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Support Edge Regular Neutrosophic Fuzzy Graphs

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Abstract: In this paper, we introduce support edge regular neutrosophic fuzzy graph, support totally edge regular neutrosophic fuzzy graphs and investigate some theorems and results of these graphs. Also the comparative study between edge regular neutrosophic fuzzy graph and support edge regular neutrosophic fuzzy graph are done here.

Key Words: Support edge regular neutrosophic fuzzy graph, support totally edge regular neutrosophic fuzzy graph.

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§1. Introduction

Prof.Smarandache [20] introduced notion of neutrosophic set which is useful for dealing real life problems having imprecise, indeterminacy and inconsistent data. They are generalization of the theory of fuzzy sets, intuitionistics fuzzy set, interval valued fuzzy set, and interval valued intuitionistic fuzzy sets. Nagoor Gani and Radha [4] introduced regular fuzzy graphs, total degree and totally regular fuzzy graphs. Irregular fuzzy graphs are introduced by Nagoor Gani, S. R. Latha [3]. Azriel Rosenfeld introduced fuzzy graphs in 1975 [5]. N. Shah [19] introduced the notion of neutrosophic graphs and different operations like union, intersection and complement in his work. A neutrosophic set is characterized by a truth membership degree (t), an indeterminacy membership degree(i), falsity membership degree(f) independently, which are with in the real standard or non standard unit interval $]^{-}0, 1^{+}[$. Divya and Dr. J. Malarvizhi introduced the notion of neutrosophic fuzzy graph and few fundamental operation on neutrosophic fuzzy graph [1]. N. R. Santhi Maheswari and C. Sekar introduced Neighbourly irregular graphs and semi neighbourly irregular graphs, m-neighbourly irregular Fuzzy graphs, m-neighbourly irregular intuitionistic Fuzzy Graph [7, 8, 9].

N. R. Santhi Maheswari and C. Sekar introduced edge irregular fuzzy graphs, neighbourly edge irregular fuzzy graphs, strongly edge irregular fuzzy graphs [10, 11, 12]. N. R. Santhi Ma-

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heswari and C. Sekar introduced edge irregular bipolar fuzzy graphs, neighbourly edge irregular bipolar fuzzy graphs, strongly edge irregular bipolar fuzzy graphs [13, 14, 15]. N. R. Santhi Maheswari, M. Sudha and Durga introduced edge irregularity intuitionistic fuzzy graph [16]. R. Muneeswari and N. R. Santhi Maheswari introduced support edge regular fuzzy graph [6].

N. R. Santhi Maheswari and K. Amutha introduced support neighbourly edge irregular graphs and 1-neighbourly edge irregular graphs [17, 18]. S. Sivabala and N. R. Santhi Maheswari introduced support edge irregular neutrosophic fuzzy graphs, neighbourly and highly irregular neutrosophic fuzzy graphs and highly edge irregular neutrosophic fuzzy graphs [21, 22, 23].

These ideas motivate us to introduce support edge regular and support totally edge regular neutrosophic fuzzy graphs.

§2. Preliminaries

In this section, we mainly recall the notions related to neutrosophic set, fuzzy graph, neutrosophic fuzzy set and neutrosophic fuzzy graph.

Definition 2.1([20]) *Let X be a space of points with generic elements in X denoted by x. A neutrosophic set $A(NSA)$ is an object having the form*

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

where the functions $T, I, F \to]^-0, 1^+[$ define respectively 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 $T_A(x), I_A(x), F_A(x)$ are real standard or non standard subsets of $]^-0, 1^+[$.

Definition 2.2([3]) *A fuzzy graph is a pair of functions $G = (\sigma, \mu)$, where σ is a fuzzy subset of a non-empty set V and is a symmetric fuzzy relation of σ i.e $\sigma : V \to [0, 1]$ and $\mu : V \times V \to [0, 1]$ such that $\mu(uv) \leq \sigma(u)\Lambda\sigma(v), \forall u, v \in V$ where uv denote the edge between u and v, and $\sigma(u)\Lambda\sigma(v)$ denotes the minimum of $\sigma(u)$ and $\sigma(v)$, σ is called the fuzzy vertex set of V and μ is called the fuzzy edge set of E.*

Definition 2.3([1]) *Let X be a space of points with generic elements in X denoted by x. A neutrosophic fuzzy set$A(NFSA)$ is characterized by truth membership function $T_A(x)$, an indeterminacy membership functions $I_A(x)$ 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 neutrosophic fuzzy set A can be written as

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

Definition 2.4([1]) *Let $A = (T_A, I_A, F_A)$ and $B = (T_B, I_B, F_B)$ be neutrosophic fuzzy sets on a set X. If $A = (T_A, I_A, F_A)$ is a neutrosophic fuzzy relation on a set X, then $A = (T_A, I_A, F_A)$*

is called a neutrosophic fuzzy relation on $B = (T_B, I_B, F_B)$ *if*

$$T_B(x,y) \leq T_A(x).T_A(y),$$
$$I_B(x,y) \leq I_A(x).I_A(y),$$
$$F_B(x,y) \leq F_A(x).F_A(y),$$

for all $x, y \in X$, *where . means the ordinary multiplication.*

Definition 2.5([1]) *A neutrosophic fuzzy graph* ($NFgraph$) *with underlying set* V *is defined to be a pair* $N_G = (A, B)$, *where*

(*i*) *The functions* $T_A, I_A, F_A : V \to [0,1]$ *denote the degree of truth membership, degree of indeterminacy membership and the degree of falsity membership of the element* $v_i \in V$ *respectively and* $0 \leq T_A(v_i) + I_A(v_i) + F_A(v_i) \leq 3$;

(*ii*) $E \subseteq V \times V$ *where the functions* $T_B, I_B, F_B : V \times V \to [0,1]$ *are defined by*

$$T_B(v_i, v_j) \leq T_A(v_i).T_A(v_j)$$
$$I_B(v_i, v_j) \leq I_A(v_i).I_A(v_j)$$
$$F_B(v_i, v_j) \leq F_A(v_i).F_A(v_j)$$

for all $v_i, v_j \in V$, *where . means ordinary multiplication denotes the degrees of truth membership, indeterminacy membership and falsity membership of the edge* $(v_i, v_j) \in E$ *respectively, where* $0 \leq T_B(v_i, v_j) + I_B(v_i, v_j) + F_B(v_i, v_j) \leq 3$ *for all* $(v_i, v_j) \in E$ $(i, j = 1, 2, \cdots, n)$.

Definition 2.6([23]) *Let* $N_G = (A, B)$ *be a neutrosophic fuzzy graph. The degree of an edge* uv *in* N_G *defined by* $d_{N_G}(uv) = d_{N_G}(u) + d_{N_G}(v) - 2(T_B(uv), I_B(uv), F_B(uv))$, $d_{N_G}(u) = (deg_T(u), deg_I(u), deg_F(u))$, $d_{N_G}(v) = (deg_T(v), deg_I(v), deg_F(v))$, *where*

$$\begin{aligned} deg_T(u) &= \sum_{uv \in E} T_B(uv), \quad deg_I(u) = \sum_{uv \in E} I_B(uv), \\ deg_F(u) &= \sum_{uv \in E} F_B(uv), \quad deg_T(v) = \sum_{uv \in E} T_B(uv), \\ deg_I(v) &= \sum_{uv \in E} I_B(uv), \quad deg_F(v) = \sum_{uv \in E} F_B(uv). \end{aligned}$$

The minimum degree of an edge is $\delta_E(N_G) = \wedge\{d_{N_G}(uv)/uv \in E\}$. *The maximum degree of an edge is* $\Delta_E(N_G) = \vee\{d_{N_G}(uv)/uv \in E\}$.

Definition 2.7([23]) *Let* $N_G = (A, B)$ *be a neutrosophic fuzzy graph. The total degree of an edge* uv *in* N_G *defined by* $td_{N_G}(uv) = d_{N_G}(uv) + (T_B(uv), I_B(uv), F_B(uv))$. *The minimum total degree of an edge is* $\delta_{tE}(N_G) = \wedge\{td_{N_G}(uv)/uv \in E\}$. *The maximum total degree of an edge is* $\Delta_{tE}(N_G) = \vee\{td_{N_G}(uv)/uv \in E\}$. z

Definition 2.8([23]) *Let* N_G *be a neutrosophic fuzzy graph on* $G(V, E)$. *Then* N_G *is said to be an edge regular neutrosophic fuzzy graph if all edges having same edge degree.*

Definition 2.9([23]) *Let* N_G *be a neutrosophic fuzzy graph on* $G(V, E)$. *Then* N_G *is said to be an edge totally regular neutrosophic fuzzy graph if all edges having same edge total degree.*

Definition 2.10([21]) *Let $N_G = (A, B)$ be a neutrosophic fuzzy graph. The support of an edge e in N_G is the sum of edge degree of its neighbour edges. That is*

$$s_{N_G}(e) = \sum_{e \in N(e_i)} d_{N_G}(e_i), \quad d_{N_G}(e_i)$$

is the degree of an edge e_i, where

$$\begin{aligned} d_{N_G}(e) &= d_{N_G}(u) + d_{N_G}(v) - 2(T_B(e), I_B(e), F_B(e)), \ e = uv \in E, \\ d_{N_G}(u) &= (deg_T(u), deg_I(u), deg_F(u)), \quad d_{N_G}(v) = (deg_T(v), deg_I(v), deg_F(v)) \end{aligned}$$

with

$$\begin{aligned} deg_T(u) &= \sum_{uv \in E} T_B(uv), \quad deg_I(u) = \sum_{uv \in E} I_B(uv), \\ deg_F(u) &= \sum_{uv \in E} F_B(uv), \quad deg_T(v) = \sum_{uv \in E} T_B(uv), \\ deg_I(v) &= \sum_{uv \in E} I_B(uv), \quad deg_F(v) = \sum_{uv \in E} F_B(uv). \end{aligned}$$

Definition 2.11([21]) *Let $N_G = (A, B)$ be a neutrosophic fuzzy graph. The total support of an edge e in N_G defined by $ts_{N_G}(e) = s_{N_G}(e) + (T_B, I_B, F_B)(e)$.*

§3. Support Edge Regular Neutrosophic Fuzzy Graphs

In this section, we have defined support edge regular and support totally edge regular neutrosophic fuzzy graphs and discuss some properties.

Definition 3.1 *Let N_G be a neutrosophic fuzzy graph on $G(V, E)$. Then N_G is said to be an support edge regular if all the edges having same edge support or $s_{N_G}(e) = (k_1, k_2, k_3)$ for all edges in N_G.*

Definition 3.2 *Let N_G be a neutrosophic fuzzy graph on $G(V, E)$. Then N_G is said to be an support totally edge regular if all the edges having same total edge support or $ts_{N_G}(e) = (tk_1, tk_2, tk_3)$ for all edges in N_G.*

Example 3.3 Let N_G be a neutrosophic fuzzy graph. Consider the neutrosophic fuzzy graph given in Figure 1. We calculated support of an edge and total support of an edge are as follows:

$d_{N_G}(e_1) = d_{N_G}(v_1v_2) = d_{N_G}(v_1) + d_{N_G}(v_2) - 2(T_B(v_1v_2), I_B(v_1v_2), F_B(v_1v_2))$.

$d_{N_G}(v_1v_2) = (0.04, 0.08, 0.12) + (0.04, 0.08, 0.12) - 2(0.02, 0.04, 0.06)$.

$d_{N_G}(v_1v_2) = (0.04, 0.08, 0.12) = d_{N_G}(e_1)$.

Similarly, $d_{N_G}(e_2) = (0.04, 0.08, 0.12)$; $d_{N_G}(e_3) = (0.04, 0.08, 0.12)$; $s_{N_G}(e_1) = d_{N_G}(e_2) + d_{N_G}(e_3) = (0.08, 0.16, 0.24)$ and $s_{N_G}(e_2) = s_{N_G}(e_3)$.

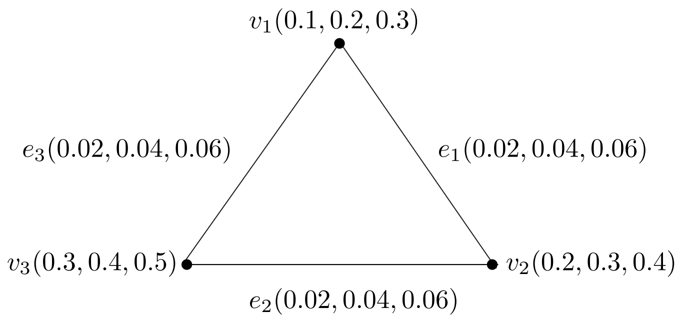

Figure 1

and $ts_{N_G}(e_1) = s_{N_G}(e_1) + (T_B, I_B, F_B)(e_1) = (0.10, 0.20, 0.30)$.

Similarly, $ts_{N_G}(e_2) = (0.10, 0.20, 0.30) = ts_{N_G}(e_3)$. Here every edges having same edge support and same total edge support. Hence this graph is support edge regular neutrosophic fuzzy graph and support totally edge regular neutrosophic fuzzy graph.

Remark 3.4 Every support edge regular neutrosophic fuzzy graph need not be support totally edge regular neutrosophic fuzzy graph.

Example 3.5 Let N_G be a neutrosophic fuzzy graph. Consider the neutrosophic fuzzy graph given in Figure.2. We calculated support of an edge and total support of an edge are as follows:

$s_{N_G}(e_1) = (0.06, 0.10, 0.14) = s_{N_G}(e_2) = s_{N_G}(e_3) = s_{N_G}(e_4)$.

$ts_{N_G}(e_1) = (0.07, 0.12, 0.17)$, $ts_{N_G}(e_2) = (0.08, 0.13, 0.18)$.

$ts_{N_G}(e_3) = (0.07, 0.12, 0.17)$, $ts_{N_G}(e_4) = (0.08, 0.13, 0.18)$.

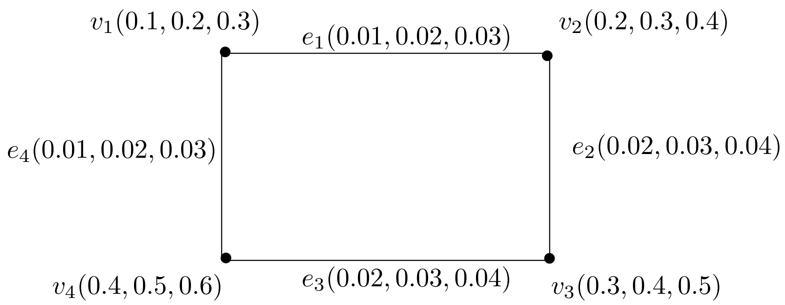

Figure.2

Here every edge has same edge support. Therefore this graph is support edge regular neutrosophic fuzzy graph. But total edge support of all edges are not same. Therefore this graph is not a support totally edge regular neutrosophic fuzzy graph.

Theorem 3.6 *Let N_G be neutrosophic fuzzy graph on $G(V, E)$ and (T_B, I_B, F_B) is constant function. Then, the following conditions are equivalent:*

(i) N_G *is support edge regular neutrosophic fuzzy graph;*

(ii) N_G *is support totally edge regular neutrosophic fuzzy graph.*

Proof Let N_G be neutrosophic fuzzy graph with (T_B, I_B, F_B) is constant function . i.e. $(T_B, I_B, F_B)(e) = (x, y, z)$, where (x, y, z) is constant for all $e \in E$. Suppose N_G is support edge regular neutrosophic fuzzy graph. Then all the edges have same edge support. Let e_1 and e_2 be two edges having same edge support. i.e. $s_{N_G}(e_1) = s_{N_G}(e_2)$.

Since $(T_B, I_B, F_B)(e) = (x, y, z)$, where (x, y, z) is constant for all $e \in E$, we have $s_{N_G}(e_1)+(x, y, z) = s_{N_G}(e_2) + (x, y, z)$. This implies that $s_{N_G}(e_1) + (T_B, I_B, F_B)(e_1) = s_{N_G}(e_2) + (T_B, I_B, F_B)(e_2)$, which implies that $ts_{N_G}(e_1) = ts_{N_G}(e_2)$, where e_1 and e_2 be two edges. Therefore all the edges having same total edge support.

Hence N_G is support totally edge regular neutrosophic fuzzy graph and $(i) \implies (ii)$ hold.

Suppose N_G is support totally edge regular neutrosophic fuzzy graph. Then all the edges having same total edge support. Without loss of generality, let e_1 and e_2 be two edges having same total edge supports, i.e. $ts_{N_G}(e_1) = ts_{N_G}(e_2)$. This implies that $s_{N_G}(e_1) + (x, y, z) = s_{N_G}(e_2) + (x, y, z)$.

Since $(T_B, I_B, F_B)(e) = (x, y, z)$, where (x, y, z) is constant for all $e \in E$, we have $s_{N_G}(e_1) = s_{N_G}(e_2)$, where e_1 and e_2 be two edges. Therefore all the edges having same edge support. Hence, N_G is support edge regular neutrosophic fuzzy graph and $(ii) \implies (i)$ hold. □

Theorem 3.7 *Let N_G be neutrosophic fuzzy graph on $G(V, E)$ and (T_B, I_B, F_B) is constant function. Then the following conditions are equivalent:*

(i) N_G *is edge regular neutrosophic fuzzy graph;*

(ii) N_G *is support edge regular neutrosophic fuzzy graph.*

Proof Let N_G be neutrosophic fuzzy graph on $G(V, E)$ and (T_B, I_B, F_B) is constant function. Suppose we take N_G is edge regular neutrosophic fuzzy graph. Then, $d_{N_G}(e_i) = (x_1, x_2, x_3)$, where (x_1, x_2, x_3) is constant for all e_i in N_G. We know that

$$s_{N_G}(e_i) = \sum_{e_j \in N(e_i)} d_{N_G}(e_j) = \sum_{e_k \in N(e_j)} d_{N_G}(e_k) = s_{N_G}(e_j)$$

since $d_{N_G}(e_i) = (x_1, x_2, x_3)$, is constant for all e_i in N_G. Therefore edge support of all edges are same. Hence this graph is support edge regular neutrosophic fuzzy graph. Hence $(i) \implies (ii)$ hold.

Suppose we take N_G is support edge regular neutrosophic fuzzy graph. Then the edge support of all edges are same. Now, To prove that the graph is edge regular neutrosophic fuzzy graph. Suppose we take the graph is not edge regular neutrosophic fuzzy graph. That is, $d_{N_G}(e_i) \neq d_{N_G}(e_j)$ for some integers i, j. This implies that $s_{N_G}(e_s) \neq s_{N_G}(e_t)$ for some s, t, where $d_{N_G}(e_i) \in s_{N_G}(e_s)$ and $d_{N_G}(e_j) \in s_{N_G}(e_t)$. This is contradiction. Therefore $d_{N_G}(e_i) = d_{N_G}(e_j)$. Hence this graph is edge regular neutrosophic fuzzy graph and $(i) \implies (ii)$ hold. □

Theorem 3.8 *Let N_G be neutrosophic fuzzy graph, where N_G is cycle with (T_B, I_B, F_B) is a constant function. Then N_G is support edge regular and support totally edge regular neutrosophic* *fuzzy graph.*

Proof Let N_G be neutrosophic fuzzy graph, a cycle of length n. Suppose $(T_B, I_B, F_B)(e_i) = (x, y, z)$, where (x, y, z) is constant for all $e \in E$. Then we know that

$$s_{N_G}(e_i) = \sum_{e_j \in N(e_i)} d_{N_G}(e_j).$$

Now,

$$s_{N_G}(e_i) = \begin{cases} d_{N_G}(e_2) + d_{N_G}(e_n) \text{if } i = 1 \\ d_{N_G}(e_{i-1}) + d_{N_G}(e_{i+1}) \text{ if } i = 2, 3, \cdots, n-1 \\ d_{N_G}(e_{i-1}) + d_{N_G}(e_1) \text{ if } i = n, \end{cases}$$

where

$$d_{N_G}(e_i) = \begin{cases} (T_B, I_B, F_B)(e_2) + (T_B, I_B, F_B)(e_n) \text{ if } i = 1 \\ (T_B, I_B, F_B)(e_{i-1}) + (T_B, I_B, F_B)(e_{i+1}) \text{ if } i = 2, 3, \cdots, n-1 \\ (T_B, I_B, F_B)(e_{i-1}) + (T_B, I_B, F_B)(e_1) \text{ if } i = n. \end{cases}$$

Since $(T_B, I_B, F_B)(e_i) = (x, y, z)$, where (x, y, z) is constant for all $e_i \in E$, we have all the edges having same edge support. Hence this graph is support edge regular neutrosophic fuzzy graph.

Since the graph is support edge regular neutrosophic fuzzy graph with (T_B, I_B, F_B) is a constant function, then by Theorem 3.6, the graph is suppor totally edge regular neutrosophic fuzzy graph. □

Theorem 3.9 *Let N_G be neutrosophic fuzzy graph, a star $K_{1,n}$ with (T_B, I_B, F_B) is a constant function. Then N_G is support edge regular and support edge totally regular neutrosophic fuzzy graph.*

Proof Let $v_1, v_2, v_3, \cdots, v_n$ be the vertices of N_G adjacent to the vertex x. Let $e_1, e_2, \cdots, e_n$ be the edges of a star N_G with (T_B, I_B, F_B) constant and

$$d_{N_G}(e_i) = ((x_1, y_1, z_1) + \cdots + (x_n, y_n, z_n)) - (x_i, y_i, z_i), \quad (1 \le i \le n).$$

Therefore all the edges e_i,$1 \le i \le n$ having same edge degrees. Therefore the graph is edge regular neutrosophic fuzzy graph. By theorem 3.7, the graph is support edge regular neutrosophic fuzzy graph. By theorem 3.6, the graph is support edge totally regular neutrosophic fuzzy graph. □

§4. Comparative Study Between Support Edge Regular N_G and Edge Regular N_G

Remark 4.1 Every support edge regular neutrosophic fuzzy graph need not be an edge regular neutrosophic fuzzy graph.

Example 4.2 Let N_G be neutrosophic fuzzy graph.

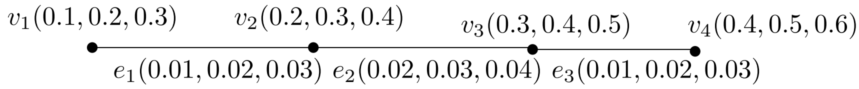

Figure 3

Consider the neutrosophic fuzzy graph given in Figure 3. We calculated degree of an edge and support of an edge are as follows:

$d_{N_G}(e_1) = (0.02, 0.03, 0.04)$, $d_{N_G}(e_2) = (0.04, 0.06, 0.08)$,

$d_{N_G}(e_3) = (0.02, 0.03, 0.04)$, $s_{N_G}(e_1) = (0.04, 0.06, 0.08)$,

$s_{N_G}(e_2) = (0.04, 0.06, 0.08)$, $s_{N_G}(e_3) = (0.04, 0.06, 0.08)$.

Here all the edges having same edge support but the edge degree of an edge e_2 which is distinct from the edges e_1 and e_3. Therefore this graph is support edge regular neutrosophic fuzzy graph but not a edge regular neutrosophic fuzzy graph.

Remark 4.3 Every edge totally regular neturosophic fuzzy graph need not be an support totally edge regular neutrosophic fuzzy graph.

Example 4.4 Let N_G be a neutrosophic fuzzy graph.

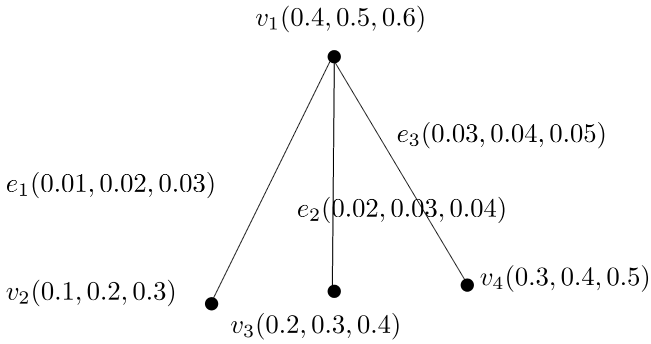

Figure 4

Consider the neutrosophic fuzzy graph given in Figure 4, we calculated degree of an edge, total degree of an edge, support of an edge and total support of an edge are as follows:

$d_{N_G}(e_1) = (0.05, 0.07, 0.09)$, $d_{N_G}(e_2) = (0.04, 0.06, 0.08)$, $d_{N_G}(e_3) = (0.03, 0.05, 0.07)$;

$td_{N_G}(e_1) = (0.06, 0.09, 0.12) = td_{N_G}(e_2) = td_{N_G}(e_3)$;

$s_{N_G}(e_1) = (0.07, 0.11, 0.15)$, $s_{N_G}(e_2) = (0.08, 0.12, 0.16)$, $s_{N_G}(e_3) = (0.09, 0.13, 0.17)$.;

$ts_{N_G}(e_1) = (0.08, 0.13, 0.18)$, $ts_{N_G}(e_2) = (0.10, 0.15, 0.20)$, $ts_{N_G}(e_3) = (0.12, 0.17, 0.22)$.

Here every edges having same edge total degree but all the edges having distinct total edge support. Therefore, this graph is edge totally regular neutrosophic fuzzy graph but not a support totally edge regular neutrosophic fuzzy graph.

References

[1] G. Divya and J. Malarvizhi, Some operations on neutrosophic fuzzy graph, *International Journal of Mathematical Archieve*, 8(9), 2017, 120-125.

[2] Florentin Smarandache, Surapati Pramavik, *New Trends in Neutrosophic Theory and its Applications*, Pons Edition, Brussels, Belgium, EU, 2016.

[3] A. Nagoor Gani and S. R. Latha, On irregular fuzzy graphs, *Applied Mathematical Sciences*, Vol.6, 11(2012), 517-523.

[4] A. Nagoor Gani and K. Radha, On regular fuzzy graphs, *Journal of Physical Sciences*, Vol.12, 2008, 33 - 40.

[5] A. Rosenfeld, *Fuzzy Graphs, Fuzzy Sets And Their Applications to Cognitive and Decision Process*, M.Eds. Academic Press, New York, 77-95, 1975.

[6] R. Muneeswari and N. R. Santhi Maheswari, Support edge regular fuzzy graphs, *International Journal of Advanced Research in Engineering and Technology*(IJARET), Volume 11, Issue 1, January 2020, 184-193.

[7] N. R. Santhi Maheswari and C. Sekar, Neighbourly irregular graphs and semi neighbourly irregular graphs, *Acta Ciencia Indica*, Vol. XLM, No.1 (2014), 71 - 77.

[8] N. R. Santhi Maheswari and C. Sekar, On m-neighbourly irregular fuzzy graphs, *International Journal of Mathematics and Soft Computing*, Vol.5, 2(2015), 145 - 153.

[9] N. R. Santhi Maheswari and C. Sekar, On m-neighboulry irregular intuitionistic fuzzy graph, *International Journal of Mathematical Combinatorics*, Vol.3(2016), 107 - 114.

[10] N. R. Santhi Maheswari and C. Sekar, On edge irregular fuzzy graphs, *International Journal of Mathematics and Soft Computing*, Vol.6, No.2, 2016, 131-143.

[11] N. R. Santhi Maheswari and C. Sekar, On neighbourly edge irregular fuzzy graphs, *International Journal of Mathematical Archieve*, Vol. 6, 10(2015), 224 - 231.

[12] N. R. Santhi Maheswari and C. Sekar, On strongly edge irregular fuzzy graphs, *Kragujevac Journal of Mathematics*, Vol. 40(1), 2016, 125 - 135.

[13] N. R. Santhi Maheswari and C. Sekar, On edge irregular bipolar fuzzy graphs, *International Journal of Modern Science and Engineering Technology*, Vol.3, 8(2016), 19-25.

[14] N. R. Santhi Maheswari and C. Sekar, On neighbourly edge irregular bipolar fuzzy graphs, *Annals of Pure and Applied Mathematics*, Vol.11, No.1, 2016, 1-8.

[15] N. R. Santhi Maheswari and C. Sekar, Strongly edge irregular bipolar fuzzy graphs, *International Journal of Mathematical Archieve*, 8(7), 2017, 1-7.

[16] N. R. Santhi Maheswari, M. Sudha and S. Durga, On edge irregularity intuitionistic fuzzy graphs, *International Journal of Innovatie Research in Sciences, Engineering and Technology*, Vol.6, 4(2017), 5770 - 5780.

[17] N. R. Santhi Maheswari and K. Amutha, Support neighbourly edge irregular graphs, *International Journal of Recent Technology and Engineering*, Vol 8, 3(2019), 5329-5332.

[18] N. R. Santhi Maheswari and K. Amutha, 1-Neighbourly edge irregular graphs, *Advances in Mathematics: Scientific Journal*, Special issue No.3, 2019, 200 - 207.

[19] N. Shah, Some studies in neutrosophic graphs, *Neutrosophic Sets and Systems*, Vol 12, 2016, 54- 64.

[20] F. Smarandache, Neutrosophic set, a generalisation of the intuitionistic fuzzy sets, *Inter. J.Pure Appl. Math.*, 24 (2005), 287-297.

[21] S. Sivabala and N. R. Santhi Maheswari, Support edge irregular neutrosophic fuzzy graphs, *International Journal of Advanced Research in Engineering and Technology (IJARET)*, Volume 11, 1(2020), 172 - 183.

[22] S. Sivabala and N. R. Santhi Maheswari, Neighbourly and highly irregular neutrosophic fuzzy graphs, *International Journal of Mathematical Combinatorics*, Volume 1, 2021, 30 - 46.

[23] S. Sivabala and N. R. Santhi Maheswari, Highly edge irregular neutrosophic fuzzy graphs, *Malaya Journal of Mathematik* (Communicated).