Topological Indices Polynomials of Domination David Derived Networks

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Abstract

The chemical properties of chemical compounds and their molecular structures are intimately connected. Topological indices are numerical values associated with chemical molecular graphs that help in understanding the physicochemical properties, chemical reactivity and biological activity of a chemical compound. This study obtains some topological properties of second and third dominating David derived (DDD) networks and computes several K Banhatti polynomial of second and third type of DDD.

Keywords: Dominating David Derived networks, F-K Banhatti indices , harmonic K Banhatti indices, K-Banhatti polynomial, K-hyper Banhatti indices, symmetric division K Banhatti indices.

Introduction

Suppose that \( G = (P,Q) \) is a finite, simple, connected graph \(^{1,2}\). A chemical compound is represented by a simple graph called a molecular graph in chemical graph theory, which is a branch of graph theory, with the vertices representing the complex atoms and the edges representing the atomic bounds. If a graph contains at least one connection between its vertices, it is referred to be connected. A network is a graph with no loops or multiple edges. More information can be found in the book \(^{5}\). Another emerging field is cheminformatics, which improves the predictions of biological activities using the structure property and quantitative structure-activity relationships. If emphasized chemicals are used in these studies, topological indices and physicochemical properties are used to predict bioactivity \(^{4,5}\). A cellular neural network, or cellular nonlinear network, is a computing paradigm used in computer science and machine learning that plays a major role in communicating between neighbouring units. CNN is used to solve partial differential equations (PDEs), perform image processing, analyze 3D surfaces, and resolve geodesic maps and sensory motor organ problems. CNN processors are systems that combine finite fixed topology, locally connected fixed location, and multiple inputs with a single output of nonlinear processing units. In the CNN processor, every cell (processor) has a single output, due to which it is communicated by other cells. The CNN processor was introduced in 1988 by Leon Chua and Lin Yang. In the original Chua Yang CNN processor (CYCNN \(^{4}\)), cells were weighted sums of different inputs, while output was a piecewise linear function \(^{6}\). A topological index is a number that describes a graphs topological. Mathematicians and chemists both studied this index \(^{7}\). Discusses how to construct \(^{8}\) an \( n \) dimensional David derived and DDD.

In \(^9\) V. R. Kulli introduced the I\textsuperscript{st} & II\textsuperscript{nd} K Banhatti indices (K B indices),

\[
B_1(G) = \sum_{r,k}[E_{r,k}[d_{c}(r) + d_{c}(k)]
\]

\[
B_2(G) = \sum_{r,k}[E_{r,k}[d_{c}(r) * d_{c}(k)]
\]

The I\textsuperscript{st} & II\textsuperscript{nd} K Banhatti Polynomials (K B Polynomial) are defined as follows using K Banhatti indices:

\[
B_1(G,x,y) = \sum_{r,k} [E_{r,k} x^{d_{c}(r)+d_{c}(k)} y^{d_{c}(r)+d_{c}(k)}]
\]

\[
B_2(G,x,y) = \sum_{r,k} [E_{r,k} x^{d_{c}(r)+d_{c}(k)} y^{d_{c}(r)+d_{c}(k)}]
\]

The I\textsuperscript{st} & II\textsuperscript{nd} K hyper Banhatti indices (K H B indices) \(^{10}\) are defined as
The 1st & 2nd Banhatti polynomials of a graph can be calculated using the K hyper Banhatti indices as follows:

\[ \text{HB}_1(G) = \sum_{r,k} |E_{r,k}| [d_G(r) + d_G(k)]^2 \quad \text{HB}_2(G) = \sum_{r,k} |E_{r,k}| [(d_G(r) * d_G(k))^2] \]

The sum and product connectivity Banhatti index (S&P C B indices) are calculated using the following formulas:

\[ \text{SB}(G) = \sum_{r,k} |E_{r,k}| \frac{1}{\sqrt{d_G(r) + d_G(k)}} \quad \text{PB}(G) = \sum_{r,k} |E_{r,k}| \frac{1}{\sqrt{d_G(r) * d_G(k)}} \]

The symmetric division K Banhatti polynomial (S D K B Polynomial) of G is defined as:

\[ \text{SDB}(G) = \sum_{r,k} |E_{r,k}| \frac{d_G(r) + d_G(k)}{d_G(r) d_G(k)} \]

The inverse sum index K Banhatti index (I S I K index) of a graph G as

\[ \text{ISB}(G) = \sum_{r,k} |E_{r,k}| \frac{d_G(r) d_G(k)}{d_G(r) + d_G(k)} \]
Result and Discussion

Second type of Domination David Derived Network

Consider the \( u \) dimensional David’s star network. Add a new vertex to each edge and divide it in two parts. The David-derived network \( DD(u) \) of dimension \( u \) will be obtained.

![Figure 1. Domination David Derived network of the second type](image)

Table 1. Edge partition of \( G \)

<table>
<thead>
<tr>
<th>( (d_x(r), d_x(s); k = r \ s) )</th>
<th>(2, 2)</th>
<th>(2, 3)</th>
<th>(2, 4)</th>
<th>(3, 4)</th>
<th>(4, 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( 4u )</td>
<td>18 ( u^2 - 22u + 6 )</td>
<td>28u - 16</td>
<td>36u^2 - 56u + 24</td>
<td>36u^2 - 56u + 20</td>
<td></td>
</tr>
</tbody>
</table>

Therefore the edge degree partition of \( G = D_2(u) \) is given below.

Table 2. Edge degree partition of \( G \)

<table>
<thead>
<tr>
<th>( (d_x(r), d_x(s); k = r \ s) )</th>
<th>(2, 2)</th>
<th>(2, 3)</th>
<th>(2, 4)</th>
<th>(3, 4)</th>
<th>(4, 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( 4u )</td>
<td>18 ( u^2 - 22u + 6 )</td>
<td>28u - 16</td>
<td>36u^2 - 56u + 24</td>
<td>36u^2 - 56u + 20</td>
<td></td>
</tr>
</tbody>
</table>

In the following Theorems, to compute the general first K Banhatti polynomial of DDD network.

**Theorem 1.**

If \( G = D_2(u) \) is DDD network, then

\[
B_1^x(G, x, y) = 4u x^{(2+2)} a y^{(2+2)} a + (18u^2 - 22u + 6) x^{(5)} a y^{(6)} a + (28u - 16) x^{(6)} a y^{(8)} a + (36u^2 - 56u + 24)x^{(10)} a y^{(10)} a
\]

\[
+ (36u^2 - 56u + 20)x^{(10)} a y^{(10)} a + 4u x^{(4)} a y^{(4)} a + (18u^2 - 22u + 6)x^{(5)} a y^{(8)} a + (36u^2 - 56u + 24)x^{(10)} a y^{(10)} a
\]

Proof. As aforesaid table 2.

\[
B_1^x(G, x, y) = \sum_{r \ k} |E_{r \ k}| x^{[d_x(r)+d_x(k)]} a y^{[d_x(r)+d_x(k)]} a
\]

The following are the results of Theorem 1.
Result 1.
The $1^\text{st}$ K B polynomial of the $D_2(u)$ is (as shown in Fig. 2.)

\[ B_1(G,x,y) = 4u x^4 y^4 + (18u^2 - 22u + 6) x^5 y^5 + (28u - 16) x^6 y^8 + (36u^2 - 56u + 24) x^8 y^9 + (36u^2 - 56u + 20) x^{10} y^{10} \]

Result 2.
The $1^\text{st}$ H K B polynomial of $D_2(u)$ is (as shown in Fig. 3.)

\[ HB_1(G,x,y) = 4u x^{16} y^{16} + (18u^2 - 22u + 6) x^{25} y^{36} + (28u - 16) x^{36} y^{64} + (36u^2 - 56u + 24) x^{64} y^{81} + (36u^2 - 56u + 20) x^{100} y^{100} \]

Result 3.
The $m$ K B polynomial of $D_2(u)$ is (as shown in Fig. 4.)

\[ mB_1(G,x,y) = 4u x^4 y^4 + (18u^2 - 22u + 6) x^5 y^5 + (28u - 16) x^6 y^8 + (36u^2 - 56u + 24)x^8 y^9 + (36u^2 - 56u + 20)x^{10} y^{10} \]

Result 4.
The $m$ C K B polynomial of $D_2(u)$ is (as shown in Fig. 5.)

\[ SB(G,x,y) = 4u x^2 y^2 + (18u^2 - 22u + 6) x^{\frac{1}{16}} y^{\frac{1}{16}} + (28u - 16)x^{\frac{1}{64}} y^{\frac{1}{64}} + (36u^2 - 56u + 24)x^{\frac{1}{64}} y^{\frac{1}{81}} + (36u^2 - 56u + 20)x^{\frac{1}{100}} y^{\frac{1}{100}} \]

Theorem 2.
If $G = D_2(u)$ is DDD network, then

\[ B_2^a(G,x,y) = 4u x^a y^a + (18u^2 - 22u + 6)x^{(6)} y^{(9)} + (28u - 16)x^{(18)} y^{(16)} + (36u^2 - 56u + 24)x^{(24)} y^{(24)} + (36u^2 - 56u + 20)x^{(24)} y^{(24)} \]

Proof. As aforesaid Table 2.

\[ B_2^a(G,x,y) = \sum_{r,k} E_{r,k} x^{[d(r)\ast d(k)]^a} y^{[d(r)\ast d(k)]^a} = 4u x^{(2+2)} y^{(2+2)} + (18u^2 - 22u + 6)x^{(2+3)} y^{(3+3)} \]
\[ (28u - 16)x^{(2+4)}y^{(4+4)} + (36u^2 - 56u + 24)x^{(3+5)}y^{(4+5)} + (36u^2 - 56u + 20)x^{(4+6)}y^{(4+6)} \]

\[ B_2^G(G, x, y) = 4u x^{(4)}y^{(4)} + (18u^2 - 22u + 6)x^{(6)}y^{(6)} + (28u - 16)x^{(8)}y^{(16)} + (36u^2 - 56u + 24)x^{(15)}y^{(20)} + (36u^2 - 56u + 20)x^{(24)}y^{(24)} \]

Result 5.
The II\textsuperscript{nd} K B polynomial of the \( D_2(u) \) is (as shown in Fig. 6.)

\[ B_2^G(G, x, y) = 4u x^{(4)}y^{(4)} + (18u^2 - 22u + 6)x^{(6)}y^{(6)} + (28u - 16)x^{(8)}y^{(16)} + (36u^2 - 56u + 24)x^{(15)}y^{(20)} + (36u^2 - 56u + 20)x^{(24)}y^{(24)} \]

Result 6.
The II\textsuperscript{nd} H K B polynomial of \( D_2(u) \) is (as shown in Fig. 7.)

\[ HB_2^G(G, x, y) = 4u x^{(16)}y^{(16)} + (18u^2 - 22u + 6)x^{(36)}y^{(36)} + (28u - 16)x^{(64)}y^{(256)} + (36u^2 - 56u + 24)x^{(225)}y^{(400)} + (36u^2 - 56u + 20)x^{(576)}y^{(576)} \]

Result 7.
The II\textsuperscript{nd} m K B polynomial of \( D_2(u) \) is (as shown in Fig. 8.)

\[ mB_2^G(G, x, y) = 4u x^{(4)}y^{(4)} + (18u^2 - 22u + 6)x^{(6)}y^{(6)} + (28u - 16)x^{(8)}y^{(16)} + (36u^2 - 56u + 24)x^{(15)}y^{(20)} + (36u^2 - 56u + 20)x^{(24)}y^{(24)} \]

Result 8.
The P C K B polynomial of \( D_2(u) \) is (as shown in Fig. 9.)

\[ PB(G, x, y) = 4u x^{(2)}y^{(2)} + (18u^2 - 22u + 6)x^{(4)}y^{(4)} + (28u - 16)x^{(8)}y^{(8)} + (36u^2 - 56u + 24)x^{(15)}y^{(20)} + (36u^2 - 56u + 20)x^{(24)}y^{(24)} \]
Proof. As aforesaid Table 2.

**Theorem 4.**
If \( G = D_2(u) \) is DDD network, then

\[
FB(G,x,y) = 4u x^2 y^2 + (18u^2 - 22u + 6) x^2 y^{18} + (28u - 16)x^2 y^{32} + (36u^2 - 56u + 24)x^4 y^{41} + (36u^2 - 56u + 20)x^2 y^{52}
\]

Proof. Using Table 2.

\[
FB(G,x,y) = \sum_{r,k} E_{r,k} x^{d_G(u)} x^{d_G(e)} y^{d_G(u)} y^{d_G(e)}
\]

\[
= 4u x^2 y^2 + (18u^2 - 22u + 6) x^2 y^{18} + (28u - 16)x^2 y^{32} + (36u^2 - 56u + 24)x^4 y^{41} + (36u^2 - 56u + 20)x^2 y^{52}
\]

**Theorem 5.**
If \( G = D_2(u) \) is DDD network, then

\[
SDB(G,x,y) = 4u x^2 y^2 + (18u^2 - 22u + 6) x^2 y^{18} + (28u - 16)x^2 y^{32} + (36u^2 - 56u + 24)x^4 y^{41} + (36u^2 - 56u + 20)x^2 y^{52}
\]

Proof. As aforesaid Table 2.

\[
SDB(G,x,y) = \sum_{r,k} E_{r,k} x^{d_G(r)} x^{d_G(k)} y^{d_G(r)} y^{d_G(k)}
\]

\[
= 4u x^2 y^2 + (18u^2 - 22u + 6) x^2 y^{18} + (28u - 16)x^2 y^{32} + (36u^2 - 56u + 24)x^4 y^{41} + (36u^2 - 56u + 20)x^2 y^{52}
\]
Theorem 6.
If $G = D_2(u)$ is DDD network, then
$$ISB(G, x, y) = 4u \times y$$
$$+ (18u^2 - 22u + 6)x^6 y^3$$
$$+ (28u - 16)x^5 y^2$$
$$+ (36u^2 - 56u + 24)x^3 y^6$$
$$+ (36u^2 - 56u + 20)x^5 y^5$$

Proof. Using Table 2.

$$ISB(G, x, y) = \sum_{r \lor k} \left| E_{r,k} \right| x^{d_G(r)+d_G(k)} y^{d_G(k)+d_G(r)}$$

$$= 4u \times y + (18u^2 - 22u +$$
$$6)x^5 y^2 + (28u - 16)x^5 y^2$$
$$+ (36u^2 - 56u + 24)x^3 y^6$$
$$+ (36u^2 - 56u + 20)x^5 y^5$$

The DDD network of the third type (as shown in Fig. 14) of dimension $u$ can be obtained by connecting vertices of degree 2 of $DDD(u)$ by an edge that are not in the boundary and is denoted by $D_3(u)$.

In $G = D_3(u)$, the edge set of $G$ can be divided into 3 partitions based on the degree of end vertices of each edge as given in Table 3.

<table>
<thead>
<tr>
<th>Table 3. Edge partition of $G$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$d_G(r), d_G(s)$;</td>
</tr>
<tr>
<td>No of edges</td>
</tr>
</tbody>
</table>

Therefore the edge degree partition of $G = D_3(u)$ is given in Table 4.

<table>
<thead>
<tr>
<th>Table 4. Edge degree partition of $G$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$d_G(r), d_G(s)$;</td>
</tr>
<tr>
<td>No of edges</td>
</tr>
<tr>
<td>$d_G(k)$</td>
</tr>
</tbody>
</table>
To compute the general 1st K B polynomial DDD network using the following Theorem.

**Theorem 7.**
If \( G = D_3(u) \) is DDD network, then
\[
B_1^a = 4u x^4 a y^4 a + (36u^2 - 20u) x^6 a y^6 a + (72u^2 - 108u + 44) x^{10} a y^{10} a
\]

**Proof.** The aforementioned data Table 4.
\[
B_1^a(G, x, y) = \sum_{r \in R} \sum_{k \in K} |E_{r,k}| x^{[d_G(r)+d_G(k)]} a y^{[d_G(r)+d_G(k)]} a
\]
\[
= 4u x^{(2+2)} a y^{(2+2)} a + (36u^2 - 20u) x^{(2+4)} a y^{(4+4)} a + (72u^2 - 108u + 44) x^{10} a y^{10} a
\]

The following are the results of Theorem 7.

**Result 9.**
The 1st K B polynomial of the \( D_3(u) \) is (as shown in Fig. 15.)
\[
B_1(G, x, y) = 4u x^4 y^4 + (36u^2 - 20u) x^6 y^6 + (72u^2 - 108u + 44) x^{10} y^{10}
\]

**Result 10.**
The 1st H K B polynomial of \( D_3(u) \) is (as shown in Fig. 16.)
\[
HB_1(G, x, y) = 4u x^{16} y^{16}
\]
\[
+ (36u^2 - 20u) x^{36} y^{36}
\]
\[
+ (72u^2 - 108u + 44) x^{100} y^{100}
\]

**Result 11.**
The m K B polynomial of \( D_3(u) \) is (as shown in Fig. 17.)
\[
m B_1(G, x, y) = 4u x^{\frac{1}{4}} y^{\frac{1}{4}} + (36u^2 - 20u)x^{\frac{1}{8}} y^{\frac{1}{8}} + (72u^2 - 108u + 44)x^{\frac{1}{10}} y^{\frac{1}{10}}
\]

**Result 12.**
The S C K B polynomial of \( D_3(u) \) is (as shown in Fig. 18.)
\[
SB(G, x, y) = 4u x^{\frac{1}{2}} y^{\frac{1}{2}} + (36u^2 - 20u)x^{\frac{1}{6}} y^{\frac{1}{6}} + (72u^2 - 108u + 44)x^{\frac{1}{10}} y^{\frac{1}{10}}
\]
To compute the general II$^a$ K B polynomial of the $D_3(u)$

**Theorem 8.**

If $G = D_3(u)$ is DDD network, then

$$B_2^a(G, x, y) = 4u x^{(4)} y^{(4)} + (36u^2 - 20u) x^{(6)} y^{(16)} + (72u^2 - 108u + 44) x^{(24)} y^{(24)}$$

Proof. The aforementioned data Table 4.

$$B_2^a(G, x, y) = \sum_{r,k} [E_{r,k}] x^{[d(r) + d(k)]} y^{[d(r) + d(k)]}$$

$$= 4u x^{(2+2)} y^{(2+2)} + (36u^2 - 20u) x^{(4+4)} y^{(4+4)} + (72u^2 - 108u + 44) x^{(6+6)} y^{(6+6)}$$

The following are the results of Theorem 8.

**Result 13.**
The II$^a$ K B polynomial of the $D_3(u)$ is (as shown in Fig. 19.)

$$B_2(G, x, y) = 4u x^4 y^4 + (36u^2 - 20u) x^6 y^{16} + (72u^2 - 108u + 44) x^{24} y^{24}$$

**Result 14.**
The II$^a$ H K B polynomial of $D_3(u)$ is (as shown in Fig. 20.)

$$HB_2(G, x, y) = 4u x^{16} y^{16} + (36u^2 - 20u) x^{64} y^{256} + (72u^2 - 108u + 44) x^{576} y^{576}$$

**Result 15.**
The m K B polynomial of $D_3(u)$ is (as shown in Fig. 21.)

$$m B_2(G, x, y) = 4u x^{\frac{1}{4}} y^{\frac{1}{4}} + (36u^2 - 20u) x^{\frac{1}{16}} y^{\frac{1}{16}} + (72u^2 - 108u + 44) x^{\frac{1}{24}} y^{\frac{1}{24}}$$

**Result 16.**
The P C K B polynomial of $D_3(u)$ is (as shown in Fig. 22.)

$$P B(G, x, y) = 4u x^{\frac{1}{2}} y^{\frac{1}{2}} + (36u^2 - 20u) x^{\frac{1}{8}} y^{\frac{1}{8}} + (72u^2 - 108u + 44) x^{\frac{1}{24}} y^{\frac{1}{24}}$$
Theorem 9.
If \( G = D_3(u) \) is DDD network, then
\[
FB(G, x, y) = 4u x^8 y^8 + (36u^2 - 20u)x^{20} y^{32} + (72u^2 - 108u + 44)x^{52} y^{52}
\]
Proof. The aforementioned data Table 4.
\[
FB(G, x, y) = \sum_{r,k} |E_{r,k}| x^{d_\alpha(r)+d_\alpha(k)} y^{d_\alpha(r)+d_\alpha(k)}
\]
\[
= 4u x^{22+2^2} y^{22+2^2} + (36u^2 - 20u)x^{44} y^{44} + (72u^2 - 108u + 44)x^{52} y^{52}
\]

FB(G, x, y) = 4u x^8 y^8 + (36u^2 - 20u)x^{20} y^{32} + (72u^2 - 108u + 44)x^{52} y^{52} (as shown in Fig. 23.)

Figure 23. F-K Banhatti polynomial of third Domination David Derived Network

Theorem 10.
If \( G = D_3(u) \) is DDD network, then
\[
H_b(G, x, y) = 4u x^2 y^2 + (36u^2 - 20u)x^{1} y^{4} + (72u^2 - 108u + 44)x^{5} y^{5}
\]
Proof. By using Table 4.
\[
H_b(G, x, y) = \sum_{r,k} |E_{r,k}| x^{d_\alpha(r)+d_\alpha(k)} y^{d_\alpha(r)+d_\alpha(k)}
\]
\[
= 4u x^{2+2} y^{2+2} + (36u^2 - 20u)x^{4} y^{4} + (72u^2 - 108u + 44)x^{5} y^{5}
\]
\[
H_b(G, x, y) = 4u x^2 y^2 + (36u^2 - 20u)x^{1} y^{4} + (72u^2 - 108u + 44)x^{5} y^{5} (as shown in Fig. 24.)
\]

Figure 24. Hyper K Banhatti polynomial of third Domination David Derived Network

Theorem 11.
If \( G = D_3(u) \) is DDD network, then
\[
SDB(G, x, y) = 4u x^2 y^2 + (36u^2 - 20u)x^{5} y^{5} + (72u^2 - 108u + 44)x^{52} y^{52}
\]
Proof. The aforementioned data Table 4.
\[
SDB(G, x, y) = \sum_{r,k} |E_{r,k}| x^{d_\alpha(r)+d_\alpha(k)} y^{d_\alpha(r)+d_\alpha(k)}
\]
\[
= 4u x^{2+2} y^{2+2} + (36u^2 - 20u)x^{4} y^{4} + (72u^2 - 108u + 44)x^{5} y^{5}
\]
\[
SDB(G, x, y) = 4u x^2 y^2 + (36u^2 - 20u)x^{5} y^{5} + (72u^2 - 108u + 44)x^{52} y^{52} (as shown in Fig. 25.)
\]

Figure 25. Symmetric Division K Banhatti polynomial of third Domination David Derived Network

Theorem 12.
If \( G = D_3(u) \) is DDD network, then
\[
ISB(G, x, y) = 4u x y + (36u^2 - 20u)x^{4} y^{2} + (72u^2 - 108u + 44)x^{12} y^{12}
\]
Proof. By using Table 4.
\[
ISB(G, x, y) = \sum_{r,k} |E_{r,k}| x^{d_\alpha(k)+d_\alpha(k)} y^{d_\alpha(k)+d_\alpha(k)}
\]
\[
ISB(G,x,y) = 4u \times x \times y + (36u^2 - 20u)x^{12}y^{12} + (72u^2 - 108u + 44)x^{15}y^{15}
\]

All \( k \)-Banhatti polynomial of \( G_1 = D_2(u) \) and \( G_2 = D_3(u) \) (as shown in Fig. 27. and Table.5)

### Table 5. Exact values of \( G_1 = D_2(u) \) and \( G_2 = D_3(u) \)

<table>
<thead>
<tr>
<th>( n )</th>
<th>( G_1 = D_2(u) )</th>
<th>( G_2 = D_3(u) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22</td>
<td>28</td>
</tr>
<tr>
<td>2</td>
<td>190</td>
<td>228</td>
</tr>
<tr>
<td>3</td>
<td>538</td>
<td>644</td>
</tr>
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<td>4</td>
<td>1066</td>
<td>1276</td>
</tr>
<tr>
<td>5</td>
<td>1774</td>
<td>2124</td>
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<tr>
<td>6</td>
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<td>3188</td>
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<td>7</td>
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<td>4468</td>
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<td>5964</td>
</tr>
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<td>9</td>
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<td>7676</td>
</tr>
<tr>
<td>10</td>
<td>8014</td>
<td>9604</td>
</tr>
</tbody>
</table>

### Conclusion:
This paper has studied and computed the second and third type of DDD network through topological indices and polynomials.

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### Authors’ declaration:
- Conflicts of Interest: None.
- We hereby confirm that all the Figures and Tables in the manuscript are mine ours. Besides, the Figures and images, which are not mine ours, have been given the permission for re-publication attached with the manuscript.
Authors’ contribution statement:
AM; Conception, Design, Acquisition of data, analysis, drafting the MS, interpreting the results and design the figures
U VCK, R M; interpretation, revision and proofreading. All the authors discussed the results and commented on the manuscript.

References: