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Research Article

Inverse Majority Neighborhood number for $2D$ –Lattice of $T \cup C_4\, C_8[a,b]$ Nanotube

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Abstract

In this article optimal location are found through inverse majority neighborhood $n_M^{-1}(G)$ for 2D – Lattice of $T \cup C_4 C_8[a,b]$. In this type of topology the number of optimal majority location are identified for different structure.

Introduction

Between 1 and 100 nanometers, nanotechnology creates new structures. It develops a broad variety of new materials and devices with applications in medicine, electronics, and computers. Nanotechnology is expected to change the world in the twenty-first century. Nanocrystals, nanowires, and nanotubes are the three main groups of nanomaterials, with the latter two being one-dimensional. Since the discovery of carbon nanotubes in 1991, there has been a significant increase in interest in one-dimensional nanomaterials. Nanotubes are 3-D structures formed out of a 2-D lattice [21,22,23,24,32,33].

A Network is simply a connected graph no multiple edges and loops. The degree of a vertex is a number of the vertices which are connected to that fixed vertex by the edges.

In this article the inverse majority neighborhood number are generalized for the structure 2D Lattice nanotube.

Theorem 1.1

For the graph G be the $2D$ –Lattice of $T \cup C_4\, C_8[a,b]$, $a \geq 2, b = 2$ then $n_m^{-1}(G) = \left\lceil \frac{11a-2}{6} \right\rceil$.

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Proof:

Let G be the $2D$ –Lattice of $T \cup C_4\, C_8[a,b]$ where a is the number of squares in a row and b is the number of rows of square. $|V(G)| = 8a$ and $|E(G)| = 11a - 2$. $V(G) = \{u_{11}, u_{12}, \dots, u_{1a}, u_{21}, \dots, u_{2j}, u_{31}, u_{32}, \dots, u_{3a}, u_{41}, \dots, u_{4a}, u_{51}, \dots, u_{5j}, u_{61}, .., u_{6a}\}$ where $j = 2a$. $\{u_{11}, u_{12}, \dots, u_{1a}\}$ are the first row $\{u_{21}, \dots, u_{2j}\}$ where $j = 2a$ are the second row $\{u_{31}, u_{32}, \dots, u_{3a}\}, \{u_{41}, \dots, u_{4a}\}$, $\{u_{51}, \dots, u_{5j}\}$, $\{u_{61}, .., u_{6a}\}$ where $j = 2a$ are the III, IV, V and VI rows respectively. I and VI row of each vertices and $\{u_{11}, \dots, u_{1a}, u_{61}, \dots, u_{6a}\}$ having degree b. Third and fourth row of each vertex having degree $(b+1)$.

Case (i) $a \le 3$

Let $S_M = \{u_{31}, u_{32}, \dots u_{3a}, u_{52}, u_{54}, u_{55}\}$. Let S'_M be the inverse neighborhood set with respect to S_M. The vertex set $S'_M = \{u_{41}, u_{42}, \dots, u_{4a}, u_{22}, u_{24}, u_{2j}\}$ where $j = 2a$.Then S'_M covers the edges $|\langle N[S'_M]\rangle| = 3\left(a(b-1) + (a - \left(\left\lceil\frac{a-4}{6}\right\rceil + 1\right)\right) + b \ge \left\lceil\frac{11a-2}{2}\right\rceil = \left\lceil\frac{q}{2}\right\rceil$ and the vertices $|N[S'_M]| = 4a + 3(a-1) + b > \left\lceil\frac{8a}{2}\right\rceil = 4a = \left\lceil\frac{p}{2}\right\rceil$. Therefore S'_M is the inverse majority neighborhood set.

Hence $n_m^{-1}(G) = |S'_M| = \left\lceil\frac{11a-2}{6}\right\rceil$. Suppose $S'_M = \{u_{41}, u_{42}, \dots, u_{4a}, u_{22}, u_{24}\}$ then $|S'_M| - 1 = \left\lceil\frac{11a-2}{6}\right\rceil - 1$ and $|\langle N[S'_M]\rangle| = 3\left(a(b-1) + (a - \left(\left\lceil\frac{a-4}{6}\right\rceil + 1\right)\right) < \left\lceil\frac{11a-2}{2}\right\rceil = \left\lceil\frac{q}{2}\right\rceil$. Therefore S'_M is not inverse majority neighborhood set. Hence $n_m^{-1}(G) = |S'_M| = \left\lceil\frac{11a-2}{6}\right\rceil$.

Case (ii) $a > 3$

Let $S_M = \{u_{31}, u_{32}, \dots, u_{3a}, u_{52}, u_{54}, u_{56}, \dots u_{5(j-2)}\}$ where $j = 2a$ with minimum cardinality $|S_M| = \left\lceil\frac{11a-2}{6}\right\rceil$. Let S'_M be the inverse neighborhood set with respect to S_M. The vertex set $S'_M = \{u_{41}, u_{42}, \dots, u_{4a}, u_{22}, u_{24}, u_{26}, \dots u_{2(j-2)}\}$ where $j = 2a$ having edges

$|\langle N[S'_M]\rangle| = 3\left(a(b-1) + a - \left(\left\lceil\frac{a-4}{6}\right\rceil + 1\right)\right) \ge \left\lceil\frac{11a-2}{2}\right\rceil = \left\lceil\frac{q}{2}\right\rceil$ and $|N[S'_M]| = (b+2)\big(a(b-1)\big) + (b+1)\left(a - \left(\left\lceil\frac{a-4}{6}\right\rceil + 1\right)\right) > \left\lceil\frac{8a}{2}\right\rceil = 4a = \left\lceil\frac{p}{2}\right\rceil$. . Therefore S'_M is the inverse majority neighborhood set. Hence $n_m^{-1}(G) = |S'_M| = a(b-1) + a - \left(\left\lceil\frac{a-4}{6}\right\rceil + 1\right) = \left\lceil\frac{11a-2}{6}\right\rceil$. Suppose $|S'_M| - 1 = \left\lceil\frac{11a-2}{6}\right\rceil - 1$ then $|\langle N[S'_M]\rangle| = 3\left(a(b-1) + a - \left(\left\lceil\frac{a-4}{6}\right\rceil + 1\right)\right) - 3 < \left\lceil\frac{11a-2}{2}\right\rceil = \left\lceil\frac{q}{2}\right\rceil$. Therefore S'_M is not inverse majority neighborhood set. Hence $n_m^{-1}(G) = |S'_M| = \left\lceil\frac{11a-2}{6}\right\rceil$.

Theorem 1.2

For the graph G be the $2D$ –Lattice of $T \cup C_4\, C_8[a,b]$, $a \ge 2$, $b = 3$ then $n_m^{-1}(G) = \left\lceil\frac{17a-3}{6}\right\rceil$.

Proof:

Let G be the $2D$ –Lattice of $T \cup C_4\, C_8[a,b]$ where a is the number of squares in a row and b is the number of rows of square. $V(G) = \{v_1(G), v_2(G), \dots, v_9(G)\}$ where $v_1(G) = \{v_{11}, v_{12}, \dots, v_{1a}\}$, $v_2(G) = \{v_{21}, v_{22}, \dots, v_{2j}\}$, $v_3(G) = \{v_{31}, v_{32}, \dots, v_{3a}\}$, $v_4(G) = \{v_{41}, v_{42}, \dots, v_{4a}\}$, $v_5(G) = \{v_{51}, v_{52}, \dots, v_{5j}\}$, $v_6(G) = \{v_{61}, v_{62}, \dots, v_{6a}\}$, $v_7(G) = \{v_{71}, v_{72}, \dots, v_{7a}\}$, $v_8(G) = \{v_{81}, v_{82}, \dots, v_{8j}\}$, $v_9(G) = \{v_{91}, v_{92}, \dots, v_{9a}\}$ where $j = 2a$. $|V(G)| = 12a$ and $|E(G)| = 17a - 3$. $\deg\big(v_1(G), v_9(G)\big) = (b-1)$. $\deg\big(v_3(G), v_4(G), v_6(G), v_7(G)\big) = b$.

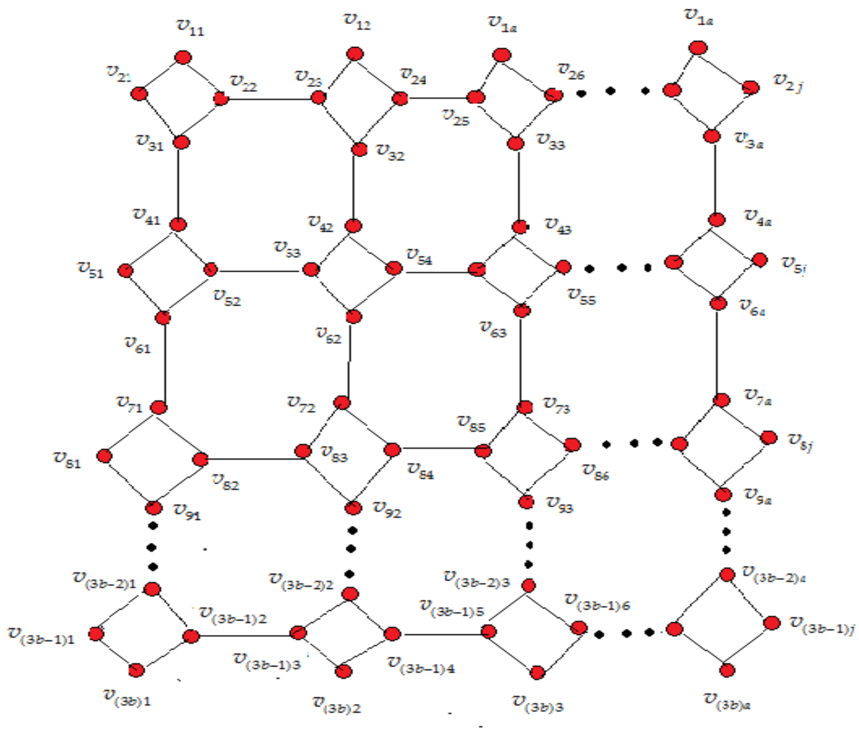
Case (i) $a = 2$

Let $S_M = \{v_{31}, v_{32}, v_{61}, v_{62}, v_{82}, v_{84}\}$ with minimum cardinality $|S_M| = \left\lceil \frac{17a-3}{6} \right\rceil$. Let S'_M be the inverse neighborhood set with respect to S_M. The vertex set $S'_M = \{v_{22}, v_{24}, v_{41}, v_{42}, v_{71}, v_{72}\}$. $|\langle N[S'_M]\rangle| = 3\left(a(b-1) + a - \left(\left\lfloor \frac{a-3}{6} \right\rfloor + 1\right)\right) + a \geq \left\lceil \frac{17a-3}{2} \right\rceil = \left\lceil \frac{q}{2} \right\rceil$ and $|N[S'_M]| = (b+1)\big(a(b-1)\big) + b\left((a - \left(\left\lfloor \frac{a-3}{6} \right\rfloor + 1\right)\right) + (b-1) > \left\lceil \frac{12a}{2} \right\rceil = 6a = \left\lceil \frac{p}{2} \right\rceil$. Therefore S'_M is the inverse majority neighborhood set with cardinality $|S'_M| = \left\lceil \frac{17a-3}{6} \right\rceil$. Suppose $|S'_M| - 1 = \left\lceil \frac{17a-3}{6} \right\rceil - 1$ then $|\langle N[S'_M]\rangle| = 3\left(a(b-1) + a - \left(\left\lfloor \frac{a-3}{6} \right\rfloor + 1\right)\right) < \left\lceil \frac{17a-3}{2} \right\rceil = \left\lceil \frac{q}{2} \right\rceil$. Therefore S'_M is not inverse majority neighborhood set. Hence $n_m^{-1}(G) = |S'_M| = \left\lceil \frac{17a-3}{6} \right\rceil$.

Case (i) $a > 2$

Let $S_M = \{v_{31}, \ldots, v_{3a}, v_{61}, \ldots, v_{6a}, v_{82}, v_{84}, v_{86}, \ldots v_{8(j-2)}\}$ where $j = 2a$ with minimum cardinality $|S_M| = \left\lceil \frac{17a-3}{6} \right\rceil$. $S'_M \subseteq V - S_M$ be the inverse neighborhood set with respect to S_M. $S'_M = \{v_{41}, \ldots v_{4a}, v_{71}, \ldots v_{7a}, v_{22}, v_{24}, v_{26}, \ldots v_{2(j-2)}\}$ where $j = 2a$. Each S'_M covers exactly (b) edges. $|\langle N[S'_M]\rangle| = 3\left(a(b-1) + a - \left(\left\lfloor \frac{a-3}{6} \right\rfloor + 1\right)\right) \geq \left\lceil \frac{17a-3}{2} \right\rceil = \left\lceil \frac{q}{2} \right\rceil$ and $|N[S'_M]| = (b+1)\big(a(b-1)\big) + b\left((a - \left(\left\lfloor \frac{a-3}{6} \right\rfloor + 1\right)\right) > \left\lceil \frac{12a}{2} \right\rceil = 6a = \left\lceil \frac{p}{2} \right\rceil$. Therefore S'_M is the inverse majority neighborhood set with cardinality $|S'_M| = \left\lceil \frac{17a-3}{6} \right\rceil$. Suppose $|S'_M| - 1 = \left\lceil \frac{17a-3}{6} \right\rceil - 1$ then $|\langle N[S'_M]\rangle| = 3\left(a(b-1) + a - \left(\left\lfloor \frac{a-3}{6} \right\rfloor + 1\right)\right) - 3 < \left\lceil \frac{17a-3}{2} \right\rceil = \left\lceil \frac{q}{2} \right\rceil$. Therefore S'_M is not inverse majority neighborhood set. Hence $n_m^{-1}(G) = |S'_M| = \left\lceil \frac{17a-3}{6} \right\rceil$.

Example



Theorem 1.3

For the graph G be the $2D$ −Lattice of $T \cup C_4\, C_8[a,b]$, $a \geq 2$, $b = 4$ then $n_m^{-1}(G) = \left\lceil \frac{23a-4}{6} \right\rceil$.

Proof:

Let G be the $2D$ −Lattice of $T \cup C_4\, C_8[a,b]$ where a is the number of squares in a row and b is the number of rows of square. $V(G) = \{v_1(G), v_2(G), \dots, v_{12}(G)\}$ where $v_1(G) = \{v_{11}, v_{12}, \dots, v_{1a}\}$, $v_2(G) = \{v_{21}, v_{22}, \dots, v_{2j}\}$, $v_3(G) = \{v_{31}, v_{32}, \dots, v_{3a}\}$, $v_4(G) = \{v_{41}, v_{42}, \dots, v_{4a}\}$, $v_5(G) = \{v_{51}, v_{52}, \dots, v_{5j}\}$, $v_6(G) = \{v_{61}, v_{62}, \dots, v_{6a}\}$, $v_7(G) = \{v_{61}, v_{62}, \dots, v_{6a}\}$, $v_8(G) = \{v_{81}, v_{82}, \dots, v_{8j}\}$, $v_9(G) = \{v_{91}, v_{92}, \dots, v_{9a}\}$, $v_{10}(G) = \{v_{10\,1}, v_{10\,2}, \dots, v_{10a}\}$ $v_{11}(G) = \{v_{11\,1}, v_{11\,2}, \dots, v_{11j}\}$ $v_{12}(G) = \{v_{12\,1}, \dots, v_{12\,a}\}$ where $j = 2a$. $|V(G)| = 16a$ and $|E(G)| = 23a - 4$.

Let $S_M = \{v_{41}, \dots, v_{4a}, v_{71}, \dots, v_{7a}, v_{10\,1}, \dots, v_{10a}, v_{22}, v_{24}, v_{26}, \dots v_{2(j-2)}\}$ where $j = 2a$ with minimum cardinality $|S_M| = \left\lceil \frac{23a-4}{6} \right\rceil$. $S'_M \subseteq V - S_M$ be the inverse neighborhood set with respect to S_M. $S'_M = \{v_{31}, \dots v_{3a}, v_{61}, \dots v_{6a}, v_{91}, \dots v_{9a}, v_{11\,2}, v_{11\,4}, v_{11\,6}, \dots v_{11(j-2)}\}$ where $j = 2a$. S'_M covers the edges $3\left(a(b-1) + a - \left(\left\lceil \frac{a-2}{6} \right\rceil + 1\right)\right)$. (i.e) $|\langle N[S'_M] \rangle| = 3\left(a(b-1) + a - \left(\left\lceil \frac{a-2}{6} \right\rceil + 1\right)\right) \geq \left\lceil \frac{23a-4}{2} \right\rceil = \left\lceil \frac{q}{2} \right\rceil$ and $|N[S'_M]| = (b)\big(a(b-1)\big) + (b-1)\left((a - \left(\left\lceil \frac{a-2}{6} \right\rceil + 1\right)\right) >$

$\left\lceil\frac{16a}{2}\right\rceil = 8a = \left\lceil\frac{p}{2}\right\rceil$. Therefore S'_M is the inverse majority neighborhood set . $|S'_M| = a(b-1) + \left(a - \left(\left\lfloor\frac{a-2}{6}\right\rfloor + 1\right)\right) \Rightarrow n_m^{-1}(G) = \left\lceil\frac{23a-4}{6}\right\rceil$.

Suppose $|S'_M| - 1 = \left\lceil\frac{23a-4}{6}\right\rceil - 1$ then $|\langle N[S'_M]\rangle| = 3\left(a(b-1) + a - \left(\left\lfloor\frac{a-2}{6}\right\rfloor + 1\right)\right) - 3 < \left\lceil\frac{23a-4}{2}\right\rceil = \left\lceil\frac{q}{2}\right\rceil$. Therefore S'_M is not inverse majority neighborhood set. Hence $n_m^{-1}(G) = |S'_M| = \left\lceil\frac{23a-4}{6}\right\rceil$.

Theorem 1.4

For the graph G be the $2D$ −Lattice of $T \cup C_4\, C_8[a,b]$, $a \geq 2$, $b = 5$ then $n_m^{-1}(G) = \left\lceil\frac{29a-5}{6}\right\rceil$

Proof:

Let G be the $2D$ −Lattice of $T \cup C_4\, C_8[a,b]$ where a is the number of squares in a row and 5 is the number of rows of square. $V(G) = \{v_1(G), v_2(G), \dots, v_{15}(G)\}$ where $v_1(G) = \{v_{11}, v_{12}, \dots, v_{1a}\}$, $v_2(G) = \{v_{21}, v_{22}, \dots, v_{2j}\}$, $v_3(G) = \{v_{31}, v_{32}, \dots, v_{3a}\}$, $v_4(G) = \{v_{41}, v_{42}, \dots, v_{4a}\}$, $v_5(G) = \{v_{51}, v_{52}, \dots, v_{5j}\}$, $v_6(G) = \{v_{61}, v_{62}, \dots, v_{6a}\}$, $v_7(G) = \{v_{61}, v_{62}, \dots, v_{6a}\}$, $v_8(G) = \{v_{81}, v_{82}, \dots, v_{8j}\}$, $v_9(G) = \{v_{91}, v_{92}, \dots, v_{9a}\}$, $v_{10}(G) = \{v_{10\,1}, v_{10\,2}, \dots, v_{10a}\}$ $v_{11}(G) = \{v_{11\,1}, v_{11\,2}, \dots, v_{11j}\}$ $v_{12}(G) = \{v_{12\,1}, \dots, v_{12\,a}\}$, $v_{13}(G) = \{v_{13\,1}, \dots, v_{13\,a}\}$, $v_{15}(G) = \{v_{15\,1}, \dots, v_{15\,a}\}$ where $j = 2a$. $|V(G)| = 20a$ and $|E(G)| = 29a - 5$.

Let $S_M = \{v_{41}, \dots, v_{4a}, v_{71}, .., v_{7a}, v_{10\,1}, .., v_{10a}, v_{13\,1}, .., v_{13a}, v_{22}, v_{24}, v_{26}, \dots v_{2(j-2)}\}$ where $j = 2a$ with minimum cardinality $|S_M| = \left\lceil\frac{29a-5}{6}\right\rceil$. $S'_M \subseteq V - S_M$ be the inverse neighborhood set with respect to S_M. $S'_M = \{v_{31}, \dots v_{3a}, v_{61}, .. v_{6a}, v_{91}, .. v_{9a}, v_{12\,1}, .., v_{12a}, v_{14\,2}, v_{14\,4}, v_{14\,6}, \dots v_{14(j-2)}\}$ where $j = 2a$. S'_M covers the edges $3\left(a(b-1) + a - \left(\left\lfloor\frac{a-1}{6}\right\rfloor + 1\right)\right)$. (i.e) $|\langle N[S'_M]\rangle| = 3\left(a(b-1) + a - \left(\left\lfloor\frac{a-1}{6}\right\rfloor + 1\right)\right) \geq \left\lceil\frac{29a-5}{2}\right\rceil = \left\lceil\frac{q}{2}\right\rceil$ and $|N[S'_M]| = (b-1)\big(a(b-1)\big) + (b-2)\left(\left(a - \left(\left\lfloor\frac{a-2}{6}\right\rfloor + 1\right)\right) > \left\lceil\frac{20a}{2}\right\rceil = 10a = \left\lceil\frac{p}{2}\right\rceil\right.$. Therefore S'_M is the inverse majority neighborhood set . $|S'_M| = a(b-1) + \left(a - \left\lfloor\frac{a-1}{6}\right\rfloor + 1\right) \Rightarrow n_m^{-1}(G) = \left\lceil\frac{29a-5}{6}\right\rceil$. Suppose $|S'_M| - 1 = \left\lceil\frac{29a-5}{6}\right\rceil - 1$ then $|\langle N[S'_M]\rangle| = 3\left(a(b-1) + a - \left(\left\lfloor\frac{a-1}{6}\right\rfloor + 1\right)\right) - 3 < \left\lceil\frac{29a-5}{2}\right\rceil = \left\lceil\frac{q}{2}\right\rceil$. Therefore S'_M is not inverse majority neighborhood set. Hence $n_m^{-1}(G) = |S'_M| = \left\lceil\frac{29a-5}{6}\right\rceil$.

Theorem 1.5

For the graph G be the $2D$ −Lattice of $T \cup C_4\, C_8[a,b]$, $a \geq 2$, $b \geq 6$ then $n_m^{-1}(G) = \left\lceil\frac{6ab-a-b}{6}\right\rceil$

Proof:

We consider the graph the sequence of $C_{4\,,}C_{8\,,}C_{4\,,}\dots$. This $2D$ −Lattice of $T \cup C_4\, C_8$ is denoted by $T \cup C_4\, C_8[a,b]$ where a is the number of squares in a row and b is the number of rows of squares. $|V(G)| = p = 4ab$ and $|E(G)| = q = 6ab - a - b$. $V(G) = X_1 \cup X_2$ where $X_1 = \{v_{j1},\ v_{j2}, \dots v_{j(2a)}, v_{(j+3)1}, \dots v_{j+3(2a)}, v_{(j+6)1}, \dots, v_{(j+6)(2a)}, \dots v_{(3b-1)1}, \dots, v_{(3b-1)2a}\}$ where $j = 2$ and $X_2 = V(G) - X_1 \ni \{v_{k1}, \dots v_{ka}\}$. Let S'_M be the inverse neighborhood set with respect to S_M . We choose the vertex set $S'_M = V_r(G) \cup V_t(G)$ where $V_r(G) = \{v_{k1}, \dots v_{ka}, v_{(2k)1}, \dots v_{(2k)a} \dots v_{k(b-1)1}, \dots v_{k(b-1)a}\}$ where $k = 3$ and $V_t(G) = \{v_{(3b-1)2\,,}v_{(3b-1)4\,,}\dots v_{(3b-1)(j-2)}\}$ where $j = 2a$. Therefore $S'_M = \{v_{k1}, \dots v_{ka}, v_{(2k)1}, \dots v_{(2k)a}, \dots, v_{[k(b-1)]1}, \dots, v_{[k(b-1)]a}, v_{(3b-1)2\,,}v_{(3b-1)4\,,}\dots v_{(3b-1)(j-2)}\}$ where $k = 3$, $j = 2a$. $|V_r(G)| = a(b-1)$ and $|V_t(G)| = (a-1)$. The vertex set $V_r(G)$ covers edges $3a(b-1)$ and $V_t(G)$ covers edges $3(a-1)$. S'_M covers edges $|\langle N[S'_M]\rangle| = 3a(b-1) + 3\left(a - \left(\left\lfloor\frac{a+(b-6)}{6}\right\rfloor + 1\right)\right) \geq \left\lceil\frac{6ab-a-b}{2}\right\rceil = \left\lceil\frac{q}{2}\right\rceil$ and $|N[S'_M]| = 4\big(a(b-1)\big) + 3\left(a - \left(\left\lfloor\frac{a+(b-6)}{6}\right\rfloor + 1\right)\right)$. Therefore S'_M is the inverse majority neighborhood set. $|S'_M| = a(b-1) + \left(a - \left(\left\lfloor\frac{a+(b-6)}{6}\right\rfloor + 1\right)\right) \Longrightarrow n_m^{-1}(G) = \left\lceil\frac{6ab-a-b}{6}\right\rceil$.Suppose $|S'_M| - 1 = \left\lceil\frac{6ab-a-b}{6}\right\rceil - 1$ then $|\langle N[S'_M]\rangle| = 3a(b-1) + 3\left(a - \left(\left\lfloor\frac{a+(b-6)}{6}\right\rfloor + 1\right)\right) - 3 < \left\lceil\frac{29a-5}{2}\right\rceil = \left\lceil\frac{q}{2}\right\rceil$. Therefore S'_M is not inverse majority neighborhood set. Hence

$$|S'_M| = a(b-1) + \left(a - \left(\left\lfloor\frac{a+(b-6)}{6}\right\rfloor + 1\right)\right) \Longrightarrow n_m^{-1}(G) = \left\lceil\frac{6ab-a-b}{6}\right\rceil.$$

Results for Linear $T \cup C_4\, C_8[a,b]$

Theorem

For the graph $T \cup C_4\, C_8[a,b]$ $a \geq 1$, $b = 1$ then $n_m^{-1}(G) = \left\lceil\frac{5a-1}{6}\right\rceil$

Proof:

Let G be the linear $T \cup C_4\, C_8[a,b]$ where a is the number of squares in a row and b is the number of rows of square. $V(G) = \{v_1(G), v_2(G), v_3(G)\}$ where $v_1(G) = \{v_{11\,,}v_{12\,,}\dots, v_{1a}\}$, $v_2(G) = \{v_{21\,,}v_{22\,,}\dots, v_{2j}\}$, $v_3(G) = \{v_{31\,,}v_{32\,,}\dots, v_{3a}\}$ Where $j = 2a$. $|V(G)| = p = 4a$ and $|E(G)| = q = 5a - 1$.

Case (i) $a \leq 4$

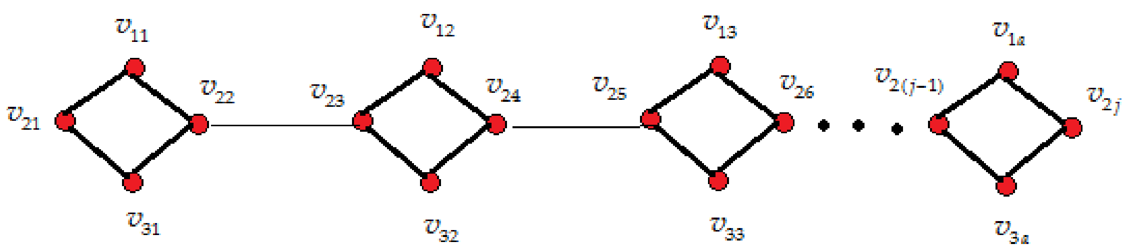
Let $S_M = \{v_{21\,,}v_{23,}v_{25,}\dots.v_{2(j-1),}\}$ where $j = 2a$ with minimum cardinality $|S_M| = \left\lceil\frac{5a-1}{6}\right\rceil$. $S'_M \subseteq V - S_M$ be the inverse neighborhood set with respect to S_M. $S'_M = \{v_{22\,,}v_{24,}v_{26,}\dots.,v_{2j}\}$ Where $= 2a$. $|\langle N[S'_M]\rangle| = 3\big((a-1)\big) + (b+1) \geq \left\lceil\frac{5a-1}{2}\right\rceil = \left\lceil\frac{q}{2}\right\rceil$ and $|N[S'_M]| = (b+3)(a-1) + (b+2)$. Therefore S'_M is the inverse majority neighborhood set. $|S'_M| = (a-1) + 1 = a \Longrightarrow n_m^{-1}(G) = \left\lceil\frac{5a-1}{6}\right\rceil$.

Suppose $|S'_M| - 1$ then $|\langle N[S'_M]\rangle| = 3\big((a-1)\big) < \left\lceil\frac{5a-1}{2}\right\rceil = \left\lceil\frac{q}{2}\right\rceil$. Therefore S'_M is not inverse majority neighborhood set. Hence $|S'_M| = n_m^{-1}(G) = \left\lceil\frac{5a-1}{6}\right\rceil$

Case (ii) $a > 4$

Let $S_M = \{ v_{22}, v_{24}, v_{26}, \ldots . v_{2(j-2)}\}$ where $j = 2a$ with minimum cardinality $|S_M| = \left\lceil\frac{5a-1}{6}\right\rceil$. $S'_M \subseteq V - S_M$ be the inverse neighborhood set with respect to S_M. $S'_M = \{ v_{23}, v_{25}, v_{27}, \ldots, v_{2(j-1)} \}$ where $j = 2a$. $|\langle N[S'_M]\rangle| = 3((a-1)) \geq \left\lceil\frac{5a-1}{2}\right\rceil = \left\lceil\frac{q}{2}\right\rceil$ and $|N[S'_M]| = 4((a-1)) > \left\lceil\frac{4a}{2}\right\rceil = 2a = \left\lceil\frac{p}{2}\right\rceil$. Therefore S'_M is the inverse majority neighborhood set. Hence $|S'_M| = \left\lceil\frac{a+2}{6}\right\rceil - 1 \Longrightarrow n_m^{-1}(G) = \left\lceil\frac{5a-1}{6}\right\rceil$. Suppose $|S'_M| - 1$ then $|\langle N[S'_M]\rangle| = 3\big((a-1)\big) - 3 < \left\lceil\frac{5a-1}{2}\right\rceil = \left\lceil\frac{q}{2}\right\rceil$. Therefore S'_M is not inverse majority neighborhood set. Hence $|S'_M| = n_m^{-1}(G) = \left\lceil\frac{5a-1}{6}\right\rceil$.

Example



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