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# CONNECTED TOTAL DOMINATING SETS AND ITS POLYNOMIAL OF $K_n \times P_r$

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***ABSTRACT***

*In this paper, we are going to study the connected total domination polynomial of $K_n \times P_r$. The connected total domination polynomial of a graph $G$ of order $n$ is defined $D_{ct}(G,i) = \sum_{i=\gamma_{ct}(G)} d_{ct}(G,i)x^i$, where $d_{ct}(G,i)$ is the number of connected total dominating sets of $G$ with size $i$ and $\gamma_{ct}(G)$ is the connected total domination number of $G$.*

***Keywords:*** *Connected total dominating set, connected total domination number, connected total domination polynomial.*

## 1. INTRODUCTION

Let $G = (V,E)$ be a simple graph of order n. For any vertex $v \in V$, the open neighborhood of $v$ is the set $N(v) = \{u \in V / uv \in E\}$ and the closed neighborhood of v is the set $N[v] = N(v) \cup \{v\}$. For a set $S \subseteq V$, the open neighborhood of S is N(S) = ∪ N($v$) and the closed neighborhood of S is $N[S] = N(S) \cup S$. A set $S \subseteq V$ is a connected total dominating set of G if every vertex $v \in V$ is adjacent to atleast one element of $S$ and the induced sub graph $< S >$ is connected. The connected total domination number $\gamma_{ct}$(G) is called a γ-set.

The polynomial, $D_{ct}(G, x) = \sum_{i=\gamma_{ct}(G)} d_{ct}(G,i)x^i$ is defined as connected total domination polynomial of $G$.

where $d_{ct}(G,i)$ is the number of connected total dominating sets with size $i$.

## 2. CONNECTED TOTAL DOMINATION POLYNOMIALS

**Definition: 2.1** A graph $G$ consists of a pair (V(G), E(G) ), where $V(G)$ is a non empty finite set whose elements are called points (or) vertices and $E(G)$ is a set of unordered pairs of distinct elements of $V(G)$. The elements of $E(G)$ are called lines or edges of the graph $G$.

**Definition: 2.2** If $e = \{u,v\}$ is an edge of a graph $G$, written $e = uv$, we say that $e$ joins the vertices $u$ and $v$. Also we say that $u$ and $v$ are adjacent vertices, $u$ and $v$ are incident with $e$. If two vertices or not joined, then we say that they are not-adjacent.

**Definition: 2.3** The graph $G$ is complete if every two distinct vertices of $G$ are adjacent. A complete graph with $n$ vertices is denoted by $K_n$.

**Definition: 2.4** A walk of a graph $G$ is an alternating sequence of points and lines $v_0, x_1, v_1, x_2, v_2, \ldots, v_{n-1}, x_n, v_n$ beginning and ending with points such that each line $x_i$ is incident with $v_{i-1}$ and $v_i$, A walk is called a path if all its points are distinct.

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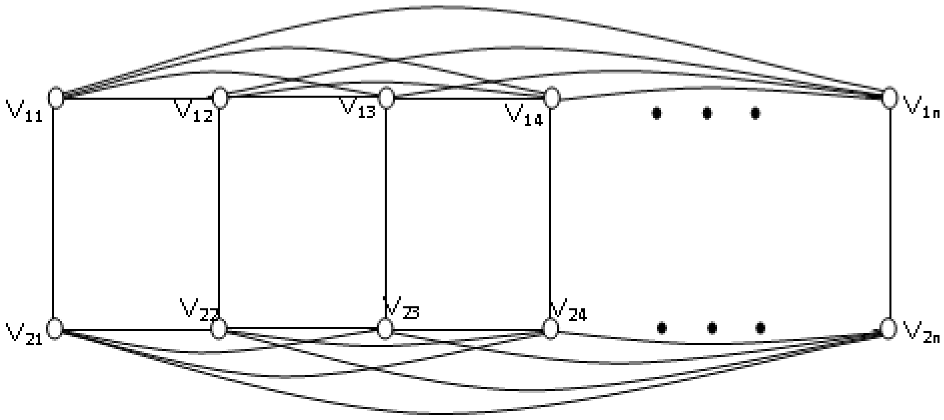
**Definition: 2.5** A subset $S$ of vertices in a graph $G$ is said to be a dominating set, if every vertex $v \in V - S$ is adjacent to atleast one element of $S$. A dominating set of $G$ is said to be a total dominating set, if every vertex $v \in V$ is adjacent to atleast one element of $S$.

**Definition: 2.6** A total dominating set of G is said to be a connected total dominating set, if the induced sub graph $< S >$ of $G$ is connected.

**Theorem: 2.7** Let $G = K_n \times P_2$, then the total connected domination polynomial of G is,

$$D_{ct}(G,x) = nx^2[1+x]^{2(n-1)} - n\left[\overline{2(n-1)C}_1 - 2\right]x^{2n-1} - (n-1)x^{2n} + 2x^n[1+x]^n$$

**Proof:** $G_1 = K_n$ be the complete graph with n vertices, $G_2 = P_2$, its product $G = G_1 \times G_2$ is given in figure 1.1.




$G = K_n \times P_2$

**Figure 1.1**

The vertices of $G$ are denoted by $\{v_{11}, v_{12}, \dots, v_{1n}, v_{21}, v_{22}, \dots, v_{2n}\}$

Let, $S_i = \{V_{ki} / \ k = 1,2;\ i = 1,2,\dots,n\}$ and
$T_j = \{V_{jk} / \ j = 1,2;\ k = 1,2,\dots,n\}$

The total connected dominating set with cardinality 2 are,

$$D_{ct}(G,2) = \{\{S_i\} / \ i = 1,2,\dots,n\}$$

Therefore, $d_{ct}(G,2) = n$

The total connected dominating set with cardinality 3 are,

$$D_{ct}(G,3) = \{S_i \cup \{x_j\} / \ i,j = 1,2,\dots,n; \quad i \neq j\}$$

Therefore, $d_{ct}(G,3) = n\left[\overline{2(n-1)C}_1\right]$

The total connected dominating set with cardinality 4 are,

$$D_{ct}(G,4) = \{S_i \cup \{x_j, x_k\} / \ i,j,k = 1,2,\dots,n; \quad i \neq j,k\}$$

Therefore, $d_{ct}(G,4) = n\left[\overline{2(n-1)C}_2\right]$

The total connected dominating set with cardinality 5 are,

$$D_{ct}(G,5) = \{S_i \cup \{x_j, x_k, x_l\} / \ i,j,k,l = 1,2,\dots,n; \quad i \neq j,k,l\}$$

Therefore, $d_{ct}(G,5) = n\left[\overline{2(n-1)C}_3\right]$

Proceeding in this way, we get

The total connected dominating set with cardinality n are,

$$D_{ct}(G,n) = \{S_i \cup \{x_j, x_k, \dots, x_t\} / \ i,j,k,\dots,t = 1,2,\dots,n; \quad i \neq j,k,\dots,t\} \cup \{\{T_j\} / \ j = 1,2\}$$

Therefore, $d_{ct}(G,n) = n\left[\overline{2(n-1)C}_{n-2}\right] + 2$

The total connected dominating set with cardinality $n+1$ are,

$$D_{ct}(G,n+1) = \{S_i \cup \{x_j, x_k, \dots, x_t, x_{t+1}\} / \ i,j,k,\dots,t+1 = 1,2,\dots,n; \quad i \neq j,k,\dots,t+1\}$$
$$\cup \left\{T_j \cup \{x_k\} / \ \{x_k\} \notin T_j, \ j = 1,2; \quad k = 1,2,\dots,n; \ \ j \neq k\right\}$$

Therefore, $d_{ct}(G,n+1) = n\left[\overline{2(n-1)C}_{n-1}\right] + 2(nC_1)$

The total connected dominating set with cardinality $n+2$ are,

$$D_{ct}(G,n+2) = \{S_i \cup \{x_j, x_k, \dots, x_{t+2}\} / \ i,j,k,\dots,t+2 = 1,2,\dots,n; \quad i \neq j,k,\dots,t+2\}$$
$$\cup \left\{T_j \cup \{x_k, x_l\} / \ \{x_k, x_l\} \notin T_j, \ j = 1,2; \quad k,l = 1,2,\dots,n; \ \ j \neq k,l\right\}$$

Therefore, $d_{ct}(G,n+2) = n\left[\overline{2(n-1)C}_{n}\right] + 2(nC_2)$

Proceeding in this way, we get

The total connected dominating set with cordinality $2n-2$ are,

$$D_{ct}(G,2n-2) = \{S_i \cup \{x_j, x_k, \dots, x_t, \dots, x_\alpha\} / \ i,j,\dots,\alpha = 1,2,\dots,n; \quad i \neq j,\dots,\alpha\}$$
$$\cup \left\{T_j \cup \{x_k, x_l, \dots, x_\alpha\} / \ \{x_k, x_l, \dots, x_\alpha\} \notin T_j, j = 1,2; \quad k,l,\dots,\alpha = 1,2,\dots,n; \ \ j \neq k,l,\dots,\alpha\right\}$$

Therefore, $d_{ct}(G,2n-2) = n\left[\overline{2(n-1)C}_{2(n-1)-2}\right] + 2(nC_{n-2})$

The total connected dominating set with cardinality $2n-1$ are,

$$D_{ct}(G,2n-1) = \{S_i - \{x_i\} / \ \{x_i\} \in S_i; \qquad i = 1,2,\dots,n\}$$

Therefore, $d_{ct}(G,2n-1) = 2n$

The total connected dominating set with cardinality $2n$ are,

$$D_{ct}(G,2n) = 1$$

Therefore, $d_{ct}(G,2n) = 1$

Hence, the total connected domination polynomial of $G$ is,

$$D_{ct}(G,x) = nx^2 + n[\overline{2(n-1)C}_1]x^3 + n[\overline{2(n-1)C}_2]x^4$$
$$\dots + \left[n[\overline{2(n-1)C}_{(n-2)}] + 2\right]x^n + \left[n[\overline{2(n-1)C}_{(n-1)}] + 2(nC_1)\right]x^{n+1}$$
$$\dots + \left[n[\overline{2(n-1)C}_{2(n-1)-2}] + 2(nC_{n-2})\right]x^{2n-2} + 2nx^{2n-1} + x^{2n}$$

$$\Rightarrow D_{ct}(G,x) = \begin{bmatrix} nx^2 + n[\overline{2(n-1)C}_1]x^3 + n[\overline{2(n-1)C}_2]x^4 + \cdots + n[\overline{2(n-1)C}_{(n-2)}]x^n \\ + n[\overline{2(n-1)C}_{(n-1)}]x^{n+1} + \cdots + n[\overline{2(n-1)C}_{2(n-1)-2}]x^{2n-2} + 2nx^{2n-1} + x^{2n} \end{bmatrix}$$
$$+ [2x^n + 2(nC_1)x^{n+1} + \cdots + 2(nC_{n-2})x^{2n-2}]$$

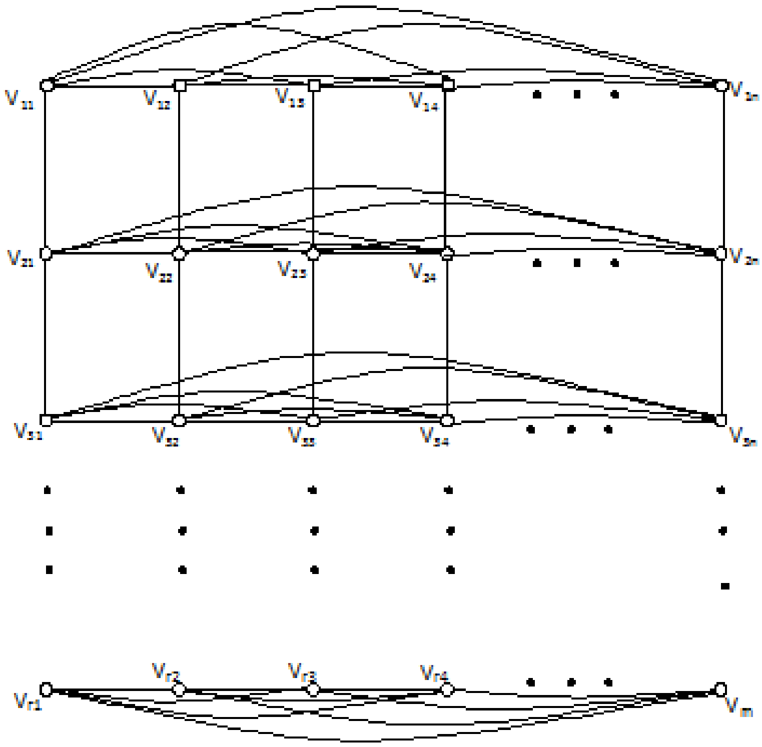
$$\Rightarrow D_{ct}(G,x) = \Big[nx^2 + n[\overline{2(n-1)C}_1]x^3 + n[\overline{2(n-1)C}_2]x^4 + \cdots + n[\overline{2(n-1)C}_{(n-2)}]x^n$$
$$+ n[\overline{2(n-1)C}_{(n-1)}]x^{n+1} + \cdots + n[\overline{2(n-1)C}_{2(n-1)-2}]x^{2n-2} + n[\overline{2(n-1)C}_{2(n-1)-1}]x^{2n-1}$$
$$+ n[\overline{2(n-1)C}_{2(n-1)}]x^{2n} - n[\overline{2(n-1)C}_1 - 2]x^{2n-1} - (n-1)x^{2n}\Big]$$
$$+ [2x^n + 2(nC_1)x^{n+1} + \cdots + 2(nC_{n-2})x^{2n-2}]$$

$$\Rightarrow D_{ct}(G,x) = nx^2[1+x]^{2(n-1)} - n[\overline{2(n-1)C}_1 - 2]x^{2n-1} - (n-1)x^{2n} + 2x^n[1+x]^n$$

**Theorem: 2.8** Let $G = K_n \times P_r$, then the total connected domination polynomial of $G$ is,

$$D_{ct}(G,x) = nx^r[1+x]^{r(n-1)} - n[\overline{r(n-1)C}_1 - r]\,x^{rn-1} - (n-1)x^{rn} + (r-2)[n(n-1)]x^{r+1}[1+x]^{(n-2)r} + x^{(r-2)n}[1+x]^{2n} \text{ for some } r > 2.$$

**Proof:** $K_n$ be the complete graph with $n$ vertices, $P_r$ is a path of length $r$. Then its product $G = K_n \times P_r$ is given in figure 1.2



$G = K_n \times P_r$

**Figure: 1.2**

The vertices of G is denoted by $\{V_{ij} /\ i = 1,2,\dots,r;\ j = 1,2,\dots,n\}$

Let, $S_i = \{V_{ki} /\ k = 1,2,\dots,r;\ i = 1,2,\dots,n\}$ and
$T_j = \{V_{jk} /\ j = 1,2,\dots,r;\ k = 1,2,\dots,n\}$

The total connected dominating set with cardinality $r$ are,
$D_{ct}(G,r) = \{\{S_i\} /\ i = 1,2,\dots,n\}$

Therefore, $d_{ct}(G,r) = n$

The total connected dominating set with cardinality $r+1$ are,
$D_{ct}(G,r+1) = \{S_i \cup \{x_j\} /\ i,j = 1,2,\dots,n;\quad i \neq j\} \cup \{S_i - \{v_{ki}\} \cup \{v_{kj}\} /\ k = 1,2,\dots,r;\quad i,j = 1,2,\dots,n;\ i \neq j\}$

Therefore, $d_{ct}(G,r+1) = n\left[\overline{r(n-1)C}_1\right] + (r-2)[n(n-1)]$

The total connected dominating set with cardinality $r+2$ are,
$D_{ct}(G,r+2) = \{S_i \cup \{x_j, x_k\} /\ i,j,k = 1,2,\dots,n;\quad i \neq j,k\} \cup$
$\{S_i \cup S_j - \{v_{ki}, v_{kj}\} \cup \{x_i\} /\ k = 1,2,\dots,r;\ i,j = 1,2,\dots,n;\quad i \neq j\}$

Therefore, $d_{ct}(G,r+2) = n[\overline{r(n-1)C}_2] + (r-2)[n(n-1)][(n-2)rC_1]$

Proceeding in this way, we get

The total connected dominating set with cardinality $(r-2)n$ are,

$$D_{ct}(G,(r-2)n) = \{S_i \cup \{x_j, x_k, \dots, x_t\} / \ i,j,k,\dots,t = 1,2,\dots,n; \quad i \neq j,k,\dots,t\}$$
$$\cup \{S_i \cup S_j - \{v_{ki}, v_{kj}\} \cup \{x_i,\dots,x_t\} / \ k = 1,2,\dots,r;\ i,j,\dots,t = 1,2,\dots,n;\ i \neq j,\dots,t\}$$
$$\cup \{\{T_j\} / \ j = 1,2,\dots,r\}$$

Therefore, $d_{ct}(G,(r-2)n) = n[\overline{r(n-1)C}_{(r-2)(n-r)}] + (r-2)[n(n-1)]\ [\overline{(n-2)rC}_{(r-2)(n-r-1)}] + 1$

The total connected dominating set with cardinality $\overline{(r-2)n} + 1$ are,

$$D_{ct}(G, \overline{(r-2)n}+1) = \{S_i \cup \{x_j, x_k, \dots, x_t, x_{t+1}\} / \ i,j,k,\dots,t+1 = 1,2,\dots,n;\ i \neq j,k,\dots,t+1\}$$
$$\cup \{S_i \cup S_j - \{v_{ki}, v_{kj}\} \cup \{x_i,\dots,x_{t+1}\} / \ k = 1,2,\dots,r;\ i,j,\dots,t+1 = 1,2,\dots,n;\ i \neq j,\dots,t+1\}$$
$$\cup \{T_j \cup \{x_k\} / \{x_k\} \notin T_j;\ j = 1,2,\dots,r; k = 1,2,\dots,n; j \neq k\}$$

Therefore,

$$d_{ct}(G, \overline{(r-2)n}+1) = n[\overline{r(n-1)C}_{(r-2)(n+1-r)}] + (r-2)[n(n-1)]\ \overline{(n-2)rC}_{(r-2)(n-r)}] + (2n)C_1$$

The total connected dominating set with cardinality $\overline{(r-2)n} + 2$ are,

$$D_{ct}(G, \overline{(r-2)n}+2) = \{S_i \cup \{x_j,\dots,x_{t+2}\} / \ i,j,k,\dots,t+2 = 1,2,\dots,n;\ i \neq j,k,\dots,t+2\} \cup$$
$$\{S_i \cup S_j - \{v_{ki}, v_{kj}\} \cup \{x_i,\dots,x_{t+2}\} / \ k = 1,2,\dots,r;\ i,j,\dots,t+2 = 1,2,\dots,n;\ i \neq j,\dots,t+2\}$$
$$\cup \{T_j \cup \{x_k, x_l\} / \{x_k, x_l\} \in T_j;\ j = 1,2,\dots,r; k,l = 1,2,\dots,n; j \neq k,l\}$$

Therefore, $d_{ct} G, \overline{(r-2)n}+2) = n[\overline{r(n-1)C}_{(r-2)(n+2-r)}]$

$$+(r-2)[n(n-1)]\ \overline{(n-2)rC}_{(r-2)(n-r+1)}] + (2n)C_2$$

Proceeding in this way, we get

The total connected dominating set with cardinality $rn-2$ are,

$$D_{ct}(G, rn-2) = \{S_i \cup \{x_j, x_k, \dots, x_t, \dots, x_\alpha\} / \ i,j,k,\dots,\alpha = 1,2,\dots,n;\ i \neq j,k,\dots,\alpha\} \cup$$
$$\{S_i \cup S_j - \{v_{ki}, v_{kj}\} \cup \{x_i, x_j, \dots, x_\alpha\} / \ k = 1,2,\dots,r;\ i,j,\dots,\alpha = 1,2,\dots,n;\ i \neq j,\dots,\alpha\} \cup$$
$$\{T_j \cup \{x_k, x_l, \dots, x_\alpha\} / \{x_k, x_l, \dots, x_\alpha\} \notin T_j;\ j = 1,2,\dots,r;\ k,l = 1,2,\dots,n;\ j \neq k,l,\dots,\alpha\}$$

Therefore,

$$d_{ct} G, (rn-2) = n\ [\overline{r(n-1)C}_{r\,(n-1)-2}] + (r-2)[n(n-1)]\ \overline{(n-2)rC}_{(n-2)-(n-2)}] + (2\mathrm{n})\mathrm{C}_{2\mathrm{n}-2}$$

The total connected dominating set with cardinality $r\,n-1$ are,

$$D_{ct} G, (rn-1) = \{S_i - \{x_i\} / \ \{x_i\} \in S_i, i = 1,2,\dots,n\}$$

Therefore, $d_{ct}(G, rn-1) = rn$

The total connected dominating set with cArdinality $r\,n$ are,

$$D_{ct}(G, rn) = 1$$

Therefore, $d_{ct}(G, rn) = 1$

Hence the total connected domination polynomial of G is

$$D_{ct}(G,x) = nx^r + \left[\mathrm{n}\,[\overline{\mathrm{r(n-1)C}}_1] + (\mathrm{r}-2)\,[\mathrm{n(n-1)}]\right]\ x^{\mathrm{r}+1}$$
$$+\left[\mathrm{n}[\overline{\mathrm{r(n-1)C}}_2] + (\mathrm{r}-2)[\mathrm{n(n-1)}][(\mathrm{n}-2)\mathrm{rC}_1\right] x^{\mathrm{r}+2} +$$
$$\dots + \left[\mathrm{n}\,[\overline{\mathrm{r(n-1)C}}_{(\mathrm{r-2})(\mathrm{n-r})}] + (\mathrm{r}-2)\,[\mathrm{n(n-1)}][\overline{(\mathrm{n}-2)\mathrm{rC}}_{(\mathrm{r-2})(\mathrm{n-r-1})}] + 1\right] x^{(r-2)n}$$
$$+\left[\mathrm{n}[\overline{\mathrm{r(n-1)C}}_{(\mathrm{r-2})(\mathrm{n+1-r})}] + (\mathrm{r}-2)[\mathrm{n(n-1)}][\overline{(\mathrm{n}-2)\mathrm{rC}}_{(\mathrm{r-2})(\mathrm{n-r})}] + 2nC_1\right] x^{\overline{(\mathrm{r+2})\mathrm{n}}+1}$$
$$+\dots + \left[\mathrm{n}\,[\overline{\mathrm{r(n-1)C}}_{\mathrm{r(n-1)-2}}] + (\mathrm{r}-2)\,[\mathrm{n(n-1)}][\overline{(\mathrm{n}-2)\mathrm{rC}}_{(\mathrm{n-2})-(\mathrm{n-2})}] + 2nC_{2n-2}\right] x^{rn-2} + rnx^{rn-1} + x^{rn}$$

$$\Rightarrow D_{ct}(G,x) = \Big[\ nx^r + n[\overline{\mathrm{r(n-1)C}}_1]x^{r+1} + \mathrm{n}[\overline{\mathrm{r(n-1)C}}_2]x^{r+2} + .... + \mathrm{n}\ [\overline{\mathrm{r(n-1)C}}_{\mathrm{(r\text{-}2)(n\text{-}r)}}]x^{(r-2)n}$$
$$+ \mathrm{n}\ [\overline{\mathrm{r(n-1)C}}_{\mathrm{(r\text{-}2)(n+1\text{-}r)}}]x^{\overline{(r-2)n}+1} + .... + n[\overline{\mathrm{r(n-1)C}}_{\mathrm{r(n\text{-}1)\text{-}2}}]x^{rn-2} + rnx^{rn-1} + x^{rn}\ \Big]$$
$$+ \Big[\ (r-2)[n(n-1)]x^{r+1} + (r-2)[n(n-1)][(\overline{n-2)rC}_1]x^{r+2}$$
$$+ .... + (r-2)[n(n-1)][(\overline{n-2)rC}_{(r-2)(n-r-1)}]x^{(r-2)n}$$
$$+ (r-2)[n(n-1)][(\overline{n-2)rC}_{(r-2)(n-r)}]x^{\overline{(r-2)n}+1}$$
$$+ .... + (r-2)[n(n-1)][(\overline{n-2)rC}_{(n-2)-(n-2)}]x^{rn-(r-1)}\ \Big]$$
$$+ \Big[ x^{(r-2)n} + 2nC_1 x^{\overline{(r-2)n}+1} + ...... + 2nC_{2n-2}x^{rn-2} \Big]$$

$$\Rightarrow D_{ct}(G,x) = \Big[\ nx^r + n[\overline{\mathrm{r(n-1)C}}_1]x^{r+1} + \mathrm{n}[\overline{\mathrm{r(n-1)C}}_2]x^{r+2} + .... + \mathrm{n}\ [\overline{\mathrm{r(n-1)C}}_{\mathrm{(r\text{-}2)(n\text{-}r)}}]x^{(r-2)n}$$
$$+ \mathrm{n}\ [\overline{\mathrm{r(n-1)C}}_{\mathrm{(r\text{-}2)(n+1\text{-}r)}}]x^{\overline{(r-2)n}+1} + .... + n[\overline{\mathrm{r(n-1)C}}_{\mathrm{r(n\text{-}1)\text{-}2}}]x^{rn-2} + n[\overline{\mathrm{r(n-1)C}}_{\mathrm{r(n\text{-}1)\text{-}1}}]x^{rn-1}$$
$$+ n[\overline{\mathrm{r(n-1)C}}_{\mathrm{r(n\text{-}1)}}]x^{rn} - n[\overline{\mathrm{r(n-1)C}}_1 \text{ - r}]x^{rn-1} - (n-1)x^{rn}\ \Big]$$
$$+ \Big[\ (r-2)[n(n-1)]x^{r+1} + (r-2)[n(n-1)][(\overline{n-2)rC}_1]x^{r+2}$$
$$+ .... + (r-2)[n(n-1)][(\overline{n-2)rC}_{(r-2)(n-r-1)}]x^{(r-2)n}$$
$$+ (r-2)[n(n-1)][(\overline{n-2)rC}_{(r-2)(n-r)}]x^{\overline{(r-2)n}+1}$$
$$+ .... + (r-2)[n(n-1)][(\overline{n-2)rC}_{(n-2)-(n-2)}]x^{rn-(r-1)}\ \Big]$$
$$+ \Big[ x^{(r-2)n} + 2nC_1 x^{\overline{(r-2)n}+1} + ...... + 2nC_{2n-2}x^{rn-2} \Big]$$

$D_{ct}(G,x) = nx^r[1+x]^{r(n-1)} - n[r(\overline{n-1)C}_1 - r]x^{rn-1} - (n-1)x^{rn} + (r-2)[n(n-1)]x^{r+1}[1+x]^{(n-2)r} + x^{(r-2)n}[1+x]^{2n}$ for some $r > 2$.

Hence the Proof.

The following Table represents the coefficients of the total domination polynomial of $G = K_n \times P_2$ for all $n < 8$.

| $d_{ct}(G,i)$ / $G$ | $x^2$ | $x^3$ | $x^4$ | $x^5$ | $x^6$ | $x^7$ | $x^8$ | $x^9$ | $x^{10}$ | $x^{11}$ | $x^{12}$ | $x^{13}$ | $x^{14}$ | $x^{15}$ | $x^{16}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $K_3 \times P_2$ | 3 | 14 | 24 | 6 | 1 | | | | | | | | | | |
| $K_4 \times P_2$ | 4 | 24 | 62 | 88 | 72 | 8 | 1 | | | | | | | | |
| $K_5 \times P_2$ | 5 | 40 | 140 | 282 | 360 | 300 | 160 | 10 | 1 | | | | | | |
| $K_6 \times P_2$ | 6 | 60 | 270 | 720 | 1262 | 1524 | 1290 | 760 | 300 | 12 | 1 | | | | |
| $K_7 \times P_2$ | 7 | 84 | 462 | 1540 | 3465 | 5546 | 6482 | 5586 | 3535 | 1610 | 504 | 14 | 1 | | |
| $K_8 \times P_2$ | 8 | 112 | 728 | 2912 | 8008 | 16016 | 24026 | 27472 | 24080 | 16128 | 8148 | 3024 | 784 | 16 | 1 |

**Table: 2.1**

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