defined by

$$F_Q: D \rightarrow M^k FQ(X) \ \ such\ that\ (F_Q(\tilde{\theta})) = \emptyset\ \ if\ \tilde{\theta} \notin D$$

Here a Q −fuzzy soft set can be represented by the set of ordered pairs

$$(F_{Q,}D) = \{\tilde{\theta}, F_Q(\tilde{\theta}): \tilde{\theta} \in X, F_Q(\tilde{\theta}) \in M^k FQ(X)\}$$

The set of all Q −fuzzy soft sets over X will be denoted by $QFS(X)$

2.5. Definition. [22] Let X be a space of points (objects), with a generic element in X denoted by $\tilde{\theta}$. A SVNS N in X has the features truth-membership function T_N, indeterminacy-membership function I_N, and falsity-membership function F_N. For each point $\hat{\theta}$ in X,$T_N(\hat{\theta}), I_N(\hat{\theta}), F_N(\hat{\theta}) \in [0,1]$.

Mathematically single valued neutrosophic is expressed as follows:

$$N = \{\langle \hat{\theta}, \left(T_N(\hat{\theta}), I_N(\hat{\theta}), F_N(\hat{\theta})\right)\rangle \,|\, \hat{\theta} \in X\}$$

3 Q −Single Valued Neutrosophic Sets

3.1. Definition. Let X be a universal set and $Q \neq \emptyset$. A Q −SVNS $\tilde{N}_Q$ in X and Q is an object of the form

$$\tilde{N}_Q = \{(\hat{\theta}, \hat{u}), \mu_{\tilde{N}}(\hat{\theta}, \hat{u}), \boldsymbol{\nu}_{\tilde{N}}(\hat{\theta}, \hat{u}), \boldsymbol{\lambda}_{\tilde{N}}(\hat{\theta}, \hat{u}) : \hat{\theta} \in X, \hat{u} \in Q\}$$

Where $\mu_{\tilde{N}_Q} : X \times Q \to [0,1]$, $\boldsymbol{\nu}_{\tilde{N}_Q} : X \times Q \to [0,1]$, $\boldsymbol{\lambda}_{\tilde{N}_Q} : X \times Q \to [0,1]$, are respectively truth-membership, indeterminacy-membership and falsity membership functions for every $\hat{\theta} \in X \; and \; \hat{u} \in Q$ and satisfy the condition $0 \leq \mu_{\tilde{N}_Q}(\hat{\theta}, \hat{u}) + \boldsymbol{\nu}_{\tilde{N}_Q}(\hat{\theta}, \hat{u}) + \boldsymbol{\lambda}_{\tilde{N}_Q}(\hat{\theta}, \hat{u}) \leq 3$.

3.2. Example. Let $X = \{\boldsymbol{p}_1, \boldsymbol{p}_1, \boldsymbol{p}_3\}$ and $Q = \{\hat{u}, \hat{v}\}$, then Q −SVNS $\tilde{N}_Q$ is defined below,

$$\tilde{N}_Q = \{< (\boldsymbol{p}_1, \hat{u}), (0.4,0.3,0.5), (\boldsymbol{p}_1, \hat{v}), (0.2,0.4,0.6), (\boldsymbol{p}_2, \hat{u}), (0.6,0.1,0.3), (\boldsymbol{p}_2, \hat{v}), (0.7,0.2,0.1), (\boldsymbol{p}_3, \hat{u}), (0.3,0.6,0.4), (\boldsymbol{p}_3, \hat{v}), (0.5,0.4,0.6) >\}$$

Now we define some basic operations for $\boldsymbol{Q}$ −SVNS.

3.3. Definition. Let X be a universal set, $Q \neq \emptyset$and $\tilde{N}_Q$ be a Q −SVNS. The complement of $\tilde{N}_Q$ is denoted and defined as follows

$$\tilde{N}_Q^C = \{(\hat{\theta}, \hat{u}), \boldsymbol{\lambda}_{\tilde{N}_Q}(\hat{\theta}, \hat{u}), 1 - \boldsymbol{\nu}_{\tilde{N}_Q}(\hat{\theta}, \hat{u}), \mu_{\tilde{N}_Q}(\hat{\theta}, \hat{u}) : \hat{\theta} \in X, \hat{u} \in Q\}$$

3.4. Definition. Let $\tilde{A}_Q$ and $\tilde{N}_Q$be two Q −SVNS. Then the union and intersection is denoted and defined by

$$\tilde{A}_Q \cup \tilde{N}_Q = \{(\hat{\theta}, \hat{u}), \max(\mu_{\tilde{A}_Q}(\hat{\theta}, \hat{u}), \mu_{\tilde{N}_Q}(\hat{\theta}, \hat{u})), \min(\boldsymbol{\nu}_{\tilde{A}_Q}(\hat{\theta}, \hat{u}), \boldsymbol{\nu}_{\tilde{N}_Q}(\hat{\theta}, \hat{u})), \min(\boldsymbol{\lambda}_{\tilde{A}_Q}(\hat{\theta}, \hat{u}), \boldsymbol{\lambda}_{\tilde{N}_Q}(\hat{\theta}, \hat{u})) : \hat{\theta} \in X, \hat{u} \in Q\}$$

$$\tilde{A}_Q \cap \tilde{N}_Q = \{(\hat{\theta}, \hat{u}), \min(\mu_{\tilde{A}_Q}(\hat{\theta}, \hat{u}), \mu_{\tilde{N}_Q}(\hat{\theta}, \hat{u})), \max(\boldsymbol{\nu}_{\tilde{A}_Q}(\hat{\theta}, \hat{u}), \boldsymbol{\nu}_{\tilde{N}_Q}(\hat{\theta}, \hat{u})),$$

$$\max(\boldsymbol{\lambda}_{\tilde{A}_Q}(\tilde{\theta},\hat{u}),\boldsymbol{\lambda}_{\tilde{N}_Q}(\tilde{\theta},\hat{u}))\}$$

3.5. Definition. Let $\tilde{A}_Q$ and $\tilde{N}_Q$ be two Q −SVNSs over two non-empty universal sets G and H respectively and Q be any non-empty set. Then the product of $\tilde{A}_Q$ and $\tilde{N}_Q$ is denoted by $\tilde{A}_Q \times \tilde{N}_Q$ and defined as

$$\tilde{A}_Q \times \tilde{N}_Q = \{< ((\tilde{\theta},b),\hat{u}), \mu_{\tilde{A}_Q\times \tilde{N}_Q}((\tilde{\theta},b),\hat{u}), \nu_{\tilde{A}_Q\times \tilde{N}_Q}((\tilde{\theta},b),\hat{u}), \lambda_{\tilde{A}_Q\times \tilde{N}_Q}((\tilde{\theta},b),\hat{u}) >: \tilde{\theta} \in G, b \in H, \hat{u} \in Q\}$$

Where

$$\mu_{\tilde{A}_Q\times \tilde{N}_Q}((\tilde{\theta},b),\hat{u}) = \min\{\mu_{\tilde{A}_Q}(\tilde{\theta},\hat{u}), \mu_{\tilde{N}_Q}(b,\hat{u})\}$$

$$\boldsymbol{\nu}_{\tilde{A}_Q\times \tilde{N}_Q}(\tilde{\theta},b),\hat{u})=\max\{\boldsymbol{\nu}_{\tilde{A}_Q}(\tilde{\theta},\hat{u}),\boldsymbol{\nu}_{\tilde{N}_Q}(b,\hat{u})\}$$

$$\boldsymbol{\lambda}_{\tilde{A}_Q\times \tilde{N}_Q}\left((\tilde{\theta},b),\hat{u}\right) = \max\left\{\boldsymbol{\lambda}_{\tilde{A}_Q}(\tilde{\theta},\hat{u}),\boldsymbol{\lambda}_{\tilde{N}_Q}(b,\hat{u})\right\}$$

$For\ all\ \tilde{\theta}, b\ in\ G\ and\ \hat{u} \in Q.$

3.6. Definition. Let $\tilde{A}_Q$ a Q −single valued neutrosophic subset in a set G, the strongest Q −single valued neutrosophic relation on G, that is a Q −single valued neutrosophic relation on $\tilde{A}_Q$ is H given by

$$\mu_H((\tilde{\theta},b),\hat{u}) = \min\{\mu_{\tilde{A}_Q}(\tilde{\theta},\hat{u}), \mu_{\tilde{N}_Q}(b,\hat{u})\}$$

$$\boldsymbol{\nu}_H((\tilde{\theta},b),\hat{u})=\max\{\boldsymbol{\nu}_{\tilde{A}_Q}(\tilde{\theta},\hat{u}),\boldsymbol{\nu}_{\tilde{N}_Q}(b,\hat{u})\}$$

$$\boldsymbol{\lambda}_H\left((\tilde{\theta},b),\hat{u}\right) = \max\left\{\boldsymbol{\lambda}_{\tilde{A}_Q}(\tilde{\theta},\hat{u}),\boldsymbol{\lambda}_{\tilde{N}_Q}(b,\hat{u})\right\}$$

$For\ all\ \tilde{\theta}, b\ in\ G\ and\ \hat{u} \in Q.$

4. Multi Q −Single Valued Neutrosophic Sets

4.1. Definition. Let X be a non-empty set and Q be any non-empty set , l be any positive integer and I be a unit interval $[0,1]$ .A multi Q −SVNS $\tilde{A}_Q$ in $\boldsymbol{X}$ and $\boldsymbol{Q}$ is a set of ordered sequences

$$\tilde{A}_Q = \{(\tilde{\theta},\hat{u}), \mu_j(\tilde{\theta},\hat{u}), \boldsymbol{\nu}_j(\tilde{\theta},\hat{u}), \boldsymbol{\lambda}_j(\tilde{\theta},\hat{u}): \tilde{\theta} \in X, \hat{u} \in Q\ for\ all\ j = 1,2,..,l\}$$

Where $\mu_j: X \times Q \to I^K$, $\boldsymbol{\nu}_j: X \times Q \to I^K$,$\boldsymbol{\lambda}_j: X \times Q \to I^K$,$for\ all\ j = 1,2, \ldots, l$

and are respectively truth-membership, indeterminacy-membership and falsity membership functions for each $\hat{\theta} \in X$ *and* $\hat{u} \in Q$ and satisfy the condition

$$0 \leq \mu_j(\hat{\theta},\hat{u}) + \boldsymbol{\nu}_j(\hat{\theta},\hat{u}) + \boldsymbol{\lambda}_j(\hat{\theta},\hat{u}) \leq 3, for\ all\ j = 1,2,\dots,l$$

The functions $\mu_j(\hat{\theta},\hat{u}), \boldsymbol{\nu}_j(\hat{\theta},\hat{u}), \boldsymbol{\lambda}_j(\hat{\theta},\hat{u})$ $for\ all$ $j = 1,2,\dots,l$ are called the "truth-membership , indeterminacy-membership and falsity-membership" functions respectively of the multi Q −SVNS $\tilde{A}_Q$ and satisfy the condition

$$0 \leq \mu_j(\hat{\theta},\hat{u}) + \boldsymbol{\nu}_j(\hat{\theta},\hat{u}) + \boldsymbol{\lambda}_j(\hat{\theta},\hat{u}) \leq 3, for\ all\ j = 1,2,\dots,l$$

l is called the dimension of the Q −SVNS $\tilde{A}_Q$.The set of all Q −SVNS is denoted by $Z^k QSVN(X)$.

4.2. Example. Let $X = \{\boldsymbol{p}_1, \boldsymbol{p}_2, \boldsymbol{p}_3\}$ be a universal set and $Q = \{\hat{u}, v\}$ be a non-empty set and $l = 2$ be a positive integer. If $\tilde{A}_Q: X \times Q \to I^2$,Then the set

$$\tilde{A}_Q = \{< \left((\boldsymbol{p}_1,\hat{u}),(0.2,0.3,0.6),(0.6,0.2,0.3)\right), \left((\boldsymbol{p}_1,\hat{v}),(0.5,0.1,0.3),(0.4,0.4,0.5)\right),$$
$$\left((\boldsymbol{p}_2,\hat{u}),(0.4,0.3,0.5),(0.6,0.1,0.3)\right), \left((\boldsymbol{p}_2,\hat{v}),(0.7,0.2,0.1),(0.2,0.4,0.8)\right) >\}$$

is a multi Q −SVNS in X and Q.

4.3. Remark. Note that if $\boldsymbol{\nu}_j(\hat{\theta},\hat{u}) = 0$ *and* $\boldsymbol{\lambda}_j(\hat{\theta},\hat{u}) = 0$ then multi Q −SVNS reduces to multi Q −fuzzy set.

4.4. Definition. Let $\tilde{A}_Q$ be a Q −SVNS. The the complement of $\tilde{A}_Q$ is denoted and defined as follows

$$\tilde{A}_Q^c = \{(\hat{\theta},\hat{u}), \boldsymbol{\lambda}_j(\hat{\theta},\hat{u}), 1 - \boldsymbol{\nu}_j(\hat{\theta},\hat{u}), \mu_j(\hat{\theta},\hat{u}) : \hat{\theta} \in X\ and\ \hat{u} \in Q, for\ all\ j = 1,2,\dots,l\}$$

4.5. Definition. Let $\tilde{A}_Q$ and A_Q ***and*** B_Q be two Q −SVNSs, and l be a positive integer such that

A=$\{(\hat{\theta},\hat{u}), \mu_j(\hat{\theta},\hat{u}), \boldsymbol{\nu}_j(\hat{\theta},\hat{u}), \boldsymbol{\lambda}_j : \hat{\theta} \in X\ and\ \hat{u} \in Q\ for\ all\ j = 1,2,\dots,l\}$ and

B=$\{(\hat{\theta},\hat{u}), \mu_j^*(\hat{\theta},\hat{u}), \boldsymbol{\nu}_j^*(\hat{\theta},\hat{u}), \boldsymbol{\lambda}_j^*(\hat{\theta},\hat{u}) : \hat{\theta} \in X\ and\ \hat{u} \in Q\ for\ all\ j = 1,2,\dots,l\}$

Then we define the following basic operations for Q −SVNSs.

1. $A \subset B$ iff $\mu_j(\hat{\theta},\hat{u}) \leq \mu_j^*(\hat{\theta},\hat{u}), \boldsymbol{\nu}_j(\hat{\theta},\hat{u}) \geq \boldsymbol{\nu}_j^*(\hat{\theta},\hat{u})$ and $\boldsymbol{\lambda}_j(\hat{\theta},\hat{u}) \geq \boldsymbol{\lambda}_j^*(\hat{\theta},\hat{u})$ $for\ all\ j = 1,2,\ldots,l.$
2. $A = B$ iff $\mu_j(\hat{\theta},\hat{u}) = \mu_j^*(\hat{\theta},\hat{u}), \boldsymbol{\nu}_j(\hat{\theta},\hat{u}) = \boldsymbol{\nu}_j^*(\hat{\theta},\hat{u})$ and $\boldsymbol{\lambda}_j(\hat{\theta},\hat{u}) = \boldsymbol{\lambda}_j^*(\hat{\theta},\hat{u})$ $for\ all\ j = 1,2,\ldots,l.$
3. $A \cup B = \{(\hat{\theta},\hat{u}), \max(\mu_j(\hat{\theta},\hat{u}), \mu_j^*(\hat{\theta},\hat{u})), \min\left(\boldsymbol{\nu}_j(\hat{\theta},\hat{u}), \boldsymbol{\nu}_j^*(\hat{\theta},\hat{u})\right), \min(\boldsymbol{\lambda}_j(\hat{\theta},\hat{u}), \boldsymbol{\lambda}_j^*(\hat{\theta},\hat{u}))\}$
4. $A \cap B = \{(\hat{\theta},\hat{u}), \min(\mu_j(\hat{\theta},\hat{u}), \mu_j^*(\hat{\theta},\hat{u})), \max\left(\boldsymbol{\nu}_j(\hat{\theta},\hat{u}), \boldsymbol{\nu}_j^*(\hat{\theta},\hat{u})\right), \max(\boldsymbol{\lambda}_j(\hat{\theta},\hat{u}), \boldsymbol{\lambda}_j^*(\hat{\theta},\hat{u}))\}$

5. Q −Single Valued Neutrosophic Soft Sets

In this section we introduce the concept of Q −SVNSSs by combining soft sets and Q − SVNS. We also define some basic operations and properties of Q − SVNSSs.

5.1. Definition. Let X be a universal set, Q be any non-empty set and E be the set of parameters. Let $Z^l QSVN(X)$ denote the set of all multi Q −single valued neutrosophic subsets of X with dimension $l = 1$ Let $K \subset E$ A pair (F_Q, K) is called Q − SVNSS over X where F_Q is a mapping given

$$F_Q : K \longrightarrow Z^l QSVN(X) \quad such\ that\ (F_{Q,}(\hat{\theta})) = \emptyset\ \ if\ \hat{\theta} \notin K$$

A Q − SVNSS can be represented by the set of ordered pairs

$$(F_Q, K) = \{\hat{\theta}, F_Q(\hat{\theta}) : \hat{\theta} \in X, F_Q(\hat{\theta}) \in Z^l QSVN(X)\}$$

5.2. Example. Let $X = \{\boldsymbol{p}_1, \boldsymbol{p}_2, \boldsymbol{p}_3, \boldsymbol{p}_4\}$ be a universal set, $E = \{\boldsymbol{k}_1, \boldsymbol{k}_2, \boldsymbol{k}_3, \boldsymbol{k}_4\}$ and $Q = \{\hat{u}, \hat{v}\}$ be a non-empty set. If $K = \{\boldsymbol{k}_1, \boldsymbol{k}_2, \boldsymbol{k}_3\} \subset E$,

$F_{Q,}(\boldsymbol{k}_1) = \{((\boldsymbol{p}_1,\hat{u}),(0.3,0.4,0.6)),((\boldsymbol{p}_1,\hat{v}),(0.2,0.3,0.5)),((\boldsymbol{p}_2,\hat{u}),(0.6,0.2,0.4))\}$

$F_{Q,}(\boldsymbol{k}_1) = \{((\boldsymbol{p}_1,\hat{u}),(0.5,0.3,0.4)),((\boldsymbol{p}_1,\hat{v}),(0.4,0.1,0.7)),((\boldsymbol{p}_3,\hat{u}),(0.8,0.1,0.2))\}$

$F_{Q,}(\boldsymbol{k}_3) = \{((\boldsymbol{p}_1,\hat{u}),(0.9,0.1,0.1)),((\boldsymbol{p}_1,\hat{v}),(0.8,0.2,0.3)),((\boldsymbol{p}_3,\hat{v}),(0.4,0.3,0.6))\}$

Then

$(F_Q,K) = \{(\boldsymbol{k}_1, ((\boldsymbol{p}_1,\hat{u}), (0.3,0.4,0.6)), ((\boldsymbol{p}_1,\hat{v}), (0.2,0.3,0.5)), ((\boldsymbol{p}_2,\hat{u}), (0.6,0.2,0.4)),$
$\boldsymbol{k}_2, ((\boldsymbol{p}_1,\hat{u}), (0.5,0.3,0.4)), ((\boldsymbol{p}_1,\hat{v}), (0.4,0.1,0.7)), ((\boldsymbol{p}_3,\hat{u}), (0.8,0.1,0.2)),$
$\boldsymbol{k}_3, ((\boldsymbol{p}_1,\hat{u}), (0.9,0.1,0.1)), ((\boldsymbol{p}_1,\hat{v}), (0.8,0.2,0.3)), ((\boldsymbol{p}_3,\hat{v}), (0.4,0.3,0.6))\}$

is a Q −SVNSS.

5.3. Definition. Let $(F_Q,K) \in QSVNSS(X)$. If $F_Q(\hat{\theta}) = \emptyset$ for all $\hat{\theta} \in E$ then (F_Q,K) is called a null Q −SVNSS denoted by $(\emptyset, K)$.

5.4. Example. Let X, E *and* Q be defined in the above example 5.2 then

$(\emptyset,K) = \{(\boldsymbol{k}_1, ((\boldsymbol{p}_1,\hat{u}), (0,1,1)), ((\boldsymbol{p}_1,\hat{v}), (0,1,1)), ((\boldsymbol{p}_2,\hat{u}), (0,1,1)), \boldsymbol{k}_2,$
$((\boldsymbol{p}_1,\hat{u}), (0,1,1)), ((\boldsymbol{p}_1,\hat{v}), (0,1,1)), ((\boldsymbol{p}_3,\hat{u}), (0,1,1)),$
$\boldsymbol{k}_3, ((\boldsymbol{p}_1,\hat{u}), (0,1,1)), ((\boldsymbol{p}_1,\hat{v}), (0,1,1)), ((\boldsymbol{p}_3,\hat{v}), (0,1,1))\}$

5.5. Definition. Let $(F_Q,K) \in QSVNSS(X)$, If $F_Q(\hat{\theta}) = X$ for all $\hat{\theta} \in E$ then (F_Q,K) is called a null $Q - SVNSS$ denoted by (X, K).

5.6. Example. Let X, E *and* Q be defined in the above example 5.2 then

$(X,K) = \{(\boldsymbol{k}_1, ((\boldsymbol{p}_1,\hat{u}), (1,0,0)), ((\boldsymbol{p}_1,\hat{v}), (1,0,0)), ((\boldsymbol{p}_2,\hat{u}), (1,0,0)),$
$\boldsymbol{k}_2, ((\boldsymbol{p}_1,\hat{u}), (1,0,0)), ((\boldsymbol{p}_1,\hat{v}), (1,0,0)), ((\boldsymbol{p}_3,\hat{u}), (1,0,0)),$
$\boldsymbol{k}_3, ((\boldsymbol{p}_1,\hat{u}), (1,0,0)), ((\boldsymbol{p}_1,\hat{v}), (1,0,0)), ((\boldsymbol{p}_3,\hat{v}), (1,0,0))\}$

5.7. Definition. Let $(F_Q,K), (G_Q,L) \in QSVNS(X)$. Then (F_Q,K) is Q −SVNSS subset of (G_Q,L) , denoted by $(F_Q,K) \subset (G_Q,L)$ if $K \subset L$ and $F_Q(\hat{\theta}) \subset G_Q(\hat{\theta})$ for all $\theta \in X$.

5.8. Proposition. Let $(F_Q,K), (G_Q,L), (M_Q,N) \in QSVNS(X)$. Then

1. $(F_Q,K) \subset (G_Q,E)$
2. $(\emptyset,K) \subset (G_Q,L)$
3. $(F_Q,K) \subset (G_Q,L)$ *and* $(G_Q,L) \subset (M_Q,N)$ then $(F_Q,K) \subset (M_Q,N)$.
4. If $(F_Q,K) = (G_Q,L)$ and $(G_Q,L)= (M_Q,N)$ *then* $(F_Q,K) = (M_Q,N)$

Proof : Straightforward.

5.9. Definition. Let $(F_Q,K) \in QSVNS(X)$, Then the complement of $Q -$ SVNSS set is written as $(F_Q,K)^C$ and is defined by $(F_Q,K)^C = (F_Q^C,\neg K)$ where

$$F_Q^C : \neg K \to QSVNS(X)$$

is the mapping given by F_Q^C(e) Q −single valued neutrosophic complement for each $e \in K$.

5.10. Proposition. Let $(F_Q,K) \in QSVNS(X)$, Then

1. $((F_Q,K)^C)^C = (F_Q,K)$
2. $(\emptyset,K)^C = (X,E)$
3. $(X,E)^C = (\emptyset,E)$

Proof . 1. Let $k \in K$. Then

$$(F_Q,K) = F_Q(k) = \{(\boldsymbol{p}_1,\hat{u}),\left(\mu_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u})\right): \hat{u} \in Q,\boldsymbol{p}_1 \in X\}$$

$$(F_Q,K)^C = (F_Q(k))^C = \left\{(\boldsymbol{p}_1,\hat{u}),\left(\boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),1-\boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\mu_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u})\right)\right\}$$

$$((F_Q,K)^C)^C = \left\{(\boldsymbol{p}_1,\hat{u}),\left(\mu_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),1-\left(1-\boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u})\right),\boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u})\right)\right\}$$

$$((F_Q,K)^C)^C = \left\{(\boldsymbol{p}_1,\hat{u}),\left(\mu_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u})\right)\right\}$$

$$((F_Q,K)^C)^C = (F_Q,K)$$

2. $Let\ (\emptyset,K) = (F_Q,K)$, Than for all $k \in K$

$$F_Q(k) = \{(\boldsymbol{p}_1,\hat{u}),\left(\mu_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u})\right): \hat{u} \in Q,\boldsymbol{p}_1 \in X\}$$
$$= \{(\boldsymbol{p}_1,\hat{u}),(0,1,1) : \hat{u} \in Q,\boldsymbol{p}_1 \in X\}$$

$$(\emptyset,K)^C = (F_Q,K)^C = (F_Q(k))^C = \{(\boldsymbol{p}_1,\hat{u}),(1,1-1,0): \hat{u} \in Q,\boldsymbol{p}_1 \in X\}$$
$$= \{(\boldsymbol{p}_1,\hat{u}),(1,0,0): \hat{u} \in Q,\boldsymbol{p}_1 \in X\}$$
$$= (X,E)$$

3. $Let\ (X,E) = (F_Q,E)$, Then for all $k \in K$

$$F_Q(k) = \{(\boldsymbol{p}_1,\hat{u}),\left(\mu_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u})\right): \hat{u} \in Q,\boldsymbol{p}_1 \in X\}$$

$= \{(\boldsymbol{p}_1, \hat{u}), (1{,}0{,}0) : \hat{u} \in Q, \boldsymbol{p}_1 \in X\}$

$(X, E)^C = (F_Q, E)^C = (F_Q(k))^C = \{(\boldsymbol{p}_1, \hat{u}), (0{,}1 - 0{,}1) : \hat{u} \in Q, \boldsymbol{p}_1 \in X\}$

$= \{(\boldsymbol{p}_1, \hat{u}), (0{,}1{,}1) : \hat{u} \in Q, \boldsymbol{p}_1 \in X\}$

$= (\emptyset, E)$

5.11. Definition. Let (F_Q, K) *and* $(G_Q, L) \in QSVNS(X)$ .Then the union of two Q −SVNSSs (F_Q, K) *and* (G_Q, L) is the Q −SVNSS, (M_Q, N) written as $(F_Q, K) \cup (G_Q, L) = (M_Q, N)$ where $N = K \cup L$ for all $l \in N$ and

$$(M_Q, N) = \begin{cases} F_Q(l) & if\ l \in K - L \\ G_Q(l) & if\ l \in L - K \\ F_Q(l) \cup G_Q(l) & if\ l \in K \cap L \end{cases}$$

5.12. Example. Let $X = \{\boldsymbol{p}_1, \boldsymbol{p}_2, \boldsymbol{p}_3, \boldsymbol{p}_4, \boldsymbol{p}_5\}$ be a universal set, $E = \{\boldsymbol{a}_1, \boldsymbol{a}_2, \boldsymbol{a}_3, \boldsymbol{a}_4, \boldsymbol{a}_5\}$ be a set of parameters and $Q = \{\hat{u}, \hat{v}, w\}$ be a non-empty set. Let $N = \{\boldsymbol{a}_1, \boldsymbol{a}_3, \boldsymbol{a}_4\} \subset E, and\ M = \{\boldsymbol{a}_1, \boldsymbol{a}_2, \boldsymbol{a}_3\}$

$(F_Q, N) = \{(\boldsymbol{a}_1, ((\boldsymbol{p}_1, \hat{u}), (0.3{,}0.4{,}0.5)), ((\boldsymbol{p}_1, \hat{v}), (0.5{,}0.3{,}0.4)), ((\boldsymbol{p}_1, w), (0.6{,}0.1{,}0.2)))$
$(\boldsymbol{a}_3, ((\boldsymbol{p}_1, \hat{u}), (0.2{,}0.3{,}0.4)), ((\boldsymbol{p}_1, \hat{v}), (0.4{,}0.2{,}0.3)), ((\boldsymbol{p}_1, w), (0.6{,}0.2{,}0.4)), ((\boldsymbol{p}_3, \hat{u}), (0.7{,}0.1{,}0.2)),$
$((\boldsymbol{p}_3, \hat{v}), (0.8{,}0.2{,}0.2)), ((\boldsymbol{p}_3, w), (0.2{,}0.4{,}0.6))\}), (\boldsymbol{a}_4, \{((\boldsymbol{p}_2, \hat{u}), (0.6{,}0.2{,}0.1)), ((\boldsymbol{p}_2, \hat{v}), (0.4{,}0.2{,}0.5))$
$, ((\boldsymbol{p}_2, w), (0.5{,}0.4{,}0.4))\},$

and

$(G_Q, M) = \{(\boldsymbol{a}_1, ((\boldsymbol{p}_1, \hat{u}), (0.4{,}0.3{,}0.5)), ((\boldsymbol{p}_1, \hat{v}), (0.3{,}0.3{,}0.4)), ((\boldsymbol{p}_1, w), (0.4{,}0.2{,}0.3))),$
$(\boldsymbol{a}_2, ((\boldsymbol{p}_2, \hat{u}), (0.4{,}0.5{,}0.2)), ((\boldsymbol{p}_2, \hat{v}), (0.7{,}0.1{,}0.1)), ((\boldsymbol{p}_2, w), (0.6{,}0.2{,}0.3)),$
$(\boldsymbol{a}_3, \{((\boldsymbol{p}_1, \hat{u}), (0.4{,}0.3{,}0.5), (\boldsymbol{p}_1, \hat{v}), (0.2{,}0.2{,}0.4), (\boldsymbol{p}_1, w), (0.4{,}0.1{,}0.4))$
$, ((\boldsymbol{p}_3, \hat{v}), (0.6{,}0.1{,}0.2)), ((\boldsymbol{p}_3, w), (0.7{,}0.2{,}0.3))\},$

Then

$(K_Q, L) = \{(\boldsymbol{a}_1, \{((\boldsymbol{p}_1, \hat{u}), (0.4{,}0.3{,}0.5)), ((\boldsymbol{p}_1, \hat{v}), (0.5{,}0.3{,}0.4)), ((\boldsymbol{p}_1, w), (0.6{,}0.1{,}0.2))\}),$
$\boldsymbol{a}_2, ((\boldsymbol{p}_2, \hat{u}), (0.4{,}0.5{,}0.2)), ((\boldsymbol{p}_2, \hat{v}), (0.7{,}0.1{,}0.1)), ((\boldsymbol{p}_2, w), (0.6{,}0.2{,}0.3)),$
$\boldsymbol{a}_3, ((\boldsymbol{p}_1, \hat{u}), (0.4{,}0.3{,}0.4)), ((\boldsymbol{p}_1, \hat{v}), (0.4{,}0.2{,}0.3)), ((\boldsymbol{p}_1, w), (0.6{,}0.1{,}0.4)), (\boldsymbol{p}_3, \hat{u}), (0.8{,}0.1{,}0.1),$
$(\boldsymbol{p}_3, \hat{v}), (0.8{,}0.1{,}0.2),$

$(\boldsymbol{p}_3, w), (0.7,0.2,0.3))\}) , \boldsymbol{a}_4, \{((\boldsymbol{p}_2, \hat{u}), (0.6,0.2,0.1)), ((\boldsymbol{p}_2, \hat{v}), (0.4,0.2,0.5)), ((\boldsymbol{p}_2, w), (0.5,0.4,0.4))\}$.

5.13. Definition. Let (F_Q, K) *and* $(G_Q, L) \in QSVNSS(X)$ .Then the intersection of two Q −SVNSSs, (F_Q, K) *and* (G_Q, L) is the $Q-$ SVNSS (M_Q, N) written as $(F_Q, K) \cap (G_Q, L) = (M_Q, N)$ where $N = K \cap L$ for all $l \in N$ and

$$(M_Q, N) = \{e, \min\left(\mu_{F_Q}(\hat{\theta}, \hat{u}), \mu_{G_Q}(\hat{\theta}, \hat{u})\right), \max\left(\boldsymbol{\nu}_{F_Q}(\hat{\theta}, \hat{u}), \boldsymbol{\nu}_{G_Q}(\hat{\theta}, \hat{u})\right),$$
$$\max\left(\lambda_{F_Q}(\hat{\theta}, \hat{u}), \lambda_{G_Q}(\hat{\theta}, \hat{u})\right) : \hat{\theta} \in X, \hat{u} \in Q \text{ and } j = 1,2, \dots, l\}$$

5.14. Example. Let $X = \{\boldsymbol{p}_1, \boldsymbol{p}_2, \boldsymbol{p}_3, \boldsymbol{p}_4, \boldsymbol{p}_5\}$ be a universal set, $E = \{\boldsymbol{a}_1, \boldsymbol{a}_2, \boldsymbol{a}_3, \boldsymbol{a}_4, \boldsymbol{a}_5\}$ be a set of parameters and $Q = \{\hat{u}, \hat{v}, w\}$ be a non-empty set. Let $N = \{\boldsymbol{a}_1, \boldsymbol{a}_3, \boldsymbol{a}_4\} \subset E, and\ M = \{\boldsymbol{a}_1, \boldsymbol{a}_2, \boldsymbol{a}_3\}$

$(F_Q, N) = \{(\boldsymbol{a}_1, ((\boldsymbol{p}_1, \hat{u}), (0.3,0.4,0.5)), ((\boldsymbol{p}_1, \hat{v}), (0.5,0.3,0.4)), ((\boldsymbol{p}_1, w), (0.6,0.1,0.2)))$
$(\boldsymbol{a}_3, ((\boldsymbol{p}_1, \hat{u}), (0.2,0.3,0.4)), ((\boldsymbol{p}_1, \hat{v}), (0.4,0.2,0.3)), ((\boldsymbol{p}_1, w), (0.6,0.2,0.4)), ((\boldsymbol{p}_3, \hat{u}), (0.7,0.1,0.2)),$
$((\boldsymbol{p}_3, \hat{v}), (0.8,0.2,0.2)), ((\boldsymbol{p}_3, w), (0.2,0.4,0.6))\}), (\boldsymbol{a}_4, \{((\boldsymbol{p}_2, \hat{u}), (0.6,0.2,0.1)), ((\boldsymbol{p}_2, \hat{v}), (0.4,0.2,0.5))$
$, ((\boldsymbol{p}_2, w), (0.5,0.4,0.4))\},$

and

$(G_Q, M) = \{(\boldsymbol{a}_1, ((\boldsymbol{p}_1, \hat{u}), (0.4,0.3,0.5)), ((\boldsymbol{p}_1, \hat{v}), (0.3,0.3,0.4)), ((\boldsymbol{p}_1, w), (0.4,0.2,0.3))),$
$(\boldsymbol{a}_2, ((\boldsymbol{p}_2, \hat{u}), (0.4,0.5,0.2)), ((\boldsymbol{p}_2, \hat{v}), (0.7,0.1,0.1)), ((\boldsymbol{p}_2, w), (0.6,0.2,0.3)),$
$(\boldsymbol{a}_3, \{((\boldsymbol{p}_1, \hat{u}), (0.4,0.3,0.5), (\boldsymbol{p}_1, \hat{v}), (0.2,0.2,0.4), (\boldsymbol{p}_1, w), (0.4,0.1,0.4))$
$, ((\boldsymbol{p}_3, \hat{v}), (0.6,0.1,0.2)), ((\boldsymbol{p}_3, w), (0.7,0.2,0.3))\},$

Then

$(K_Q, L) = \{(\boldsymbol{a}_1, \{((\boldsymbol{p}_1, \hat{u}), (0.3,0.4,0.5)), ((\boldsymbol{p}_1, \hat{v}), (0.3,0.3,0.4)), ((\boldsymbol{p}_1, w), (0.4,0.2,0.3))\}),$
$\boldsymbol{a}_3, ((\boldsymbol{p}_1, \hat{u}), (0.2,0.3,0.5)), ((\boldsymbol{p}_1, \hat{v}), (0.2,0.2,0.4)), ((\boldsymbol{p}_1, w), (0.4,0.2,0.4)), (\boldsymbol{p}_3, \hat{u}), (0.7,0.2,0.2),$
$(\boldsymbol{p}_3, \hat{v}), (0.6,0.2,0.2), (\boldsymbol{p}_3, w), (0.2,0.4,0.6))\})$

5.15 Proposition. Let $(F_Q, K), (M_Q, N)$ *and* $(G_Q, L) \in QSVNSS(X)$. Then

1. $(F_Q, K) \cup (\emptyset, K) = (F_Q, K)$
2. $(F_Q, K) \cup (X, K) = (X, K)$
3. $(F_Q, K) \cup (F_Q, K) = (F_Q, K)$

4. $(F_Q,K) \cup (G_Q,L) = (G_Q,L) \cup (F_Q,K)$
5. $(F_Q,K) \cup ((G_Q,L) \cup (M_Q,N)) = ((G_Q,L) \cup (F_Q,K))) \cup (M_Q,N)$

Proof. 1. We have

$(F_Q,K) = \{(\boldsymbol{p}_1,\hat{u}),\left(\mu_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u})\right):\hat{u}\in Q,\boldsymbol{p}_1\in X$

$(\emptyset,K) = \{(\boldsymbol{p}_1,\hat{u}),(0,1,1) : \hat{u}\in Q,\boldsymbol{p}_1 \in X\}$

$(F_Q,K) \cup (\emptyset,K)$

$= \{k,\left(\left\{(\boldsymbol{p}_1,\theta\hat{u}),\max\left(\mu_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),0\right),\min\left(\boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),1\right),\min\left(\boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),1\right)\right\}\right)\}$

$=\{(\boldsymbol{p}_1,\hat{u}),\left(\mu_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p}_1,\tilde{\hat{u}})\right):\hat{u}\in Q,\boldsymbol{p}_1\in X$

$=(F_Q,K)$

2. Let $(X,K) = (G_Q,K)$ then

$(F_Q,K) = \{(\boldsymbol{p}_1,\tilde{\hat{u}}),\left(\mu_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u})\right):\hat{u}\in Q,\boldsymbol{p}_1\in X\}$

$(G_Q,L) = \{(\boldsymbol{p}_1,\hat{u}),(1,0,0) : \hat{u}\in Q,\boldsymbol{p}_1 \in X\}$

$(F_Q,K) \cup (G_Q,K)$

$= \{k,\left(\left\{(\boldsymbol{p}_1,\hat{u}),\max\left(\mu_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),1\right),\min\left(\boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),0\right),\min\left(\boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),0\right)\right\}\right)\}$

$=\{(\boldsymbol{p}_1,\hat{u}),(1,0,0):\hat{u}\in Q,\boldsymbol{p}_1\in X\}$

$=(G_Q,K) = (X,K)$

3. Let

$(F_Q,K) = \{(\boldsymbol{p}_1,\hat{u}),\left(\mu_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u})\right):\hat{u}\in Q,\boldsymbol{p}_1\in X$

$(F_Q,K) \cup (F_Q,K)$

$$= \{k,\left(\left\{\begin{array}{c}(\boldsymbol{p}_1,\hat{u}),\max\left(\mu_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\mu_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u})\right),\min\left(\boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u})\right),\\ \min\left(\boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u})\right):\hat{u}\in Q,\boldsymbol{p}_1\in X\}\end{array}\right\}\right)\}$$

$= \{(\boldsymbol{p}_1,\hat{u}),\left(\mu_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u}),\boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p}_1,\hat{u})\right):\hat{u}\in Q,\boldsymbol{p}_1\in X$

$=(F_Q,K)$

4 and 5 can be proved easily in a similar way.

5.16. Proposition. Let $(F_Q,K), (M_Q,N)$ and $(G_Q,L) \in QSVNSS(X)$. Then

1. $(F_Q,K) \cap (\emptyset,K) = (\emptyset,K)$
2. $(F_Q,K) \cap (X,K) = (F_Q,K)$
3. $(F_Q,K) \cap (F_Q,K) = (F_Q,K)$
4. $(F_Q,K) \cap (G_Q,L) = (G_Q,L) \cap (F_Q,K)$
5. $(F_Q,K) \cap ((G_Q,L) \cap (M_Q,N)) = ((G_Q,L) \cap (F_Q,K)) \cap (M_Q,N)$

Proof. 1. We have

$(F_Q,K) = \{(\boldsymbol{p_1},\hat{u}),\left(\mu_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u}), \boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u}), \boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u})\right): \hat{u} \in Q, \boldsymbol{p_1} \in X$

$(\emptyset,K) = \{(\boldsymbol{p_1},\hat{u}),(0,1,1) : \hat{u} \in Q, \boldsymbol{p_1} \in X\}(F_Q,K) \cap (\emptyset,K)$

$= \{k,\left(\left\{(\boldsymbol{p_1},\hat{u}), \min\left(\mu_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u}),0\right), \max\left(\boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u}),1\right), \max\left(\boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u}),1\right)\right\}\right)\}$

$=\{(\boldsymbol{x_1},\hat{u}),(0,1,1): \hat{u} \in Q, \boldsymbol{p_1} \in X$

$= (\emptyset,K)$

2. Let $(X,K) = (G_Q,L)$ then

$(F_Q,K) = \{(\boldsymbol{p_1},\hat{u}),\left(\mu_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u}), \boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u}), \boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u})\right): \hat{u} \in Q, \boldsymbol{p_1} \in X\}$

$(G_Q,L) = \{(\boldsymbol{p_1},\tilde{u}),(1,0,0) : \tilde{u} \in Q, \boldsymbol{p_1} \in X\}$

$(F_Q,K) \cap (G_Q,L)$

$= \{k,\left(\left\{(\boldsymbol{p_1},\hat{u}), \min\left(\mu_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u}),1\right), \max\left(\boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u}),0\right), \max\left(\boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u}),0\right)\right\}\right)\}$

$=\{(\boldsymbol{p_1},\hat{u}),\left(\mu_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u}), \boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u}), \boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u})\right): \hat{u} \in Q, \boldsymbol{p_1} \in X\}$

$= (F_Q,K)$

3. Let

$(F_Q,K) = \{(\boldsymbol{p_1},\hat{u}),\left(\mu_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u}), \boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u}), \boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u})\right): \hat{u} \in Q, \boldsymbol{p_1} \in X\}$

$(F_Q,K) \cap (F_Q,K) = \{(\boldsymbol{p_1},\hat{u}),(min\left(\mu_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u}), \mu_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u})\right),$

$\min\left(\boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u}), \boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u})\right), \boldsymbol{min}(\boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u}), \boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u})): \hat{u} \in Q, \boldsymbol{p_1} \in X\}$

$=\{(\boldsymbol{p_1},\hat{u}),\left(\mu_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u}), \boldsymbol{\nu}_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u}), \boldsymbol{\lambda}_{F_{Q(k)}}(\boldsymbol{p_1},\hat{u})\right): \hat{u} \in Q, \boldsymbol{p_1} \in X\}$

$=(F_Q,K)$

4 and 5 can be proved easily in a similar way.

5.17. Proposition. Let (F_Q,K) and $(G_Q,L) \in QSVNSS(X)$. Then

1. $((F_Q,K) \cup (G_Q,L))^C = (F_Q,K)^C \cap (G_Q,L)^C$
2. $((F_Q,K) \cap (G_Q,L))^C = (F_Q,K)^C \cup (G_Q,L)^C$

Proof. Straightforward

5.18. Proposition. Let $(F_Q,K), (M_Q,N)$ and $(G_Q,L) \in QSVNSS(X)$. **Then**

$(F_Q,K) \cap ((G_Q,L) \cup (M_Q,N)) = ((F_Q,K) \cap (G_Q,L)) \cup ((F_Q,K)) \cap (M_Q,N))$

$(F_Q,K) \cup ((G_Q,L) \cap (M_Q,N)) = ((F_Q,K) \cup (G_Q,L)) \cap ((F_Q,K) \cup (M_Q,N)$

Proof. Straightforward.

5.19. Definition. Let $(F_Q,K), (M_Q,N)$ and $(G_Q,L) \in QSVNSS(X)$. Then the "AND" operation of two $Q-$ SVNSSs (F_Q,K) and $(G_Q,L)$is the $Q-$ SVNSS denoted by $(F_Q,K) \wedge (G_Q,L)$ and is defined by

$$(F_Q,K) \wedge (G_Q,L) = (M_Q,K \times L)$$

Where $M_Q(\gamma,\delta) = F_Q(\gamma) \cap G_Q(\delta)$ for all $\gamma \in K,\ \delta \in L$ is the intersection of two $Q-$ SVNSSs.

5.20. Definition. Let $(F_Q,K), (M_Q,N)$ and $(G_Q,L) \in QSVNS(X)$.Then the "OR" operation of two $Q-$ SVNSSs (F_Q,K) and (G_Q,L) is the $Q-$ SVNSS denoted by $(F_Q,K) \vee (G_Q,L)$ and is defined by

$$(F_Q,K) \vee (G_Q,L)) = (M_Q,K \times L)$$

Where $M_Q(\gamma,\delta) = F_Q(\gamma) \cup G_Q(\delta)$ for all $\gamma \in K,\ \delta \in L$ is the union of two $Q-$SVNSSs.

Conclusion

In this paper we have inaugurated the concept of Q-SVNS, Multi Q-SVNS. We also gave the concept of Q- SVNSS and studied some related properties with associate proofs. The equality, subset, complement, union, intersection, AND or OR operations have been defined on the Q- SVNSS. This new wing will be more useful than Q-fuzzy soft set, Q-intuitionistic fuzzy soft set and provide a substantial addition to existing theories for handling uncertainties, and pass to possible areas of further research and relevant applications.

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