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Some Super Hyper Degrees and Co-Super Hyper Degrees on Neutrosophic Super Hyper Graphs and Super Hyper Graphs Alongside Applications in Cancer's Treatments

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Abstract

In this research, new setting is introduced for new notions, namely, Super Hyper Degree and Co-Super Hyper Degree. Two different types of definitions are debut for them but the research goes further and the Super Hyper Notion, Super Hyper Uniform, and Super Hyper Class based on that are well-defined and well-reviewed. The literature review is implemented in the whole of this research. For shining the elegancy and the significancy of this research, the comparison between this Super Hyper Notion with other Super Hyper Notions and fundamental Super Hyper Numbers are featured. The definitions are followed by the examples and the instances thus the clarifications are driven with different tools. The applications are figured out to make sense about the theoretical aspect of this ongoing research. The cancer's treatments are the under research to figure out the challenges make sense about ongoing and upcoming research. The special case is up. The cells are viewed in the deemed ways. There are different types of them. Some of them are individuals and some of them are well-modeled by the group of cells. These types are all officially called "Super Hyper Vertex" but the relations amid them all officially called "Super Hyper Edge". The frameworks "Super Hyper Graph" and "neutrosophic Super Hyper Graph" are chosen and elected to research about "cancer's treatments". Thus, these complex and dense Super Hyper Models open up some avenues to research on theoretical segments and "cancer's treatments". Some avenues are posed to pursue this research. It's also officially collected in the form of some questions and some problems. If there's a Super Hyper Edge between two Super Hyper Vertices, then these two Super Hyper Vertices are called Super Hyper Neighbors. The number of Super Hyper Neighbors for a given Super Hyper Vertex is called Super Hyper Degree. The number of common Super Hyper Neighbors for some Super Hyper Vertices is called Co-Super Hyper Degree for them and used Super Hyper Vertices are called Co-Super Hyper Neighbors. A graph is Super Hyper Uniform if it's Super Hyper Graph and the number of elements of Super Hyper Edges are the same. Assume a neutrosophic Super Hyper Graph. There are some Super Hyper Classes as follows. It's SuperHyperPath if it's only one SuperVertex as intersection amid two given Super Hyper Edges with two exceptions; it's SuperHyperCycle if it's only one SuperVertex as intersection amid two given Super Hyper Edges; it's Super Hyper Star it's only one SuperVertex as intersection amid all Super Hyper Edges; it's SuperHyperBipartite it's only one SuperVertex as intersection amid two given Super Hyper Edges and these SuperVertices, forming two separate sets, has no Super Hyper Edge in common; it's SuperHyperMultiPartite it's only one SuperVertex as intersection amid two given Super Hyper Edges and these SuperVertices, forming multi separate sets, has no Super Hyper Edge in common; it's SuperHyperWheel if it's only one SuperVertex as intersection amid two given Super Hyper Edges and one SuperVertex has one Super Hyper Edge with any common SuperVertex. The number of Super Hyper Edges for a given Super Hyper Vertex is called Super Hyper Degree.

The number of common Super Hyper Edges for some Super Hyper Vertices is called Co-Super Hyper Degree for them. The number of Super Hyper Vertices for a given Super Hyper Edge is called Super Hyper Degree. The number of common Super Hyper Vertices for some Super Hyper Edges is called Co-Super Hyper Degree for them. The model proposes the specific designs. The model is officially called "Super Hyper Graph" and "Neutrosophic Super Hyper Graph". In this model, the "specific" cells and "specific group" of cells are modeled as "Super Hyper Vertices" and the common and intended properties between "specific" cells and "specific group" of cells are modeled as "Super Hyper Edges". Sometimes, it's useful to *have some degrees of determinacy, indeterminacy, and neutrality to have more precise model which in this case the model is called "neutrosophic". In the future research, the foundation will be based on the caner's treatment and the results and the definitions will be introduced in redeemed ways. A basic familiarity with Super Hyper Graph theory and neutrosophic Super Hyper Graph theory is proposed.*

Keywords: (Neutrosophic) SuperHyperGraph, (Neutrosophic) SuperHyperDegrees,Cancer's Treatments

AMS Subject Classification: 05C17, 05C22, 05E45

Background

There are some studies covering the topic of this research. In what follows, there are some discussion and literature reviews about them.

First article is titled "properties of Super Hyper Graph and neutrosophic Super Hyper Graph" in **Ref**. [8] by Henry Garrett (2022). It's first step toward the study on neutrosophic Super Hyper Graphs. This research article is published on the journal "Neutrosophic Sets and Systems" in issue 49 and the pages 531-561. In this research article, different types of notions like dominating, resolving, coloring, Eulerian(Hamiltonian) neutrosophic path, n-Eulerian(Hamiltonian) neutrosophic path, zero forcing number, zero forcing neutrosophic- number, independent number, independent neutrosophic-number, clique number, clique neutrosophic-number, matching number, matching neutrosophic-number, girth, neutrosophic girth, 1-zero-forcing number, 1-zero- forcing neutrosophic-number, failed 1-zero-forcing number, failed 1-zero-forcing neutrosophic-number, global- offensive alliance, t-offensive alliance, t-defensive alliance, t-powerful alliance, and global-powerful alliance are defined in Super Hyper Graph and neutrosophic Super Hyper Graph. Some Classes of Super Hyper Graph and Neutrosophic Super Hyper Graph are cases of study. Some results are applied in family of Super Hyper Graph and neutrosophic Super Hyper Graph. Thus, this research article has concentrated on the vast notions and introducing the majority of notions.

The seminal paper and groundbreaking article are titled "neutrosophic co-degree and neutrosophic degree alongside chromatic numbers in the setting of some classes related to neutrosophic hypergraphs" in **Ref**. [6] by Henry Garrett (2022). In this research article, a novel approach is implemented on Super Hyper Graph and neutrosophic Super Hyper Graph based on general forms without using neutrosophic classes of neutrosophic Super Hyper Graph. It's published in prestigious and fancy journal is entitled "Journal of Current Trends in Computer Science Research (JCTCSR)" with abbreviation "J Curr Trends Comp Sci Res" in volume 1 and issue 1 with pages 06-14. The research article studies deeply with choosing neutrosophic hypergraphs instead of neutrosophic Super Hyper Graph. It's the breakthrough toward independent results based on initial background.

In two articles are titled "Initial Material of Neutrosophic Preliminaries to Study Some Neutrosophic Notions Based on Neutrosophic Super Hyper Edge (NSHE) in Neutrosophic Super Hyper Graph (NSHG)" in **Ref**. [5] by Henry Garrett (2022) and "Basic Neutrosophic Notions Concerning SuperHyperDominating and Neutrosophic SuperHyperResolving in Super Hyper Graph" in **Ref**. [3] by Henry Garrett (2022), there are some efforts to formalize the basic notions about neutrosophic Super Hyper Graph and Super Hyper Graph.

Some studies and researches about neutrosophic graphs, are proposed as book in **Ref**. [4] by Henry Garrett (2022) which is indexed by Google Scholar and has more than 2225 readers in Scribd. It's titled "Beyond Neutrosophic Graphs" and published by Ohio: E-publishing: Educational Publisher 1091 West 1st Ave Grandview Heights, Ohio 43212 United State. This research book covers different types of notions and settings in neutrosophic graph theory and neutrosophic Super Hyper Graph theory.

Also, some studies and researches about neutrosophic graphs, are proposed as book in **Ref**. [7] by Henry Garrett (2022) which is indexed by Google Scholar and has more than 2921 readers in Scribd. It's titled "Neutrosophic Duality" and published by Florida: GLOBAL KNOWLEDGE - Publishing House 848 Brickell Ave Ste 950 Miami, Florida 33131 United States. This research book presents different types of notions SuperHyperResolving and SuperHyperDominating in the setting of duality in neutrosophic graph theory and neutrosophic Super Hyper Graph theory. This research book has scrutiny on the complement of the intended set and the intended set, simultaneously. It's smart to consider a set but acting on its complement that what's done in this research book which is popular in the terms of high readers in Scribd.

Motivation and Contributions

In this research, there's an idea which could be considered as a motivation. I try to bring the motivation in the narrative ways. Some cells have been faced with some attacks from the situation which is caused by the cancer's attacks. In this case, there are some embedded analysis on the ongoing situations which in that, the cells could be labelled as some groups and some groups or individuals have excessive labels which all are raised from the behaviors to overcome the cancer's attacks. In the embedded situations, the individuals of cells and the groups of cells could be considered as "new groups". Thus, it motivates us to find the proper model for getting more proper analysis on this messy story. I've found the SuperHyperModels which are officially called "Super Hyper Graphs" and

"Neutrosophic Super Hyper Graphs". In this SuperHyperModel, the cells and the groups of cells are defined as "Super Hyper Vertices" and the relations between the individuals of cells and the groups of cells are defined as "Super Hyper Edges". Thus, it's another motivation for us to do research on this SuperHyperModel based on the "cancer's treatments". Sometimes, the situations get worst. The situation is passed from the certainty and precise style. Thus, it's the beyond them. There are three descriptions, namely, the degrees of determinacy, indeterminacy and neutrality, for any object based on vague forms, namely, incomplete data, imprecise data, and uncertain analysis. The latter model could be considered on the previous SuperHyperModel. It's SuperHyperModel. It's Super Hyper Graph but it's officially called "Neutrosophic Super Hyper Graphs".

Question 1.1. *How to define the notions and to do research on them to find the "amount" of either individual of cells or the groups of cells based on the fixed cell or the fixed group of cells, extensively, the "common amount" of based on the fixed groups of cells or the fixed groups of groups of cells?*

Question 1.2. *What are the best descriptions for the cancer's treatments in terms of these messy and dense SuperHyperModels where embedded notions are illustrated?*

It's motivation to find notions to use in this dense model is titled "Super Hyper Graphs". Thus, it motivates us to define different types of "Super Hyper Degree" and "Co-Super Hyper Degree" on "Super Hyper Graph" and "Neutrosophic Super Hyper Graph". Then the research has taken more motivations to define Super Hyper Classes and to find some connections amid this Super Hyper Notion with other Super Hyper Notions. It motivates us to get some instances and examples to make clarifications about the framework of this research. The general results and some results about some connections are some avenues to make key point of this research, "cancer's treatments", more understandable and more clear.

The framework of this study is as follows. In the beginning, I introduce basic definitions to clarify about preliminaries. In the subsection "Preliminaries", initial definitions about Super Hyper Graphs and neutrosophic Super Hyper Graph are deeply-introduced and in-depth-discussed. The elementary concepts are clarified and illustrated completely and sometimes review literature are applied to make sense about what's going to figure out about the upcoming sections. The main definitions and their clarifications alongside some results about new notions, Super Hyper Degree and Co-Super Hyper Degree are figured out in section "New Ideas on Super Hyper Graphs". In the sense of tackling on getting results and in order to make sense about continuing the research, the ideas of Super Hyper Uniform and Neutrosophic Super Hyper Uniform are introduced and as their consequences, corresponded Super Hyper Classes are figured out to debut what's done in this section, titled "Super Hyper Uniform and Neutrosophic Super Hyper Uniform". As going back to origin of the notions, there are some smart steps toward the common notions to extend the new notions in new frameworks, Super Hyper Graph and Neutrosophic Super Hyper Graph, in the section "Super Hyper Degree and Co-Super Hyper Degree: Common and Extended Definition in Super Hyper Graphs". The starter research about the relation with Super Hyper Parameters and as concluding and closing section of theoretical research are contained in section "The Relations with Super Hyper Parameters". Some Super Hyper Parameters are fundamental and they are well-known as fundamental numbers as elicited and discussed in the sections, "The Relations With Super Hyper Dominating" and "The Relations with Super Hyper Resolving". There are curious questions about what's done about the relations with Super Hyper Parameters to make sense about excellency of this research and going to figure out the word "best" as the description and adjective for this research as presented in sections, "The Relations With Super Hyper Order", "The Relations with Super Hyper Regularity", "The Minimum Super Hyper Degree", "The Maximum Super Hyper Degree". The keyword of this research debut in the section "Applications in Cancer's Treatments" with two cases and subsections "Case 1: Super Hyper Degree and Co-Super Hyper Degree in the Simple Super Hyper Model" and "Case 2: Super Hyper Degree and Co-Super Hyper Degree in the More Complicated Super Hyper Model". In the section, "Open Problems", there are some scrutiny and discernment on what's done and what's happened in this research in the terms of "questions" and "problems" to make sense to figure out this research in featured style. The advantages and the limitations of this research alongside about what's done in this research to make sense and to get sense about what's figured out are included in the section, "Conclusion and Closing Remarks".

Preliminaries

In this subsection, basic material which is used in this article, is presented. Also, new ideas and their clarifications are elicited.

Definition 1.3 (Neutrosophic Set). (**Ref**. [2], Definition 2.1, p.87). Let X be a space of points (objects) with generic elements in X denoted by x; then the **neutrosophic set** A $(NS\ A)$ is an object having the form

$$A = \{< x: T_A(x), I_A(x), F_A(x) >, x \in X\}$$

where the functions $T, I, F: X \rightarrow]^{-}0,1^{+}[$ define respectively the a **truth-membership function,** an **indeterminacy-membership function,** and a **falsity-membership function** of the element $x \in X$ to the set A with the condition

$$-0 \leq T_A(x) + I_A(x) + F_A(x) \leq 3^{+}.$$

The functions $T_A(x), I_A(x)$ and $F_A(x)$ are real standard or nonstandard subsets of $]^{-}0,1^{+}[$.

Definition 1.4 (Single Valued Neutrosophic Set). (**Ref**. [11], Definition 6, p.2).

Let X be a space of points (objects) with generic elements in X denoted by x. A

single valued neutrosophic set A *(SVNS A)* is characterized by truth-membership function $TA(x)$, an indeterminacy-membership function $I_A(x)$, and a falsity-membership function $F_A(x)$. For each point x in X, $T_A(x),I_A(x),F_A(x) \in [0,1]$. A SVNS A can be written as

$A = \{< x: TA(x),IA(x),FA(x) >,x \in X\}$.

Definition 1.5. The degree of truth-membership, indeterminacy-membership and falsity-membership of the subset $X \subset A$ of the single valued neutrosophic

set $A = \{< x: T_A(x), IA(x), FA(x) >, x \in X\}$:
$TA(X) = \min [TA (vi), TA (vj)]vi,vj\in X$,
$IA(X) = \min [IA (vi), IA (vj)]vi,vj\in X$,
and $FA(X) = \min [FA (vi), FA (vj)]vi,vj\in X$.

Definition 1.6. The **support** of $X \subset A$ of the single valued neutrosophic *set* $A = \{< x: T_A(x),I_A(x),F_A(x) >,x \in X\}$:

$supp(X) = \{x \in X: T_A(x),I_A(x),F_A(x) > 0\}$.

Definition 1.7 (Neutrosophic Super Hyper Graph (NSHG)). (**Ref**. [10], Definition 3, p.291).

Assume V^0 is a given set. A **neutrosophic Super Hyper** Graph (NSHG) S is an ordered pair $S = (V,E)$, where
(i) $V = \{V_1,V_2,...,V_n\}$ a finite set of finite single valued neutrosophic subsets of V^0;
(ii) $V = \{(V_i,T_V\ 0(V_i),I_V\ 0(V_i),F_V\ 0(V_i)) : T_V\ 0(V_i),I_V\ 0(V_i),F_V\ 0(V_i) \geq 0\}, (i = 1,2,...,n)$;
(iii) $E = \{E_1,E_2,...,E_n 0\}$ a finite set of finite single valued neutrosophic subsets of V ;
(iv) $E = \{(E_i0,T_V^{\ 0} (E_i^0),I_V0 (E_i0),F_V^{\ 0} (E_i0)) : T_V^{\ 0} (E_i0),I_V^{\ 0} (E_i^0),F_V^{\ 0} (E^i0) \geq 0\}, (i^0 = 1,2,...,n^0)$;
(v) V_i 6= ∅, $(i = 1,2,...,n)$;
(vi) E_i0 6= ∅, $(i^0 = 1,2,...,n^0)$;
(vii) $^{P}i\ supp\ (V_i) = V, (i = 1,2,...,n)$; (*viii*) $P_i0\ supp(E_i0) = V, (i^0 = 1,2,...,n^0)$; (*ix*) and the following conditions hold:

$T_V^{\ 0} (E^{i0}) \leq \min [T_V\ 0(V_i),T_V 0(V_j)]_{Vi,V_{j\in Ei}}0$,

$I_V^{\ 0} (E_i0) \leq \min [I_V\ 0(V_i),I_V\ 0(V_j)]V_i,V_j\in E_i0$, and $F_V0\ (E_i0) \leq \min[F_V\ 0(V_i),F_V\ 0(V_j)]V_i,V_j\in E_i0$

where $i^0 = 1,2,...,n^0$.

Here the neutrosophic Super Hyper Edges (NSHE) E_j0 and the neutrosophic Super Hyper Vertices (NSHV) V_j are single valued neutrosophic sets. $T_V\ 0(V_i),I_V\ 0(V_i)$, and $F_V0(V_i)$ denote the degree of truth-membership, the degree of indeterminacy-membership and the degree of falsity-membership the neutrosophic Super Hyper Vertex (NSHV) V_i to the neutrosophic Super Hyper Vertex (NSHV) V. $T_V0\ (E_i0),T_V0\ (E_i0)$, and TV0 (Ei0) denote the degree of truth-membership, the degree of indeterminacy-membership and the degree of falsity-membership of the neutrosophic Super Hyper Edge (NSHE) *Ei*0 to the neutrosophic Super Hyper Edge (NSHE) E. Thus, the ii^0th element of the **incidence matrix** of neutrosophic Super Hyper Graph (NSHG) are of the form $(V_i,T_V^{\ 0} (E_i0),I_V^{\ 0} (E_i^{\ 0}),F_V^{\ 0} (E_i0))$, the sets V and E are crisp sets.

Definition 1.8 (Characterization of the Neutrosophic Super Hyper Graph (NSHG)). (**Ref**. [10], Section 4, pp.291-292).

Assume a neutrosophic Super Hyper Graph (NSHG) S is an ordered pair $S = (V, E)$. The neutrosophic Super Hyper Edges (NSHE) Ei0 and the neutrosophic

Super Hyper Vertices (NSHV) Vi of neutrosophic Super Hyper Graph (NSHG) S = (V, E) could be characterized as follow-up items.

(i) If $|V_i| = 1$, then V_i is called **vertex**;
(ii) if $|V_i| \geq 1$, then V_i is called **SuperVertex;**
(iii) if for all V_is are incident in E_i0, $|Vi| = 1$, and $|E_i0| = 2$, then E_i0 is called edge;
(iv) if for all Vis are incident in Ei0, |Vi| = 1, and |Ei0| ≥ 2, then E_i^0 is called **HyperEdge**;
(v) if there's a V_i is incident in E_i0 such that $|V_i| \geq 1$, and $|E_i0| = 2$, then E_i0 is called **SuperEdge**;
(vi) if there's a V_i is incident in E_i0 such that $|V_i| \geq 1$, and $|E_i0| \geq 2$, then E_i0 is called **Super Hyper Edge.**

If we choose different types of binary operations, then we could get hugely diverse types of general forms of neutrosophic Super Hyper Graph (NSHG).

Definition 1.9 (t-norm). (**Ref**. [9], Definition 5.1.1, pp.82-83).
A binary operation $\otimes$: $[0,1] \times [0,1] \to [0,1]$ is a *t*-**norm** if it satisfies the following for $x,y,z,w \in [0,1]$:
(i) $1 \otimes x = x$;
(ii) $x \otimes y = y \otimes x$;
(iii) $x \otimes (y \otimes z) = (x \otimes y) \otimes z$;
(iv) If $w \leq x$ and $y \leq z$ then $w \otimes y \leq x \otimes z$.

Definition 1.10. The degree of truth-membership, indeterminacy-membership and falsity-membership of the subset $X \subset A$ of the single valued neutrosophic set $A = \{< x: T_A(x),I_A(x),F_A(x) >,x \in X\}$ (with respect to t-norm T_{norm}):

$TA(X) = T_{norm}[TA(vi),TA(vj)]vi,vj\in X$,
$IA(X) = T_{norm}[IA(vi),IA(vj)]vi,vj\in X$,
and $FA(X) = T^{norm}[FA(vi),FA(vj)]vi,vj\in X$.

Definition 1.11. The **support** of $X \subset A$ of the single valued neutrosophic set $A = \{< x: T_A(x), IA(x), FA(x) >, x \in X\}$:
$supp(X) = \{x \in X: T_A(x), IA(x), FA(x) > 0\}$.

Definition 1.12. (General Forms of Neutrosophic Super Hyper Graph (NSHG)). Assume V 0 is a given set. A **neutrosophic Super Hyper Graph** (NSHG) S is an ordered pair $S = (V, E)$, where
(i) $V = \{V_1, V_2, ..., V_n\}$ a finite set of finite single valued neutrosophic subsets of V^0;
(ii) $V = \{(V_i, T^V 0(V^i), I_V 0(V_i), F_V 0(V_i)) : T_V 0(V_i), I_V 0(V^i), F^V 0(V^i) \geq 0\}$, $(i = 1,2,...,n)$;
(iii) $E = \{E_1, E_2, ..., E_n 0\}$ a finite set of finite single valued neutrosophic subsets of V;
(iv) $E = \{(E_i 0, TV^0 (E_i 0), I_V^0 (E_i^0), FV^0 (E_i 0)) : T_V 0 (E_i 0), IV0 (Ei0), F_V^0 (E_i^0) \geq 0\}$, $(i^0 = 1,2,...,n^0)$;
(v) V^i 6= ∅, $(i = 1,2,...,n)$;
(vi) $E_i 0$ 6= ∅, $(i^0 = 1,2,...,n^0)$; (vii) $^P i \ supp(V_i) = V, (i = 1,2,...,n)$;
(viii) $^P{}_i 0 \ supp(E_i 0) = V, (i^0 = 1,2,...,n^0)$.

Here the neutrosophic Super Hyper Edges (NSHE) $E_j 0$ and the neutrosophic Super Hyper Vertices (NSHV) V_j are single valued neutrosophic sets. $T_V 0(V_i), I_V 0(V_i)$, and $F_V 0(V_i)$ denote the degree of truth-membership, the degree of indeterminacy-membership and the degree of falsity-membership the neutrosophic Super Hyper Vertex (NSHV) V_i to the neutrosophic Super Hyper Vertex (NSHV) V. $T_V^0 (E_i 0), T_V^0 (E_i^0)$, and $T_V^0 (E_i 0)$ denote the degree of truth-membership, the degree of indeterminacy-membership and the degree of falsity-membership of the neutrosophic Super Hyper Edge (NSHE) E_i^0 to the neutrosophic Super Hyper Edge (NSHE) E. Thus, the ii0th element of the **incidence matrix** of neutrosophic Super Hyper Graph (NSHG) are of the form $(V_i, TV^0 (E_i 0), I_V^0 (E_i 0), F_V^0 (E_i 0))$, the sets V and E are crisp sets.

Definition 1.13 (Characterization of the Neutrosophic Super Hyper Graph (NSHG)).
(**Ref**. [10], Section 4, pp.291-292).
Assume a neutrosophic Super Hyper Graph (NSHG) S is an ordered pair $S = (V, E)$.
The neutrosophic Super Hyper Edges (NSHE) $E_i 0$ and the neutrosophic
Super Hyper Vertices (NSHV) V_i of neutrosophic Super Hyper Graph (NSHG) $S = (V,E)$ could be characterized as follow-up items.

Table 1. The Values of Vertices, Super Vertices, Edges, Hyper Edges, and Super Hyper Edges Belong to The Neutrosophic Super Hyper Graph Mentioned in the Example (2.2)

The Values of The Vertices	The Number of Position in Alphabet
The Values of The Super Vertices	The Minimum Values of Its Vertices
The Values of The Edges	The Minimum Values of Its Vertices
The Values of The Hyper Edges	The Minimum Values of Its Vertices
The Values of The Super Hyper Edges	The Minimum Values of Its Endpoints

(i) If $|V_i| = 1$, then V_i is called **vertex**;
(ii) if $|V_{i|} \geq 1$, then V^i is called **Super Vertex**;
(iii) if for all $V_i s$ are incident in $E_i 0$, $|V_i| = 1$, and $|E_i 0| = 2$, then Ei0 is called **edge**;
(iv) if for all $V_i s$ are incident in $E_i 0$, $|V^i| = 1$, and $|E_i 0| \geq 2$, then $E^i 0$ is called **Hyper Edge;**
(v) if there's a V_i is incident in Ei0 such that |Vi| ≥ 1, and |Ei0| = 2, then Ei0 is called **Super Edge;**
(vi) if there's a Vi is incident in Ei0 such that |Vi| ≥ 1, and |Ei0| ≥ 2, then Ei0 is called Super Hyper Edge.

New Ideas on Super Hyper Graphs

Definition 2.1. If there's a Super Hyper Edge between two Super Hyper Vertices, then these two Super Hyper Vertices are called **Super Hyper Neighbors.** The number of Super Hyper Neighbors for a given Super Hyper Vertex is called **Super Hyper Degree.**

The number of common Super Hyper Neighbors for some Super Hyper Vertices is called **Co-Super Hyper Degree** for them and used Super Hyper Vertices are called **Co-Super Hyper Neighbors.**

Example 2.2. A Super Hyper Graph is depicted in the Figure (1). The characterization of Super Hyper Degree is as follows. The Super Hyper Degree of Super Hyper Vertices, $M, J, P, F, L_6, M_6, R, V_1, V_2$ and V_3, are the same and equals to the Super Hyper Order, ten. By using the Figure (1), and the Table (1), the neutrosophic Super Hyper Graph is obtained and the computations are straightforward to make sense about what's figured out on determinacy, indeterminacy and neutrality.

Example 2.3. A Super Hyper Graph is depicted in the Figure (2). The characterization of Super Hyper Degree for interior Super Hyper Vertices is as follows.
(i) The Super Hyper Degree of Super Hyper Vertices, T_3, S_3, U_3, V_4 and V_5 are the same and equals to six.
(ii) The Super Hyper Degree of Super Hyper Vertices, S_6, R_6, T_6, V_7, V_8 and V_9 are the same and equals to ten.
(iii) Super Hyper Degree of Super Hyper Vertices, H_6, C_6, O_6, and E_6 are the same and equals to twelve.
(iv) The Super Hyper Degree of Super Hyper Vertices, R, P, J, and M are the same and equals to ten.
The characterization of Super Hyper Degree for exterior Super Hyper Vertices is as follows.

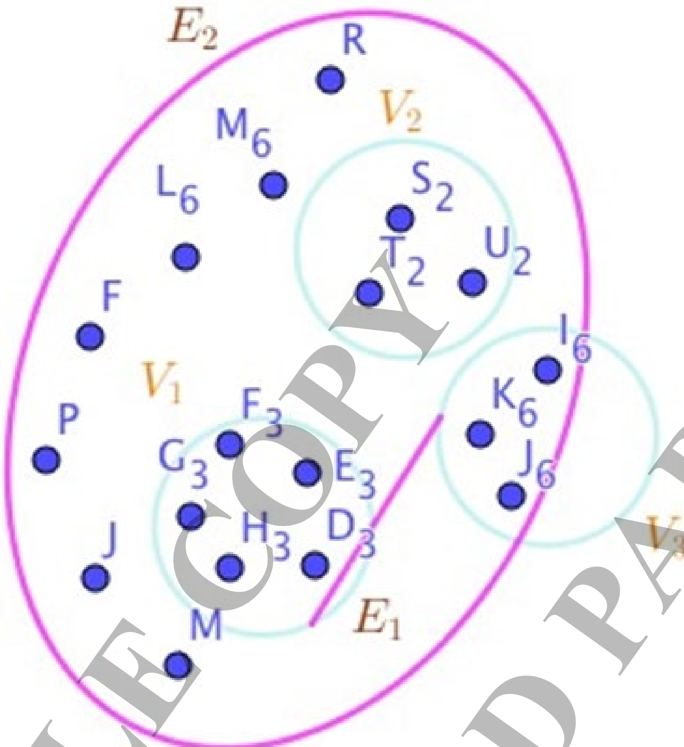

Figure 1: A Super Hyper Graph Associated to the Notions of Super Hyper Degree in the Example (2.2)

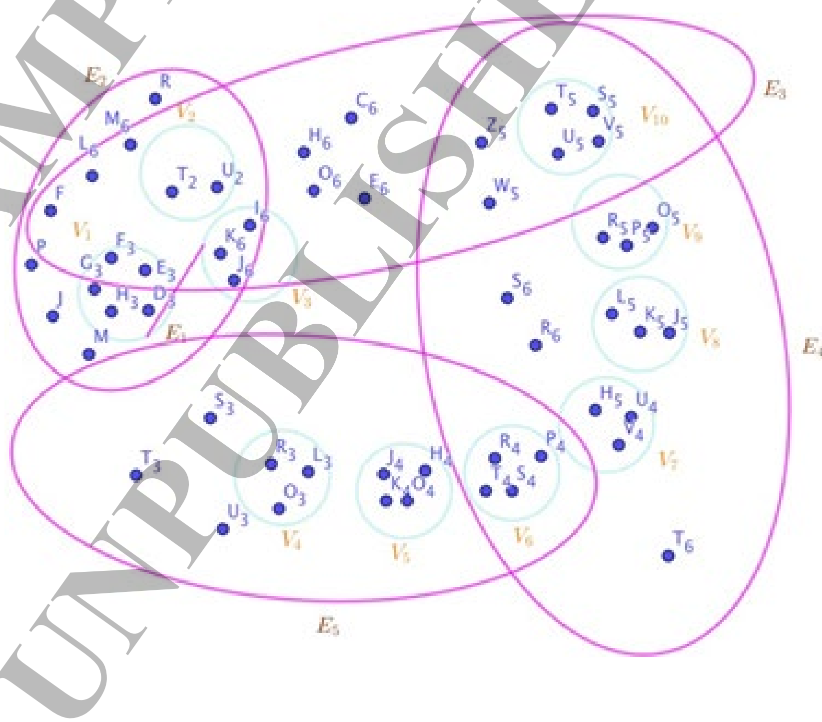

Figure 2: A Super Hyper Graph Associated to the Notions of Super Hyper Degree in the Example (2.3)

Table 2. The Values of Vertices, Super Vertices, Edges, Hyper Edges, and Super Hyper Edges Belong to The Neutrosophic Super Hyper Graph Mentioned in the Example (2.3)

The Values of The Vertices	The Number of Position in Alphabet
The Values of The Super Vertices	The Minimum Values of Its Vertices
The Values of The Edges	The Minimum Values of Its Vertices
The Values of The Hyper Edges	The Minimum Values of Its Vertices
The Values of The Super Hyper Edges	The Minimum Values of Its Endpoints

(i) The Super Hyper Degree of Super Hyper Vertex, V_4 equals to fourteen.
(ii) The Super Hyper Degree of Super Hyper Vertices, Z_5, W_5 and V_{10} are the same and equals to eighteen.
(iii) Super Hyper Degree of Super Hyper Vertices, $F, L_6, M_6, V_2,$ and V_3 are the same and equals to sixteen.
By using the Figure (2), and the Table (2), the neutrosophic Super Hyper Graph is obtained and the computations are straightforward to make sense about what's figured out on determinacy, indeterminacy and neutrality.
Proposition 2.4. *The Super Hyper Degree of interior Super Hyper Vertices are the same.*

Proof. Interior Super Hyper Vertices belong to one Super Hyper Edges, according to the definition of being interior Super Hyper Vertices. Thus, They've common Super Hyper Edge. And there's no more Super Hyper Edge in common version. It implies the Super Hyper Degree of every interior Super Hyper Vertex is the fixed amount and same number. It induces that the Super Hyper Degree of interior Super Hyper Vertices are the same.

The operation on the Super Hyper Degree is the matter. One case is about the situation in that, the changes or, prominently, "adding" is acted as an operation. In what follows, the operation, adding has the key role to play with the flexibilities of notions. But it's important to mention that these operations, adding and changes, couldn't be applied to the framework and the setting of Super Hyper Degree since there's only one Super Hyper Degree in this setting. Another idea is about the "corresponded set" which is excerpt Super Hyper Degree as initial notion. The number is titled Super Hyper Degree is obtained from "corresponded set".

Proposition 2.5. *The changes or adding any number of exterior Super Hyper Vertices has no change in Co-Super Hyper Degree.*

Proof. The changes have no effect on the corresponded set related Co-Super Hyper Degree since the obtained number isn't changed. Adding any number of exterior Super Hyper Vertices hasn't formed any new corresponded set related to that Co-Super Hyper Degree. Since they're exterior Super Hyper Vertices thus they belong to same Super Hyper Edges and they've same situations in the terms of Super Hyper Neighbors. Thus, adding any amount of exterior Super Hyper Vertices doesn't make new Super Hyper Neighbor and the number of Super Hyper Neighbors hasn't changed when adding exterior Super Hyper Vertices has happened. Since all exterior Super Hyper Vertices have same amount of Super Hyper Neighbors and it's predicted to have smaller "corresponded set" but the cardinality of new "corresponded set" hasn't changed and it's the same. Generally, the operation, adding, makes the "corresponded set" to be the same or smaller. That, the first case is happened and the new "corresponded set" and the old "corresponded set" are the same. To sum them up, the changes or adding any number of exterior Super Hyper Vertices has no change in Co-Super Hyper Degree.

In the upcoming result, the comparison is featured between the Super Hyper Degree and the Co-Super Hyper Degree where one Super Hyper Vertex could be the intersection of these new notions.

Proposition 2.6. *The Super Hyper Degree based on a Super Hyper Vertex is greater than the Co-Super Hyper Degree based on that Super Hyper Vertex. Proof.* The Co-Super Hyper Degree of a Super Hyper Vertex and other Super Hyper Vertices induces the number of common Super Hyper Neighbors is the matter. Thus, the number of Super Hyper Neighbors of intended Super Hyper Vertex which is interpreted as Super Hyper Degree, has exceed when the number of common Super Hyper Neighbors is on demand and requested in some cases but the number of common Super Hyper Neighbors is at most equal to the number of Super Hyper Neighbors of intended Super Hyper Vertex. Thus, the Super Hyper Degree based on a Super Hyper Vertex is greater than the Co-Super Hyper Degree based on that Super Hyper Vertex.

Example 2.7. A Super Hyper Graph is mentioned in the Example (2.2). The characterization of Co-Super Hyper Degree for all Super Hyper Vertices is as follows. The Co-Super Hyper Degree for any amount of the Super Hyper Vertices are the same and equals to ten.

Example 2.8. A Super Hyper Graph is mentioned in the Example (2.3). The characterization of Co-Super Hyper Degree for all Super Hyper Vertices is as follows.
(i) The Co-Super Hyper Degree for any amount of the Super Hyper Vertices $\{M, J, P, F, L_6, M_6, R, V_1, V_2, V_3\}$ are the same and equals to ten.
(ii) The Co-Super Hyper Degree for any amount of the Super Hyper Vertices $\{F, L_6, M_6, V_2, V_3\}$ and any amount of the Super Hyper Vertices $\{C_6, H_6, O_6, E_6, Z_5, W_5, V_{10}\}$ are the same and equals to twelve.
(iii) The Co-Super Hyper Degree for any amount of the Super Hy-

per Vertices $\{M, J, P, R, V_1\}$ and any amount of the Super Hyper Vertices $\{C_6, H_6, O_6, E_6, Z_5, W_5, V_{10}\}$ are the same and equals to zero.
(iv) The Co-Super Hyper Degree for any amount of the Super Hyper Vertices $\{F, L_6, M_6, V_2, V_3\}$ with any amount of the Super Hyper Vertices $\{Z_5, W_5, V_{10}\}$ are the same and equals to three.
(v) The Co-Super Hyper Degree for any amount of the Super Hyper Vertices $\{M, J, P, R, V_1\}$ with any amount of the Super Hyper Vertices $\{Z_5, W_5, V^{10}, S_6, R_6, V_6, V_7, V_8, V_9\}$ are the same and equals to zero.
(vi) The Co-Super Hyper Degree for any amount of the Super Hyper Vertices $\{H_6, O_6, C_6, E_6\}$ with any amount of the Super Hyper Vertices $\{S_6, R_6, V_6, V_7, V_8, V_9\}$ are the same and equals to zero.
(vii) The Co-Super Hyper Degree for any amount of the Super Hyper Vertices $\{H_6, O_6, C_6, E_6\}$ with any amount of the Super Hyper Vertices $\{Z_5, W_5, V_{10}\}$ are the same and equals to three.
(viii) The Co-Super Hyper Degree for any amount of the Super Hyper Vertices $\{M, J, P, F, L_6, M_6, R, V_1, V_2, V_3, H_6, O_6, C_6, E_6, Z_5, W_5, V_{10}, S_6, R_6, V_7, V_8, V_9\}$ with any amount of the Super Hyper Vertices $\{S_3, T_3, U_3, V_4, V_5, V_6\}$ are the same and equals to zero.
(ix) The Co-Super Hyper Degree for any amount of the Super Hyper Vertices {V6} with any amount of the Super Hyper Vertices $\{S_3, T_3, U_3, V_4, V_5, V_6\}$ are the same and equals to one.
(x) The Co-Super Hyper Degree for any amount of the Super Hyper Vertices $\{F, L_6, M_6, V_2, V_3, H_6, O_6, C_6, E_6,\}$ are the same and equals to ten.
(xi) The Co-Super Hyper Degree for any amount of the Super Hyper Vertices $\{Z_5, W_5, V_{10}, S_6, R_6, V_6, V_7, V_8, V_9\}$ are the same and equals to nine.
(xii) The Co-Super Hyper Degree for any amount of the Super Hyper Vertices $\{Z_3, T_3, U_3, V_4, V_5, V_6\}$ are the same and equals to six.

Super Hyper Uniform and Neutrosophic Super Hyper Uniform

Definition 3.1. A graph is Super Hyper Uniform if it's Super Hyper Graph and the number of elements of Super Hyper Edges are the same.

The characterizations of all Super Hyper Vertices are concluded in the terms of Super Hyper Degree in the following result.

Proposition 3.2. *In a SuperHyperUniform, the interior Super Hyper Degree of every Super Hyper Vertex is the same with each other.*

Proof. Every Super Hyper Edge has same amount of Super Hyper Vertices but interior Super Hyper Vertices are incident to only and only one Super Hyper Edge and by the elements of all Super Hyper Edges are the same, thus every interior Super Hyper Vertex has same amount of Super Hyper Neighbors implying the Super Hyper Degree has to be a fixed number. Thus, in a SuperHyperUniform, the interior Super Hyper Degree of every Super Hyper Vertex is the same with each other.

Definition 3.3. Assume a neutrosophic Super Hyper Graph. There are some Super Hyper Classes as follows.
(i). It's **Super Hyper Path** if it's only one Super Vertex as intersection amid two given Super Hyper Edges with two exceptions;
(ii). it's **Super Hyper Cycle** if it's only one Super Vertex as intersection amid two given Super Hyper Edges;
(iii). it's **Super Hyper Star** it's only one Super Vertex as intersection amid all Super Hyper Edges;
(iv). it's **Super Hyper Bipartite** it's only one Super Vertex as intersection amid two given Super Hyper Edges and these Super Vertices, forming two separate sets, has no Super Hyper Edge in common;
(v). it's **Super Hyper MultiPartite** it's only one Super Vertex as intersection amid two given Super Hyper Edges and these Super Vertices, forming multi separate sets, has no Super Hyper Edge in common;
(vi). it's **Super Hyper Wheel** if it's only one Super Vertex as intersection amid two given Super Hyper Edges and one Super Vertex has one Super Hyper Edge with any common Super Vertex.

The same amount is considered on specific parameters and it's considered as the notation, r, in the used notion, uniform.

Proposition 3.4. *In the Super Hyper Star, there's a Super Hyper Vertex such that its Super Hyper Degree equals to Super Hyper Order.*
Proof. One Super Hyper Vertex is incident to all possible Super Hyper Edges. Thus, this Super Hyper Vertex is Super Hyper Neighbor to all possible Super Hyper Vertices. It implies the Super Hyper Vertex Has Super Hyper Degree number of Super Hyper Neighbors.

Thus, in the Super Hyper Star, there's a Super Hyper Vertex such that its Super Hyper Degree equals to Super Hyper Order.

Proposition 3.5. *In the Super Hyper Path, the Super Hyper Degree is $2r$ for exterior Super Hyper Vertices and the Super Hyper Degree is r for interior Super Hyper Vertices.*

Proof. The interior Super Hyper Vertices are incident to one Super Hyper Edge but it's Super Hyper Uniform, thus the elements of every Super Hyper Edge is the same is denoted by r. Thus, the Super Hyper Degree is r for interior Super Hyper Vertices. The exterior Super Hyper Vertices are incident to only and only two Super Hyper Edges. There are two different Super Hyper Neighbors for exterior Super Hyper Vertices. One kind is labeled as interior Super Hyper Vertices with the number r via using Super Hyper Uniform style and another sort is titled as exterior Super Hyper Vertices are counted to be s since the number hasn't to be fixed implying it's different for every exterior Super Hyper Vertex. Thus, the Super Hyper Degree is $2r$ for exterior Super Hyper Vertices. To sum them up, in the Super Hyper Path, the Super Hyper Degree is $2r$ for exterior Super Hyper Vertices and the Super Hyper Degree is r for interior Super Hyper Vertices.

Proposition 3.6. *In the SuperHyperCycle, the Super Hyper Degree is 2r − s for exterior Super Hyper Vertices and the Super Hyper Degree is r for interior Super Hyper Vertices.*

Proof. The interior Super Hyper Vertices are uniquely characterized by one Super Hyper Edge having r exterior Super Hyper Vertices and interior Super Hyper Vertices.

Thus, the Super Hyper Degree is r for interior Super Hyper Vertices. The exterior Super Hyper Vertices are uniquely characterized by two Super Hyper Edges having $2r - s$ exterior Super Hyper Vertices and interior Super Hyper Vertices where s is the number of common exterior Super Hyper Vertices between two used Super Hyper Edges. To sum them up, in the Super Hyper Cycle, the Super Hyper Degree is $2r - s$ for exterior Super Hyper Vertices and the Super Hyper Degree is r for interior Super Hyper Vertices.

Proposition 3.7. *In the Super Hyper Star, the Super Hyper Degree is either (r − 1) s or r.*

Proof. One Super Hyper Vertex is incident to all possible Super Hyper Edges. Thus, this Super Hyper Vertex has the number of other Super Hyper Vertices multiplying the Super Hyper Uniform constant minus one. In other words, it's $(r - 1)\ s$. There are two categories of Super Hyper Vertices. Other Super Hyper Vertices have no Super Hyper Edges with each other. Thus, the amount of Super Hyper Degree is the same with Super Hyper Uniform constant which is r.
Thus, in the Super Hyper Star, the Super Hyper Degree is either $(r - 1)\ s$ or r.

Proposition 3.8. *In the SuperHyperBipartite, the Super Hyper Degree is either nr or mr.*

Proof. Every SuperHyperBipartite has two the SuperHyperParts. Any Super Hyper Vertex has only Super Hyper Edges with another SuperHyperPart. There are some Super Hyper Vertices don't belong to any SuperHyperPart. Every Super Hyper Edge has r Super Hyper Vertices by applying Super Hyper Uniform properties. Thus, the maximum number of cardinalities for SuperHyperParts, is determined to decide about the multiplier for Super Hyper Uniform constant r. Thus, in the SuperHyperBipartite, the Super Hyper Degree is either nr or mr.

Proposition 3.9. *In the SuperHyperMultiPartite, the Super Hyper Degree is either of* $(\sum_{i=1}^{s} n_i - n_{j_{j=1,2,\ldots,s}})r.$ Proof. In the SuperHyperMultiPartite, there's only one Super Hyper Vertex from a SuperHyperPart incident to a Super Hyper Edge. The Super Hyper Uniform implies having r as multiplier for every Super Hyper Vertex from a SuperHyperPart. For a fixed Super Hyper Vertex from a SuperHyperPart, there are some SuperHyperParts and r Super Hyper Neighbors from every of them. Thus, In the SuperHyperMultiPartite, the Super Hyper Degree is either of (
$\sum_{i=1}^{s} n_i - n_{j_{j=1,2,\ldots,s}})r.$

Proposition 3.10. *In the SuperHyperWheel, the Super Hyper Degree is 3r − 2s − 1 for exterior Super Hyper Vertices and the Super Hyper Degree is r − 1 for interior Super Hyper Vertices. For the Super Hyper Center, Super Hyper Degree is r (n − 1).*
Proof. The exterior Super Hyper Vertices are incident to only and only three
Super Hyper Edges. It implies at most $3r$ Super Hyper Vertices by applying Super Hyper Uniform property. But the exterior Super Hyper Vertices are incident three times. It induces they've $3r - 2s - 1$ Super Hyper Neighbors. The interior Super Hyper Vertices are incident to one Super Hyper Edge. Thus, they've $r - 1$ Super Hyper Neighbors by using the Super Hyper Uniform property. The third category has only one Super Hyper Vertex, namely, the Super Hyper Center has n the Super Hyper Edges inducing rn Super Hyper Neighbors via applying the Super Hyper Uniform property. To sum them up, in the SuperHyperWheel, the Super Hyper Degree is $3r - 2s - 1$ for exterior Super Hyper Vertices and the Super Hyper Degree is r for interior Super Hyper Vertices. For the Super Hyper Center, Super Hyper Degree is $r\ (n - 1)$.

Super Hyper Degree and Co-Super Hyper Degree: Common and Extended Definition in Super Hyper Graphs

Definition 4.1. The number of Super Hyper Edges for a given Super Hyper Vertex is called **Super Hyper Degree.** The number of common Super Hyper Edges for some Super Hyper Vertices is called Co-Super Hyper Degree for them. The number of Super Hyper Vertices for a given Super Hyper Edge is called **Super Hyper Degree.** The number of common Super Hyper Vertices for some Super Hyper Edges is called **Co-Super Hyper Degree** for them

.

Example 4.2. Assume the Example (2.2). The whole possible cases are investigated as follows. The Super Hyper Degree for any given Super Hyper Vertex is one. The Co-Super Hyper Degree for some Super Hyper Vertices is one. The Super Hyper Degree for any given Super Hyper Edge is ten. The Co-Super Hyper Degree for some Super Hyper Edges is ten.

Example 4.3. Assume the Example (2.3). The following cases characterize all possible situations.
(i) : The Super Hyper Degree for any given Super Hyper Vertex from
$\{M, J, P, R, V_1, H_6, O_6, C_6, E_6, S_6, R_6, V_7, V_8, V_9, V_4, V_5, T_3, S_3, U_3\}$
is one.
(ii) : The Co-Super Hyper Degree for some Super Hyper Vertices from
$\{M, J, P, F, R, V_1, H_6, O_6, C_6, E_6, S_6, R_6, V_7, V_8, V_9, V_4, V_5, T_3, S_3, U_3\}$ is one.
(iii) : The Super Hyper Degree for any given Super Hyper Vertex from $\{F, L_6, M_6, V_2, V_3, Z_5, W_5, V_{10}, V_6\}$ is two.
(iv) : The Co-Super Hyper Degree for some Super Hyper Vertices from either of $\{F, L_6, M_6, V_2, V_3,\}$, $\{Z_5, W_5, V_{10}\}$, $\{V_6\}$ is two.
(v) : The Super Hyper Degree for Super Hyper Edge, E_1 is two.
(vi) : The Super Hyper Degree for Super Hyper Edge, E_2 is ten.
(vii) : The Super Hyper Degree for Super Hyper Edge, E_3 is twelve.

(viii) : The Super Hyper Degree for Super Hyper Edge, E_4 is nine.
(ix) : The Super Hyper Degree for Super Hyper Edge, E_5 is six.
(x) : The Co-Super Hyper Degree for Super Hyper Edges, E_1, E_2 is two.
(xi) : The Co-Super Hyper Degree for Super Hyper Edges, E_1, E_2, E_3 is one.
(xii) : The Co-Super Hyper Degree for Super Hyper Edges, E_1, E_3 is one.
(xiii) : The Co-Super Hyper Degree for Super Hyper Edges, E_2, E_3 is five.
(xiv) : The Co-Super Hyper Degree for Super Hyper Edges, E_3, E_4 is three.
(xv) : The Co-Super Hyper Degree for Super Hyper Edges, E_4, E_5 is one.
(xvi) : The Co-Super Hyper Degree for Super Hyper Edges rather than above cases is zero.

Proposition 4.4. *In the Super Hyper Path, the Super Hyper Degree is either one or two.*

Proof. Every Super Hyper Vertex is incident to one or two Super Hyper Edges. Thus, the Super Hyper Degree for any given Super Hyper Vertex is one or two. Thus, in the Super Hyper Path, the Super Hyper Degree is either one or two.

Proposition 4.5. *In the Super Hyper Cycle, the Super Hyper Degree is two.*
Proof. Every Super Hyper Edge contains too many Super Hyper Vertices and there's obvious number. It's *r*. Since it's Super Hyper Uniform. But, reversely, any Super Hyper Vertices contains only two Super Hyper Edges. The latter is called to be the Super Hyper Degree for those Super Hyper Vertices. Thus, the notion is far away from Super Hyper Neighbors and there's no connection amid them to said the Super Hyper Degree. Thus, in the Super Hyper Cycle, the Super Hyper Degree is two.

Proposition 4.6. *In the Super Hyper Star, the Super Hyper Degree is either s or one.*

Proof. All Super Hyper Edges cross from the Super Hyper Center. Thus, the Super Hyper Center is the Super Hyper Neighbor to all Super Hyper Vertices. To get more, there's no Super Hyper Edge beyond that. It implies Other Super Hyper Vertices has only one Super Hyper Edge with the Super Hyper Center. It induces they've only one Super Hyper Neighbor, namely, the Super Hyper Center. Thus, in the Super Hyper Star, the Super Hyper Degree is either s or one.

Proposition 4.7. *In the SuperHyperBipartite, the Super Hyper Degree is either n or m.*
Proposition 4.8. *In the SuperHyperMultiPartite, the Super Hyper Degree is either of* $.\sum_{i=1}^{s} n_i - n_{j_{j=1,2,\ldots,s}}$.
Proposition 4.9. *In the SuperHyperWheel, the Super Hyper Degree is either s or three.*

The Relations with SuperHyperParameters 6 The Relations with Super Hyper Dominating
Proposition 6.1. *A Super Hyper Vertex Super Hyper Dominates at least Super Hyper Degree Super Hyper Vertices.*
Proposition 6.2. *If the Super Hyper Degree is m, then there are at least m Supe r Hyper Dominated Super Hyper Vertices.*
Proposition 6.3. *If the Super Hyper Degree is m, then the Super Hyper Vertex has m, the Super Hyper Neighbors.*
Proposition 6.4. *The notions the Super Hyper Degree and the Super Hyper Dominating coincide.*
Proposition 6.5. *A Super Hyper Vertex Super Hyper Dominates is equivalent to its Super Hyper Degree.*
Proposition 6.6. *A Super Hyper Vertex Super Hyper Dominates only and only Super Hyper Degree Super Hyper Vertices.*
Proposition 6.7. *If the Super Hyper Degree of Super Hyper Vertex is m, then that Super Hyper Vertex Super Hyper Dominates only and only m Super Hyper Vertices.*

The Relations with SuperHyperResolving
Proposition 7.1. *A Super Hyper Vertex doesn't SuperHyperResolve at least Super Hyper Degree Super Hyper Vertices.*

The Relations with Super Hyper Order
Proposition 8.1. *In the Super Hyper Star, the Super Hyper Degree of the Super Hyper Center is Super Hyper Order with its consideration.*

The Relations with SuperHyperRegularity
Proposition 9.1. *In the SuperHyperCycle, the all Super Hyper Degrees are SuperHyperRegular.*
Proposition 9.2. *In the SuperHyperBipartite, the all Super Hyper Degrees in every SuperHyperPart are SuperHyperRegular.*
Proposition 9.3. *In the SuperHyperMultiPartite, the all Super Hyper Degrees in every SuperHyperPart are SuperHyperRegular.*

The Minimum Super Hyper Degree
Proposition 10.1. *In the Super Hyper Star, the all Super Hyper Degrees are the minimum with the exception of Super Hyper Center.*

The Maximum Super Hyper Degree
Proposition 11.1. *In the SuperHyperCycle, the all Super Hyper Degrees are the maximum.*
Proposition 11.2. *In the SuperHyperPath, the all Super Hyper Degrees are the maximum with the exceptions of two Super Hyper Vertices.*

Applications in Cancer's Treatments
The treatments for cancer are spotlight. The cells and vessels have vital roles in the body. In the cancer as disease, the attacks on cells could act differently. In some cases, there are some situations which are messy and they've needed to have complicated detailed-oriented models. The situations are embedded to each other and there is too many information.

In this study, there are some directions about the roles of cells and the properties are raised from them. In this complicated situation, the objects are embedded to each other and it's hard to characterize the useful data and proper direction to make the situations more understandable for getting more directions to treat the cancer.

Step 1. (Definition) The situations are complicated. Some cells are the same in the terms of the situation in front of the cancer's attacks. But the situation goes to be more complex where the cells and the groups of cells have some common properties with each others.

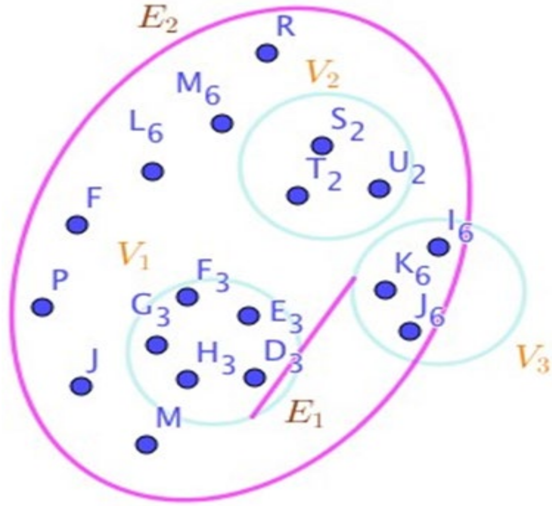

Figure 3: A Super Hyper Graph Associated to the Notions of Super Hyper Degree in the Section (12)

Step 2. (Issue) The cancer attacks to some cells and some cells have same situations but sometimes the cells and groups of cells have elected some directions to protect themselves and sometimes they've some special attributes.

Step 3. (Model) The model proposes the specific designs. The model is officially called "Super Hyper Graph" and "Neutrosophic Super Hyper Graph". In this model, the "specific" cells and "specific group" of cells are modeled as "Super Hyper Vertices" and the common and intended properties between "specific" cells and "specific group" of cells are modeled as "Super Hyper Edges". Sometimes, it's useful to have some degrees of determinacy, indeterminacy, and neutrality to have more precise model which in this case the model is called "neutrosophic".

Case 1: Super Hyper Degree and Co-Super Hyper Degree in the Simple SuperHyperModel

Step 4. (Solution) The model is illustrated in the Figure (3). A Super Hyper Graph is depicted in the Figure (3). The characterization of Super Hyper Degree is as follows.

The Super Hyper Degree of Super Hyper Vertices, $M, J, P, F, L_6, M_6, R, V_1, V_2$ and V_3, are the same and equals to the Super Hyper Order, ten.

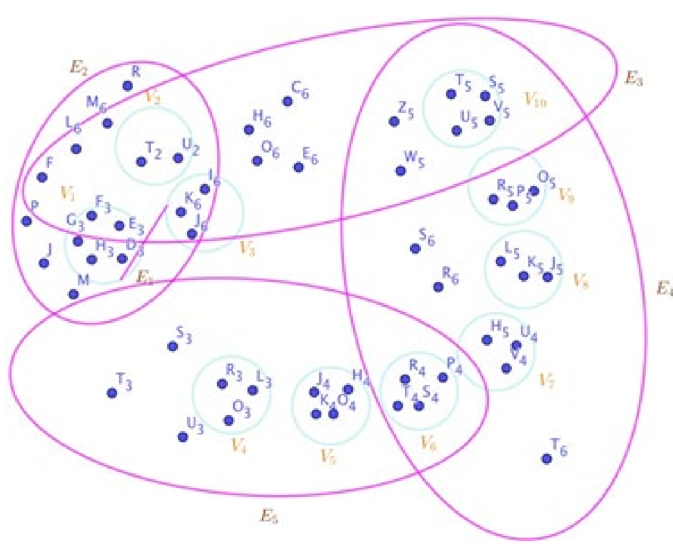

Figure 4: A Super Hyper Graph Associated to the Notions of Super Hyper Degree in the Section (12)

Case 2: Super Hyper Degree and Co-Super Hyper Degree in the More Complicated SuperHyperModel

Step 4. (Solution) A Super Hyper Graph is depicted in the Figure (4). The characterization of Super Hyper Degree for interior Super Hyper Vertices is as follows.

(i) The Super Hyper Degree of Super Hyper Vertices, T_3, S_3, U_3, *V4 and* V_5 are the same and equals to six.

(ii) The Super Hyper Degree of Super Hyper Vertices, S_6, R_6, T_6, V_7, V_8 *and* V_9 are the same and equals to ten.

(iii) Super Hyper Degree of Super Hyper Vertices, H_6, C_6, O_6, and E_6 are the same and equals to twelve.

(iv) The Super Hyper Degree of Super Hyper Vertices, *R, P, J,* and *M* are the same and equals to ten.

The characterization of Super Hyper Degree for exterior Super Hyper Vertices is as follows.

(i) The Super Hyper Degree of Super Hyper Vertex, V_4 equals to fourteen.

(ii) The Super Hyper Degree of Super Hyper Vertices, Z_5, W_5 and V_{10} are the same and equals to eighteen.

(iii) Super Hyper Degree of Super Hyper Vertices, *F,* L_6, M_6, V_2, *and* V_3 are the same and equals to sixteen.

By using the Figures (3), (4) and the Table (3), the neutrosophic Super Hyper Graph is obtained.

Table 3. The Values of Vertices, SuperVertices, Edges, HyperEdges, and Super Hyper Edges Belong to The Neutrosophic Super Hyper Graph Mentioned in the Section (12)

The Values of The Vertices	The Number of Position in Alphabet
The Values of The SuperVertices	The Minimum Values of Its Vertices
The Values of The Edges	The Minimum Values of Its Vertices
The Values of The HyperEdges	The Minimum Values of Its Vertices
The Values of The Super Hyper Edges	The Minimum Values of Its Endpoints

Open Problems

This research proposes some tools to provide the backgrounds for Super Hyper Degree and Co-Super Hyper Degree with applications in cancer's treatments. The results are the starters to tackle the complexities in the theoretical issues and applications.

There are some avenues to pursue this research. This issue is addressed as "questions" and "problems". The notions of Super Hyper Degree and Co-Super Hyper Degree have the eligibilities to make continuous research to make the concept more understandable.

Question 13.1. *Are there other types of notions to define in this model to do research about this special case in cancer's treatment?*
Question 13.2. *How to define notions in this embedded model?*
Question 13.3. *What's the specific research based on cancer's treatment but in these models, namely, Super Hyper Graphs and neutrosophic Super Hyper Graphs?*
Question 13.4. *In this research, the concentrations are on the cells and embedded relations amid them, are there other types of foundations?*
Problem 13.5. *What are the special cases in real challenges of cancer's treatment related to these models, namely, Super Hyper Graphs and neutrosophic Super Hyper Graphs, and their procedures of modeling on cells and embedded cells based on "specific" properties?*
Problem 13.6. *How to characterize the borders of this case in cancer's treatment, completely?*
Problem 13.7. *How to advance the theoretical backgrounds of this research to overcome the challenges in cancer's treatment?*

Conclusion and Closing Remarks

In this section, concluding remarks and closing remarks are represented. The drawbacks of this article are illustrated. Some benefits and advantages of this study are highlighted.

This research uses some approaches to make neutrosophic Super Hyper Graphs more understandable. In this way, the cancer's treatments, are the cases to make the theoretical concept. The caner's treatment involves the cells and their roles in relations with each other. In this way, I propose, the specific models, namely, Super Hyper Graphs and neutrosophic Super Hyper Graphs, in redeemed ways in that, the cells are only considered in the caner's attacks. In the viewpoint of mathematical perspective, I define some Super Hyper Classes and there are some categories about the theoretical results. In the future research, the foundation will be based on the caner's treatment and the results and the definitions will be introduced in redeemed ways. In the Table (4), some limitations and advantages of this study are pointed out.

Table 4. A Brief Overview about Advantages and Limitations of this Research

Advantages	Limitations
1. Defining Super Hyper Degree	1.Detail-Oriented Applications
2. Defining Co-Super Hyper Degree Extended and Common Definition	2.General Results
4. Connection with Other SuperHyperNotions 5. Used Super Hyper Classes	3.Connections Amid Results

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