A Research on Cancer’s Recognition and Neutrosophic Super Hypergraph by Eulerian Super Hyper Cycles and Hamiltonian Sets as Hyper Covering Versus Super separations

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Abstract
In this research, assume a Super Hyper Graph. Then some notions on Extreme Super Hyper Cycle based on the backgrounds of Eulerian and Hamiltonian styles are proposed. Some results are directed in the way that, the starting definitions make sense on the motivation and the continuous approaches for this research. A basic familiarity with neutrosophic Super HyperCycle theory, Super HyperGraphs, and neutrosophic Super HyperGraphs theory are proposed.

Keywords: Neutrosophic Superhypergraph, (Neutrosophic) Superhypercycle, Cancer’s Neutrosophic Recognition

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

Wondering open Problems but As the Directions to Forming the Motivations
In what follows, some “Neutrosophic problems” and some “Neutrosophic questions” are Neutrosophically proposed.

The SuperHyperCycle and the neutrosophic SuperHyperCycle are Neutrosophically defined on a real-world Neutrosophic application, titled “Cancer’s neutrosophic recognitions”.

Question 1.1. Which the else neutrosophic SuperHyperModels could be defined based on Cancer’s neutrosophic recognitions?

Question 1.2. Are there some neutrosophic SuperHyperNotions related to SuperHyperCycle and the neutrosophic SuperHyperCycle?

Question 1.3. Are there some Neutrosophic Algorithms to be defined on the neutrosophic SuperHyperModels to compute them Neutrosophically?

Question 1.4 Which the neutrosophic SuperHyperNotions are related to beyond the SuperHyperCycle and the neutrosophic SuperHyperCycle?

Problem 1.5 The SuperHyperCycle and the neutrosophic SuperHyperCycle do Neutrosophically a neutrosophic SuperHyperModel for the Cancer’s neutrosophic recognitions and they’re based Neutrosophically on neutrosophic SuperHyperCycle, are there else Neutrosophically?

Problem 1.6 Which the fundamental Neutrosophic SuperHyper-Numbers are related to these Neutrosophic SuperHyperNumbers types-results?

Problem 1.7 What’s the independent research based on Cancer’s neutrosophic recognitions concerning the multiple types of neutrosophic SuperHyperNotions?

The Surveys of Mathematical Sets on The Results but As the Initial Motivation
For the SuperHyperCycle, extreme SuperHyperCycle, and the neutrosophic SuperHyperCycle, some general results are introduced.

Proposition 2.1 Let ESHG : (V, E) be a neutrosophic SuperHyperUniform SuperHyperGraph which is a SuperHyperStar/SuperHyperComplete SuperHyperBipartite/SuperHyperComplete SuperHyperMultpartite. Then the number of

(i) : dual SuperHyperDefensive SuperHyperCycle;
(ii) : strong dual SuperHyperDefensive SuperHyperCycle;
(iii) : connected dual SuperHyperDefensive SuperHyperCycle;
(iv) : $\frac{\text{ESHG}}{2} + 1$ dual SuperHyperDefensive SuperHyperCycle;
(v) : strong $\frac{\text{ESHG}}{2} + 1$ dual SuperHyperDefensive SuperHyperCycle;
(vi) : connected $\frac{\text{ESHG}}{2} + 1$ dual SuperHyperDefensive SuperHyperCycle.

is one and it’s only S, a SuperHyperSet contains [the SuperHyperCenter and] the half of multiplying $r$ with the number of all the SuperHyperEdges plus one of all the SuperHyperVertices.
Proposition 2.2 Let ESHG : (V, E) be a neutrosophic SuperHyperGraph. The number of connected component is |V − S| if there’s a SuperHyperSet which is a dual
(i) : SuperHyperDefensive SuperHyperCycle;
(ii) : strong SuperHyperDefensive SuperHyperCycle;
(iii) : connected SuperHyperDefensive SuperHyperCycle;
(iv) : SuperHyperCycle;
(v) : strong 1-SuperHyperDefensive SuperHyperCycle;
(vi) : connected 1-SuperHyperDefensive SuperHyperCycle.

Proposition 2.3 Let ESHG : (V, E) be a neutrosophic SuperHyperGraph. Then the number is at most O(ESHG) and the neutrosophic number is at most O\(\delta\)(ESHG).

Proposition 2.4 Let ESHG : (V, E) be a neutrosophic SuperHyperGraph which is SuperHyperComplete. The number is \(O(ESHG(V, E)) + 1\) and the neutrosophic number is \(\delta(ESHG(V, E)) + 1\) in the setting of dual
(i) : SuperHyperDefensive SuperHyperCycle;
(ii) : strong SuperHyperDefensive SuperHyperCycle;
(iii) : connected SuperHyperDefensive SuperHyperCycle;
(iv) : \(O(ESHG(V, E)) + 1\)- SuperHyperDefensive SuperHyperCycle;
(v) : strong \(O(ESHG(V, E)) + 1\)- SuperHyperDefensive SuperHyperCycle;
(vi) : connected \(O(ESHG(V, E)) + 1\)- SuperHyperDefensive SuperHyperCycle.

Proposition 2.5 Let ESHG : (V, E) be a neutrosophic SuperHyperGraph which is SuperHyperComplete. Then \(\delta(ESHG(V, E)) \leq 0\) and the neutrosophic number is 0, for an independent SuperHyperSet in the setting of dual
(i) : SuperHyperDefensive SuperHyperCycle;
(ii) : strong SuperHyperDefensive SuperHyperCycle;
(iii) : connected SuperHyperDefensive SuperHyperCycle;
(iv) : 0-SuperHyperDefensive SuperHyperCycle;
(v) : strong 0-SuperHyperDefensive SuperHyperCycle;
(vi) : connected 0-SuperHyperDefensive SuperHyperCycle.

Proposition 2.6 Let ESHG : (V, E) be a neutrosophic SuperHyperGraph which is SuperHyperComplete. Then there’s no independent SuperHyperSet.

Proposition 2.7 Let ESHG : (V, E) be a neutrosophic SuperHyperGraph which is SuperHyperCycle/SuperHyperPath/SuperHyperWheel. The number is \(O(ESHG : (V, E))\) and the neutrosophic number is \(O(ESHG : (V, E))\), in the setting of a dual
(i) : SuperHyperDefensive SuperHyperCycle;
(ii) : strong SuperHyperDefensive SuperHyperCycle;
(iii) : connected SuperHyperDefensive SuperHyperCycle;
(iv) : \(O(ESHG : (V, E))\)- SuperHyperDefensive SuperHyperCycle;
(v) : strong \(O(ESHG : (V, E))\)- SuperHyperDefensive SuperHyperCycle;
Proposition 2.15 Let ESHG : (V, E) be an even SuperHyperPath. Then
(i) the set \( S = \{ v_{2j}, v_{2j+1}, \ldots, v_n \} \) is a dual SuperHyperDefensive SuperHyperCycle;
(ii) \( r = \lceil \frac{n}{2} \rceil + 1 \) and corresponded SuperHyperSets are \( \{ v_{2j}, v_{2j+2}, \ldots, v_n \} \) and \( \{ v_{2j+1}, v_{2j+3}, \ldots, v_n \} \);
(iii) \( \Gamma_s = \min \{ \sum_{s=\{v_{2j}, v_{2j+2}, \ldots, v_n\}}^2 \sigma(s), \sum_{s=\{v_{2j+1}, v_{2j+3}, \ldots, v_n\}}^2 \sigma(s) \} \);
(iv) the SuperHyperSets \( S_1 = \{ v_{2j+1}, v_{2j+3}, \ldots, v_n \} \) and \( S_2 = \{ v_{2j+2}, v_{2j+4}, \ldots, v_n \} \) are only a dual SuperHyperCycle.

Proposition 2.16. Let ESHG : (V, E) be an even SuperHyperCycle. Then
(i) the SuperHyperSet \( S = \{ v_{2j}, v_{2j+2}, \ldots, v_n \} \) is a dual SuperHyperDefensive SuperHyperCycle;
(ii) \( r = \lceil \frac{n}{2} \rceil \) and corresponded SuperHyperSets are \( \{ v_{2j}, v_{2j+2}, \ldots, v_n \} \) and \( \{ v_{2j+1}, v_{2j+3}, \ldots, v_n \} \);
(iii) \( \Gamma_s = \min \{ \sum_{s=\{v_{2j}, v_{2j+2}, \ldots, v_n\}}^2 \sigma(s), \sum_{s=\{v_{2j+1}, v_{2j+3}, \ldots, v_n\}}^2 \sigma(s) \} \);
(iv) the SuperHyperSets \( S_1 = \{ v_{2j+1}, v_{2j+3}, \ldots, v_n \} \) and \( S_2 = \{ v_{2j+2}, v_{2j+4}, \ldots, v_n \} \) are only a dual SuperHyperCycle.

Proposition 2.17. Let ESHG : (V, E) be an odd SuperHyperCycle. Then
(i) the SuperHyperSet \( S = \{ v_{2j}, v_{2j+1}, \ldots, v_n \} \) is a dual SuperHyperDefensive SuperHyperCycle;
(ii) \( r = \lceil \frac{n}{2} \rceil + 1 \) and corresponded SuperHyperSet is \( \{ v_{2j}, v_{2j+1}, \ldots, v_n \} \);
(iii) \( \Gamma_s = \min \{ \sum_{s=\{v_{2j}, v_{2j+1}, \ldots, v_n\}}^2 \sigma(s), \sum_{s=\{v_{2j+2}, v_{2j+2}, \ldots, v_n\}}^2 \sigma(s) \} \);
(iv) the SuperHyperSets \( S_1 = \{ v_{2j+2}, v_{2j+3}, \ldots, v_n \} \) and \( S_2 = \{ v_{2j+4}, v_{2j+5}, \ldots, v_n \} \) are only a dual SuperHyperCycle.

Proposition 2.18 Let ESHG : (V, E) be SuperHyperStar. Then
(i) the SuperHyperSet \( S = \{ c \} \) is a dual maximal SuperHyperCycle;
(ii) \( \Gamma = 1 \);
(iii) \( \Gamma_s = \sum_{c}^2 \sigma(c) \);
(iv) the SuperHyperSets \( S = \{ c \} \) and \( S \subseteq S \) are only dual SuperHyperCycle.

Proposition 2.19 Let ESHG : (V, E) be SuperHyperWheel. Then
(i) the SuperHyperSet \( S = \{ v_1, v_2 \} \cup \{ v_3, v_4, \ldots, v_n \} \) is a dual maximal SuperHyperDefensive SuperHyperCycle;
(ii) \( r = \lceil \frac{n}{2} \rceil \) and corresponded SuperHyperSet \( \{ v_1, v_2 \} \cup \{ v_3, v_4, \ldots, v_n \} \);
(iii) \( \Gamma_s = \sum_{v_1, v_2} \sigma(s) \);
(iv) the SuperHyperSet \( \{ v_1, v_2 \} \cup \{ v_3, v_4, \ldots, v_n \} \) is only a dual maximal SuperHyperDefensive SuperHyperCycle.

Proposition 2.20 Let ESHG : (V, E) be an odd SuperHyperComplete. Then
(i) the SuperHyperSet \( S = \{ v \} \) is a dual SuperHyperDefensive SuperHyperCycle;
(ii) \( \Gamma = \lceil \frac{n}{2} \rceil + 1 \);
(iii) \( \Gamma_s = \min \{ \sum_{s=\{v_{2j+1}, v_{2j+2}, \ldots, v_n\}}^2 \sigma(s), \sum_{s=\{v_{2j+3}, v_{2j+4}, \ldots, v_n\}}^2 \sigma(s) \} \);
(iv) the SuperHyperSet \( S = \{ v \} \) is a dual SuperHyperDefensive SuperHyperCycle.

Proposition 2.21 Let ESHG : (V, E) be an even SuperHyperComplete. Then
(i) the SuperHyperSet \( S = \{ v \} \) is a dual SuperHyperDefensive SuperHyperCycle;
(ii) \( \Gamma = \lceil \frac{n}{2} \rceil \);
(iii) \( \Gamma_s = \min \{ \sum_{s=\{v_{2j+1}, v_{2j+2}, \ldots, v_n\}}^2 \sigma(s), \sum_{s=\{v_{2j+3}, v_{2j+4}, \ldots, v_n\}}^2 \sigma(s) \} \);
(iv) the SuperHyperSet \( S = \{ v \} \) is a dual maximal SuperHyperDefensive SuperHyperCycle.

Proposition 2.22. Let N SHF : (V, E) be a m-SuperHyperFamily of neutrosophic SuperHyperStars with common neutrosophic SuperHyperVertex SuperHyperSet. Then
(i) the SuperHyperSet \( S = \{ c_1, c_2, \ldots, c_m \} \) is a dual SuperHyperDefensive SuperHyperCycle for N SHF;
(ii) \( r = \lceil \frac{n}{2} \rceil \) for N SHF ; (V, E);
(iii) \( \Gamma_s = \sum_{c=\{c_1, c_2, \ldots, c_m\}}^2 \sigma(s) \) for N SHF ; (V, E);
(iv) the SuperHyperSets \( S = \{ c_1, c_2, \ldots, c_m \} \) and \( S \subseteq S \) are only dual SuperHyperCycle for N SHF ; (V, E).

Proposition 2.23 Let N SHF : (V, E) be an m-SuperHyperFamily of odd SuperHyperComplete SuperHyperGraphs with common neutrosophic SuperHyperVertex SuperHyperSet. Then
(i) the SuperHyperSet \( S = \{ v \} \) is a dual maximal SuperHyperDefensive SuperHyperCycle for N SHF;
(ii) \( r = \lceil \frac{n}{2} \rceil + 1 \) for N SHF ; (V, E);
(iii) \( \Gamma_s = \sum_{v=\{v\}}^2 \sigma(s) \) for N SHF ; (V, E);
(iv) the SuperHyperSets \( S = \{ v \} \) are only dual maximal SuperHyperCycle for N SHF ; (V, E), i = 1

Proposition 2.24. Let N SHF : (V, E) be a m-SuperHyperFamily of even SuperHyperComplete SuperHyperGraphs with common neutrosophic SuperHyperVertex SuperHyperSet. Then
(i) the SuperHyperSet \( S = \{ v \} \) is a dual SuperHyperDefensive SuperHyperCycle for N SHF ; (V, E);
(ii) \( r = \lceil \frac{n}{2} \rceil \) for N SHF ; (V, E);
(iii) \( \Gamma_s = \sum_{v=\{v\}}^2 \sigma(s) \) for N SHF ; (V, E);
(iv) the SuperHyperSets \( S = \{ v \} \) are only dual maximal SuperHyperCycle for N SHF ; (V, E).

Proposition 2.25 Let ESHG : (V, E) be a strong neutrosophic SuperHyperGraph. Then following statements hold:
(i) if \( s \geq t \) and a SuperHyperSet \( S \) of SuperHyperVertices is an t-SuperHyperDefensive SuperHyperCycle, then \( S \) is a s-SuperHyperDefensive SuperHyperCycle;
(ii) if \( s \leq t \) and a SuperHyperSet \( S \) of SuperHyperVertices is a dual t-SuperHyperDefensive SuperHyperCycle, then \( S \) is a dual s-SuperHyperDefensive SuperHyperCycle.
Proposition 2.26 Let ESHG : (V, E) be a strong neutrosophic SuperHyperGraph. Then following statements hold: 
(i) If \( s \geq t + 2 \) and a SuperHyperSet \( S \) of SuperHyperVertices is an \( t \)-SuperHyperDefensive SuperHyperCycle, then \( S \) is an \( s \)-SuperHyperPowerful SuperHyperCycle; 
(ii) If \( s \leq t \) and a SuperHyperSet \( S \) of SuperHyperVertices is a dual \( t \)-SuperHyperDefensive SuperHyperCycle, then \( S \) is a dual \( s \)-SuperHyperPowerful SuperHyperCycle.

Proposition 2.27. Let ESHG : (V, E) be a SuperHyperUniform-strong-neutrosophic SuperHyperGraph. Then following statements hold: 
(i) If \( \forall \in S, \text{N}(a) \cap S < \frac{1}{2} + 1 \) then ESHG : (V, E) is an 2-SuperHyperDefensive SuperHyperCycle; 
(ii) If \( \forall \in V \cap S, \text{N}(a) \cap S > \frac{1}{2} + 1 \) if ESHG : (V, E) is a dual 2-SuperHyperDefensive SuperHyperCycle; 
(iii) If \( \forall \in S, \text{N}(a) \cap V \cap S = 0 \) if ESHG : (V, E) is an \( r \)-SuperHyperDefensive SuperHyperCycle; 
(iv) If \( \forall \in V \cap S, \text{N}(a) \cap V \cap S = 0 \) if ESHG : (V, E) is a dual \( r \)-SuperHyperDefensive SuperHyperCycle.

Proposition 2.28 Let ESHG : (V, E) be a SuperHyperUniform-strong-neutrosophic SuperHyperGraph. Then following statements hold: 
(i) \( \forall \in S, \text{N}(a) \cap S < \frac{1}{2} + 1 \) if ESHG : (V, E) is an 2-SuperHyperDefensive SuperHyperCycle; 
(ii) \( \forall \in V \cap S, \text{N}(a) \cap S > \frac{1}{2} + 1 \) if ESHG : (V, E) is a dual 2-SuperHyperDefensive SuperHyperCycle; 
(iii) \( \forall \in S, \text{N}(a) \cap V \cap S = 0 \) if ESHG : (V, E) is an \( r \)-SuperHyperDefensive SuperHyperCycle; 
(iv) \( \forall \in V \cap S, \text{N}(a) \cap V \cap S = 0 \) if ESHG : (V, E) is a dual \( r \)-SuperHyperDefensive SuperHyperCycle.

Proposition 2.29 Let ESHG : (V, E) be a SuperHyperUniform-strong-neutrosophic SuperHyperGraph which is a SuperHyperComplete. Then following statements hold: 
(i) \( \forall \in S, \text{N}(a) \cap S < \frac{1}{2} + 1 \) if ESHG : (V, E) is an 2-SuperHyperDefensive SuperHyperCycle; 
(ii) \( \forall \in V \cap S, \text{N}(a) \cap S > \frac{1}{2} + 1 \) if ESHG : (V, E) is a dual 2-SuperHyperDefensive SuperHyperCycle; 
(iii) \( \forall \in S, \text{N}(a) \cap V \cap S = 0 \) if ESHG : (V, E) is an \( r \)-SuperHyperDefensive SuperHyperCycle; 
(iv) \( \forall \in V \cap S, \text{N}(a) \cap V \cap S = 0 \) if ESHG : (V, E) is a dual \( r \)-SuperHyperDefensive SuperHyperCycle.

Proposition 2.30 Let ESHG : (V, E) be a SuperHyperUniform-strong-neutrosophic SuperHyperGraph which is a SuperHyperComplete. Then following statements hold: 
(i) If \( \forall \in S, \text{N}(a) \cap S < 2 \) if ESHG : (V, E) then ESHG : (V, E) is an 2-SuperHyperDefensive SuperHyperCycle; 
(ii) If \( \forall \in V \cap S, \text{N}(a) \cap S > 2 \) then ESHG : (V, E) is a dual 2-SuperHyperDefensive SuperHyperCycle; 
(iii) \( \forall \in S, \text{N}(a) \cap V \cap S = 0 \) if ESHG : (V, E) is an \( (O - 1) \)-SuperHyperDefensive SuperHyperCycle; 
(iv) \( \forall \in V \cap S, \text{N}(a) \cap V \cap S = 0 \) if ESHG : (V, E) is a dual \( (O - 1) \)-SuperHyperDefensive SuperHyperCycle.

Proposition 2.31 Let ESHG : (V, E) be a SuperHyperUniform-strong-neutrosophic SuperHyperGraph which is a SuperHyperCycle. Then following statements hold: 
(i) If \( \forall \in S, \text{N}(a) \cap S < 2 \), then ESHG : (V, E) is an \( 2 \)-SuperHyperDefensive SuperHyperCycle; 
(ii) If \( \forall \in V \cap S, \text{N}(a) \cap S > 2 \), then ESHG : (V, E) is a dual \( 2 \)-SuperHyperDefensive SuperHyperCycle; 
(iii) If \( \forall \in S, \text{N}(a) \cap V \cap S = 0 \), then ESHG : (V, E) is an \( 2 \)-SuperHyperDefensive SuperHyperCycle; 
(iv) If \( \forall \in V \cap S, \text{N}(a) \cap V \cap S = 0 \), then ESHG : (V, E) is a dual \( 2 \)-SuperHyperDefensive SuperHyperCycle.

Proposition 2.32 Let ESHG : (V, E) be a SuperHyperUniform-strong-neutrosophic SuperHyperGraph which is a SuperHyperCycle. Then following statements hold: 
(i) If \( \forall \in S, \text{N}(a) \cap S < 2 \), then ESHG : (V, E) is an \( 2 \)-SuperHyperDefensive SuperHyperCycle; 
(ii) If \( \forall \in V \cap S, \text{N}(a) \cap S > 2 \), then ESHG : (V, E) is a dual \( 2 \)-SuperHyperDefensive SuperHyperCycle; 
(iii) If \( \forall \in S, \text{N}(a) \cap V \cap S = 0 \), then ESHG : (V, E) is a \( 2 \)-SuperHyperDefensive SuperHyperCycle; 
(iv) If \( \forall \in V \cap S, \text{N}(a) \cap V \cap S = 0 \), then ESHG : (V, E) is a dual \( 2 \)-SuperHyperDefensive SuperHyperCycle.

Applied Notions Under The Scrutiny Of The Motivation Of This Research
In this research, there are some ideas in the featured frameworks of motivations. I try to bring the motivations in the narrative ways.

Question 3.1 How to define the SuperHyperNotions and to do research on them to find the “amount of SuperHyperCycle” of either individual of cells or the groups of cells based on the fixed cell or the fixed group of cells, extensively, the “amount of SuperHyperCycle” based on the fixed groups of cells or the fixed groups of group of cells?

Question 3.2 What are the best descriptions for the “Cancer’s Recognition” in terms of these messy and dense SuperHyper-Models where embedded notions are illustrated? It’s motivation to find notions to use in this dense model is titled “SuperHyperGraphs”. Thus it motivates us to define different types of “SuperHyperCycle” and “neutrosophic SuperHyperCycle” on “SuperHyperGraph” and “neutrosophic SuperHyperGraph”.

Preliminaries Of This Research On the Redeemed Ways
In this section, the basic material in this research, is referred to [Single Valued neutrosophic Set] [38],Definition 2.2.2,2.2.4, [neutrosophic Set] [47],Definition 2.1.1, [neutrosophic SuperHyperGraph (NSHG)] [47],Definition 2.5.5,2.5.2, [Characterization of the neutrosophic SuperHyperGraph (NSHG)] [47],Definition 2.7,2.7.3, [t-norm] [47], Definition 2.7.3, and [Characterization of the neutrosophic SuperHyperGraph (NSHG)] [47],Definition 2.7,2.7.3. Also, the new ideas and their clarifications are addressed to [47].
**Definition 4.1.** ((neutrosophic) SuperHyperCycle).
Assume a SuperHyperGraph. Then

(i) an **Extreme SuperHyperCycle** (NSHG) for an extreme SuperHyperGraph NSHG : (V, E) is the maximum extreme cardinality of an extreme SuperHyperSet S of high extreme cardinality of the extreme SuperHyperEdges in the consecutive extreme sequence of extreme SuperHyperEdges and extreme SuperHyperVertices such that they form the extreme SuperHyperCycle and either all extreme SuperHyperVertices or all extreme SuperHyperEdges;

(ii) a **Neutrosophic SuperHyperCycle** (NSHG) for a neutrosophic SuperHyperGraph NSHG : (V, E) is the neutrosophic cardinality of the neutrosophic SuperHyperEdges of a neutrosophic SuperHyperSet S of high neutrosophic cardinality consecutive neutrosophic SuperHyperEdges and neutrosophic SuperHyperVertices such that they form the neutrosophic SuperHyperCycle and either all neutrosophic SuperHyperVertices or all neutrosophic SuperHyperEdges;

(iii) an **Extreme SuperHyperCycle** SuperHyperPolynomial (NSHG) for an extreme SuperHyperGraph NSHG : (V, E) is the extreme SuperHyperPolynomial contains the extreme coefficients defined as the extreme number of the maximum extreme cardinality of the extreme SuperHyperEdges of an extreme SuperHyperSet S of high extreme cardinality consecutive extreme SuperHyperEdges and extreme SuperHyperVertices such that they form the extreme SuperHyperCycle and either all extreme SuperHyperVertices or all extreme SuperHyperEdges; and the extreme power is corresponded to its extreme coefficient;

(iv) a **Neutrosophic SuperHyperCycle SuperHyperPolynomial** (NSHG) for a neutrosophic SuperHyperGraph NSHG : (V, E) is the neutrosophic SuperHyperPolynomial contains the neutrosophic coefficients defined as the neutrosophic number of the maximum neutrosophic cardinality of the neutrosophic SuperHyperEdges of a neutrosophic SuperHyperSet S of high neutrosophic cardinality consecutive neutrosophic SuperHyperEdges and neutrosophic SuperHyperVertices such that they form the neutrosophic SuperHyperCycle and either all neutrosophic SuperHyperVertices or all neutrosophic SuperHyperEdges; and the neutrosophic power is corresponded to its neutrosophic coefficient;

(v) an **Extreme R-SuperHyperCycle** (NSHG) for an extreme SuperHyperGraph NSHG : (V, E) is the maximum extreme cardinality of an extreme SuperHyperSet S of high extreme cardinality of the extreme SuperHyperVertices in the consecutive extreme sequence of extreme SuperHyperEdges and extreme SuperHyperVertices such that they form the extreme SuperHyperCycle and either all extreme SuperHyperVertices or all extreme SuperHyperEdges;

(vi) a **Neutrosophic R-SuperHyperCycle** (NSHG) for a neutrosophic SuperHyperGraph NSHG : (V, E) is the maximum neutrosophic cardinality of the neutrosophic SuperHyperVertices of a neutrosophic SuperHyperSet S of high neutrosophic cardinality consecutive neutrosophic SuperHyperEdges and neutrosophic SuperHyperVertices such that they form the neutrosophic SuperHyperCycle and either all neutrosophic SuperHyperVertices or all neutrosophic SuperHyperEdges;

(vii) an **Extreme R-SuperHyperCycle** SuperHyperPolynomial (NSHG) for an extreme SuperHyperGraph NSHG : (V, E) is the extreme SuperHyperPolynomial contains the extreme coefficients defined as the extreme number of the maximum extreme cardinality of the extreme SuperHyperVertices of an extreme SuperHyperSet S of high extreme cardinality consecutive extreme SuperHyperEdges and extreme SuperHyperVertices such that they form the extreme SuperHyperCycle and either all extreme SuperHyperVertices or all extreme SuperHyperEdges; and the extreme power is corresponded to its extreme coefficient;

(viii) a **Neutrosophic SuperHyperCycle SuperHyperPolynomial** (NSHG) for a neutrosophic SuperHyperGraph NSHG : (V, E) is the neutrosophic SuperHyperPolynomial contains the neutrosophic coefficients defined as the neutrosophic number of the maximum neutrosophic cardinality of the neutrosophic SuperHyperVertices of a neutrosophic SuperHyperSet S of high neutrosophic cardinality consecutive neutrosophic SuperHyperEdges and neutrosophic SuperHyperVertices such that they form the neutrosophic SuperHyperCycle and either all neutrosophic SuperHyperVertices or all neutrosophic SuperHyperEdges; and the neutrosophic power is corresponded to its neutrosophic coefficient.

**Definition 4.2.** ((neutrosophic/neutrosophic)δ SuperHyperCycle). Assume a SuperHyperGraph. Then

(i) an δ **SuperHyperCycle** is a neutrosophic kind of neutrosophic SuperHyperCycle such that either of the following expressions hold for the neutrosophic cardinalities of SuperHyper-Neighbors of s ∈ S:

\[ |S ∩ N (s)| > |S ∩ (V \setminus N (s))| + δ; \]

\[ |S ∩ N (s)| < |S ∩ (V \setminus N (s))| + δ. \]

The Expression (4.1), holds if S is an δ−SuperHyperOffensive. And the Expression (4.1), holds if S is an δ−SuperHyperDefensive;

(ii) a Neutrosophic δ SuperHyperCycle is a neutrosophic kind of neutrosophic SuperHyperCycle such that either of the following neutrosophic expressions hold.
Table 1. The Values of Vertices, SuperVertices, Edges, HyperEdges, and SuperHyperEdges Belong to The neutrosophic SuperHyperGraph Mentioned in the Definition (4.5)

<table>
<thead>
<tr>
<th>The Values of The Vertices</th>
<th>The Number of Position in Alphabet</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Values of The SuperVertices</td>
<td>The maximum Values of Its Vertices</td>
</tr>
<tr>
<td>The Values of The Edges</td>
<td>The maximum Values of Its Vertices</td>
</tr>
<tr>
<td>The Values of The HyperEdges</td>
<td>The maximum Values of Its Vertices</td>
</tr>
<tr>
<td>The Values of The SuperHyperEdges</td>
<td>The maximum Values of Its Endpoints</td>
</tr>
</tbody>
</table>

Table 2. The Values of Vertices, SuperVertices, Edges, HyperEdges, and SuperHyperEdges Belong to The neutrosophic SuperHyperGraph, Mentioned in the Definition

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</tr>
<tr>
<td>The Values of The HyperEdges</td>
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</tr>
<tr>
<td>The Values of The SuperHyperEdges</td>
<td>The maximum Values of Its Endpoints</td>
</tr>
</tbody>
</table>

for the neutrosophic cardinalities of SuperHyperNeighbors of \( s \in S \):

\[
|S \cap N(s)|_{Neutrosophic} > |S \cap (V \setminus N(s))|_{Neutrosophic} + \delta; \\
|S \cap N(s)|_{Neutrosophic} < |S \cap (V \setminus N(s))|_{Neutrosophic} + \delta.
\]

The Expression (4.1), holds if S is a Neutrosophic \( \delta \)-SuperHyperOffensive. And the Expression (4.1), holds if S is a Neutrosophic \( \delta \)-SuperHyperDefensive.

For the sake of having a neutrosophic SuperHyperCycle, there's a need to “redefine” the notion of “neutrosophic SuperHyperGraph”. The SuperHyperVertices and the SuperHyperEdges are assigned by the labels from the letters of the alphabets. In this procedure, there's the usage of the position of labels to assign to the values.

**Definition 4.3.** Assume a neutrosophic SuperHyperGraph. It's redefined Neutrosophic SuperHyperGraph if the Table (1) holds. It's useful to define a “neutrosophic” version of SuperHyperClasses. Since there's more ways to get neutrosophic type-results to make a neutrosophic more understandable.

**Definition 4.4** Assume a neutrosophic SuperHyperGraph. There are some Neutrosophic SuperHyperClasses if the Table (2) holds. Thus neutrosophic SuperHyperPath, SuperHyperCycle, SuperHyperStar, SuperHyperBipartite, SuperHyperMultiPartite, and SuperHyperWheel, are Neutrosophic SuperHyperPath, Neutrosophic SuperHyperCycle, Neutrosophic SuperHyperStar, Neutrosophic SuperHyperBipartite, Neutrosophic SuperHyperMultiPartite, and Neutrosophic SuperHyperWheel if the Table(2) holds.

It's useful to define a “neutrosophic” version of a neutrosophic SuperHyperCycle. Since there’s more ways to get type-results to make a neutrosophic SuperHyperCycle more neutrosophically understandable.

For the sake of having a neutrosophic SuperHyperCycle, there’s a need to “redefine” the neutrosophic notion of “neutrosophic SuperHyperCycle”. The SuperHyperVertices and the SuperHyperEdges are assigned by the labels from the letters of the alphabets. In this procedure, there’s the usage of the position of labels to assign to the values.

**Definition 4.5.** Assume a SuperHyperCycle. It’s redefined a Neutrosophic SuperHyperCycle if the Table (3) holds.

**Neutrosophic SuperHyperCycle But As The Extensions Except From Eulerian And Hamiltonian Forms**

The extreme SuperHyperNotion, namely, extreme SuperHyperCycle, is up. Thus the non-obvious extreme SuperHyperCycle, S is up. The extreme type-SuperHyperSet of the extreme SuperHyperCycle, is: S is an extreme SuperHyperSet, is: S does include only more than four extreme SuperHyperVertices in a connect-ed neutrosophic SuperHyperGraph ESHG : \((V, E)\). It’s interesting to mention that the extreme type-SuperHyperSet called the “extreme SuperHyperCycle” amid those obvious[non-obvi-ous] simple[non-simple] extreme type-SuperHyperSets called
the SuperHyperCycle, is only and only S in a connected neutro-
osophic SuperHyperGraph ESHG : (V, E) with an illustra-
ed Super Hyper Modeling. But all only obvious[non-obvious] simple[non-simple] extreme type-SuperHyperSets of the obvi-
ous[non-obvious] simple[non-simple] extreme SuperHyperCy-
cle amid those type-SuperHyperSets, are S.

A connected neutrosophic SuperHyperGraph ESHG : (V, E) as a
linearly-over-packed SuperHyperModel is featured on the Fig-
ures.

**Example 5.1** Assume the SuperHyperGraphs in the Figures (??),
(??), (??), (??), (??), (??), (??), (??), (??), (??), (??), (??), (??), (??),
(??), (1), (??), (??), and (??), the SuperHyperNotion,
namely, SuperHyperCycle, is up. The Algorithm is straightforward. But we regard to one instance, instantly.

On the Figure (1), the SuperHyperNotion, namely, SuperHyper-
Cycle, is up. There’s neither empty SuperHyperEdge nor loop
SuperHyperEdge. The following neutrosophic SuperHyperSet
of neutrosophic SuperHyperEdges[SuperHyperVertices] is the
simple neutrosophic type-SuperHyperSet of the neutrosophic
SuperHyperCycle. The Neutrosophic SuperHyperSet of neutro-
sophic SuperHyperEdges[SuperHyperVertices],

\[
\begin{align*}
C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} &= \{V_8, E_3, V_9, E_4, V_8\}, \\
C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} &= \{V_9, E_4, V_8, E_9, V_9\}, \\
C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} &= \{V_4, E_3, V_{11}, E_4, V_4\}, \\
C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} &= \{V_9, E_3, V_{10}, E_4, V_9\}, \\
C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} &= \{V_9, E_4, V_{10}, E_9, V_9\}, \\
C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} &= \{V_{11}, E_3, V_4, E_4, V_{11}\}, \\
C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} &= \{V_{11}, E_4, V_4, E_9, V_{11}\}, \\
C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} &= \{V_{15}, E_3, V_{17}, E_4, V_{15}\}, \\
C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} &= \{V_{17}, E_3, V_{15}, E_4, V_{17}\}, \\
C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} &= \{V_{11}, E_3, V_{10}, E_9, V_{11}\}, \\
C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} &= \{V_{11}, E_4, V_{10}, E_9, V_{11}\}, \\
C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} &= \{V_{15}, E_3, V_{17}, E_4, V_{15}\}, \\
C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} &= \{V_{17}, E_3, V_{15}, E_4, V_{17}\}. \\
\end{align*}
\]

**Figure 1.** The SuperHyperGraphs Associated to the Notions of SuperHyperCycle in the Example (5.1)

**Example (5.1)**

- C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} = \{V_9, V_{11}, V_9\},
- C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} = \{V_{10}, V_8, V_{10}\},
- C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} = \{V_{10}, V_9, V_{10}\},
- C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} = \{V_{11}, V_{11}, V_{10}\},
- C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} = \{V_{11}, V_8, V_{11}\},
- C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} = \{V_{11}, V_9, V_{11}\},
- C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} = \{V_{11}, V_{10}, V_{11}\},
- C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} = \{V_{15}, V_{17}, V_{15}\},
- C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} = \{V_{17}, V_{15}, V_{17}\}.

**C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}}**

- C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} = \{V_{10}, E_3, V_9, E_4, V_{10}\},
- C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} = \{V_{11}, E_3, V_4, E_4, V_{11}\},
- C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} = \{V_{11}, E_4, V_4, E_9, V_{11}\},
- C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} = \{V_{15}, E_3, V_{17}, E_4, V_{15}\},
- C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} = \{V_{17}, E_3, V_{15}, E_4, V_{17}\}.

**C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}}**

\[
\begin{align*}
\text{Proposition 5.2.} & \text{ Assume a connected loopless neutrosophic SuperHyperGraph} \\
\text{ESHG} : (V, E). & \text{Then in the worst case, literally,} \\
C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} & = \{V_1, V_2, V_3, E_2, V_4, E_3, V_5\}, \\
C(\text{NSHG})_{\text{NeutrosophicQuasi-SuperHyperCycle}} & = \{V_1, V_2, V_3, V_4, V_1\}. \\
\end{align*}
\]
Is a neutrosophic type-result-SuperHyperCycle. In other words, the least cardinality, the lower sharp bound for the cardinality, of a neutrosophic type-result-SuperHyperCycle is the cardinality of \( C(NSHG)_{\text{NeutrosophicQuasi-SuperHyperCycle}} \). Then \( C(NSHG)_{\text{NeutrosophicQuasi-SuperHyperCycleSuperHyperPolynomial}} = z \).

**Proposition 5.3.** Assume a simple neutrosophic SuperHyper-Graph \( ESHG : (V, E) \).
Then the neutrosophic number of type-result-R-SuperHyperCycle has, the least neutrosophic cardinality, the lower sharp neutrosophic bound for neutrosophic cardinality, is the neutrosophic cardinality of \( V \setminus (a_1, b_1, c_1, a_2, b_2, c_2, \ldots) \) \( \in \{E^r_{ESHG(V,E)} \mid |E| = \max \{|E| \mid E \in E_{EESHG(V,E)} \} \} \).

If there’s a neutrosophic type-result-R-SuperHyperCycle with the least neutrosophic cardinality, the lower sharp neutrosophic bound for cardinality.

**The Departures on The Theoretical Results Toward Theoretical Motivations**
The previous neutrosophic approaches apply on the upcoming neutrosophic results on neutrosophic SuperHyperClasses.

**Proposition 6.1** Assume a connected neutrosophic SuperHyper-Path \( ESHP : (V, E) \).

Then \( C(NSHG)_{\text{NeutrosophicQuasi-SuperHyperCycle}} = \{E_{2i} = \emptyset \mid \text{Neutrosophic Cardinality} \} \).

\( C(NSHG)_{\text{NeutrosophicQuasi-SuperHyperCycleSuperHyperPolynomial}} = 2z^r \).

\( C(NSHG)_{\text{NeutrosophicQuasi-SuperHyperCycleSuperHyperPolynomial}} = \{V_i \mid \text{Neutrosophic Cardinality} \} \).

**Example 6.4.** In the Figure (3), the connected neutrosophic SuperHyperCycle \( NSHC : (V, E) \), is highlighted and featured. The obtained neutrosophic SuperHyperSet, in the neutrosophic SuperHyperModel (3), is the neutrosophic SuperHyperCycle.

**Example 6.2.** In the Figure (2), the connected neutrosophic SuperHyperPath \( ESHP : (V, E) \), is highlighted and featured. The neutrosophic SuperHyperSet, in the neutrosophic SuperHyperModel (2), is the SuperHyperCycle.

**Proposition 6.3.** Assume a connected neutrosophic SuperHyperCycle \( ESHC : (V, E) \).

Then \( C(NSHG)_{\text{NeutrosophicQuasi-SuperHyperCycle}} = \{E_{2i} = \emptyset \mid \text{Neutrosophic Cardinality} \} \).

\( C(NSHG)_{\text{NeutrosophicQuasi-SuperHyperCycleSuperHyperPolynomial}} = 2z^r \).

\( C(NSHG)_{\text{NeutrosophicQuasi-SuperHyperCycleSuperHyperPolynomial}} = \{V_i \mid \text{Neutrosophic Cardinality} \} \).

**Proof.** Let \( C : V_1, E_1, V_2, E_2, \ldots, V_i \) is a longest path taken from a connected neutrosophic SuperHyperPath \( ESHP : (V, E) \). Then there’s no cycle. Thus the notion of quasi is up. The latter is straightforward.

**Example 6.2.** In the Figure (2), the connected neutrosophic SuperHyperPath \( ESHP : (V, E) \), is highlighted and featured. The neutrosophic SuperHyperSet, in the neutrosophic SuperHyperModel (2), is the SuperHyperCycle.

**Proposition 6.3.** Assume a connected neutrosophic SuperHyperCycle \( ESHC : (V, E) \).
Then the connected neutrosophic SuperHyperStar $ESHS : (V, E)$. Then
$$C(NSHG)_{\text{Neutrosophic-Quasi-SuperHyperCycle}} = \{E \in E_{ESHS(V, E)}\}.$$ $C(NSHG)_{\text{Neutrosophic-Quasi-SuperHyperCycleSuperHyperPolynomial}} =$ $\sum_{E \in E_{ESHS(V, E)}} z^{E |\text{Neutrosophic Cardinality} = E \in E_{ESHS(V, E)}}.$ $C(NSHG)_{\text{Neutrosophic-Quasi-SuperHyperCycle}} = (V_1 \cup V_2 \cup V_3 \cup \ldots).$ $C(NSHG)_{\text{Neutrosophic-Quasi-SuperHyperCycleSuperHyperPolynomial}} =$ $z^{V_1} + z^{V_2} + \ldots$ $C(NSHG)_{\text{Neutrosophic-Quasi-SuperHyperCycleSuperHyperPolynomial}} =$ $az^s.$

**Proof.** Let $P : V_1, E_1, V_2, E_2, \ldots, V_r$ is a longest path taken from a connected neutrosophic SuperHyperStar $ESHS : (V, E)$. Then there's no cycle. Thus the notion of quasi is up. The latter is straightforward.

**Example 6.6.** In the Figure (4), the connected neutrosophic SuperHyperStar $ESHS : (V, E)$, is highlighted and featured. The obtained neutrosophic SuperHyperSet, by the algorithm in previous neutrosophic result, of the neutrosophic SuperHyperVertices of the connected neutrosophic SuperHyperStar $ESHS : (V, E)$, in the neutrosophic SuperHyperModel (4), is the neutrosophic SuperHyperCycle.

**Proposition 6.7.** Assume a connected neutrosophic SuperHyperBipartite

**Example 6.8.** In the neutrosophic Figure (5), the connected neutrosophic SuperHyperBipartite $ESHB : (V, E)$, is neutrosophic highlighted and neutrosophic featured. The obtained neutrosophic SuperHyperSet, by the neutrosophic Algorithm in previous neutrosophic result, of the neutrosophic SuperHyperVertices of the connected neutrosophic SuperHyperBipartite $ESHB : (V, E)$, in the neutrosophic SuperHyperModel (5), is the neutrosophic SuperHyperCycle.

**Proposition 6.9.** Assume a connected neutrosophic SuperHyperMultipartite
Figure 6. a neutrosophic SuperHyperMultipartite Associated to the Notions of neutrosophic SuperHyperCycle in the Example (6.10)

\[ ESHM : (V, E). \text{ Then} \]
\[
\begin{align*}
\mathbb{C}(NSHG)_{\text{NeutrosophicQuasi} - \text{SuperHyperCycle} }^\text{Cardinality} & = \{E\} - \sum_{i=1}^{s} |P_{ESHG}(V,E)|_{\text{Neutrosophic Cardinality}} \\
\mathbb{C}(NSHG)_{\text{NeutrosophicQuasi} - \text{SuperHyperCycle} \text{SuperHyperPolynomial}} & = \sum_{i=1}^{s} |P_{ESHG}(V,E)|_{\text{Neutrosophic Cardinality}} \\
\mathbb{C}(NSHG)_{\text{NeutrosophicQuasi} - \text{SuperHyperCycle} \text{SuperHyperPolynomial}} & = \{V_i\}^{s}_{i=1} \\
\mathbb{C}(NSHG)_{\text{NeutrosophicQuasi} - \text{SuperHyperCycle} \text{SuperHyperPolynomial}} & = az^{s} \\
\end{align*}
\]

*Proof.* Let \( C : V_1, E_1, V_2, E_2, \ldots, V_z \) is a longest cycle taken from a connected neutrosophic SuperHyperMultipartite \( ESHM : (V, E) \). Then there’s at least one cycle. Thus the notion of quasi isn’t up and the SuperHyperNotions based on SuperHyperCycle could be applied. There are only \( z' \) SuperHyperParts. Thus every SuperHyperPart could have one SuperHyperVertex as the representative in the \( C : V_1, E_1, V_2, E_2, \ldots, V_z \) is a connected neutrosophic SuperHyperMultipartite \( ESHM : (V, E) \). Thus only \( z' \) SuperHyperVertices and only \( z' \) SuperHyperEdges are attained in any solution \( C : V_1, E_1, V_2, E_2, \ldots, V_z \). The latter is straightforward.

**Example 6.10.** In the Figure (6), the connected neutrosophic SuperHyperMultipartite \( ESHM : (V, E) \), is highlighted and neutrosophic featured. The obtained neutrosophic SuperHyperSet, by the Algorithm in previous neutrosophic result, of the neutrosophic SuperHyperVertices of the connected neutrosophic SuperHyperMultipartite \( ESHM : (V, E) \), in the neutrosophic SuperHyperModel (6), is the neutrosophic SuperHyperCycle.

**Proposition 6.11.** Assume a connected neutrosophic SuperHyperWheel

Figure 7: a neutrosophic SuperHyperWheel neutrosophic Associated to the neutrosophic Notions of neutrosophic SuperHyperCycle in the neutrosophic Example (6.12)
Neutrosophic Super Hyper Wheel $ESHW : (V, E)$. Then there’s at least one cycle. Thus the notion of quasi isn’t up and the SuperHyperNotions based on SuperHyperCycle could be applied. The unique embedded SuperHyperCycle proposes some longest cycles excerpt from some representatives. The latter is straightforward.

**Example 6.12.** In the neutrosophic Figure (7), the connected neutrosophic SuperHyperWheel $NSHW : (V, E)$, is neutrosophic highlighted and featured. The obtained neutrosophic SuperHyperSet, by the Algorithm in previous result, of the neutrosophic SuperHyperVertices of the connected neutrosophic SuperHyperWheel $ESHW : (V, E)$, in the neutrosophic SuperHyperModel (7), is the neutrosophic SuperHyperCycle.

**Background**


References

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