Certain Kinds of Bipolar Interval Valued Neutrosophic Graphs

[1]L. Jagadeeswari, [1]V.J. Sudhakar ,[2]V.Navaneethakumar,[3] Said Broumi
[1]PG and Research Department of Mathematics, Islamiah College (Autonomous), Vaniyambadi, Thiruvalluvar University, Serkkadu, Vellore 632 115, Tamil Nadu, India
[2] CMS Business School, Jain University, Bengaluru, India
[3] Laboratory of Information Processing, Faculty of Science Ben M'Sik, University Hassan II,B.P.7955, Sidi Othman, Casablanca, Morocco
jaga25maths@gmail.com[1], vjsvec1@gmail.com[1],nava2000ster@gmail.com[2],broumisaid78@gmail.com[3]

Abstract

Neutrosophic theory has several application in the field of graph theory. In this paper we initiated Certain Kinds of Bipolar interval valued nentrosphic graphs. Such as, sub divsicon BIVNG, Total BIVNG, BIVNLG and also investigate the isomorphism, Coweak isomorphism of BIVNG with properties .
Keywords: Isomorphism, Co weak isomorphism, total, subdivision BIVNG

1 Introduction

The idea of Neutrosophic set is the generalised form of fuzz set concepts [1]. Atanassov introduced the concept that is intuitionistic fuzzy graphs [2] and Akram. et al. given the new concept single valued neutrosophic hypergraphs, planer graphs [3] [4]. Broumi et al introduced, single Valued neutrosophc graphs. [5][6][7]. V.J. Sudhakar et al. Introduced the idea of IVSNG, IVRNG and SCIVN graphs [8][9][10].

2 Kinds of BIVNG

In this part we initiate the some special kinds of BIVNG. That is, subdivision, Total, Lined and intersection of BIVNG. So first we give the definition of Homomorphism, Isomorphism, weak isomorphism and co weak isomorphism of BIVNG.

Definition 2.1. If $G_1 = (R_1, S_1)$ and $G_2 = (R_2, S_2)$ be the two BIVNGs of $G_1^\bullet = (V_1, E_1)$ and $G_2^\bullet = (V_2, E_2)$, Then the homomorphism $\phi : G_1 \longrightarrow G_2$ is a mapping $\phi : V_1 \longrightarrow V_2$ which proves the following conditions.

$$\begin{aligned}
&T^P_{R_1U}(m) \le T^P_{R_2U}(\phi(m)),\ T^P_{R_1L}(m) \le T^P_{R_2L}(\phi(m))\\
&I^P_{R_1U}(m) \ge I^P_{R_2U}(\phi(m)),\ I^P_{R_1L}(m) \ge I^P_{R_2L}(\phi(m))\\
&F^P_{R_1U}(m) \ge F^P_{R_2U}(\phi(m)),\ F^P_{R_1L}(m) \ge F^P_{R_2L}(\phi(m))\\
&T^N_{R_1U}(m) \ge T^N_{R_2U}(\phi(m)),\ T^N_{R_1L}(m) \ge T^N_{R_2L}(\phi(m))\\
&I^N_{R_1U}(m) \le I^N_{R_2U}(\phi(m)),\ I^N_{R_1L}(m) \le I^N_{R_2L}(\phi(m))\\
&F^N_{R_1U}(m) \le F^N_{R_2U}(\phi(m)),\ F^N_{R_1L}(m) \le F^N_{R_2L}(\phi(m)) \quad \forall\, m \in V_1.
\end{aligned}$$

Doi :https://doi.org/10.54216/IJNS.160105
Received: July 10, 2021 Accepted: November 08, 2021

$$T^P_{S_1U}(mn) \le T^P_{S_2U}(\phi(m)\phi(n))$$
$$T^P_{S_1L}(mn) \le T^P_{S_2L}(\phi(m)\phi(n))$$
$$I^P_{S_1U}(mn) \ge I^P_{S_2U}(\phi(m)\phi(n))$$
$$I^P_{S_1L}(mn) \ge I^P_{S_2L}(\phi(m)\phi(n))$$
$$F^P_{S_1U}(mn) \ge F^P_{S_2U}(\phi(m)\phi(n))$$
$$F^P_{S_1L}(mn) \ge F^P_{S_2L}(\phi(m)\phi(n))$$
$$T^N_{S_1U}(mn) \ge T^N_{S_2U}(\phi(m)\phi(n))$$
$$T^N_{S_1L}(mn) \ge T^N_{S_2L}(\phi(m)\phi(n))$$
$$I^N_{S_1U}(mn) \le I^N_{S_2U}(\phi(m)\phi(n))$$
$$I^N_{S_1L}(mn) \le I^N_{S_2L}(\phi(m)\phi(n))$$
$$F^N_{S_1U}(mn) \le F^N_{S_2U}(\phi(m)\phi(n))$$
$$F^N_{S_1L}(mn) \le F^N_{S_2L}(\phi(m)\phi(n))$$

for every $mn \in E_1$.

Definition 2.2. If $G_1 = (R_1, S_1)$ and $G_2 = (R_2, S_2)$ be the two BIVNGs of $G_1^\bullet = (V_1, E_1)$ and $G_2^\bullet = (V_2, E_2)$, Then the weak isomorphism $\omega : G_1 \longrightarrow G_2$ is a bijective mapping $\omega : V_1 \longrightarrow V_2$ which satisfies the following conditions.
Here ω is a homomorphism.

$$T^P_{R_1U}(m) = T^P_{R_2U}(\omega(m))$$
$$T^P_{R_1L}(m) = T^P_{R_2L}(\omega(m))$$
$$I^P_{R_1U}(m) = I^P_{R_2U}(\omega(m))$$
$$I^P_{R_1L}(m) = I^P_{R_2L}(\omega(m))$$
$$F^P_{R_1U}(m) = F^P_{R_2U}(\omega(m))$$
$$F^P_{R_1L}(m) = F^P_{R_2L}(\omega(m))$$
$$T^N_{R_1U}(m) = T^N_{R_2U}(\omega(m))$$
$$T^N_{R_1L}(m) = T^N_{R_2L}(\omega(m))$$
$$I^N_{R_1U}(m) = I^N_{R_2U}(\omega(m))$$
$$I^N_{R_1L}(m) = I^N_{R_2L}(\omega(m))$$
$$F^N_{R_1U}(m) = F^N_{R_2U}(\omega(m))$$
$$F^N_{R_1L}(m) = F^N_{R_2L}(\omega(m))$$

for every $m \in V_1$.

Definition 2.3. If $G_1 = (R_1, S_1)$ and $G_2 = (R_2, S_2)$ be the two BIVNGs of $G_1^\bullet = (V_1, E_1)$ and $G_2^\bullet = (V_2, E_2)$, Then the co-weak isomorphism $\zeta : G_1 \longrightarrow G_2$ is a bijective mapping $\zeta : V_1 \longrightarrow V_2$ it must satisfies the below conditions.

Doi :https://doi.org/10.54216/IJNS.160105
Received: July 10, 2021 Accepted: November 08, 2021

Here ζ is a homomorphism such that

$$T^P_{S_1U}(mn) = T^P_{S_2U}(\zeta(m)\zeta(n))$$
$$T^P_{S_1L}(mn) = T^P_{S_2L}(\zeta(m)\zeta(n))$$
$$I^P_{S_1U}(mn) = I^P_{S_2U}(\zeta(m)\zeta(n))$$
$$I^P_{S_1L}(mn) = I^P_{S_2L}(\zeta(m)\zeta(n))$$
$$F^P_{S_1U}(mn) = F^P_{S_2U}(\zeta(m)\zeta(n))$$
$$F^P_{S_1L}(mn) = F^P_{S_2L}(\zeta(m)\zeta(n))$$
$$T^N_{S_1U}(mn) = T^N_{S_2U}(\zeta(m)\zeta(n))$$
$$T^N_{S_1L}(mn) = T^N_{S_2L}(\zeta(m)\zeta(n))$$
$$I^N_{S_1U}(mn) = I^N_{S_2U}(\zeta(m)\zeta(n))$$
$$I^N_{S_1L}(mn) = I^N_{S_2L}(\zeta(m)\zeta(n))$$
$$F^N_{S_1U}(mn) = F^N_{S_2U}(\zeta(m)\zeta(n))$$
$$F^N_{S_1L}(mn) = F^N_{S_2L}(\zeta(m)\zeta(n))$$

for every $mn \in E_1$.

Definition 2.4. If $G_1 = (R_1, S_1)$ and $G_2 = (R_2, S_2)$ be the two BIVNGs of $G_1^\bullet = (V_1, E_1)$ and $G_2^\bullet = (V_2, E_2)$, Then the Isomorphism $\eta : G_1 \longrightarrow G_2$ is a bijective mapping $\eta : V_1 \longrightarrow V_2$ it must satisfy the following conditions.

$$T^P_{R_1U}(m) = T^P_{R_2U}(\eta(m))$$
$$T^P_{R_1L}(m) = T^P_{R_2L}(\eta(m))$$
$$I^P_{R_1U}(m) = I^P_{R_2U}(\eta(m))$$
$$I^P_{R_1L}(m) = I^P_{R_2L}(\eta(m))$$
$$F^P_{R_1U}(m) = F^P_{R_2U}(\eta(m))$$
$$F^P_{R_1L}(m) = F^P_{R_2L}(\eta(m))$$
$$T^N_{R_1U}(m) = T^N_{R_2U}(\eta(m))$$
$$T^N_{R_1L}(m) = T^N_{R_2L}(\eta(m))$$
$$I^N_{R_1U}(m) = I^N_{R_2U}(\eta(m))$$
$$I^N_{R_1L}(m) = I^N_{R_2L}(\eta(m))$$
$$F^N_{R_1U}(m) = F^N_{R_2U}(\eta(m))$$
$$F^N_{R_1L}(m) = F^N_{R_2L}(\eta(m))$$

for every $m \in V_1$.

$$T^P_{S_1U}(mn) = T^P_{S_2U}(\eta(m)\eta(n))$$
$$T^P_{S_1L}(mn) = T^P_{S_2L}(\eta(m)\eta(n))$$
$$I^P_{S_1U}(mn) = I^P_{S_2U}(\eta(m)\eta(n))$$
$$I^P_{S_1L}(mn) = I^P_{S_2L}(\eta(m)\eta(n))$$
$$F^P_{S_1U}(mn) = F^P_{S_2U}(\eta(m)\eta(n))$$
$$F^P_{S_1L}(mn) = F^P_{S_2L}(\eta(m)\eta(n))$$
$$T^N_{S_1U}(mn) = T^N_{S_2U}(\eta(m)\eta(n))$$
$$T^N_{S_1L}(mn) = T^N_{S_2L}(\eta(m)\eta(n))$$
$$I^N_{S_1U}(mn) = I^N_{S_2U}(\eta(m)\eta(n))$$
$$I^N_{S_1L}(mn) = I^N_{S_2L}(\eta(m)\eta(n))$$
$$F^N_{S_1U}(mn) = F^N_{S_2U}(\eta(m)\eta(n))$$
$$F^N_{S_1L}(mn) = F^N_{S_2L}(\eta(m)\eta(n))$$

for every $mn \in E_1$.

Doi :https://doi.org/10.54216/IJNS.160105

Received: July 10, 2021 Accepted: November 08, 2021

Definition 2.5. The sub division BIVNG be $S(G) = (R, S)$ of $G = (X, Y)$, where R is a BIVNS on $V \cup E$ and S is a BIVNR on R, then

(i) $R = X$ on V and $R = Y$ on E.

(ii) If $v \in V$ be on edge $e \in E$

Therefore, we have

$$\begin{aligned}
T^P_{SU}(ve) &= \text{Minimum } \left(T^P_{XU}(v), T^P_{YU}(e)\right)\\
T^P_{SL}(ve) &= \text{Minimum } \left(T^P_{XL}(v), T^P_{YL}(e)\right)\\
I^P_{SU}(ve) &= \text{Maximum } \left(I^P_{XU}(v), I^P_{YU}(e)\right)\\
I^P_{SL}(ve) &= \text{Maximum } \left(I^P_{XL}(v), I^P_{YL}(e)\right)\\
F^P_{SU}(ve) &= \text{Maximum } \left(F^P_{XU}(v), F^P_{YU}(e)\right)\\
F^P_{SL}(ve) &= \text{Maximum } \left(F^P_{XL}(v), F^P_{YL}(e)\right)\\
T^N_{SU}(ve) &= \text{Maximum } \left(T^N_{XU}(v), T^N_{YU}(e)\right)\\
T^N_{SL}(ve) &= \text{Maximum } \left(T^N_{XL}(v), T^N_{YL}(e)\right)\\
I^N_{SU}(ve) &= \text{Minimum } \left(I^N_{XU}(v), I^N_{YU}(e)\right)\\
I^N_{SL}(ve) &= \text{Minimum } \left(I^N_{XL}(v), I^N_{YL}(e)\right)\\
F^N_{SU}(ve) &= \text{Minimum } \left(F^N_{XU}(v), F^N_{YU}(e)\right)\\
F^N_{SL}(ve) &= \text{Minimum } \left(F^N_{XL}(v), F^N_{YL}(e)\right)
\end{aligned}$$

else

$$S(ve) = 0 = (0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0)$$

Example 2.6. Let us consider the BIVNG $G = (X, Y)$ of a $G^\bullet = (V, E)$ where $V = \{x, y, z\}$ and $E = \{i = xy, j = yz, k = zx\}$

Doi :https://doi.org/10.54216/IJNS.160105
Received: July 10, 2021 Accepted: November 08, 2021

3 BIVNS - BIVNG

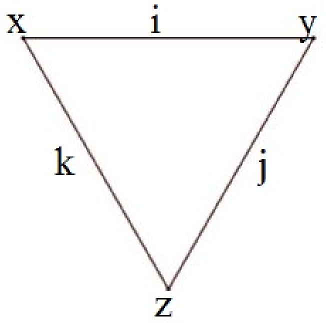

Figure 1: BIVNG

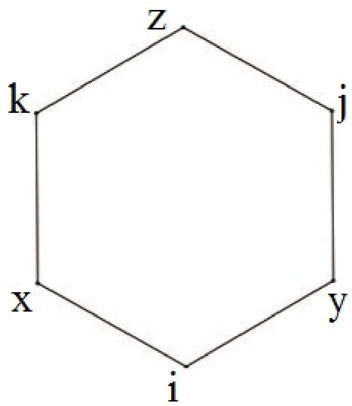

Figure 2: SDBIVNG

Table 1

	BIVNS-BIVNG											
X	T^P_{XU}	T^P_{XL}	I^P_{XU}	I^P_{XL}	F^P_{XU}	F^P_{XL}	T^N_{XU}	T^N_{XL}	I^N_{XU}	I^N_{XL}	F^N_{XU}	F^N_{XL}
x	0.1	0.1	0.3	0.4	0.1	0.1	-0.1	-0.4	-0.2	-0.1	-0.1	-0.5
y	0.2	0.3	0.4	0.5	0.2	0.5	-0.4	-0.6	-0.3	-0.5	-0.4	-0.7
z	0.3	0.7	0.5	0.2	0.5	0.2	-0.6	-0.1	-0.4	-0.2	-0.3	-0.8
Y	T^P_{YU}	T^P_{YL}	I^P_{YU}	I^P_{YL}	F^P_{YU}	F^P_{YL}	T^N_{YU}	T^N_{YL}	I^N_{YU}	I^N_{YL}	F^N_{YU}	F^N_{YL}
i	0.1	0.2	0.3	0.3	0.1	0.2	-0.2	-0.3	-0.1	-0.2	-0.2	-0.4
j	0.2	0.6	0.2	0.4	0.2	0.4	-0.3	-0.5	-0.3	-0.4	-0.3	-0.6
k	0.4	0.7	0.5	0.1	0.3	0.1	-0.5	-0.2	-0.2	-0.6	-0.1	-0.7

(i) The BIVNS X and Y are defined on V and E of a BIVNG G. The SDG is in Fig.2.

(ii) The BIVNS, R and S are defined in the Table 2.

Table 2

	BIVNS - SDBIVNG											
R	T^P_{RU}	T^P_{RL}	I^P_{RU}	I^P_{RL}	F^P_{RU}	F^P_{RU}	T^N_{RU}	T^N_{RL}	I^N_{RU}	I^N_{RL}	F^N_{RU}	F^N_{RU}
x	0.1	0.1	0.3	0.4	0.1	0.1	-0.1	-0.4	-0.2	-0.1	-0.1	-0.5
i	0.1	0.2	0.3	0.3	0.1	0.2	-0.2	-0.3	-0.1	-0.2	-0.2	-0.4
y	0.2	0.3	0.4	0.5	0.2	0.5	-0.4	-0.6	-0.3	-0.5	-0.4	-0.7
j	0.2	0.6	0.2	0.4	0.2	0.4	-0.3	-0.5	-0.3	-0.4	-0.3	-0.6
z	0.3	0.7	0.5	0.2	0.5	0.2	-0.6	-0.1	-0.4	-0.2	-0.3	-0.8
k	0.4	0.7	0.5	0.1	0.3	0.1	-0.5	-0.2	-0.2	-0.6	-0.1	-0.7
S	T^P_{SU} min	T^P_{SL} min	I^P_{SU} max	I^P_{SL} max	F^P_{SU} max	F^P_{SL} max	T^N_{SU} max	T^N_{SL} max	I^N_{SU} min	I^N_{SL} min	F^N_{SU} min	F^N_{SU} min
xi	0.1	0.1	0.3	0.4	0.1	0.2	-0.1	-0.3	-0.2	-0.2	-0.2	-0.5
iy	0.1	0.2	0.4	0.5	0.2	0.5	-0.2	-0.6	-0.3	-0.5	-0.4	-0.7
yj	0.2	0.3	0.4	0.5	0.2	0.5	-0.3	-0.5	-0.3	-0.5	-0.4	-0.7
jz	0.2	0.6	0.5	0.4	0.5	0.4	-0.3	-0.1	-0.4	-0.4	-0.3	-0.8
zk	0.3	0.7	0.5	0.2	0.5	0.2	-0.5	-0.1	-0.4	-0.6	-0.3	-0.8
kx	0.1	0.1	0.5	0.4	0.3	0.1	-0.1	-0.2	-0.2	-0.6	-0.1	-0.7

Doi :https://doi.org/10.54216/IJNS.160105
Received: July 10, 2021 Accepted: November 08, 2021

Definition 3.1. The Total BIVNG (TSBIVNG) is $T(G) = (R, S)$ of $G = (X, Y)$ where R is a BIVNS on $V \cup E$ and S is a BIVNR on R.
$\Rightarrow$ (i) $R = X$ on V and $S = Y$ on E.
(ii) If $v \in V$ lies on the edge $e \in E$, then

$$\begin{aligned}
T^P_{DU}(ve) &= \text{Minimum } \left(T^P_{XU}(v), T^P_{YU}(e)\right)\\
T^P_{DL}(ve) &= \text{Minimum } \left(T^P_{XL}(v), T^P_{YL}(e)\right)\\
I^P_{DU}(ve) &= \text{Maximum } \left(I^P_{XU}(v), I^P_{YU}(e)\right)\\
I^P_{DL}(ve) &= \text{Maximum } \left(I^P_{XL}(v), I^P_{YL}(e)\right)\\
F^P_{DU}(ve) &= \text{Maximum } \left(F^P_{XU}(v), F^P_{YU}(e)\right)\\
F^P_{DL}(ve) &= \text{Maximum } \left(F^P_{XL}(v), F^P_{YL}(e)\right)\\
T^N_{DU}(ve) &= \text{Maximum } \left(T^N_{XU}(v), T^N_{YU}(e)\right)\\
T^N_{DL}(ve) &= \text{Maximum } \left(T^N_{XL}(v), T^N_{YL}(e)\right)\\
I^N_{DU}(ve) &= \text{Minimum } \left(I^N_{XU}(v), I^N_{YU}(e)\right)\\
I^N_{DL}(ve) &= \text{Minimum } \left(I^N_{XL}(v), I^N_{YL}(e)\right)\\
F^N_{DU}(ve) &= \text{Minimum } \left(F^N_{XU}(v), F^N_{YU}(e)\right)\\
F^N_{DL}(ve) &= \text{Minimum } \left(F^N_{XL}(v), F^N_{YL}(e)\right)
\end{aligned}$$

else

$$S(ve) = 0 = (0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0)$$

(iii) Let γ, δ if $\gamma\delta \in E$ then

$$\begin{aligned}
T^P_{SU}(\gamma\delta) &= T^P_{YU}(\gamma\delta)\\
T^P_{SL}(\gamma\delta) &= T^P_{YL}(\gamma\delta)\\
I^P_{SU}(\gamma\delta) &= I^P_{YU}(\gamma\delta)\\
I^P_{SL}(\gamma\delta) &= I^P_{YL}(\gamma\delta)\\
F^P_{SU}(\gamma\delta) &= F^P_{YU}(\gamma\delta)\\
F^P_{SL}(\gamma\delta) &= F^P_{YL}(\gamma\delta)\\
T^N_{SU}(\gamma\delta) &= T^N_{YU}(\gamma\delta)\\
T^N_{SL}(\gamma\delta) &= T^N_{YL}(\gamma\delta)\\
I^N_{SU}(\gamma\delta) &= I^N_{YU}(\gamma\delta)\\
I^N_{SL}(\gamma\delta) &= I^N_{YL}(\gamma\delta)\\
F^N_{SU}(\gamma\delta) &= F^N_{YU}(\gamma\delta)\\
F^N_{SL}(\gamma\delta) &= F^N_{YL}(\gamma\delta)
\end{aligned}$$

If $gh \in E$, and it is a common vertex.

$$\begin{aligned}
T^P_{SU}(gh) &= \min\left(T^P_{YU}(g), T^P_{YU}(h)\right)\\
T^P_{SL}(gh) &= \min\left(T^P_{YL}(g), T^P_{YL}(h)\right)\\
I^P_{SU}(gh) &= \max\left(I^P_{YU}(g), I^P_{YU}(h)\right)\\
I^P_{SL}(gh) &= \max\left(I^P_{YL}(g), I^P_{YL}(h)\right)\\
F^P_{SU}(gh) &= \max\left(F^P_{YU}(g), F^P_{YU}(h)\right)\\
F^P_{SL}(gh) &= \max\left(F^P_{YL}(g), F^P_{YL}(h)\right)\\
T^N_{SU}(gh) &= \max\left(T^N_{YU}(g), T^N_{YU}(h)\right)\\
T^N_{SL}(gh) &= \max\left(T^N_{YL}(g), T^N_{YL}(h)\right)\\
I^N_{SU}(gh) &= \min\left(I^N_{YU}(g), I^N_{YU}(h)\right)\\
I^N_{SL}(gh) &= \min\left(I^N_{YL}(g), I^N_{YL}(h)\right)\\
F^N_{SU}(gh) &= \min\left(F^N_{YU}(g), F^N_{YU}(h)\right)\\
F^N_{SL}(gh) &= \min\left(F^N_{YL}(g), F^N_{YL}(h)\right)
\end{aligned}$$

Doi :https://doi.org/10.54216/IJNS.160105
Received: July 10, 2021 Accepted: November 08, 2021

else

$$S(gh) = 0 = (0,0,0,0,0,0,0,0,0,0,0,0)$$

Example 3.2. By Example 2.6, The TBIVNG, $T(G) = (R, S)$

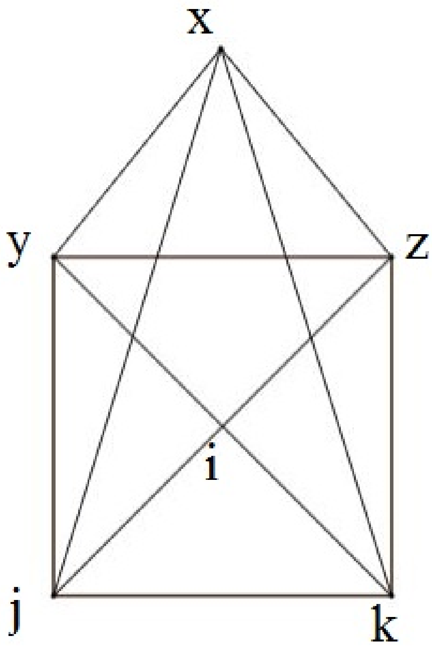

Figure 3: TBIVNG

Table 3

	TBIVNG											
S	T_{SU}^P	T_{SL}^P	I_{SU}^P	I_{SL}^P	F_{SU}^P	F_{SL}^P	T_{SU}^N	T_{SL}^N	I_{SU}^N	I_{SL}^N	F_{SU}^N	F_{SL}^N
xy	0.1	0.1	0.4	0.5	0.2	0.5	−0.1	−0.4	−0.3	−0.5	−0.4	−0.7
yz	0.2	0.3	0.5	0.5	0.5	0.5	−0.4	−0.1	−0.4	−0.5	−0.4	−0.8
zx	0.1	0.1	0.5	0.4	0.5	0.2	−0.1	−0.1	−0.4	−0.2	−0.3	−0.8
ij	0.1	0.2	0.3	0.4	0.2	0.4	−0.2	−0.3	−0.3	−0.4	−0.3	−0.6
jk	0.2	0.6	0.5	0.4	0.3	0.4	−0.3	−0.2	−0.3	−0.6	−0.3	−0.7
ki	0.1	0.1	0.5	0.3	0.3	0.2	−0.2	−0.2	−0.2	−0.6	−0.2	−0.7
xi	0.1	0.1	0.3	0.4	0.1	0.2	−0.1	−0.3	−0.2	−0.2	−0.2	−0.5
iy	0.1	0.2	0.4	0.5	0.2	0.5	−0.2	−0.3	−0.3	−0.5	−0.4	−0.7
yj	0.2	0.3	0.4	0.5	0.2	0.5	−0.3	−0.5	−0.3	−0.5	−0.4	−0.7
jz	0.2	0.6	0.5	0.4	0.5	0.4	−0.3	−0.1	−0.4	−0.4	−0.3	−0.8
zk	0.3	0.7	0.5	0.2	0.5	0.2	−0.5	−0.1	−0.4	−0.6	−0.3	−0.8
kx	0.1	0.1	0.5	0.4	0.3	0.1	−0.1	−0.2	−0.2	−0.6	−0.1	−0.7

Definition 3.3. Let $\mathscr{T} = (U, V)$ be the intersection graph of $G^{\bullet}$. Let R_1 and S_1 be the BIVNS on V and E respectively. R_2 and S_2 be the BIVNS on U and V. Then the bipolar interval valued neutrosophic intersection graph of BIVNG, $G = (R_1, S_1)$ is a BIVNG. $P(G) = (R_2, S_2)$.
$\Rightarrow$

$$T_{R_2U}^P(U_i) = T_{R_1U}^P(v_i)$$
$$T_{R_2L}^P(U_i) = T_{R_1L}^P(v_i)$$
$$T_{R_2U}^N(U_i) = T_{R_1U}^N(v_i)$$
$$T_{R_2L}^N(U_i) = T_{R_1L}^N(v_i)$$

Doi :https://doi.org/10.54216/IJNS.160105
Received: July 10, 2021 Accepted: November 08, 2021

$$I^P_{R_2U}(U_i) = I^P_{R_1U}(v_i)$$
$$I^P_{R_2L}(U_i) = I^P_{R_1L}(v_i)$$
$$I^N_{R_2U}(U_i) = I^N_{R_1U}(v_i)$$
$$I^N_{R_2L}(U_i) = I^N_{R_1L}(v_i)$$
$$F^P_{R_2U}(U_i) = F^P_{R_1U}(v_i)$$
$$F^P_{R_2L}(U_i) = F^P_{R_1L}(v_i)$$
$$F^N_{R_2U}(U_i) = F^N_{R_1U}(v_i)$$
$$F^N_{R_2L}(U_i) = F^N_{R_1L}(v_i)$$
$$T^P_{S_2U}(U_iU_j) = T^P_{S_1U}(v_iv_j)$$
$$T^P_{S_2L}(U_iU_j) = T^P_{S_1L}(v_iv_j)$$
$$T^N_{S_2U}(U_iU_j) = T^N_{S_1U}(v_iv_j)$$
$$T^N_{S_2L}(U_iU_j) = T^N_{S_1L}(v_iv_j)$$
$$I^P_{S_2U}(U_iU_j) = I^P_{S_1U}(v_iv_j)$$
$$I^P_{S_2L}(U_iU_j) = I^P_{S_1L}(v_iv_j)$$
$$I^N_{S_2U}(U_iU_j) = I^N_{S_1U}(v_iv_j)$$
$$I^N_{S_2L}(U_iU_j) = I^N_{S_1L}(v_iv_j)$$
$$F^P_{S_2U}(U_iU_j) = F^P_{S_1U}(v_iv_j)$$
$$F^P_{S_2L}(U_iU_j) = F^P_{S_1L}(v_iv_j)$$
$$F^N_{S_2U}(U_iU_j) = F^N_{S_1U}(v_iv_j)$$
$$F^N_{S_2L}(U_iU_j) = F^N_{S_1L}(v_iv_j)$$

for every $U_i, U_j \in U$ and V.

Proposition 3.4. *Prove that BIVNIG is a BIVNG and also prove that BIVNG $\approx$ BIVNIG*

Proof. Let $G = (X_1, Y_1)$ is the BIVNG of $G^\bullet = (V, E)$ and take $P(G) = (X_2, Y_2)$ be a BIVNIG of $P(S)$.
By the previous definition of BIVNIG, we write

$$\begin{aligned}
T^P_{Y_2U}(m_im_j) &= T^P_{Y_1U}(v_iv_j)\\
&\le \min\left(T^P_{X_1U}(v_i), T^P_{X_1U}(v_j)\right)\\
&= \min\left(T^P_{X_2U}(m_i), T^P_{X_2U}(m_j)\right)\\
T^P_{Y_2L}(m_im_j) &= T^P_{Y_1L}(v_iv_j)\\
&\le \min\left(T^P_{X_1L}(v_i), T^P_{X_1L}(v_j)\right)\\
&= \min\left(T^P_{X_2L}(m_i), T^P_{X_2L}(m_j)\right)\\
T^N_{Y_2U}(m_im_j) &= T^N_{Y_1U}(v_iv_j)\\
&\ge \max\left(T^N_{X_1U}(v_i), T^N_{X_1U}(v_j)\right)\\
&= \max\left(T^N_{X_2U}(m_i), T^N_{X_2U}(m_j)\right)\\
T^N_{Y_2L}(m_im_j) &= T^N_{Y_1L}(v_iv_j)\\
&\ge \max\left(T^N_{X_1L}(v_i), T^N_{X_1L}(v_j)\right)\\
&= \max\left(T^N_{X_2L}(m_i), T^N_{X_2L}(m_j)\right)\\
I^P_{Y_2U}(m_im_j) &= I^P_{Y_1U}(v_iv_j)\\
&\ge \max\left(I^P_{X_1U}(v_i), I^P_{X_1U}(v_j)\right)\\
&= \max\left(I^P_{X_2U}(m_i), I^P_{X_2U}(m_j)\right)\\
I^P_{Y_2L}(m_im_j) &= I^P_{Y_1L}(v_iv_j)\\
&\ge \max\left(I^P_{X_1L}(v_i), I^P_{X_1L}(v_j)\right)\\
&= \max\left(I^P_{X_2L}(m_i), I^P_{X_2L}(m_j)\right)
\end{aligned}$$

Doi :https://doi.org/10.54216/IJNS.160105
Received: July 10, 2021 Accepted: November 08, 2021

$$\begin{aligned}
I^N_{Y_2U}(m_im_j) &= I^N_{Y_1U}(v_iv_j)\\
&\le \min\left(I^N_{X_1U}(v_i), I^N_{X_1U}(v_j)\right)\\
&= \min\left(I^N_{X_2U}(m_i), I^N_{X_2U}(m_j)\right)\\
I^N_{Y_2L}(m_im_j) &= I^N_{Y_1L}(v_iv_j)\\
&\le \min\left(I^N_{X_1L}(v_i), I^N_{X_1L}(v_j)\right)\\
&= \min\left(I^N_{X_2L}(m_i), I^N_{X_2L}(m_j)\right)\\
F^P_{Y_2U}(m_im_j) &= F^P_{Y_1U}(v_iv_j)\\
&\ge \max\left(F^P_{X_1U}(v_i), F^P_{X_1U}(v_j)\right)\\
&= \max\left(F^P_{X_2U}(m_i), F^P_{X_2U}(m_j)\right)\\
F^P_{Y_2L}(m_im_j) &= F^P_{Y_1L}(v_iv_j)\\
&\ge \max\left(F^P_{X_1L}(v_i), F^P_{X_1L}(v_j)\right)\\
&= \max\left(F^P_{X_2L}(m_i), F^P_{X_2L}(m_j)\right)\\
F^N_{Y_2U}(m_im_j) &= F^N_{Y_1U}(v_iv_j)\\
&\le \min\left(F^N_{X_1U}(v_i), F^N_{X_1U}(v_j)\right)\\
&= \min\left(F^N_{X_2U}(m_i), F^N_{X_2U}(m_j)\right)\\
F^N_{Y_2L}(m_im_j) &= F^N_{Y_1L}(v_iv_j)\\
&\le \min\left(F^N_{X_1L}(v_i), F^N_{X_1L}(v_j)\right)\\
&= \min\left(F^N_{X_2L}(m_i), F^N_{X_2L}(m_j)\right)
\end{aligned}$$

From the above we proved that the BIVNIG is a BIVNG.
Let us define the mapping $g : v \to m$ by $g(v_i) = m_i,$ here $i = 1, 2, \ldots, n.$
The function g is clearly a bijective function $v_iv_j \in E$ iff $m_i, m_j \in T$

$$\Rightarrow \quad T = \{g(v_i)g(v_j);\ v_iv_j \in E\}$$

and

$$\begin{aligned}
T^P_{X_2U}\left(g(v_i)\right) &= T^P_{X_2U}\left(m_i\right); & T^N_{X_2U}\left(g(v_i)\right) &= T^N_{X_2U}\left(m_i\right);\\
&= T^P_{X_1U}(v_i) & &= T^N_{X_1U}(v_i)\\
T^P_{X_2L}\left(g(v_i)\right) &= T^P_{X_2L}\left(m_i\right); & T^N_{X_2L}\left(g(v_i)\right) &= T^N_{X_2L}\left(m_i\right);\\
&= T^P_{X_1L}(v_i) & &= T^N_{X_1L}(v_i)\\
I^P_{X_2U}\left(g(v_i)\right) &= I^P_{X_2U}\left(m_i\right); & I^N_{X_2U}\left(g(v_i)\right) &= I^N_{X_2U}\left(m_i\right);\\
&= I^P_{X_1U}(v_i) & &= I^N_{X_1U}(v_i)\\
I^P_{X_2L}\left(g(v_i)\right) &= I^P_{X_2L}\left(m_i\right); & I^N_{X_2L}\left(g(v_i)\right) &= I^N_{X_2L}\left(m_i\right);\\
&= I^P_{X_1L}(v_i) & &= I^N_{X_1L}(v_i)\\
F^P_{X_2U}\left(g(v_i)\right) &= F^P_{X_2U}\left(m_i\right); & F^N_{X_2U}\left(g(v_i)\right) &= F^N_{X_2U}\left(m_i\right);\\
&= F^P_{X_1U}(v_i) & &= F^N_{X_1U}(v_i)\\
F^P_{X_2L}\left(g(v_i)\right) &= F^P_{X_2L}\left(m_i\right); & F^N_{X_2L}\left(g(v_i)\right) &= F^N_{X_2L}\left(m_i\right);\\
&= F^P_{X_1L}(v_i) & &= F^N_{X_1L}(v_i)
\end{aligned}$$

for all $v_i \in V$.

$$\begin{aligned}
T^P_{Y_2U}\left(g(v_i)g(v_j)\right) &= T^P_{Y_2U}\left(m_im_j\right); & T^N_{Y_2U}\left(g(v_i)g(v_j)\right) &= T^N_{Y_2U}\left(m_im_j\right)\\
&= T^P_{Y_1U}(v_iv_j) & &= T^N_{Y_1U}(v_iv_j)\\
T^P_{Y_2L}\left(g(v_i)g(v_j)\right) &= T^P_{Y_2L}\left(m_im_j\right); & T^N_{Y_2L}\left(g(v_i)g(v_j)\right) &= T^N_{Y_2L}\left(m_im_j\right)\\
&= T^P_{Y_1L}(v_iv_j) & &= T^N_{Y_1L}(v_iv_j)\\
I^P_{Y_2U}\left(g(v_i)g(v_j)\right) &= I^P_{Y_2U}\left(m_im_j\right); & I^N_{Y_2U}\left(g(v_i)g(v_j)\right) &= I^N_{Y_2U}\left(m_im_j\right)\\
&= I^P_{Y_1U}(v_iv_j) & &= I^N_{Y_1U}(v_iv_j)
\end{aligned}$$

Doi :https://doi.org/10.54216/IJNS.160105
Received: July 10, 2021 Accepted: November 08, 2021

$$\begin{aligned} I^P_{Y_2L}\left(g(v_i)g(v_j)\right) &= I^P_{Y_2L}\left(m_im_j\right); & I^N_{Y_2L}\left(g(v_i)g(v_j)\right) &= I^N_{Y_2L}\left(m_im_j\right) \\ &= I^P_{Y_1L}(v_iv_j) & &= I^N_{Y_1L}(v_iv_j) \\ F^P_{Y_2U}\left(g(v_i)g(v_j)\right) &= F^P_{Y_2U}\left(m_im_j\right); & F^N_{Y_2U}\left(g(v_i)g(v_j)\right) &= F^N_{Y_2U}\left(m_im_j\right); \\ &= F^P_{Y_1U}(v_iv_j) & &= F^N_{Y_1U}(v_iv_j) \\ F^P_{Y_2L}\left(g(v_i)g(v_j)\right) &= F^P_{Y_2L}\left(m_im_j\right); & F^N_{Y_2L}\left(g(v_i)g(v_j)\right) &= F^N_{Y_2L}\left(m_im_j\right); \\ &= F^P_{Y_1L}(v_iv_j) & &= F^N_{Y_1L}(v_iv_j) \end{aligned}$$

for every $v_iv_j \in E$.
Hence BIVNG is $\approx$ BIVNIG. □

Definition 3.5. If $G^\bullet = (V, E)$ and $l(G^\bullet) = (I, J)$ be the ling graph, then C_1 and D_1 be the BIVNS on V and E and take A_2 and D_2 be the BIVNS on I and J respectively.

$l(G^\bullet) = (C_2, D_2)$ is the BIVNLG of BIVNG = G= (C_1, D_1)

$$\begin{aligned} T^P_{C_2U}\left(P_i\right) &= T^P_{D_1U}\left(i\right) &;\ T^N_{C_2U}\left(P_i\right) &= T^N_{D_1U}\left(i\right) \\ &= T^P_{D_1U}(u_iv_i) & &= T^N_{D_1U}(u_iv_i) \\ T^P_{C_2L}\left(P_i\right) &= T^P_{D_1L}\left(i\right) &;\ T^N_{C_2L}\left(P_i\right) &= T^N_{D_1L}\left(i\right) \\ &= T^P_{D_1L}(u_iv_i) & &= T^N_{D_1L}(u_iv_i) \\ I^P_{C_2U}\left(P_i\right) &= I^P_{D_1U}\left(i\right) &;\ I^N_{C_2U}\left(P_i\right) &= I^N_{D_1U}\left(i\right) \\ &= I^P_{D_1U}(u_iv_i) & &= I^N_{D_1U}(u_iv_i) \\ I^P_{C_2L}\left(P_i\right) &= I^P_{D_1L}\left(i\right) &;\ I^N_{C_2L}\left(P_i\right) &= I^N_{D_1L}\left(i\right) \\ &= I^P_{D_1L}(u_iv_i) & &= I^N_{D_1L}(u_iv_i) \\ F^P_{C_2U}\left(P_i\right) &= F^P_{D_1U}\left(i\right) &;\ F^N_{C_2U}\left(P_i\right) &= F^N_{D_1U}\left(i\right) \\ &= F^P_{D_1U}(u_iv_i) & &= F^N_{D_1U}(u_iv_i) \\ F^P_{C_2L}\left(P_i\right) &= F^P_{D_1L}\left(i\right) &;\ F^N_{C_2L}\left(P_i\right) &= F^N_{D_1L}\left(i\right) \\ &= F^P_{D_1L}(u_iv_i) & &= F^N_{D_1L}(u_iv_i) \end{aligned}$$

for each $P_i, P_j \in I$ and

$$\begin{aligned} T^P_{D_2U}\left(P_iP_j\right) &= \min\left(T^P_{D_1U}(i), T^P_{D_1U}(j)\right) \\ T^P_{D_2L}\left(P_iP_j\right) &= \min\left(T^P_{D_1L}(i), T^P_{D_1L}(j)\right) \\ T^N_{D_2U}\left(P_iP_j\right) &= \max\left(T^N_{D_1U}(i), T^N_{D_1U}(j)\right) \\ T^N_{D_2L}\left(P_iP_j\right) &= \max\left(T^N_{D_1L}(i), T^N_{D_1L}(j)\right) \\ I^P_{D_2U}\left(P_iP_j\right) &= \max\left(I^P_{D_1U}(i), I^P_{D_1U}(j)\right) \\ I^P_{D_2L}\left(P_iP_j\right) &= \max\left(I^P_{D_1L}(i), I^P_{D_1L}(j)\right) \\ I^N_{D_2U}\left(P_iP_j\right) &= \min\left(I^N_{D_1U}(i), I^N_{D_1U}(j)\right) \\ I^N_{D_2L}\left(P_iP_j\right) &= \min\left(I^N_{D_1L}(i), I^N_{D_1L}(j)\right) \\ F^P_{D_2U}\left(P_iP_j\right) &= \max\left(F^P_{D_1U}(i), F^P_{D_1U}(j)\right) \\ F^P_{D_2L}\left(P_iP_j\right) &= \max\left(F^P_{D_1L}(i), F^P_{D_1L}(j)\right) \\ F^N_{D_2U}\left(P_iP_j\right) &= \min\left(F^N_{D_1U}(i), F^N_{D_1U}(j)\right) \\ F^N_{D_2L}\left(P_iP_j\right) &= \min\left(F^N_{D_1L}(i), F^N_{D_1L}(j)\right) \end{aligned}$$

for each $P_i, P_j \in J$ and

Proposition 3.6. *Prove that $L(G^\bullet) = (IJ)$ is a crisp lined graph of $G^\bullet$. If $L(G)$ is the BIVNLG of BIVNG.*

Proof. We know that $L(G)$ is a BIVNG.

$$\begin{aligned} T^P_{C_2U}\left(P_i\right) &= T^P_{D_1U}\left(i\right) \\ T^P_{C_2L}\left(P_i\right) &= T^P_{D_1L}\left(i\right) \\ T^N_{C_2U}\left(P_i\right) &= T^N_{D_1U}\left(i\right) \\ T^N_{C_2L}\left(P_i\right) &= T^N_{D_1L}\left(i\right) \end{aligned}$$

Doi :https://doi.org/10.54216/IJNS.160105
Received: July 10, 2021 Accepted: November 08, 2021

$$I^P_{C_2U}(P_i) = I^P_{D_1U}(i)$$
$$I^P_{C_2L}(P_i) = I^P_{D_1L}(i)$$
$$I^N_{C_2U}(P_i) = I^N_{D_1U}(i)$$
$$I^N_{C_2L}(P_i) = I^N_{D_1L}(i)$$
$$F^P_{C_2U}(P_i) = F^P_{D_1U}(i)$$
$$F^P_{C_2L}(P_i) = F^P_{D_1L}(i)$$
$$F^N_{C_2U}(P_i) = F^N_{D_1U}(i)$$
$$F^N_{C_2L}(P_i) = F^N_{D_1L}(i)$$

Here for each $i \in E, P_i \in I$ iff $i \in E$ and

$$T^P_{D_2U}(P_iP_j) = \min\left(T^P_{D_1U}(i), T^P_{D_1U}(j)\right)$$
$$T^P_{D_2L}(P_iP_j) = \min\left(T^P_{D_1L}(i), T^P_{D_1L}(j)\right)$$
$$T^N_{D_2U}(P_iP_j) = \max\left(T^N_{D_1U}(i), T^N_{D_1U}(j)\right)$$
$$T^N_{D_2L}(P_iP_j) = \max\left(T^N_{D_1L}(i), T^N_{D_1L}(j)\right)$$
$$I^P_{D_2U}(P_iP_j) = \max\left(I^P_{D_1U}(i), I^P_{D_1U}(j)\right)$$
$$I^P_{D_2L}(P_iP_j) = \max\left(I^P_{D_1L}(i), I^P_{D_1L}(j)\right)$$
$$I^N_{D_2U}(P_iP_j) = \min\left(I^N_{D_1U}(i), I^N_{D_1U}(j)\right)$$
$$I^N_{D_2L}(P_iP_j) = \min\left(I^N_{D_1L}(i), I^N_{D_1L}(j)\right)$$
$$F^P_{D_2U}(P_iP_j) = \max\left(F^P_{D_1U}(i), F^P_{D_1U}(j)\right)$$
$$F^P_{D_2L}(P_iP_j) = \max\left(F^P_{D_1L}(i), F^P_{D_1L}(j)\right)$$
$$F^N_{D_2U}(P_iP_j) = \min\left(F^N_{D_1U}(i), F^N_{D_1U}(j)\right)$$
$$F^N_{D_2L}(P_iP_j) = \min\left(F^N_{D_1L}(i), F^N_{D_1L}(j)\right)$$

Here for each P_i, P_j are belongs to J.

Then $J = \{P_i, P_j : P_i \cap P_j$ is not equal to null set and $ij \in E$ also $i \neq j$ $\}$ □

Proposition 3.7. *Prove that $L(G) = (C_2, D_2)$ is a BIVNLG of a BIVNG, $G = (C_1, D_1)$*

Proof. Let us consider

$$T^P_{D_2U}(P_iP_j) = \min\left(T^P_{C_2U}(P_i), T^P_{C_2U}(P_j)\right)$$
$$T^P_{D_2L}(P_iP_j) = \min\left(T^P_{C_2L}(P_i), T^P_{C_2L}(P_j)\right)$$
$$T^N_{D_2U}(P_iP_j) = \max\left(T^N_{C_2U}(P_i), T^N_{C_2U}(P_j)\right)$$
$$T^N_{D_2L}(P_iP_j) = \max\left(T^N_{C_2L}(P_i), T^N_{C_2L}(P_j)\right)$$
$$I^P_{D_2U}(P_iP_j) = \max\left(I^P_{C_2U}(P_i), I^P_{C_2U}(P_j)\right)$$
$$I^P_{D_2L}(P_iP_j) = \max\left(I^P_{C_2L}(P_i), I^P_{C_2L}(P_j)\right)$$
$$I^N_{D_2U}(P_iP_j) = \min\left(I^N_{C_2U}(P_i), I^N_{C_2U}(P_j)\right)$$
$$I^N_{D_2L}(P_iP_j) = \min\left(I^N_{C_2L}(P_i), I^N_{C_2L}(P_j)\right)$$
$$F^P_{D_2U}(P_iP_j) = \max\left(F^P_{C_2U}(P_i), F^P_{C_2U}(P_j)\right)$$
$$F^P_{D_2L}(P_iP_j) = \max\left(F^P_{C_2L}(P_i), F^P_{C_2L}(P_j)\right)$$
$$F^N_{D_2U}(P_iP_j) = \min\left(F^N_{C_2U}(P_i), F^N_{C_2U}(P_j)\right)$$
$$F^N_{D_2L}(P_iP_j) = \min\left(F^N_{C_2L}(P_i), F^N_{C_2L}(P_j)\right)$$

Here for every P_i and $P_j \in J$ and also take

$$T^P_{C_1U}(i) = T^P_{C_2U}(P_i); \quad T^P_{C_1L}(i) = T^P_{C_2L}(P_i)$$
$$T^N_{C_1U}(i) = T^N_{C_2U}(P_i); \quad T^N_{C_1L}(i) = T^N_{C_2L}(P_i)$$
$$I^P_{C_1U}(i) = I^P_{C_2U}(P_i); \quad I^P_{C_1L}(i) = I^P_{C_2L}(P_i)$$
$$I^N_{C_1U}(i) = I^N_{C_2U}(P_i); \quad I^N_{C_1L}(i) = I^N_{C_2L}(P_i)$$

Doi :https://doi.org/10.54216/IJNS.160105
Received: July 10, 2021 Accepted: November 08, 2021

$$F^P_{C_1U}(i) = F^P_{C_2U}(P_i); \quad F^P_{C_1L}(i) = F^P_{C_2L}(P_i)$$
$$F^N_{C_1U}(i) = F^N_{C_2U}(P_i); \quad F^N_{C_1L}(i) = F^N_{C_2L}(P_i)$$

here for every $i \in E$

$$\begin{aligned}
T^P_{D_2U}(P_iP_j) &= \min\left(T^P_{C_2U}(P_i), T^P_{C_2U}(P_j)\right) \\
&= \min\left(T^P_{C_2U}(i), T^P_{C_2U}(j)\right) \\
T^P_{D_2L}(P_iP_j) &= \min\left(T^P_{C_2L}(P_i), T^P_{C_2L}(P_j)\right) \\
&= \min\left(T^P_{C_2L}(i), T^P_{C_2L}(j)\right) \\
T^N_{D_2U}(P_iP_j) &= \max\left(T^N_{C_2U}(P_i), T^N_{C_2U}(P_j)\right) \\
&= \max\left(T^N_{C_2U}(i), T^N_{C_2U}(j)\right) \\
T^N_{D_2L}(P_iP_j) &= \max\left(T^N_{C_2L}(P_i), T^N_{C_2L}(P_j)\right) \\
&= \max\left(T^N_{C_2L}(i), T^N_{C_2L}(j)\right) \\
I^P_{D_2U}(P_iP_j) &= \max\left(I^P_{C_2U}(P_i), I^P_{C_2U}(P_j)\right) \\
&= \max\left(I^P_{C_2U}(i), I^P_{C_2U}(j)\right) \\
I^P_{D_2L}(P_iP_j) &= \max\left(I^P_{C_2L}(P_i), I^P_{C_2L}(P_j)\right) \\
&= \max\left(I^P_{C_2L}(i), I^P_{C_2L}(j)\right) \\
I^N_{D_2U}(P_iP_j) &= \min\left(I^N_{C_2U}(P_i), I^N_{C_2U}(P_j)\right) \\
&= \min\left(I^N_{C_2U}(i), I^N_{C_2U}(j)\right) \\
I^N_{D_2L}(P_iP_j) &= \min\left(I^N_{C_2L}(P_i), I^N_{C_2L}(P_j)\right) \\
&= \min\left(I^N_{C_2L}(i), I^N_{C_2L}(j)\right) \\
F^P_{D_2U}(P_iP_j) &= \max\left(F^P_{C_2U}(P_i), F^P_{C_2U}(P_j)\right) \\
&= \max\left(F^P_{C_2U}(i), F^P_{C_2U}(j)\right) \\
F^P_{D_2L}(P_iP_j) &= \max\left(F^P_{C_2L}(P_i), F^P_{C_2L}(P_j)\right) \\
&= \max\left(F^P_{C_2L}(i), F^P_{C_2L}(j)\right) \\
F^N_{D_2U}(P_iP_j) &= \min\left(F^N_{C_2U}(P_i), F^N_{C_2U}(P_j)\right) \\
&= \min\left(F^N_{C_2U}(i), F^N_{C_2U}(j)\right) \\
F^N_{D_2L}(P_iP_j) &= \min\left(F^N_{C_2L}(P_i), F^N_{C_2L}(P_j)\right) \\
&= \min\left(F^N_{C_2L}(i), F^N_{C_2L}(j)\right)
\end{aligned}$$

The BIVNS C_1 proves the property

$$\begin{aligned}
T^P_{D_1U}(ij) &\leq \min\left(T^P_{C_1U}(i), T^P_{C_1U}(j)\right) \\
T^P_{D_1L}(ij) &\leq \min\left(T^P_{C_1L}(i), T^P_{C_1L}(j)\right) \\
T^N_{D_1U}(ij) &\geq \max\left(T^N_{C_1U}(i), T^N_{C_1U}(j)\right) \\
T^N_{D_1L}(ij) &\geq \max\left(T^N_{C_1L}(i), T^N_{C_1L}(j)\right) \\
I^P_{D_1U}(ij) &\geq \max\left(I^P_{C_1U}(i), I^P_{C_1U}(j)\right) \\
I^P_{D_1L}(ij) &\geq \max\left(I^P_{C_1L}(i), I^P_{C_1L}(j)\right) \\
I^N_{D_1U}(ij) &\leq \min\left(I^N_{C_1U}(i), I^N_{C_1U}(j)\right) \\
I^N_{D_1L}(ij) &\leq \min\left(I^N_{C_1L}(i), I^N_{C_1L}(j)\right) \\
F^P_{D_1U}(ij) &\geq \max\left(F^P_{C_1U}(i), F^P_{C_1U}(j)\right) \\
F^P_{D_1L}(ij) &\geq \max\left(F^P_{C_1L}(i), F^P_{C_1L}(j)\right) \\
F^N_{D_1U}(ij) &\leq \min\left(F^N_{C_1U}(i), F^N_{C_1U}(j)\right) \\
F^N_{D_1L}(ij) &\leq \min\left(F^N_{C_1L}(i), F^N_{C_1L}(j)\right)
\end{aligned}$$

Hence proved. □

Doi :https://doi.org/10.54216/IJNS.160105
Received: July 10, 2021 Accepted: November 08, 2021

4 Conclusion

In this paper we talk about certain kinds of BIVNGs, Sub division of BIVNG, Total BIVNGs, BIVNLG and BIVNIG with isomorphism properties. In future we develop this concept to some other kinds of BIVNGs.

References

[1] Zadeh.L.A, Fuzzy sets, Inform and control 8,pp.338 - 353,1965.

[2] Shannon.A and K. Atanassov, A First step to a theory of the Intuitionistic Fuzzy graphs. proc. of the First workshop on Fuzzy bassed expert system (D. 9 kov . Ed.), sofia ,pp.59 - 861,1994.

[3] Akram.M and S. Shahzadi Representation of graphs using intuitionistic neutrosophic soft Sets, Journal of mathematical Analysis, 7,pp.1 - 23,2016.

[4] Akram.M and S. Shahzadi, Neutrosophic soft graphs with application, Journal of Intelligent and Fuzzy Systens DOI: 10.3233 / JIFS-16090, pp.1 - 8,2016.

[5] Broumi.S, M. Talea, F. Smarandache and A. Bakali, Single valued Nentrorophic graphs, Degree Order Size IEEE world congress on computational intelligence, pp.2444 - 2451,2016.

[6] Broumi.S, M.Talea, A. Bakali and F. Smarandache isolated single valued Neutrosophic Graphs, Neutrosophic sets and systems 11, pp.74 - 78,2016.

[7] Broumi.S, M.Talea, A.Bakali and F.Smarandache, Single valued Neutrosophic graphs, Journal of New Theory 10, pp.86 - 101,2016.

[8] Sudhakar.V.J., Mohamed Ali.A and Vinoth.D, Interval valued signed neutrosophic graphs. International journal of Mathematical Archive ,Vol.9, No.9, pp 35 - 43, 2018.

[9] Sudhakar.V.J., Navaneethakumar.V and Jayaprakasam.S. Interval valued Regular neutrosophic graphs. International Journal of Science and Humanities, vol.5. No.2, pp. 76 - 85,2019.

[10] Sudhakar.V.J., Navaneethakumar.V and Yuvaraj., Self- Centered Interval valued Neutrosophic graphs, International Journal of Science and Humanities vol 5, No 2, pp 86 - 102,2019.

Doi :https://doi.org/10.54216/IJNS.160105

Received: July 10, 2021 Accepted: November 08, 2021